Digitized by the Internet Archive
in 2010 with funding from
University of Toronto

http://www.archive.org/details/emjengineeringmi93newy

M & M. Dep

The Engineering and Mining Journal

ISSUED WEEKLY

VOLUME XCIII

January 1 to June 30, 1912

124867
11/11/12

Hill Publishing Co.
505 PEARL STREET
NEW YORK

Th
[illegible]
c.2

THE ENGINEERING AND MINING JOURNAL

INDEX TO VOLUME 93

January 1 to June 30, 1912

Illustrated Articles are Designated by an Asterisk (*). Names of Books are Indicated by a Dagger (†).

A

PAGE

Abangarez report 651
Abbe-Frenier sand pump *1172
Abitibi pulp limit 1052
Accident compensation discussed, Canada 535
Accident compensation, Mich. 463
Accident, Fatal, rates, World 1142
Accidents in Cornish mines 165
Accidents on the Rand 1052, 1141
Accidents—International Congress ..422, 468
Accidents, Loss of time from 838
Accidents, Ontario mining 585
Accidents, Transvaal 85
Accounting, Mine, Conservative 631
Acetylene lamp costs 345
Acid-treating filter leaves *639, 742
Acker's sodium cyanide patent 885
Adams mine, Minn. 1105
Adirondack gold schemes 392, 437
Adventure mine, Mich. 12, 571, 959, 1199, 1293
Africa. See "Transvaal," "Rand," "Rhodesia," "South," "West," "Madagascar," "Congo," "Katanga," "Mozambique," "Nigeria," "Diamonds," etc.
Afterthought mine, Calif. 1198
Agate Co., Ore. 190
Ages, North German miners 705
Agitating pulp, Purifying air for *692
Agitation, Continuous, Piping for *591
Agitation, Slime, in 1911 45
Agitator, Pulp, Hafer *1038
Agriculture, Dept., potash laboratory 392
Aguacate, Costa Rica 82, 240, 335
Ahmeek, Mich ..11, 371, 521, 712, 1221, 1245
Aid fund, Breitung 487
Air, Compressed, hoisting systems..993, 1035
Air, Compressed, per ton mined, Cop. Queen 789
Air-compressing plants, Central, at Butte *356
Air compressor cylinder, Patching *492
Air compresor cylinders, Cleaning 1221
Air-compressor lubrication, Soapy water for 933
Air compressor lubrication 1125
Air compressor stroke counter 1269
Air compressors, Elec. driven 517
Air compressors, Volumetric efficiency of *1028
Air consumption of drills, Testing *1268
Air cylinders for changing cages *253
Air-driven side-dump car *932
Air drying in telephone 1127
Air ducts, Collapsible, for fires *638
Air, Effects on miners 852
Air escape, small pump columns 1030
Air exhaust, Preventing freezing of 783
Air-lift pump 986
Air-line drain heater, Elec. *831
Air, Mine, Testing 641
Air pipes, Friction in 834
Air pipes, Hanging *735, Placing in shafts 786
Air, Purifying, for agitating pulp *692
Air receiver leaks, Stopping *351
Air reheating for drills *350
Ajax mill, Colo. 53, 59, 711, 742, *753, 1153
Alabama Consol. 1291, 1297, 1298
Alabama gold and silver 3
Alabama iron market 30
Alabama iron production 367
Alaska coal—Mg. & Met. Soc. recommendations 154
Alaska Consol. Cop. Co. 1151
Alaska copper 53, *55, 57, 1044
Alaska gold and silver 3, *55, 235
Alaska gold dredges 555, 556
Alaska Gold Exploration Co. 283
Alaska, Guggenheims in 726, 728
Alaska-Juneau Co. 55, 910
Alaska law changes proposed 930
Alaska, Map of *54
Alaska-Mexican report 1218
Alaska mining in 1911 .... *55
Alaska placer law proposed 262
Alaska—Sitka district 308
Alaska tin 19, 57
Alaska-Treadwell 45, 297, 345, 377, 451, *692, 787, 822, 1023
—Cost of machine drilling 741
—Amalgamation tables *835
—Development work costs 938
Alaska United report 1192
Alaskan Exploration Co. 857
Albert, T., Death of 1194
Alexo nickel mine, Ont. 537, 1296
Algoma Steel Corp., Ltd. 1064
Algomah, Mich. 12, 141, 659

PAGE

Algonquin mine, Mich. 1199
Alice Co., Mont. 141, 185
Allen, R. C. Crystal Falls dist 1020
—"Mineral Resources of Mich." 1264
Allis-Chalmers Co. 804, *1222
Allouez, Mich. 11, 189, 534
—Production costs 1226
Alloy, Pyrophoric 1082
"Alloys, Brass and the Non-Ferrous, Technical Analysis of" .... †757
Alloys, Distilling, in vacuo 642
Alloys, Light, Failure of 749
Alpha Copper Co. 1294
Alpine Horn mine, Colo 1054
Alta Bert Gold Dredging Co. 610, 1048, 1104
Alta Consol. 475, 523, 861, 961, 1057, 1202
Alta Tunnel & Trans. 239
Alum, Clarifying solutions with 739
Alumina and ferric oxide separation 372
Alumina determination, Rapid methods .1143
Aluminum, Advance in 970
Aluminum alloy resisting acid 1076
Aluminum alloys, Failure of 749
Aluminum Co. of America suit..674, 1018, 1020, 1171
Aluminum, Density of 358
Aluminum disease 1082
Aluminum dust explosions 308
Aluminum, Elec. reduction of 641
Aluminum for transmission lines 458
Aluminum, foreign trade 340
Aluminum, Galvanizing 642
Aluminum nitride, Cyanides from 986
Aluminum, Preparation of 1043
Aluminum prices *13
Aluminum production, Competition in ..1212
Aluminum production in 1911 1038
Aluminum, Soldering 441
Aluminum trade agreement reported 480, 674, 866
Aluminum without cryolite bath 357
Alundum, Properties of 1081, 1082
Alunite, Commercial availability of 564
Alunite deposit, Marysville, Utah ..226, †565
Alunite, Prospecting for: test 511
Alvarado, Mex. 382, 430, 862
Amalgamated Asbestos Corp. 616, 956, 1248, 1290
Amalgamated Cop. Co. ...*356, 391, 550, 908
Amalgamated Oil Co. 1124
Amalgamation in 1911 53
Amalgamation plates, Gold absorption by 541
—By retorts 513, 533
Amalgamation table, Adjustable *1222
Amalgamation tables, Alaska-Treadwell *835
Amalgamation tables, Argonaut *983
Amalgamation tables Homestake *739
Amalgamation tables, Huntington mills *1078
Amalgamation tables, North Star *1270
Amber in Russia 824
American Asphaltum Asso. 855
American Chemical Society 118, 1050
American Co., Mo. 473
American Eagles, Colo. ...236, 426, 472, 618
American Fork M. & P. 475
American Gas Institute *177
American Gem Mg. Co. 960
American Gold Mine Co. 1295
American Goldfields, Ont. 240, 476
American Inst. Chem. Engineers 1001
American Inst. Consulting Engineers ..1002
American Inst. of Metals 954
American Inst. Mg. Eng. 136, 327, 374, 613, 758, 854, 1050, 1100, 1194, 1240
—Proposed constitutional amendments 199, 223, 299
—Annual business meeting 401, 438
—Various papers 370, 394, *505, 515, 537, 642, 705
—Hoisting systems (discussion) ...970, 993, 1035
—Iron and steel division 922, 923
American Iron & Steel Asso. 27, 52, 229, 289, 296, 307, 479, 596, 652, 830, 991
—Second Supplement to Directory .... †1001
—Work transferred to Institute 1066
American Iron & Steel Co. 813
American Iron & Steel Inst. ..806, 977, 1050, 1066
American Metal Co. 196, 245, 1148
American Mg. Congress 111, 300
—"Report of Proceedings" .... †373
—Southwestern L. & Z. Chapter 422
American Peat Society 806
American Placer, Colo 188
American Potash Co. 423
American River, Upper, Dredges *997
American Sisters mine, Colo. 331
American Smelters' Securities Co. ...581, 585

PAGE

American Smg. & Ref. Co. ...8, 47, 483, 615, 630, 666, 680, 761, 1019, 1052, 1101, 1149, 1201, 1247
—In Mexico 144, 186, 192, 430, 476, 712, 734
—Report 581, 585
—Alleged smelting trust ..440, 613, 630, 632
American Soc., Testing Materials ..181, 516
American Vanadium Co. 40, 83, 428
American Zinc, Lead & Smg. Co. 21, 22, 667, 850
Amino white-lead process 1082
Ammonium sulphate, Great Brit. 293, 529
Ammonium sulphate, U. S. 1, 529
Ammonium sulphate, World production .. 529
"Amortization" defined 553
Amparo Mg. Co. 125
Ampère Co.—Ferro-tungsten 173
Amphidizer and amphidization 403, 533
Amster buys R. R. R. mine 830
Amy and Matchless, Idaho 520
Anaconda Cop. Mg. Co. 8, 10, 63, 64, 137, 141, 185, 186, 189, 201, 233, 237, 281, 300, *356, 391, 375, 380, 423, 473, 521, 549, 550, 615, 663, 680, 711, 759, 807, 932, 993, 994, 1023, *1125, *1175, 1289
—Report: costs 977, 1131
—The Bradley process 47, *403, 533
Anaconda G. M. & R. Co. 813
Analcite, Composition of 1271
Analyses, Proximate, Rapid methods 1143, 1166
Analytical methods, Research in 872, 974
Anchor bolts, Forging *205
Anchoring new bolts in old foundation 690
Ancient mine workings, Transvaal 1074
Anderson, A. E. Explosive "don'ts" 256
—Recent developments in explosives (with discussion) 248, 270, 347, 411, 533, 584, 633, 681, 730, 825, 872, 1165
Andros, S. O. Conservation of water in placer prospecting *1266
Anemometer, Mine, Davis-Biram ..*358, 633
Angerman, E. H., Death of (later denied) 468
Anglo-American Club, Freiburg 486
Ankylostomiasis in Cornwall 851
Ankylostomiasis, Linares, Spain 513
Ankylostomiasis, Prevention of 1271
Annealing temperature of brass 642
Antelope mine, Southern Rhodesia 213
Anti-trust proceedings. See "Aluminum" and other companies by name.
Antimony, Ark., development 283
Antimony, Chinese 1239
Antimony in 1911 .... 6, 340
Antimony prices *13
Apache Box mines, N. M. 621, 1057
Apache Creek, N. M., gold find 522
Apache Mtns., Ariz., activity 1197
Apex, Law of, To abolish 728, 773, 777
App mine, Calif. ..188, 378, 1006, 1054, 1152
—Not sold 1244, 1292
Appalachian oil fields 93, 97
Applied Chemistry, International Congress 710
Appraising mines 780, 1238, 1276
Apron for feeding crushers *159
Arch supports, Steel, in tunnels 107
Areas, Irregular, Estimating *587
Arentz, Samuel S. 374
Argall, Philip, & Sons 758
Argall, Philip, and cyaniding 155
—Stratton's Independence mill 442
Argentina in 1911 .... 82, 83, 728
Argentina petroleum 83, 618
Argentine Govt. aërial tram *601, *693
Argo Reduc. & Ore Pur. Co. 1195
Argonaut amalgamation tables *983
Arica-La Paz railroad 556
Arizona Commercial 235, 377, 680, 713
Ariz. copper 7, 12, 1044
Ariz. Cop. Co., Ltd. 12, 13, 47, 856, 857, 1053
—Report 148
Ariz. gold and silver 3, 66
Ariz. gold mine, once famous, History of *372
Ariz. in 1911 66
Ariz. legislation, Proposed ..922, 969, 1196
Ariz. Morenci Cop. Co. 774
Ariz. State geological survey 518
Ariz. taxation 500
Ariz. tungsten 39
Arizota Mg. Co. 1005
Arkansas diamond field 6
Armstead, Henry H. 566
Armstrong, F. C. Temperature chart for tapes 1128, 1260
Arsenic in 1911 83
Arsenic, U. S. 1, 83

PAGE
Asbestos, Canada 561, 612
Asbestos, Goodyear Bar, Calif. 1198
Asbestos Corp. of Canada 1248, 1290
Asbestos in Urals 886
Asbestos lands bill 1086
Asbestos, Prospecting for 1283
Asbestos, U. S. 652
Aschersleben potash report 1082
Ashanti. See "West Africa."
Ashio smeltery, Japan, neutralizing towers, etc. 206, 537
Ashley, George H. 516, 683
Asphaltite deposits 1093
Assay, Gold, silver, platinum 1280
Assay, Iodide copper ..326, 1021, 1166, 1214
Assay, Niter *347
Assay office abolishment 930, 978
Assay Office, Deadwood 186, 664, 712, 1004
Assay Office, Seattle 235
Assay Office, Salt Lake—Cadmium and nickel in cyanide bullion 733
Assay, Wet, of cop. mattes 262
Assays, Smelter, Rapid 1143, 1166
Assayers & Metallurgists, S. F. 394
Assaying copper at Granby 1071
Assaying courses, technical schools 203, 298, 584, 729, 730
Assaying, Fire, Manual of ....†565
Assessment work, Legislation on 534
Associated mine, Kalgoorlie 369
Associated Oil Co. 94, 593, 1051
—Report 1086
Atlantic Mg. Co. 1023, 1035
Atmosphere, Mine, Effects of, on miners 852
Atolia Mg. Co. 62
Atomic weights, International 117
Atomizing metals 778
Auburn, Calif., experiment station 174
Aubury, Marion, Death of 1148
Aurora mine, Mex., vanadium 249
Australasia coal 542, 596, 648, 796, 1068
Australasia mining 87
Australasia silver 88, 542, 596, 1068
Australasia, Australia, copper 8, 89, 596, 648, 680, 728, 796, 951, 1044, 1068
Australia, Australasia gold...3, 87, 88, 774
—New Zealand 542, 774
—West Australia 596, 774
—Tasmania 648, 774, 796
—South Australia 774, 951
—Queensland 774, 951
—New South Wales 774, 1068
Australia, Gas engines, etc., In 538
Australia—N. S. W. production 1068
Australia—Queensland production 951
Australia, South—Alding prospectors 1066, 1117
Australia, South, production 951
Australia—Tasmania production 648, 774, 796
Australia tin 19, 89, 596, 1068
Australia tungsten 220
Australia, West, mineral production 596, 774
Australian tin scrap plant 790
Austria coal 383, 404, 767
Austrian mineral production 404
Austrian radium monopoly 790
Auto trucks for mines *796
Ave Maria ore bin *1223
Avery C. M. Slag disposal, Granby...*935
—Feeders for belt conveyors *1121

B

Bachelor mine, Colo. 520, 858
Back sighting, Winze survey *687
Bacon's zinc dust burette *165
Bahney, L. W. Research work, tech. schools 584, 729, 730
Bain, H. F. "Types of Ore Deposits"..†1193
Baird, S. P. Leveling rod 588
Baker, Charles Whiting 327
Baker mine, Colo. 188, 331
Balaklala smeltery, Calif. 44, 49, 331
—Smelting operation costs 937
Balbach S. & R. Co 8, *1032
Ball milling practice 541
Ball, S. H. Diamonds, Congo *268, 310
Balloon hunt for gold 583
Baltic mine, Mich. (See also "Copper Range") *351, *735, *785, 978, 1023, 1131
Baltic mining method..821, *843, *897, *947
Baltimore Cop. S. & R. Co. 8, 1055, 1132
Baltimore reservoir site lands 1271
Bamberger, [illegible] Caving system, Ohio [illegible] mine *701
Ba[illegible] J. Superficial examination, [illegible] 695
[illegible] Howland 1148
[illegible] A. D. [illegible] for vanadium bearing iron sand 347, 633
[illegible] C. O. Blast roasting galena *750
[illegible] 855
[illegible] der Co. 762
[illegible] separation method . 372
[illegible] stack *303
[illegible] the primer go? 347, 411, [illegible] 584, 633, 681, 730, 825, 872
[illegible] mine with elec. turbine [illegible] 1027
[illegible] Colo. 1104
[illegible] 280
[illegible] Blende separating 929, 1120, 1184

PAGE
"Barite Deposits of Germany" ....†757
Barker district, Mont. 275
Barling, H. B. 280
Barney Cop. Co. 187, 569, 665, 761
Barren, H. A. 232
Barth's speiss treatment expts. 1096
Bartlesville Zinc Co. 22, 41, 850, 961
Bartlett zinc-lead process 128
Bärtling, R. Barite, Germany ....†757
Barytes, Ky. 165
Barytes and calcite, Kentucky 458
Bassick, W. R. 1194
Bat guano 122
Bat guano in Mexico 514, 584
Bateman, G. C. Elec. heater for air-line drains *831
Bates, B. R. 662
Bates, Mowry 758
Bayer's cage signal device *1076
Bayldon on slow chileans 260
Bayliss, R. T., on El Oro 163
Beals, Roger L. 1050
Bear Top-Orofino 331, 762, 959, 1105
Bearings, Hot, Sand for 445
Beartop-Orofino 331
Beauce Co., Que., hydraulicking *1083
Beaver Combination, Utah 239
Beaver Consol., Ont. 143, 574, 1108
—Reports 896, 1248
Beaver Gold Dredging Co. *999
Beck mine, Wyo. 1010
Beck Tunnel, Utah ..334, 523, 573, 716, 808, 913, 1295
Behr's pulp distributor *1269
Belgian Congo. See "Congo."
Belgium, Coal 671
Belgium iron and ore 433, 479
Belgium spelter 202
Bell, Ralston 1288
Bell, R. N. Idaho mining 69
Belleview Consol., Colo. 810
Bellridge Oil Co. 188
Belmont. See "Tonopah-Belmont."
Belt conveyors, Feeders for *1121
Belt, Elevator, take-up device *787, 936
Belt feeder, Carr's homemade *1224
Belts, Conveyor, Flanged, Grooved Idlers for 1130
Belts, Lacing, with wire *1178
Benedict, W. de L. 907
Beneficating Lake iron ores 222
Benner, R. C. Smoke investigation.... 394
—Cooperation in research work 729
Bennie, J. W. Cop. ore treatment 985
Benoni mill, Transvaal ..84, 796, 1184, 1222, 1238
Benson Mines Co. 961
Berger, Victor 439, 440
Bessemer laboratory, Royal School 642
Bevan, Henry 1002
Bewick, Moreing & Co. ...62, 144, 616, 683, 814, 1296
Big Creek, Idaho, discoveries 70
Big Pete Canadian mines 909
Bigham, G. W. Okla. lead and zinc 23
Bignell, L. G. E. 758
Bill and the Supe 105
Bin for concentrate, Joplin *936
Bin, Ore, construction, Joplin *1222
Bin, Ore, gates, etc. ..*157, *254, *256, *351, *735
Binder for copper chips 267
Bingham Bank, Locomotive enters 424
Bingham Copper, Utah 1155
Bingham Mines, Utah 239, 861, 961, 1155, 1247
Bingham-New Haven 287, 669
Bismarck Consol., S. D. 65
Bismuth in 1911 39
Bixler, H. Z. 758
Black Hills Grub Staking Concern ..334, 813
Black Hills Smelting Co. ..65, 621, 716, 808
Black Jack mine, Mo 929, 1120
Black Oak mine, Calif 810
Blackburn, W. Drill bit design *927
Blast. See also "Furnace," "Roasting," "Gas," etc.
Blast desiccation by calcium chloride . *595
Brief mention 50
Blasting. See also "Explosive," "Primer," "Drill."
Blasting—Cartridges for tamping..*879, 1021, *1127, 1177
Blasting—Fuse burning rate 689
Blasting—Fuse cutting table *933
Blasting in Laramie tunnel 933
Blasting in wet shafts 1077
Blasting—Joplin scraper and loading stick *1030
Blasting near buildings 514
Blasting. Teaching rock drilling....*1227
Blatchley, R. S. Petroleum, Ill 96
Bleecker process for vanadium ores 514
Blende and barite, Separating ..*929, 1120, 1184
Blende roasting, Practice in *557
Blister copper Refining 1272
Bloemhof Moolfontein diamond fields .. 657
Blue powder prevention, zinc smelting . 320
Blueprint cabinet Kink for *880
Blueprints, Writing on 391
Boericke, W. F. Shaft sinking costs . 938
Boilers, Flameless gas fired *178, 179, 180, 249, 309

PAGE
Bolivia mining, etc. 83, 728, 1168
Bolivian tin imports, European 244
Bolivia, Tipuani, rush 971, 1069
Bolts, Anchor, Forging *205
Bolts, Anchoring new, in old foundation. 690
Bonanza mine, Alaska 726, 728, 1151
—Dividend 425, 440, 486
Bonanza mine, Nicaragua 81
Bond, J. Amster buys R. R. R. mine.. 830
Bone, W. A. Flameless gas combustion *177, 249, 309
Book notices 183, 373, 565, 757, 805, 1001, 1193
Book popular with miners 348
Booth, M. Mining on forest reserves ..*1215
Borax, Calif. 976
Borax, Chilean, export duty 992
Borax Lake, Calif., potash 643, 678, 870, 926, 975, 1069, 1263
Borax lands, Bill regarding 594
Borchers, Dr. Richard 907
Bordeaux, A. Vladivostok dist. 1236
Borehole surveying instrument *980
—Long core barrels 1128
—Two cores, one hole *1176
—Correcting meandering of holes *1220
Boreholes in shaft sinking 1212
Borrowman, G. Cinder concrete 1180
Bosch's production of cyanides 986
Bosqui zinc-dust feeder *1095
Boston & Corbin 64, 238, 286, 668, 811, 859, 912
Boston-Idaho Gold Dr. Co. 70, 667, 762
Boston & Mont. smeltery 908
Botsford, H. L. Safety catch *636
—Hiawatha mine cage 688
—Light mine cage *736
Botsford, R. S. 758
Boulder Tungsten Production Co. ..858, 1006
Boulders, Stacking *882
Bowron, James 422
Bowron, W. L. 327
Boycott, E. A. Ankylostomiasis 851
Brackenbury, C. Unwatering with elec. turbine pumps..397, 446, 489, *538, 786
Braden Cop. Co...83, 288, 300, 524, 766, 862, 962, 1108
Bradley copper process; amphidization, etc. 47, *403, 533
Bradley rust-proofing process 538
Bradt, Eugene F. 806
Brady, A. C. Guanajuato mining 80
—Jalisco mining 125
Bragdon, H. T., Death of 907
Brake, Whitmore, for hoists *445
Brakpan mine, Transvaal 518, 796
Brandon Oil Syndicate 574, 622
Branner, John C. 327
"Brass and Non-Ferrous Alloys, Technical Analysis of" ....†757
Brass, Annealing temperature of 642
Brass, Effect of varying zinc in 514
Bray, E. V. 327
Brazil in 1911 ....82, 173
Brazil, Unit labor costs 838
Brazilian diamond field discovery 814
Brazilian gold mine pumping plant *851
Breaking ground without powder *1047
Breast stoping, Placing holes in 882
Breitung, E. N. 136
Breitung aid fund 487
Breitung Mines Corp. 1296
Brier Hill Steel Co. 241
Brinker, H. L. 710
Brinsmade, R. B. 280
—"Mining without Timber" ....†373
Briquetting Copper chip binder 267
Briquetting fine iron ore 223
Briquetting iron borings 50
Briquetting process, Schumacher 642
Brisacher, Solomon, Death of 422
Brislee on aluminum density 758
British. See also "United Kingdom."
British Canadian Power Co. *831
Brit. cement combination 273
Brit. Col. Cop. Co. 36, 75, 76, 191, 381, 562, 670, 1058, 1096
Brit. Col. in 1911 75
Brit. Col. Mineowners' Asso. 566
Brit. Col. production 488, 561, 562, 563
Brit. Col. smelting 1096
Brit. South Af. Co. matters ..87, 357, 612, 742, 1264
Broad, Wallace 710
Brockunier, S. H. Mine road 785
Broderick, C. T. Secondary sulphide enrichment 729
Broken Hill Junction North 89
Broken Hill, Missing zinc at 415
Broken Hill notes 88, 1280
Broken Hill Prop. 41, 88, 415, 1068
Broken Hill slime, Smelting, Trollhättan 314
Broken Hill South 88, 112, 883
Report 799
Bronze, Chromax 985
Bronzes, The magnetic 1081
Brooke, George, Death of 184
Brooks, A. H. Alaska in 1911 ....*55
Brown, Austin H. 1194
Brown, C. H. Sizing fine dry ore *1281
Brown, Henry P. 954
Brown, H. S. Where should primer go? 533, 584, 633, 681, 730, 825, 872
—Placing holes, breast stoping 882

PAGE
Brown, W. N. 758
Brown Mtn. Smelting Co. 469, 909
Brown Ore Development Co. 765
Browne, D. H. Canadian Cop. Co. 1286
Brownlee, A. G., Death of 232
Bruce, J. L. Ore dressing, Joplin dist. •405, •459, •506, 553
Brückner roasters 400
Brule, W. H. 136
Bruni, G. Diffusion of metals 790
Brush, Geo. J., Death of 374
Brushes, Dynamo and motor 688
Bryant, F. C. Separating blende and barite .... •929, 1120, 1184
Bucket cars, Joplin .... •979
Bucket elevator. See "Elevator."
Buckley, E. R., Death of 262
Buffalo mine, Ont. 335, 962, 1296
Buffalo-Ont. S. & R. 430
Buffalo Spiro turbine .... •319
Buffalo Union Furnace Co. 1108
Buick lease, Calif. 188
Buick Oil Co., Calif. 517, 957
Bulgaria, Mineral deposits in 371
Bully Boy & Webster 239, 475
Bully Hill mine, Calif 331
Bunker Hill mine, Calif. 330, 378, 425, 1101
—Caving of shaft 402, 485, 570
Bunker Hill & Sullivan 400, 911, 1171
Burch, Caetani & Hershey 280
Bureau of Mines—Mg. & Met. Soc recommendations 154
—Gas analysis, fighting fires 1271
—Cold-storage rules 315
—Explosives for coal mining 358
—Explosion test, Bruceton 403
—Sample reducing machine .... •444
—Foster's amendment to act 487
—Poindexter's amendment 532, 534
—Facts about explosives 687
—Rate of fuse burning 689
—Work of the Bureau—Report to Senate 1169
—Gas analysis, fighting fires 1271
Bureau of Standards 1259, 1277
Burette attachment, Self-filling .... •1031
Burette for zinc-dust analysis .... •165
Burgess, C. F. Copper-nickel additions to iron 1089
Burnett, L. H. 907
Burnham, George, Sr. 710
Burr, R. A. Mining codes 825, 1069
Burt, R. O. Car dump .... •305
Burt filter, Chispas mill .... 216, •219
Butte-Alex. Scott 64, 189, 521, 959, 1105
Butte & Anaconda 190, 190, 1008
Butte-Ballaklava 64, 189, 1200
Butte, Central compressing plants at .... •356
Butte Central Cop. Co.: Ophir mine 64, 237, 329, 332, 473, 521, 859, 1056
Butte mines in 1911 10
Butte, Mont., Observations in 549
Butte & Radersburg 960, 1246
Butte & Superior 10, 21, 41, 328, 427, 473, 521, 959, 1051, 1056, 1105, 1242
Butte & Vipond 859
Butters wins first decision in filter litigation 440

C

C. & C. mine, Nev. .... •167, •171, 572, 1008
C. O. D. Consol 1294
Cable. See also "Rope," "Tramway."
Cables—Damage by electroylsis 1229
Cables, High-tension, underground 686
Cableway, African freight 790
Cableway, Argentine Govt. .... •601, •693
Cableway, Evolution of .... •1278
Cabot, Chas. M. 782, 823
Cadmium and nickel in cyanide bullion 733
—Note 180
Cadmium in 1911 40
Cadmium production, Upper Silesia 449
Cage. See also "Landing chairs," "Safety," "Signal," 'Hoisting," etc.
Cage, Hiawatha mine .... •688
Cage, Light mine .... •736
Cages, Air cylinders for changing .... •253
Cairnes, D. D. 1050
Calamon mine, Stoping at .... •637
Calcining siderite ore 223
Calcite, Kentucky 458
Calcium chloride. Blast desiccation by .... •595
Calculator for cyanide plant 691
Caldecott, Doctor 357
Caledonia mine, Idaho 663, 959
Calif. borax 976
Calif. copper 7, 62, 1044
Calif. dredging. See also "Dredge."
Calif. Dredging Co. 555, 556
Calif., Electric railroads in 250
Calif. Exploration Co., Ltd. .... 181, 187, 519, •682
Calif. gold and silver 3, 61
Calif. gold dredge .... •359, •417, •455, •597
Calif. gold dredging—Oroville .... [illegible]
—Northern Calif.: map .... •907
—Upper American River: map .... •997
Calif. highways, Constructing 1149
Calif. mining in 1911 61
Calif. Mg. & Dredging Co. 235
Calif. Oil Producers' Agency 878
Calif-Oregon Power Co. 529

PAGE
Calif. petroleum items 301, 1054
—Production, etc., in 1911 .... 93, 387
—Production, months 258, 878, 1135
—Dividends 392, 852, 1026
—Water in fields 469, 641
—Marketing Calif. oil 644, 728
—Oil gushers 923, 1124, 1244
Calif. potash, Searles Lake .. 643, 678, 870, 926, 975, 1069, 1263
Calif. quicksilver 38
Calif. State Mining Museum 1195
Calif. Trona Co. 911, 1244
Calif. tungsten 39, 62
Calif. water power 233, 469, 1051
Calumet & Ariz. 12, 139, 857
—Report 634
—Electric hoist .... •162
—The smeltery 682
—Costs 1132
Calumet & Hecla 8, 11, 12, 35, 253, 332, 379, 424, 531, 534, 680, 714, 811, 822, 859, 887, 1067
—Ore cars .... •110
—Timbering methods .... •255, •302
—Various practice •159, •350, 396, 397, 443, •589, •687, 786, •880, 1174
—Report 1068
Calumet & Mont. 142
Cam & Motor mine 829, 1150
Cambria Fuel Co. 775
Cambria Steel Co. .... •587, 642, 1075
Cameron Island mine, Ont. 814
Camp Bird, Ltd.... 328, 472, 666, 670, 911, 1292
—In copper 532, 556, 1238
Campbell, A. B., Death of 422
Canada. See also provinces, etc., by name.
Canada coal and coke 561, 563
Canada Cement Co. 1290, 1296
Canada Consol. Clay Co. 430
Canada copper ... 7, 8, 561, 562, 728, 1044
Canada gold 3, 561
Canada Gypsum Deposits, Maritime .... †183
Canada iron 438, 479, 561, 563
—Bounties 138, 329, 616
—Eastern Michipicoten range .... •1090
Canada, Mineral production of 561
Canada, Molybdenum Ores of .... †373
Canada, Royal Society of 1002
Canada silver 561, 562
Canada Union Furnace Co. 1296
Canadian Coal Consol. 686, 962
Canadian Cop. Co. 73, 192, 240, 300
—Recent changes 1286
Canadian Mg. & Explo. Co., Ltd. .. 1116, 1117
Canadian Mg. Inst.—Meeting plans 184, 202, 252, 374
—Branches 136, 327, 470, 992
—Western Branch meeting 488
—Annual meeting 535, 1096
—Discussion of mining law 493
Canadian-Venezuelan Ore Co. Imataca mines 200, 291
Canadian Western Nat. Gas, etc., Co. .. 239
Cananea Consol. (See also "Greene") 48, 250, 524
—Report 1217
Canda crusher plate .... •996
Cannon for loosening keys .... •834
Cañon Diablo crater 679, 730, 974
Cape Cop. Co. 132, 357, 1264
Capital mine, Colo. 1101, 1152
Car, Air-driven side-dump .... •932
Car dumping device .... •305
Car, Joplin bucket .... •978
Car, Joplin concentrate tram .... •788
Car, Joplin, for boulders .... •690
Car, Man. Copper Range .... •1126
Car, Roller bearing, lubrication 1046
Car, Steel lined dump, Joplin .... •460
Car, Tram, for stope filling .... •443
Car wheel face taper .... •159
Cars, Cradle for dumping .... •539
Cars, Min., Roller bearings on 320
Cars, Ore, Cal. & Hec. .... •110
Carbon, Combustion of 1272
Carbon in steel, Determining .... •1285
Carbon solubility in iron 51
Carlyle, F. J. 516, 1194
—Cop. smelting at Kyshtim .... •1271
Carlyle oil development 96
Carn Brea & Tincroft 488
Carnegie and Stanley, Messrs. 152, 153, 166, 200
Carnotite 1093
Carnotite, Concentration of 1185
Carnotite in Peru 1179
Carp river power system .... •274
Carson Hudson Mg. Co. 2
Carter, T. L., Nicaragua 81
Cartridges for tamping dynamite •879, 1021, •1127, 1175
Cascade dist., Mich. 476
Case Longyear law suit 1126
Case Resmelting Co. 1201
Casey mine, Ont. 766, 1248
Casper, Wyo., oil field 1229, 1277
Castle Valley Coal Co. 828, 1196
Catalysis, Physical chemistry 1088
Catch, Cage safety .... •630
Catches, Cage safety, Testing 588
Catelle, W. R. "The Diamond" .... †183
Catskill aqueduct, etc. .... •450, 512, •942

PAGE
Caucasus Cop. Co. 348
Caving, Baltic mining methods .... •947
Caving of Bunker Hill shaft 402, 485
Caving system, Ohio cop. mine .... •701
Cavnah, R. E. 907
Caylloma Consolidada 862
Cement, Aging, with steam 1081
Cement, Canada 75, 561, 563, 612
—Shortage, duties 1196, 1242
Cement, Cast iron tank 1266
Cement combination, British 273
Cement floors, Covering for 640
Cement for piping 881
Cement-gun concrete, Panama 833
Cement merger, Kansas, Okla. 328, 711
Cement, Mich., labor costs 1132
Cement, Portland, production, U. S. 308
Cement industry in 1911 40
Centennial, Mich. 11, 521
Centennial-Eureka 186, 808
Central American operations 81, 82, 173
Central Eureka, Calif. .. 809, 910, 1103, 1151, 1289
Central Mg. & Invest. Corp. 354
Cerro de Pasco Mg. Co. 83
Chains, Crane, Strength of 1222
Chairs, Landing .... •257, •589
Challenge feeder, Simplified .... •209
Chambers, D. B., Death of 1240
Chambers-Ferland, Ont. 1202, 1248
Chambers, Frank M. 1194
Champion cop. mine, Mich. (See also "Copper Range") •490, 680, 786, 822, •843, •881, 897, •900, •947, 978, 1023, 1036, 1131, •1265
Champs d'Or Rigaud Vaudreuil .... •1083
Channing, J. P. 297, 345, 877, 1067
—Safety devices in inclines 926
Chanute Zinc Co. 850
Chapala Hydro Elec. & Ir. Co. 125
Chapin mine, Mich. 521, 838
Chapman, Grenville 954
Chapman, T. Miami dist. .... •1146
Chapman & Lennan 23, 522, 860
Charleton, A. G. Separating rock from clay 738
Charlton, W. H. 136
Chase, Charles A. 1100
Chase, Frederick M. 1240
Chatelet gold mines, France 320
Chemical analyses, Charges for 727
Chemical duties, The 404
Chemicals, U. S. foreign trade 340
Chemistry, Physical 597, 653, 696, 800, 987, 1041, 1087, 1137
—Editorials and discussion .. 582, 774, 1165, 1211
"Chemistry, Physical" (in German) .... †805
Chiantla M. & S. Co. 476
Chicago iron market 29
Chief Consol. 381, 523, 716, 808, 861
Chihuahua, Mining in 78
Chile borax export duty 992
Chile copper 8, 83, 728, 794, 1044
Chile—Gold at Putú 971
Chile, Longitudinal Ry. of 415
Chile mining 83
Chile nitrate 37, 83, 197
Chile, Ore wharf in .... •981
Chile, Petroleum deposits 756
Chilean mill practice 53
Chilean mill, Slow speed 259, 393
Chilton, J. Rand accidents 1052, 1141
China clay. See "Clay."
China gold 3
China silver 229, 230, 727
Chinese pig iron 390
Chinese tin and antimony 1239
Chinese zinc smelting, Early .... •1185
Chino Cop. Co. 14, 61, 428, 522, 875, 1009, 1057
—Reports 449, 875
—Operations despite labor trouble 1121
Chisos Mg. Co. 38
Chispas cyanide plant, Sonora .... 200, •215
Chloride Flat, N. M. 522
Choix Consol., Mex. 476
Christmas Gold Mg. Co. 59, 379
Chromax bronze 985
Chrome ore production 1258
Chrome ore, New Caledonia 579, 1201
Chromiferous iron ore, Smelting 747
Chronology of mining 1911 83
—Monthly, 1912 .... 300, 486, 680, 875, 1148
Chute, Measuring pocket, Osceola .... •146
Chute, Ore, gates .... •157, •251, •256, •351, •735
Chute, 6-ton loading .... •301
Chutes, Ore, Safeguarding 257
Chautla companies, Mex. 430
Cinco Co., Mex. 125
Cinder concrete disintegration 1180
Cinderella Consol. 205, 1184
Cirkel, Fritz 1288
—Hydraulicking, Beauce Co., Que. .... •1083
City Deep 52, 53, 84, 354, 795, 1032
City lots, Prospecting on 420
Claim. What constitutes valid?—East Tintic decision 1163, 1167, 1289
Clam shell buckets, Handling broken slag with .... •1032
Clarifiers, Solution .... •158
Clarifying cyanide solutions 739, 936

PAGE
Clark, W. A., properties, Mont. 10, 21, 137, 1289
Clark, R. H. 136
Clark placer mining apparatus 1180
Clarkson, G. D. S. 758
Classifier, Pulsator, Richards, improved *896
Classifier, Simple vortex *787
Classification, Hydraulic, at Quincy 536
Classification, Progress in 546
Clay, Geology and mining of 263, 485
Clay—Mexican kaolin deposit 524
Clay, Separating rock from *304, 738
Clays, Great Brit. 123, 648
Cleaveland, E. C. Oil engine fuel 691
Cleland on testing catches 588
Clerc, F. L. Igneous concentration of zinc ore 127
Cleveland mine, N. M. 860, 1009, 1247
Cleveland-Cliffs Iron Co. ..105, 108, 138, 153, 189, 204, 329, *395, 379, 424, 427, 517, 586, 616, 652, 677, 837, 838, 909, 1105, 1196
—Power system *274
—Training school for miners 582
—The school 923
Cleveland, Newton 1194
Cliff copper mine, Mich. 811
Cliff mine, Utah 191, 334, 568, 716
Clifford, H. B. "Rocks in Road to Fortune" ....†183
Clippings, Filing 112
Coal, Alaska—Mg. & Met. Soc. recommendations 154
Coal, Anthracite, wage discussion 438
Coal, Australasia ...89, 542, 596, 648, 796, 1068
Coal, Austria 383, 404, 767
Coal, Baffin's Land, discovery 1004
Coal, Belgium 671
Coal Brit. Col 75
Coal, Canada 561, 563
Coal, Chile, deposits 415
Coal-dust firing, Canadian Cop. Co. 1286
Coal field, Dan River 1257
Coal, France 718
Coal, Germany 431, 752, 1024
Coal, Japan 978
Coal-land, withdrawals, etc., Utah ..568, 615, 1101
Coal mining, Explosives for 358
Coal, Nev., U. S. Smg. in 828
Coal, Nova Scotia 336, 563
Coal prices, Federal control 300
Coal rates 623, 1109, 1297
Coal, Rhodesia 87
Coal, Russia 92, 1074
Coal shipments to Lakes 336
Coal, South Africa 671
Coal storage rules 315
Coal strike, The 532, 582, 678, 815
Coal strikes, European ..300, 390, 484, 532, 678, 718, 767, 779, 970
Coal-traffic notes, Various 289, 336, 575, 623
Coal, Transvaal 86, 671
Coal, United Kingdom 241, 648
Coal, U. S. 1, 98
  Foreign trade 336
Coal, Vanadium in 1094
Coal, Volatile matter in 639
Coalinga Royal 1054
Cobalt development work costs 1033
Cobalt district in 1911 ....*73, 562
Cobalt—Knight's coming report 470
Cobalt Lake Co., Ont. ..523, 717, 1033, 1248, 1296
Cobalt—Prospects of district 344
Cobalt, Review of 363
Cobalt Townsite 143
Cobalt's production 992
Cobre mines, Fighting at 1213
Codes, Mining 825, 1069
Cody, William F. 569
Cody-Dyer Mg. Co. 39
Coeur d'Alene lead mining 16, 69
Cohn, Elias, Death of 758
Coil mine, Ky., explosion 858
Coke, Canada oven 563
Coke ovens, Byproduct 497, 778
Coke, U. S. 1, 98, 336
Colburn-Ajax mill, Colo. *753
—Notes, etc. 53, 59, 711, 742, 1153
Cole, A. A. Food supplies ..837, 974, 1022, 1259
Coleman, James V. 908, 910
Coll, Charles J. 327
Collahuasi, Chile, development 794
Collar, Drill post, Improved *979
College men underground 250, 778
Collins, Edgar 954
Collins, F. W. Graphic solution of skip loads *982
Collins, George E. 136
  Metal mining in Colo. 59
Collinsville Zinc Co. 850
Colloidal solution 774, 800
Colombia, Cyaniding tailings in *498
Colombia, Flume construction in *649, *880
Colombia in 1911 82
Colombia platinum 83, 917
Colombia, Traveling in 156
Colonel Sellers mine, Idaho 810
Colonial Co., Ont. 430
Colorado Carnotite Co. 188, 666
Colo. copper 7, 60, 1044

PAGE
Colo. forest reserves mining *1215
Colo. Fuel & Iron Co. 61
Colo., Geology and Ore Deposits near Lake City ....†183
Colo. gold and silver 3, 59, 924
Colo. lead 60, 773
Colo. metal mining, 1911 59
Colo. mining decisions 542
Colo., Mining in 1118
Colo. petroleum 93
Colo, prospecting 60, 807, 1289
Colo. School of Mines 422, 1066, 1241
Colo. tungsten, vanadium, uranium ..39, 40, 60, 140, 188, 226, 666, 667, 714, 911, 955, 1003, 1093, 1094, 1104, 1149, 1241, 1292
Colo., White marble in 648
Colo.-Yule Marble Co. 648
Colo. zinc 21, 59, 60, 1003, 1039
Colo. mine, Utah 239, 334, 1009, 1295
Columbia mine, S. D. 856
Columbia University 516, 806
Columbus Consol. .429, 523, 913, 1155, 1201
—Correction 1295
—Unwatering 1027
Columbus tunnel, Idaho 571
Columbus mine, S. D. 239
Combination mine, Comstock, Nev. *167, 428
Commercial movement, gold and silver 4, 152, 166, 229, 291, 433, 673
Commonwealth Extension, Ariz. 66
Commutators, Maintenance of 688
Company stores, Grass Valley 1003, 1022
Compensation, Injured workmen's, Mich. 463
—Canadian Mg. Inst. discussion........ 535
Compressed air. See "Air."
Comstock in 1911 68
Comstock-Phœnix, Nev. 522
Comstock, Position on the *167
Comstock, Theodore B. 516
Concentrate, Bin for, Joplin *936
Concentrate, Cyaniding of 822, *839, 973
Concentrate, Tram car for *788
Concentrating. See also "Separating," "Sorting," "Flotation."
Concentrating practice, Progress in 545
Concentration, Centrifugal slime 469
Concentration, Copper ore, Gahl's....... 885
Concentration, Igneous, zinc ore 127
Concentration, Joplin dist. ..407, *459, *501
Concentration of molybdenite ores *227
Concentration, Pyrometallurgical, zinc .. 41
Concentration, Wet, of furnace slags....1262
Concentrators, Huff electrostatic 1272
—Notes, etc. 236, 520, 1104, 1120
Concklin, B. M. Temporary staging staple *880
—Mining dangerous ground, Mesabi ...*1219
Concrete aging with steam 1081
Concrete and cement, Some books on †183, 565, 1001
Concrete, Cinder, disintegration 1180
Concrete, Effect of metal-bearing aggregate on 1271
Concrete mixer heater attachment *208
Concrete, Reinforced, in tunnel ..109, *1273
Concrete, reinforcement, Old cable 253
Concrete roof, powder house *490
Concrete sands, Defective 1180
Concrete stations in shafts 1221
Concrete, Stresses allowed in 249
Concrete survey monuments 1268
Concrete trench for pipes *350
Concrete work, Waterproof 986
Condenser with automatic drain *275
Congo, Belgian, diamonds; map *268, 310
Congo copper ..14, 162, 366, 612, 729, 1164, 1168
Congress, Legislation in ..166, 174, 199, 202, 213, 295, 300, 310, 346, 348, 390, 404, 394, 440, 487, 532, 534, 594, 634, 644, 728, 773, 777, 930, 953, 978, 1026, 1086, 1183, 1218
Congress, Smelting investigation ..440, 613, 630, 632
Congress, Steel investigations ..152, 153, 166, 200, 262, 344, 596, 909, 1258
Congress mine, Colo. 1104
Coniagas, Ont. 192, 430, 470, 664, 1202
Conklin, H. R. Piping for continuous agitation *591
—Elec. furnace, Lluvia de Oro, *1189, 1164
Conkling Mg. Co. 329
Connection, Raise, Surveying with transit 1125
Connely mine, Ont. 717
Conner, C. R. 422
Conservation and mining law 493
Conservation of natural gas 463
Colsolidated Ariz. Smg. Co. 486
Consol. Fuel Co 828, 1195
Consol. Goldfields—Golden Kopple mine.1150
Consol. Goldfields of South Af. 86, 795, 917, *1269
Consol. Goldfields of Rhodesia 555
Consol Imperial, Nev. 1106
Consol. Langlaagte 612
Consol. Mercur 47, 71, 72, 1052
Consol. Mg. Co.—Casados 125
Consol. M. & S. Co., Can. ..76, 191, 1096, 1107, 1156
Consol. Nevada-Utah Co. 611
Consol Virginia 142, *169, 190, 668, 1200

PAGE
Constans, A. W. 566
Contact Cop. Co. 189, 197, 715
Contact dist., Nev. 798
Continental Cop. Co. 476
Continental Zinc Co. ..*405, *459, *501, 553
Continuous cyanidation 46
Converting, Basic copper 48, 1078, *1234, 1286
Conveyor belts, Flanged, Grooved idlers for 1130
Conveyors, Belt, Feeders for *1121
Cooke City dist., Mont. 469
Cooper, Arthur 1100
Cooper, W. 1194
Coöperation in research work 203, 298, 584, 729, 730
Cope, W. C. Fuse burning rate 689
Copper, Alaska 7, *55, 57, 1044
Copper, Ariz. 7, 12, 1044
Copper, Arsenical, Influence of oxygen on 1081
Copper assays, Iodide, Kink in 326, 1021, 1166, 1214
Copper, Australasia 8, 89, 596, 648, 680, 728, 796, 951, 1044, 1068
Copper, Blister, Refining of 1272
Copper, Brit. Col. 76, 562
—Smelting 1096
Copper, Butte, mining; production 549
Copper, Calif. 7, 62, 1044
Copper, Camp Bird in 532, 556, 1238
Copper, Canada 7, 8, 561, 562, 728, 1044
Copper, Chile 8, 83, 728, 794, 1044
Copper chips, Binder for 267
Copper, Colo. 7, 60, 1044
Copper Co., Canadian—Furnaces 1286
Copper consumption, Ratio to pig iron.. 776
Copper converting, Basic 48, 1078, *1234, 1286
Copper, Cuba 7, 8, 728, 1044
Copper, Determining oxygen in 1179
Copper determination, Rapid—Oxalate method, etc. 1143, 1166
Copper determinations at Granby 1071
Copper, exports—Discrepancies 346
Copper Extraction Process Co.: Bradley process 47, *403, 533
Copper, Germany, 8, 124, 480, 728, 752, 1024, 1044
Copper, Hard, Ancient tools 986
Copper, How it is sold 877, 939
Copper, Idaho 7, 70, 1044
Copper industry in 1911 7
Copper, Japan 8, 860, 728, 1044
—Neutralizing towers, Ashio smeltery .. 206
—Mine water treatment 537
Copper junk, Treatment of *452
Copper, Katanga 14, 162, 366, 729, 1164, 1168
Copper, Lake, practice changes 484
Copper leaching—"Mabuki-Prozess" ...†1001
Copper market and pries in 1911, etc., N. Y. 8, *13, *20
Copper market in 1911, London..9, *13, *20
Copper, Maryland and Penn. 1218
Copper mattes, Wet assay 262
Copper melting, Electric—Physiological effect 548
Copper metallurgy in 1911 ....47, *403, 533
Copper, Mexico 7, 8, 728, 1044
Copper, Mex.—New district, Sonora 717
Copper, Mich. 7, 11, 1044
—Mines appraisal 780, 1238
Copper milling plans, Lake 531, 534
Copper mine water precipitation 345
Copper mining costs, Utah, Lake, etc. 921, 925, 1023
Copper, Mont 7, 10, 63, 550, 1044
Copper, Nevada 7, 8, 1044
Copper, New Mex. 7, 8, 61, 1044
Copper-nickel additions to iron 1089
Copper ore, Low-grade, mining during high price 1115
Copper ores—Gahl's concentration, leaching, decantation 885, *1046
Copper ores, Low-grade oxide, Treatment of 985
Copper, Peru 8, 728, 930, 1044
Copper Producers' Asso. 346, 1044
Copper, Prospects for 824
Copper Queen, Ariz. 12, *349, 838
—Report 593
—Unit labor costs 741
—Compressed air per ton 789
—Smelting operations 837
—Time loss from accidents 838
Copper Range Consol. 12, *254, *443, *490, *539, *735, 763, 786, 822, 859, *881, 959, 1023, 1036, 1105
—Baltic mining method 821, *843, *897, *947
—Report 978
—Mine car *1126
—Pipe flanges without gasket *1128
—Costs *844, 846, *898, *950, 1131
—Ore skip *1265
Copper Reef, Ariz. ..377, 1005, 1103, 1131
Copper refiner, Early—H. Johns 1183
Copper refinery stocks 1065
Copper refineries, Elec., Capacity 8
Copper, Reworking stope fillings for .. 469
Copper, Rhodesia 87
Copper River Ry. .. *55, 57, 440, 726, 728
Copper, Russia 8, 91, 202, 728, 1014, 1024, 1014, *1231

PAGE
Copper sampling, Mathematics of ..*703, 729, 1213
Copper—Secondary sulphide enrichment 364, 729
Copper & Silver Zone ... 139
Copper situation and market—Editorials, etc. ..152, 296, 629, 870, 922, 969, 1116, 1296
Copper situation, Some aspects ...1209
Copper smelting at Kyshtim ...*1231
Copper, South Af. mines ... 357
Copper, Spain and Portugal 8, 674, 728, 1044
Copper sulphate, U. S. ...1, 40, 340
Copper, Tex., explorations ... 621
Copper, Transvaal ... 86
Copper, United Kingdom ..123, 310, 340, 728
Copper, U. S. ...1, 7, 8, 680, 728, 1044
—Foreign trade ...340, 346
Copper, Utah ...7, 8, 71, 234, 1044
Copper wire bars, Standard specifications 181
Copper, World, production and consumption ...7, 680, 728, 1044
Copying old mine plans ...353, 589
Corbin Cop. Co. ...64, 190, 715, 764
Corbin Copper King ... 142
Corbin J. R. Vanadium sands ... 633
Cordova mines, Ont. ...831, 1156
Core barrels, Long, for vertical boreholes 1128
Cores, Two, from one borehole ..*1176, *1220
Corey, W. E. ... 422
Cornish mines, Accidents in ... 165
Cornish mining notes ... 488
Cornwall, Ankylostomiasis in ...851
Coronado Chemical Co. ... 660
Corrigan, McKinney & Co. ...1212
Corrosion—Removal, prevention ...506, 538, 560, 879
Cortez mine, Mex. ...766, 1202
Coslettizing process and improvement 105, 161
Cost, Copper wire drawing ...1034
Cost data, principal mines ... 132
Cost of mining ton of ore ...1023
Cost, Mining, Miami, Ariz. ...*120
Cost of power installations ... 367
Costa Rica mining ..82, 192, 240, 335, 651
Costs, Copper Range Consol. *844, 846, *898, *950, 1131
Costs of diamond drilling ...1018
Costs of mining and treating small vein 488
Costs on the Comstock ...*172
Costs—Ore extraction, Detroit; Trenching, Nipissing; Machine drilling, Alaska-Treadwell; Unit labor, Copper Queen; Mining in India ... 741
—Labor output, U. S. Steel Corporation; Republic I. & S. Co.; Compressed air, Cop. Queen ... 789
—Melting gold precipitates; Cop. Queen smelting; Mich. iron mining and furnace production; cost of fires; data on underground mining; loss of time from accidents; unit labor costs, Brazil ... 837
—Food supplies ...837, 974, 1022, 1259
—Tonopah-Belmont: unit production, Tenn. Cop. Co.; elec. power, Pac. G. & E. Co.; Balaklala smelting; unit costs, small cyanide mill; shaft sinking, Wis.; locomotive supplies; openpit mining, Mesabi; development work, Alaska-Treadwell ... 937
—North Butte; Tonopah-Belmont; Osceola; development work, Cobalt; wages, Porcupine; Temiskaming; Mohawk; Gt. Boulder Perseverance; water consumption, Detroit Cop.; smelting, Tenn. Cop. ...1033
—Oriental Consol.; Tamarack; Anaconda; Cop. Range; Cal. & Ariz.; unit labor, Mich. cement; Robinson, Transvaal; power, Balto. Cop. Wks. .1131
—Hand sorting and developing, Ferreira Deep; Mass Consol.; Ivanhoe; pig iron making in 1909; Minas del Tajo milling; Allouez ...1226
Costs, Ore dressing, Joplin ... 553
Costs, Snake Creek tunnel ...*1275
Costs, Tonnage, Basis of calculating 247, 250, 298, 393
Costs, Utah Cop. Co., in Lake Sup. figures ... 921, 925
Cottrell process ...44, 49
Coulson, R. H. Cornish mine accidents 165
Coulston, P. B. Exhaust steam turbines *356
Coupal, J. Sam ... 758
Cox, William Rowland ...184, 232
—Suggestions to mining students ... 220
Cradle for dumping cars ...*539
Crane, Balanced cable ...*1278
Crane chains, Strength of ...1222
Crane, Traveling, safety device ...*740
Crane ranch, Calif., gold ...1243
Crane on technical schools ...203, 584
Crane, W. R. ...1148
Cranston, Robert E. ... 614
—Calif. gold dredge ..*359, *417, *455, *507
Creede, Colo., district map ...†606
Creede Triune Mines Co. ... 423
Crescent Mg. Co., Wash. ...1202
Cribb, Henry ... 710
Cripple Creek ore and waste plant ... *1173
Cripple Creek ores, Cyaniding ... 155
PAGE
Cripple Creek drainage ... 325
Notes ...60, 185, 281, 472, 663, 1004
Crobaugh, Frank L. ... 614
Croesus mine, Calif. ...618, 1101
Crosley, William ... 954
Crossheads, Safety, for hoisting ...*588
Crossland, J. N. ... 632
Crossover switch, Calculating ...*1128
Crown Chartered, Ont. ...430, 476, 670, 766, 914, 1108, 1248
Crown Mines ...46, 795, 924
Crown Point mine, Nev. ...142, *168, 170, 333, 380, 474
Crown Reserve, Ont. ...288, 1108, 1296
Crusher and elevator, Portable ... 884
Crusher feeder, Grizzly ...*883
Crusher, Gyratory, Lowering bottom plate of ...*398
Crusher plate, Canda ...*996
Crushers, Feeding boulders to ...*159
Crushing, Coarse battery, South Crofty.. 174
Crushing frozen concentrate ... 691
Crushing furnace slags ...1262
Crushing, Joplin district ... 408
Crushing plant, Rock, Kensico ...*450
Crushing plant underground ...1265
Crushing practice, Progress in ... 543
Crushing rolls, Improvements in ..370, 394
Cryolite, Greenland, exports ...613, 1124
Crystal Falls Iron dist. ...1020
Cuba copper ...7, 8, 728, 1044
Cuba iron ore ...195, 200
Cuba, Situation in ...1209, 1213
Cubilete Co., Mex. ... 622
Culbertson, J. D., Death of ... 614
Culebra cut, Heated areas ... 685
Culley tunnel, Colo. ... 233
Cumberland mine, Mont. ... 233
Cunningham, W. H. ... 422
Curie's, Mme., radium studies ...1137
Curnow, John ... 614
Curran, T. F. V. Vanadium—Its ores and uses ...1093
Cuyuna iron range ...1025
—The ores ...1284
—Minor mention; shipments; deposits, railroads ...32, 652, 1101, 1188
Cyanidation in 1911 ... 45
Cyanidation, Physical chemistry and..1165
Cyanide bullion, Cadmium and nickel in 733
Cyanide cleanup, The ...1164, *1189
Cyanide industry in 1911; potassium cyanide imports; Foesterling patent; cyanamide ... 126
Cyanide mill metallurgical records ...*791
Cyanide mill, Small, Unit costs ... 937
Cyanide mills, Extraction determination .970
Cyanide plant, Calculator for ...*691
Cyanide plant, Chispas, Sonora ..200, *215
Cyanide plants, Homestake sampler for *541
Cyanide poisoning of cattle ...1179
Cyanide poisoning prevention, Transvaal 642
Cyanide process, History of ...1119
Cyanide, Sodium, Making ... 885
Cyanide solutions, Clarifying..*158, 739, 936
Cyanides from aluminum nitride ... 986
Cyaniding—Colburn-Ajax mill ..53, 59, 711, 742, *753, 1153
Cyaniding—Continuous-agitation piping *591
Cyaniding Cripple Creek ores ... 155
Cyaniding—Filter leaf wash ...*639
Cyaniding—Gravity filters, Mont. ...*368
Cyaniding—Hafer pulp agitator ...*1038
Cyaniding, Lime in ... 869
Cyaniding, Note on ... 249
Cyaniding, Nova Scotia mill ...1133
Cyaniding of concentrate; sodium sulphide as precipitant ...822, *839, 973
Cyaniding—Purifying air for agitating pulp ...*692
Cyaniding—Settling mill slimes ...389, *411
Cyaniding—Slime problem; Trent separator ...821, *1259
Cyaniding, Stratton's Independence 296, *311, 442
Cyaniding tailings in Colombia ...*498
Cyaniding, Tests of zinc dust for ...*943
—Murray's investigation ...641, 946
Cyaniding—Zinc-dust feeders, ...*755, *1095
Cyaniding—Zinc-dust precipitation ...1081
Cyaniding weathered pyritic tailing ... 605
Cyferfontein farm gold discovery ... 204
Cylinder, Air-compressor, Patching ...*492

D

Daley, James ... 758
Dalton & Lark report ... 573
Daly Judge, Utah ...765, 1247
—Reports ...752, 1010
Daly Reduction Co. ... 791
Daly West, Utah 239, 281, 334, 475, 622, 716, 1058, 1155, 1295
Dam for settling pond ...*491
Dam, Mine, Strength of ... 879
Dam, Timber, for mine use ...*161
Dams, Witherbee-Sherman, burst ... 876
Dana, R. T. "Rock Drilling" ... †183
Dangerous ground on Mesabi, Mining ..*1219
Daniels, J. Gravity plane ...*933
Dankwardt, Paul ... 614
Data of world's principal mines; tonnage costs ...132, 250, 298, 393
Data on underground mining ... 838
PAGE
Daubine's blast desiccation method ...*595
Davis-Biram mine anemometer ...*358, 633
Davis-Daly, Mont. 64, 332, 521, 668, 859, 1008, 1151
Dawley, C. A. ... 907
De Bavay process ... 89
De Beers Consol. ...5, 87, 357, 403, 1023
De Camp, W. C. ... 614
De Sabla, Eugene ... 184
Del Mar, Algernon ... 758
—High Grade dist., Calif ... *799
Deadwood Assay Office statistics ... 186
Deadwood L. & Z. Co. ... 808
Deadwood mine, N. M. ...691, 813, 913, 1106
Deane elec. pumps, Calif. ... 934
Decantation processes, Continuous, Gahl ...*1016
Decanting hose, Flexible ... 787
Decrepitation, Ore separation by ... 1184
Dee concentrator ...*159
Defty, W. E. Vulture mine ...*1044
Del., Lack. & West. anti-accident photos. 297
Del Mar, A. Ore bin chute gate ...*735
"Demandments, Ten" ... 391
Demming, H. C. Penn. ore deposit ... 632
Dennis, J. S. ... 422
Denton, F. W. ...822, 845
Denver meeting, etc.—Government aid 103, 107, 151, 154, 185, 203, 295, 310, 328, 348, 394, 1026
Depreciation, gas and oil fields ... 319
Desilverizing process, Pattinson ...1120
Desk, Portable, Surveyor's ...*160
Desloge Consol. Lead Co. ... 18
Detinning, Electrolytic ... 702
Detinning in alkaline solutions ...1129
Detinning in Italy ...1082
Detroit Cop. Co. ...13, 593
—Ore extraction costs ... 741
—Water consumption ...1034
Development work costs, Cobalt ...1033
Dewatering devices, Progress in ... 547
Dewatering screen, Stationary ...*1177
Dewey, F. P. Platinum determination.. 515
—Screening ore samples ...533, 633
—Cadmium and nickel in cyanide bullion ... 733
Diamond drill. See "Drill."
Diamond field, South Af. ...1277
Diamond rock, Ky.—Kimberlite ... 488
"Diamond, The" ...†183
Diamond Vale Collieries Co. ... 680
Diamonds, Ariz., Search for ...679, 730, 974
Diamonds, Arkansas ... 6
Diamonds, Belgian Congo ...*268, 310
Diamonds, Brazil—New discovery ... 814
Diamonds—De Beers report ... 403
Diamonds, Hudson Bay region ...1052, 1202
Diamonds in 1911 ... 5
Diamonds, Rhodesia, Litigation ...87, 357
Diamonds, Transvaal 85, 86, 612, 924, 1238, 1277
—New diggings ...240, 657
Dielectric constants ... 699
Dierolf, J. Fred. ...1288
Diesel, Rudolph, honored ... 907
Differdange I. & S. Works ...*595
Diffusion of metals ... 790
Diller, J. S. Asbestos ... 652
Discharge manifold, Air compressor ..*1028
Disinfection of swimming pools... 253
Distilling alloys in vacuo ... 642
Dives-Pelican, Colo. ...1292
Dividends in 1911 ...35, 209
—By months, 1912..300, 486, 680, 875, 1118
Dividends, Calif. oil ...392, 852, 1026
Dividends small, "earnings" large ... 484
Divining rods ... 1019
Dobbins core drill ...*1135
Doble Mines, Ltd., wages ...1033
Doctor-Jack Pot ...542, 1245
Doe Run Lead Co. ...17, 18, 380, 1130, *1177, *1269
Dolores mine, Chihuahua, Mex. ... 430
Dolores mine, Nuevo Leon, Mex. ... 670
Dome Extension, Ont. ..476, 814, *891, 1296
Dome Lake mine, Ont. ..430, 962, 1108, 1248
Dome Mines Co., Ltd. ...73, 376, 424, 476, 524, 568, 647, 664, 760, 862, 914, *891, 1058, 1108
—Report ... 251
—Description of mine ... *731
Dominion Metals Co. ... 518
Dominion Nickel Copper Co. ..17, 335, 1108
Dominion Safety Explosives Co. ..766, 1296
Dominion Steel Corp. report ... 1284
"Don'ts" in using explosives ... 256
Dor-Delattre zinc apparatus ... 42
Dos Estrellas, Mex. ...288, 391
Douglas, Jas. Copper in Ariz. ... *12
—Ratio of copper to pig-iron consumption ... 776
Drafting board, Adjustable ... *1130
Drafting tables, Lighting trough for . *205
Draftsmen, Suggestion for ... *540
Dragon Consol., Utah ...71, 523, 621, 1201, 1295
Drainage. See also "Cripple Creek," "Snake Creek," etc.
Drainage, Mine, Ejectors for ... 353
Draining gravity planes ...*160
Draining shaft through drill hole ... 491
Drake, Francis ... 710
Draper, F. W. ... 516

PAGE
Drawing. See also "Drafting."
Drawing—Underground sketching board *834
Dredge, Bucket, Shifting a 540
Dredge buckets, Note on 439
Dredge, Calif. gold ..*359, *417, *455, *507
Dredge, Gold, installations during 1911 555
Dredge—Gold saving tables *396
Dredge, Largest ladder, Panama 391
Dredge Modern gold, Georgia *848
Dredge, New gold, at Oroville—Gardella's Oro Vista 306
—Note 281
Dredged ground, Fertility of 513
Dredges, Gold, Overturned, Righting ...*316
Dredges, Gold, Calif., Reconstructed..1048
Dredges, upper American River *997
Dredging, Alaska 57, 58
Dredging and hydraulic mining plant, Combined 742
Dredging, Calif., note 908
Dredging gold, Idaho 70, 667
Dredging gold Mont. 64
Dredging, Gold, Northern Calif. *607
Dredging, Gold recovery in 214
Dredging, Russia 92
Dredging, S. D. 66
Drift, Sealed *738
Drill bit design *927
Drill, Core, Dobbins *1135
Drill dust alleviation ..85, *540, 855, *1219
Drill holes—Surveying instrument *980
—Long core barrels 1128
—Two cores, one hole *1176
—Correcting meandering *1220
Drill post collar, Improved *979
Drill post with removable screw *395
Drill, Rock, Wizard *416
Drill steel, Landling, Champion mine ..*881
Drill steel, Tempering 931, 981
Drills in wide stopes, Scaffolding for ..*399
Drills, Stuck, Wrench for *396
Drills, Testing air consumption *1268
Drilling costs, Alaska-Trendwell 741
Drilling, Deep, Rotary rig 301
Drilling, Diamond, Costs of 1018
Drilling in breast stoping 882
Drilling into misfired holes, Prevention of *1267
Drilling methods, Cop. Range *901
Drilling, Rock, Open Cut Excavation, etc. ....†183
Drilling, Rock, teaching methods *1227
Drilling, Steel used in 778
Drinking fountains, Mine *587, 1075
Driving, Maintaining grade in 635, 831
Driving method, in heavy ground *738
Dross melting, Elec. furnace for 515
Drums, Rope capacity of 1175
Dry walling, Cop. Range *898
Drying iron ore 223
Du Pont de Nemours Powder Co.; explosives, priming, using powder, etc. 270, 347, 441, 533, 584, 633, 681, 730, 825, 872, 1165
Du Pont de Nemours trust dissolved ..1212
Ductility of zinc 402
Dufourcq, E. L. Chispas cyanide plant *215, 200
Dump plate for vertical shaft *1221
Dumping devices, Car *305, *539
Duncan, Kenneth 710
Dunlap camp, Calif. 284
Dunleavey, F. J. 1069
Duquesne group, Ariz. ...235, 330, 471, 665, 1053
Duryea, E., Jr. Reservoir evaporation.. 642
Dust, Drill, alleviation 85, 855
Dust collection, Colburn-Ajax mill.....*753
Dust, Mine, arrester, Lindhorst's ... *540
Dust, Water blast for allaying *1219
Duty. See "Tariff."
Dutton, Maj. C. E., Death of 136
Dwight-Lloyd process ..43, 50, 105, 155, 175, 705, 750
Dwyer, W. J. Nitrate of soda 37
—Bismuth in 1911 39
—Zinc dust in 1911 122
—Cyanide industry 126
Dynamite. See also "Explosive," "Blasting."
Dynamite shortage in Mexico 734

E

Eagle & Blue Bell ..287, 475, 573, 621, 808, 1107, 1201
Earle, E. P. 516
East Butte, Mont. 10, 64, 137, 286, 380, 473, 1056, 1154
East Canada Smg. Co. 524, 962
East Eureka, Calif. 1005
East Rand Prop. ..46, 357, 612, 664, 791, 795, 956
—Affairs 643
—New metallurgy 1123
East Tintic claim decision 1163, 1167, 1289
Echard, W. H., Death of 566
Eddy, L. H. Quicksilver, Calif. 38
—Calif. mining in 1911 61
—Plymouth Consol. Mines, Calif. 181
—New dredge at Oroville 306
—Righting overturned gold dredges ... *316
—Rotary rig for deep drilling 301
—Cross system gold saving tables *396

PAGE
Eddy, L. H.
—Caving of Bunker Hill shaft 402, 485
—Northern Calif. gold dredging *607
—Thiogen process demonstration *873
—Gold Cliff hoist cable break *952
—Elec. mine pumps, Calif. 934
—Dredges, upper American River *997
—Reconstructed gold dredges, Calif. ..1048
—Drying air in telephone 1127
Edgar Zinc Co. 22, 849
Edholm, C. L. Prospecting on city lots 420
—Pipe-line expansion joint *1029
Edison "giant" rolls 370, 394
Edmands, H. R. Cyaniding weathered pyritic tailing 605
Education, On technical 1066
Edwards, Thomas, Death of 854
Egnér's wire tube joint *660
Eichhorn-Liebig furnace *557
Eight-hour bill, Ont. 470, 568, 664
Eight-hour law, Transvaal 357
Eight-hour shift, Lake Sup. 586, 760
Ejector, Home-made *539
Ejectors for mine drainage 353
El Favor Mg. Co. 125, 382
El Frontal mine, Mex. 192
El Monte de San Nicolas 80
El Oro, Conditions at 163
El Oro dist. in 1911 81
El Oro Dredging Co. *316
El Oro Mg. & Ry. Co. 81, 163
El Paso, Colo. ..137, 140, 233, 570, 615, 714, 911, 1199
El Tigre mine report 1212
Elbow union, Peck adustable *367
Eldorado mine, Sinaloa, Mex. 1092
Eldorado Placer Dredging Co. *998
Eldorado & Placer Counties G. M. & P. Co. *999
Electra oilfield, Tex. 95, 97
Electric cables, High-tension, underground 686
Electric circuits, Grounding 492
Electric copper melting, Physiological effect of 548
Electric furnace for dross melting 514
Electric furnace, Girod installations... 420
Electric furnace, Lluvia de Oro..*1189, 1164
Electric Furnaces & Smelters, Ltd. 420
Electric generator and motor maintenance 688
Electric haulage, Copper Range *847
Electric heater, Air-line drain *831
Electric hoist, Cal. & Ariz. *162
Electric hoist, Negaunee mine *395
Electric hoist, shaft sinking, Rand 205
Electric hoist, West Rand 324
Electric hoists compared 993, 1035
Electric induction motor hoists, Control of *589
Electric mine pumps, German *174
Electric plant, Lehigh C. & N. 992
Electric power costs, Pac. G. & E. Co. .. 937
Electric power for mines 677
Electric production, ferro tungsten 173
Electric pumping machinery 111
Electric railroads in Calif. 250
Electric reduction of aluminum 641
Electric signals *537, 1030, *1076
Electric smelting, iron and steel 51, 62, 378, 762, 971, 1025, 1038, 1054, 1244
Electric smelting, Sault Ste. Marie 363
Electric smelting, zinc 42, 314
Electric storage battery locomotives *942
Electric transmission lines, Aluminum.. 458
Electric trolley car, Westinghouse *1134
Electric turbine pumps, Unwatering with 397, 446, 489, *538, 1027
Electric wire tube joint *660
Electrical transmission, South Af. ..742, 804, 1235, 1264
"Electro-Analysis" ....†1001
Electrolysis, Damage by 1229
Electrolysis in cyaniding at Nova Scotia mill 1131
Electrolysis, Samuel Sloan on 1165
Electrolytic copper, How sold 888
Electrolytic detinning 702
Electrolytic dissociation and solvation: electricity and chemical action 653, 696, 800, 987, 1041
Electrometallurgy of tin 410
Electrostatic separator, Payne 324
Elements, Atomic weights of 117
Elevator and crusher, Portable 884
Elevator belt take-up device *787
—Sleeves for worn pulley shafts 936
Elevator boot, Steel *1269
Elevator, Bucket, chart *592
Elevator, Bucket, catch box 740
Elevators, Link-Belt 308
Elevators, Mill, Joplin district....409, *462
Elk Mountain dist., Nev. 798
Elkhorn & Duluth Devel. Co. 333
Elkhorn mine 1056
Elkton Consol. 284, 469, 570, 1055
—Report 515
Elliott, A. H. 854
Ellis, T. W. Grounding circuits 492
Ellis, S. C. 1100
Elm Orlu, Mont. 137, 959, 1240, 1289
Elm River mine, Mich. 189, 197, 715
Ely Central, Nev. 1100
Ely Central convictions 542

PAGE
Embankments, Surveying new cross sections for *1076
Emerald discovery, Peru 914
Emerson, E. H. Fighting at Cobre....1213
Emery's ore separation method 1184
Emmons, N. H. 1194
Emmons, N. H., 2d. Showing ore reserves *505
Empire mine, Calif. 61, 140
Empire mine, Mich., hoisting 980
Employers' liability discussed, Canada.. 535
Employers' liability, Mich. 463
Empson, G. R. 806
Empson, J. B. Slow-speed Chilean mill 259, 393
Emrich, H. H. Refining blister copper..1272
Enamel Co. of Am. 6
Engine foundations 638
Engine, Hoisting, repair job *353
Engineering career, Unsuccessful 1257
Engineering frauds 996
England. See "United Kingdom."
Enterprise mine drafting board *1130
Erdletz, J. F. 662
Erie Consol. mine road 785
Ernestine, N. M. 61, 190, 239, 428, 813, 1009, 1154
Esperanza mine, El Oro *352, 476, 862, *1266
Eureka Leasing 1107
Evans, George Watkin 806
Evans mine, S. D. 1107
Evaporation from reservoirs 642
Evaporation problems, Graphic solution *354
Exhaust-steam turbines *356
Experiment stations, Govt...103, 107, 151, 154, 203, 295, 310, 348, 394, 1026
—Notes 185, 328
Explosions, Aluminum dust 308
Explosions, Mine, Prevention of 1179
Explosive. See also "Blasting."
Explosive—"Dinitrolite"—Dominion Co.'s 766, 1296
Explosive, Safety, Utahnite 416, *1039
Explosive—Whale-oil glycerine 202
Explosives—Champion powder house...*490
Explosives, Coal mining, investigation.. 358
Explosives, "Don'ts" in using 256
Explosives, Facts about 687
Explosives fumes, Neutralizing 255
Explosives, Recent developments in 248, 270
—Where should primer go?....347, 441, 533, 584, 633, 681, 730, 825, 872
—Careless use of powder 1165
Explosives trust dissolved 1212
Explosives used, Great Brit. 310
Exports. See also metals, countries, etc.
Exports of copper 346
Express companies' prosecution proposed 439
Extraction determinations, cyanide mills 970
Extraction tests, Graphic method of illustrating *639
Eye, C. M. 280
—Pres. Taft at Homestake 204

F

Famatima Development Co. 83
—Report 230
—Tramway to mines *601, *693
Fan, Shaft water to drive 783
Farrel, F., Sr., Death of 184
Farrell, J. J., Testimony of 200, 262
"Fault Problems, Graphical Solution" ..†373
Federal Lead Co. 18
Federal M. & S. Co. 16, 152, 285, 613, 1245
Feeder, Belt, Carr's homemade *1224
Feeder, Challenge, Simplified *209
Feeders, Crusher *159, *883
Feeders for belt conveyors *1121
Ferguson, S. B., Death of 854
Ferreira Deep hand sorting and developing costs 1225
Ferrell, John, Death of 201
Ferric oxide and alumina separation.. 372
Ferromanganese, Molten, Use of 1081
Ferromanganese, Duty on 829
Ferromanganese, U. S. 1
Ferrotungsten production, Electric 173
Fichtel, C. L. C. Lake Sup. dist. 11
Filing engineering notes 112
Filling methods, Copper Range ..*845, *902, *949
Filling, Sand, Simmer & Jack 1264
Filling, Stope—Tram car *443
Filter, Centrifugal slimes 790, 974
Filter leaves, Acid treating *639
—With lactic acid 742
Filter litigation 440
Filter plant, Gravity, Mont. *368
Filtration, Slime, in 1911 46
Finger-pin timbering in swelling ground *349
Finlay, J. R., and Mich. taxation ..108, 1020, 1212, 1264
—Remarks on appraising mines 780
—Mine valuation 1238
—On industrial advance 1211
"Fire Assaying, Manual of" ....†565
Fire protection, Pumps for *1075
Fires, Collapsible air ducts for *638
Fires, Mine, Cost of 838
Fires, Mine, Gas analysis in fighting ..1271

PAGE
Firebrick at high temperatures 354
Firebrick, Effect of Sulphur on 369
Firmstone, F. Gravity plane 826
First aid, Cleveland Cliffs 1196
First aid to mining machinery....*224, *321, *353
Fischer, F. W. Erecting stack 692
Fischer, S. Carnotite concentration...1180
Fishback, M. Utahnite explosive *1039
Fisher, F. L. Mont. in 1911 63
—Surveyor's backsight sconce *1125
—Shaft station safety gates *1175
Fitzgerald, F. A. J. Refractory materials 1081
—Heat-insulating materials 1082
Fitzgerald, J. M. 854
Flagg, Arthur L. 662
Flaherty, R. H. 662
Flanges, Pipe, without gasket *1128
Flanges, Triangles for drawing *540
Fleming, Henry S. 614
Floorings, Magnesia for 886
Floors, Cement, Covering for 640
Florence-Goldfield 67, 1294
—Report 827
—Ore strike 1118, 1171, 1201, 1246
Florence M. & M. Co. 807, 811
Florida fuller's earth production 782
Florida phosphate production 798
Flotation at Broken Hill 88
Flotation process, Leuschner 924
Flotation process, Molybdenite ores *227
Flow of streams, Measuring 399
Flow, Water, recorder, Lea *1089
Flue dust concentration, Lead 44
Flume construction in Colombia *649, *880
Flux in iron furnaces 49
Flux, Scrap lead refining 1271
Flynn, C. B. 1194
Foesterling cyanide patent 126
Fohs, F. Julius 458
Foley-O'Brien mine, Ont. 234, 1058
Food for miners...... 837, 974, 1022, 1259
Forbes, D. L. H. 907
—Settling mill slimes 389, *411
Ford concentrator, etc. *461, *462
Ford, Joseph, Death of 566
Foreign trade, U. S. 197, 336, 338, 340, 346, 385, 479
Forest reserves, Mining on *1215
Forestry, Practical, Piece of.....1218, 1260
Forrester, C. C. 710
Fort Bidwell Consol.........*799, 923, 972
Fortuna mine, Ariz., History..........*372
—Note 569
Foster, W. H. 374
Foundation bolts *205, 690
Foundations, Engine 638
Foundry, Repair, work *224, *321, *353
Four Metals Co. 1291
Fourth of July, Mont. 141, 1056
Foust jig, Joplin dist. *459
Fox, C. H. Acid treating filter leaves..*639
Fox, F. S., Death of 1288
France coal 718
France gold 3, 320, 673
France iron and steel and ore....385, 865
France, Vanadium industry in 515
Frank, Alberta, landslides.........686, 962
Franklin, Mich. 12, 141, 332, 379, 472, 1153
—Ten-ton skip *635
Franklin Inst. medal awards 468
Frasch, Herman 152, 184
Fraser, L. Surveying new cross sections for embankments *1076
Fraud, Stock, liability, N. Y. 1019
Frauds, Engineering 996
Frauds, Stock—Postal statistics 201
Free Gold M. & M. Co. *368
Freed Coal Land Entries 1101
Freeman, E. C., Death of 1002
Freer, P. G., Death of 854
Freezing, Shaft sinking by 552
Freezing of air exhaust, Preventing... 783
Freiberg, Anglo-American Club 486
Freibergers, Old 252
French, A. T. Proximate analyses 1143, 1166
French Guiana. See "Guiana."
Frewen, Sir M., on silver 727
Friction in air pipes 834
Friend, J. E., Death of 907
Friendly, O. N. Lining Snake Creek tunnel *1273
Fries' "Synchron" respiration apparatus.*548
Fritz, John, Autobiography of ....†805
—Illness 874, 1100
Frost, M. Peculiar tin mine 600
Frozen concentrate, Crushing 691
Fujita, Baron, Death of 1002
Fuller, J. T. Ark. diamonds 6
—Basis of tonnage costs 393
—Where should primer go? 730
—Cartridges for tamping dynamite ...1175
—Prevention of drilling into misfired holes *1267
Fuller's earth in 1911 1044
Fuller's earth production, Fla......... 782
Fulton, C. H. "Fire Assaying" ......†565
Fume. See "Smeltery," "Lead."
Furnace. See also "Electric," "Smeltery," "Converting," "Roasting," "Gas," "Concentration," etc.
Furnace—Air in pyritic smelting 797

PAGE
Furnace, Blast, Heat balance 986
Furnace, Blast, Titanium in 1082
Furnace gases, Heating by 641
Furnace gases, Sampling 115
Furnace—Gold precipitates melting cost 837
Furnace, Iron blast, changes 596
Furnace, Iron, blast desiccation *595
Furnace ports, Openhearth, Changeable 51
Furnace practice, Iron, 1911........50, 155
Furnace tap plugging device 788
Furnaces, Canadian Cop. Co. 1286
Furnaces, Flameless gas *177, 309
Furnaces for metallic junk *452, *454
Furnaces, Iron, at Buffalo 162
Furnaces, Zinc 42
Furukawa Mg. Co. 206, 537
Fuse burning, Rate of 689
Fuse, Table for cutting *933

G

Gabrielli's ore roasting patent 885
Gage for sheet zinc 463
Gagnon and other inclines 826, 926
Gahl's metallurgical processes ..885, *1046
Galena, Blast roasting of *750
Galvanizing aluminum 642
Garbutt mine, Colo. 284, 1244
Gardella's dredge, Oroville 281, 306
Garfield smeltery steel stack *303
Garnet placer-mining dist. 908
Garrey, George H. 232
Garthwaite, E. H. Mine sampling....1276
Gas analysis in fighting mine fires 1271
Gas, Blast-furnace, use 50
Gas-engine exhaust muffler, Movable ...*984
Gas fields, Depreciation of 319
Gas, Flameless combustion of *177, 249, 309
Gas, Flue, temperature pendants...... 158
Gas, Mid-Continental field 95
Gas, Natural, Canada 75, 561, 563
Gas, Natural, conservation 463
Gas, Natural, Hamburg, Germany 808
Gas, Natural, Mesa Co., Calif. 188
Gas, Natural, Mont., discovered 1149, 1242
Gas, Natural, Texas 97, 913
Gases, Blast-furnace, Heating by 641
Gases, Furnace, Sampling 115
Gases, Pyrites burner, Cooling 326
Gaskets, Wooden, for boilers 1270
Gasoline from natural gas 958
Gate, Chute, Baltic mine *351
Gate for skip loading bins *254
Gate for vertical chutes *256
Gate, Safety, for cages *161
Gate, Tailing, for jigs 692
Gates for ore-bin chutes *157, *735
Gates, Shaft station safety *1175
Gay-Lussac silver determination, Tin in 974, 986
Gayley, J. Dwight-Lloyd process 155
Gaylord Mg. Co. 1000
Geddes shovel dipper trip *447
Gee, W. J. Centrifugal slimes filter 790, 974
Geldenhuis Estate 53, 84
Gelsenkirchener mine, Locomotive at...*657
Gemini, Utah 475
Gems. See "Precious stones," "Diamonds."
General Devel. Co. 187, 189, 440, 775
General Elec. locomotives *942
General Vanadium Co. 1093
Generator and motor maintenance 688
Geological Survey. See "Survey."
Geology applied to mining 348
George, H. C. Appalachian and Lima oilfields 96
Georgetown district, Mont. 663, 1241
Georgetown Gold Mg. Co. 238
Georgia gold and silver 3
Georgia, Modern gold dredge *848
German metal trade 480
German, North, miners' ages 705
German potash-salts exports 387
German potash situation.....125, 262, 1082
German potash statistics 782, 1024
Germania Tungsten, Wash. 573
"Germany, Barite Deposits of" ....†757
Germany coal 431, 752, 1024
Germany copper 8, 124, 480, 728, 752, 1024, 1044
Germany gold; natural gas 808, 1024
Germany iron, steel and ore... 124, 296, 385, 433, 577, 865, 870, 942, 1024
Germany, Mineral production of 1024
Germany, Mining affairs in 779
Germany, Mining engineers organizing in 776
Germany, Mining industry in 124
Germany—Prussian 1910 production... 752
Germany spelter and zinc....202, 752, 1024, 1095
Germany—Upper Silesia cadmium..... 449
Geronimo mine draining 491
"Get-Rich-Quick" man 1211
Gettysburg mine, Idaho 619
Giant Mines, Rhodesia 87, 612, 829
Gibson Copper Co. 139, 471, 617, 910, 1053
Gibson, T. W. Ont. output *73
Giesecke mill 53, 84
Gilbert, G. K. 974

PAGE
Gilmore dist., Idaho ... 69
Gilpin Co., Colo., output 188
Gilsonite affairs, Utah .. 855, 908
Girod elec. furnace installations 420
Giroux Consol., Nev. 67, 142, 309, 838, 860, 961, 1118, 1210
—Report 551
Gladiator property, S. D. 282
Gladstone mine, Calif. 1292
Glass, Titanium or zirconium 790
Glass tubes, To cut 391
Glass' copper chip binder 267
Globe-Miami wage increase 1196
Globe & Phoenix, Rhodesia 45, 87, 612, 829, 924
—Report 1239
Glycerine, Dynamite, Whale oil for.... 202
Goerens, Paul 806
Goetz, A. Eastern Michipicoten range.*1090
Gold absorption by retorts 513, 523
—By amalgamation plates 541
—By mills 740
Gold, Adirondack, schemes 392, 437
Gold, Alaska 3, *55, 237
Gold, Ariz. 3, 68
Gold, Artificial 647
Gold, Australia, Australasia 3, 87, 88
—New South Wales 774, 1068
—West Australia 596, 774
—Tasmania 648, 774, 796
—South Australia 774, 951
—Queensland 774, 951
—New Zealand 542, 774
Gold, Brit. Col. 75
Gold Bullion Mg. Co. 284
Gold, Calif. 3, 61
Gold, Cambria Fuel mines 775
Gold, Canada 3, 561
Gold, China 3
Gold Cliff hoist cable break *952
—Open cut rim caving 1244
Gold Coast. See "West Africa."
Gold, Colo. 3, 59, 924
Gold, Commercial movement 4, 152, 166, 291, 433, 673
Gold Dollar mine, Colo. 1199
Gold dredge, Modern, Georgia *848
Gold dredging. See "Dredge."
Gold, France 3, 320, 673
Gold, Germany 808, 1024
Gold Hill mines, Nev. *167
Gold Hunter mine, Idaho 331
Gold, Idaho 3, 70
Gold in 1911 3
Gold, India 3, 212, 385
Gold Links mine, Colo. 1051
Gold, Madagascar 3
Gold, Manitoba, rush 201, 258
Gold manufacturing method, Verley's .. 583
Gold market, London 166
Gold, Mexico 3
Gold, Michigan 3, 1000
"Gold Mines," etc. (in French) ......†805
Gold mining near Wash., D. C. 298
Gold, Mont. 3, 64
Gold, Nevada 3, *67
Gold, Nicaragua 81
Gold, Oregon 3, 62
Gold precipitates, Melting cost 837
Gold recovery in dredging 214
Gold, Rhodesia 3, 86, 335, 555
Gold, Russia 3, 90, 1074
—In Urals 1179
Gold, San Francisco, movement........ 585
Gold saving tables *456
—Cross system *396
Gold, silver, platinum assay 1280
Gold smelting, electric furnace *1189
Gold, South America 3, 82
Gold, South Dak. 3, 67
Gold, Sumatra 31
Gold, Swaziland 258
Gold test, Titanium chloride 742
Gold, Texas, discovery reported .. . 477
Gold, Transvaal 3, 84, 152, 195, 612
—Rand output 518
—Discoveries 204
Gold, United Kingdom, movement .... [illegible]
Gold, U. S. 1
—By states 3
—Quantity used in arts 81
Gold, Utah 3, 71, 274
Gold, West Africa 3, 92, 288
Golden City, Ont., fire 138
Golden Crest, S. D. 712
Golden Cycle, Colo. 35, 59, 284, 379, 472, 714
Golden Reward, S. D. 65, 760, 1009
Goldfield Belmont 67, 190, 380, 474, 522
Goldfield Consol. 36, 67, 875, 1008
—Milling 53
—Monthly operations ...118, 142, 258, 333, 487, 522, 684, 716, 876, 960, 1124, 1154
—Production in 1911 286
—Annual report 317
Goldfield Deep; Goldfield Merger 912
Goldschmidt Thermit Co. 829
Gonzales, F. "Mining Industry, Mex." †183
Gonzales, M. C. Development at Collahuasi 794
Goodloe, Meade 778
Gosselin mine, Ont. 73, 670, 862, 1108
Gould, Charles N. 566

PAGE
Government aid to mining—Experiment stations... 103, 107, 151, 154, 185, 203, 248, 295, 310, 328, 348, 394, 1026
Government Gold Mg. Areas Consol. 1073
Gowganda dist., Ont. 1073
Gowganda and Porcupine, Geology between 1171
Grace Zinc Co. flow sheet *503
Grade, Maintaining, in driving 635, 831
Gradenwitz, A. Ore wharf, Chile *981
Granby Consol.... 35, 75, 76, 562, 563, 622, 814, 962, 1096
—Slag disposal *935
—Copper determinations 1071
Granby M. & S. Co. 22, 626, 763, 850
Grand Central G. M. Co., Calif. 426
Grand Central, Utah 669, 808
Grand View M. & D. Co. 572
Granite-Poorman, B. C. 1156
Grant, J. D. 1202
Graphite in the U. S. 1024
Graphite, Mex. 622
Graphite mining, Vicissitudes of 1279
Graphite, N. Y. 1262
Graphite, Stutzer on .... †565
Grasselli Chemical Co. 22, 41, 72, 83, 122
Gravity filter plant, Mont. *368
Gravity plane, New type 726, *743, 826
Gravity plane with auxiliary hoist *933
Gravity planes, Draining *160
Grayson, G. W., Death of 907
Great Boulder Perseverance costs 1034
Great Britain. See "United Kingdom." 88, 89
Great Cobar, Ltd. *356, 928
Great Falls Power Co. 331
Great Hope mine, Colo. 862
Great Northern Cop. Co. 286
Great Northern Ore—Report 286
Great Northern ore lands 31, 383, 652, 660, 859, 1052, 1188, 1293
Great Western Mg. Co. 286
Great Western Extension 1212
Greaves, R. H. Influence of oxygen on arsenical copper 1081
Greece, Chromiferous iron ores 547
Green Fuel Economizer Co. 158
Green-Mehan, Ont..... 143, 192, 240, 1156
Greene-Cananea (See also "Greene Consol.," "Cananea Concol.").. 14, 78, 201, 240, 524, 680, 962, 1108, 1202
Greene Consol. costs 1023, 1226
—Report 1217
Greene, R. L. 566
Greenland cryolite exports 613, 1124
Greenville mining dist., Calif. 1054
Grenville United, Cornwall 488
Grether, W. S. Elec. signals 1030
Griffin, Frank 184
Grimshaw, R. Elec. mine pumps *174
Grinding analyses and their application 681, 354
Grizzly crusher feeders *159, *883
Grizzly, Rocking bar undercurrent *207
Grondal process, Nodulizing by 790
Ground Hog Mtn. coal fields 430
Grounding electric circuits 492
Grubstake fund, Colo. 60, 807, 1289
Guadaloupe & Porce Mg. Co. 382
Guanajuato Consol. 80
Guanajuato mining in 1911 80
Guanajuato Power & Elec. Co. 81
Guanajuato Reduc. & Mines Co. 80
Guano, Bat 122, 514, 584
Guards, Shaft station *109, *1175
Guatemala mining 82, 476
Guess, George A. 184
—Notes on pyritic smelting 113, 797
Guggenheim, Benjamin 806, 827
Guggenheim, S. R. 1148
Guggenheim Exploration Co... 534, 782, 862, 971
Guggenheims on Alaska 726, 728
Guiana, French, gold 82
Guiterman, Franklin 662
Gunsolus, F. H. Where should primer go? 633, 730, 825, 872
Guy rope tightener *832
Guyot's alunite treatment 564
Gypsum Deposits, Maritime Prov., Can.. †183
Gypsum, Yerington, Nev. 333, 828, 1136

H

Hadfield, Sir Robt. A. 854
Hafer pulp agitator *1038
Hague, W. Basis of calculating tonnage costs 247, 250, 298, 393
Hahn, O. H. Mining industry, Germany 124
Haines, Calvin 1100
Haines, W. B. Zinc ductility 402
Hall, E. J. Niter assay *347
Kink in iodide assay 1166, 1214
Hamburg Bar, Calif., dredging *608
Hamburg, Germany, natural gas 808
Hamilton, E. M. Cyaniding concentrate 822, *839, 973
Hamilton, O. R. 806
Hamilton, S. H. 954
Hamilton & Hansell 954
Hamman, W. D. Searles Lake potash deposit 975
Hammond, John Hays 806
Hannuer, W. Effects of mine atmosphere on miners 852

PAGE
Hancock jig tray and support *1177
Hancock mine, Mich. 12, 189, 197, 237, 532, 534, 571, 714, 1007, 1055, 1199, 1245, 1293
Hand sorting 152, 543
Hand sorting, Ferreira Deep 1225
Hansen, W. G. 374
Hanson, C. B. Where should primer go? 872, 1165
Hanson, Henry 232
Hanson, William 710
Hanssen, C. Suggestion for draftsmen.. *540
Harbord, F. W. Trollhättan smelting.. 314
—"Metallurgy of Steel" .... †1193
Hardie, Geo., Death of 710
Hardinge, H. W. 1148
—Wet concentration, furnace slags.... 1262
Harger, J. Preventing explosions 1179
Hargrave, C. L. Cyaniding, Nova Scotia mill 1133
Hargrave, Ont., report 574
Harris, C. T. 758
Harris, E. G. Air-pipe friction 834
Harrison, J. W. Tipuani rush 1069
Hart, Oliver, Death of 422
Hart Consol. Mg. Co. 542
Hartman, Charles, Jr. 1148
Harvey, C. T., Death of 662
Hasenclever-Helbig roaster *557
Hasenclever, M., Sulphuric acid mfr. .. 175
Hatch, F. H. "Mineralogy" .... †757
Haulage, Electric, Cop. Range *847
Haulage—Gravity plane 726, *743, 826
Hauling heavy machinery 157
Hansman, F. William 566
Haviland, J. T. 854
Hawke, Robt. J., Death of 184
Hawley's niter assay method *347
Haworth, E. Oil and gas, Mid-Continental field 95
Hawthorne, Julian 105, 153
Hayden, Evans & Hayden 632
Haynes, J. R., on federal inspection 1210
Hazard, F. H. Splitting pulp samples *109
—New design undercurrent grizzly *207
Hazel T. mine, Mont. ... 238, 474, 620, 1008, 1154
Headlight mine, Calif. 137
Health of miners, Govt. investigation.. 942
Heat balance, blast furnace 986
Heat insulating materials 1082
Heater, Air-line drain elec. *831
Heath, G. L. Oxygen in copper 1179
Heather, H. J. S. Control of induction motor hoists *589
Heating attachment, Concrete mixer *208
Hecla Mg. Co. 1036
Hedley, R. R. Smelting, B. C. 1096
Hedley Gold Mg. Co. 75, 76, 717
—Report 504
Heggie, James 1050
Helena, Mont., Gold at 1019
Hendricks, Francis, Death of 614
Hendrickson, William H. 614
Henley, Charles 422
Henrotin, Charles M. 374
Henry, George J., Jr. 280
Henry sizing screen 461, *462
Heraeus resistance thermometer 355
Herbst, Prof. Hoisting ropes 1268
Hercules Mg. Co. 16
Herdy, J. A. Traveling, Colombia 156
—Geology applied to mining 348
Heroult, Paul 1212
Herron, John, Death of 374
Hessyl, U. R. Food supplies 974
Heusler on magnetic bronzes 1081
Hiawatha mine cage *688
Hicks, B. R., Death of 662
Hidden Fortune, S. D. 834
Higginson, E. Peruvian production.... 930
"High grading," Colo. 137
Highgrade dist., Calif. *799, 972
—Notes 328, 469, 761, 911, 955, 1152
—The boom 923, 974
Hill, Alexander, Death of 1240
Hill, A. E. "Qualitative Analysis" .... †373
Hill, C. L., Death of 280
Hill, J. J., Testimony of 344
Hill iron-ore lands 31, 286, 383, 652, 660, 859, 1052, 1188, 1293
Hillen, A. G. 566
Hillside houses for workmen 463
Hirsch, Aron, & Sohn 680
Hirsch, Ralph T. 566
Hirst, H. M., Death of 1100
Hixon, Hiram W. 516
Hobart, F. Gold, silver, platinum 3
—Iron and steel industry 26
Hobson, J. B., Death of 232
Hocking, J. Careless use of powder 1165
Hocking Valley cases 1249
Hockley, E. W. San Francisco mine.... 442
Hodge, W. R. Lighting trough for drafting tables *205
—Target for mine surveying *783
Hodgson, Capt. Joseph 954
Hoffman, F. L. German miners' ages... 705
Hoffman, J. I. Borehole surveying instrument *980
—Long core barrels for vertical bore holes 1128
—Two cores from one borehole *1176
—Correcting meandering of holes *1220

PAGE
Hofman, H. O. Lead metallurgy 43
Hohenlohe Werke A. G. 779
Hoist, Elec., Cal. & Ariz. *162
Hoist, Elec., for shaft sinking, Cinderella Consol. 205
Hoist, Elec., Negaunee mine *395
Hoist, Elec., West Rand Consol. 321
Hoist, Sample, Colburn-Ajax *754
Hoists, Compressed-air, Anaconda's 932
Hoists, Induction-motor, Control *589
Hoisting. See also "Safety," "Rope," "Hook," "Signal," "Car," and hoisting appliances in detail.
Hoisting, Balanced, Sheaves for 158
Hoisting cable, Old, Uses for 253
Hoisting drum rope capacity 1175
Hoisting engine repair job *353
Hoisting, Fast, in Mich. 980
Hoisting machinery, Winch for 935
Hoisting—Overwind prevention...*445, *736
Hoisting plant, Cripple Creek *1173
Hoisting station, Underground *1027
Hoisting systems, Mine, compared..970, 993, 1035
Hoisting through inclines, Safety devices for 485
Hokkaido Coal Co. explosion 875
Holcomb Valley placer gold 858
Holdsworth, F. D. Volumetric efficiency of air compressors *1028
Holland spelter 202
Hollinger, Ont. 240, 300, 329, 470, 717, 766, 814, 914, *891, 1058, 1156, 1248, 1296
—Report 251
—Visit to mine; map *645
Hollister iron mine, Mich. 223
Holloway, G. T. Nigerian tin 885
Holloway gas well, Tex. 913
Homestake Mg. Co. ... 36, 65, 142, 287, 474, *541, 621, *691, 808
—Pres. Taft at Homestake 204
—Employees' aid fund 282
—Report 593
—Amalgamation tables *739
—Water analysis after fire 985
—Conditions at the mine 1025
Hommel, W. Origin of zinc smelting...*1185
Honduras mining in 1911 .... 82, 173
Hook, Safety, for hoists *783
Hooks, Joplin hoisting-bucket *1075
Hooper's metal pouring spout 52
Hoose Mg. Co. 715
Hoover's mine valuation theory 1238
Hopkins, E. F. Nickel metallurgy 442
Hopper, Cast-iron, Making *224
Hore, R. E. Porcupine mines and ores..*891
Horn Silver, Utah 142, 191, 287, 381
Hosking, J. Tomahawk lode 777
—Where should primer go? 825
Hough, George J. 710
Houghton Cop. Co. 12, 189, 379, 521, 1293
Houses, Hillside, for workmen 463
Hoxie & Goodloe 758, 907
Hoyt, H. W., Death of 1100
Huasteca Petroleum Co. 923
Hudson Bay Mines, Ltd. *112, 909
Hudson River tunnel holed through ... 326
Huff electrostatic concentrators 1272
—Notes, etc. 236, 520, 1104, 1120
Hughes, Godfrey 1148
Hughes mine, Ont. 192, 914, 1108
Hughes' lead fume utilization 985
Hulbert, E. J. 777
Hull, J. D. 1288
Huncoat pit, England, hoist *445
Hunner, Earl E. 1288
Huntington mills, Amalgamation tables.*1078
Huntoon, L. D. 374, 854
—Stamp milling in 1911 52
Hupp mine, Calif. 137
Hussey, C. G. 1183
Hussey-Howe, Mich. 332
Hutchins, J. P. Russian Empire 90
Hutchinson, E. C. 710
Hyatt roller bearings 320, 1046
Hydraulic mining and dredging plant, Combined 712
Hydraulic outfit, Santa Rita *649, *880
Hydraulicking, Beauce County, Que ...*1083
Hydraulicking, Prospecting by 882, 1052
Hydro-Elec. Co. 807
Hydro-electric development, Tasmanian.. 886
Hydro-elec. plant, S. W. Mo. 776
Hydrometallurgical zinc processes 43

I

Idaho Continental mine 70
Idaho copper 7, 70, 1044
Idaho gold and silver 3, 69
Idaho lead and zinc.. 16, 69, 329, 773, 1039
Idaho mining in 1911 69
Idaho Tungsten Co. 1153
Idaho, University of 136, 468
Iditarod-Innoko production 58
Idlers, Grooved, for flanged conveyor belts 1130
Idlers, Rope, for inclines *254, *350
Igneous concentration, zinc ore 41, 127
Ilgner transformer hoists 995, 1037
Illinois iron production 307
Illinois petroleum 93, 96
Illinois, Univ. of 513, 907

PAGE
Illinois zinc 21, 1039
Imataca mines, Venezuela 200, 291
Immigration Commission research 106
Imperial, S. D. 1004
Imports. See "Foreign trade," metals, countries, etc.
Incline. See also "Plane," "Shaft."
Inclines, Safety devices for ...485, 826, 926
Independence mine, Idaho 70
Independence Mg. Co., Idaho 1245
Independent Lead-Silver Mg. Co...1152, 1244
Independent Powder Co. 1021
Index numbers, Metals, 1911 2
India. Early zinc smelting *1185
India gold 3, 212, 385
India, Gold coinage for 822
India mining, Data on 741
India silver 212, 229, 230, 1256
Indian currency 212
Indiana cop. mine, Mich. 715, 811
Indiana petroleum 93, 97
Induction motor hoists. Control........*589
Ingalls, W. R. 854
—Metallurgy of zinc 41
—Miami dist., Ariz. *119
—Observations in Butte, Mont. 549
—Visit to Porcupine *645
—How metals are sold—Copper....887, 939
—Spelter statistics for 1911 1039
Inland Steel Co. 297, 763, 879
Inspection, Mich. mine 103
Inspection, Proposed federal mine 1210
Inspectors. Selection of 153
Inspiration Consol... 118, 235, 345, 377, 471, 569, 910, 957, 1151
—Report 1074
Inspiration Cop. Co. *120, 139, 187, 235
Institution of Mg. & Met., Gt. Brit. 374
International Agricultural Corp. 262
International Asso., Testing Materials.. 954
International Congress, Applied Chem.. 422
International Congress on Industrial Accidents and Hygiene 422, 468
International Harvester Co. 222
International Lead & Iron Co. 334
International Smelting Co. 189
International Sm. & Ref. Co. ..47, 234, 470, 483, 517, 615, 763, 1149, 1246, 1293
—Report 1218
International Soc., Mining Accountants.. 758
International Soc. Testing Materials...1148
Iodide copper assay kink.... 326, 1021, 1166, 1214
Iron and steel div. Am. Inst. 922, 923
Iron and steel industry, 1911 26
Iron and steel markets 28
"Iron and Steel, Metallurgy" ....†1001
Iron and steel metallurgy 50, 155
Iron and Steel Wks. Directory ....†1001
Iron and steel prices *13, *20, 29, 30
Iron, Austria, statistics 404
Iron, Belgium, and ore 433, 479
Iron Blossom, Utah 143, 334, 429, 523, 765, 813, 861, 1201, 1295
Iron, Brazil, etc. 173
Iron by-products in Germany 390
Iron, Canada 438, 479, 561, 563
—Bounties 138, 329, 616
—Eastern Michipicoten range *1090
Iron Cap Cop. Co. 283
Iron, Chile, ore 83
Iron, Chinese pig 390
Iron, Copper-nickel additions to 1089
Iron Coslettizing processes 105, 161
Iron County Steel Co. 521, 667, 912
Iron, Cuba, ore 195, 200
Iron determination, Rapid methods 1143
Iron flue dust briquetting 642
Iron, France, and steel and ore....385, 865
Iron-furnace blast desiccation.........*595
Iron furnace, Oxygen additions 1181
Iron furnaces at Buffalo 162
Iron furnaces, Flux in 49
Iron, Germany, and steel and ore ..296, 385, 433, 577, 865, 870, 942, 1024
Iron, Japan 978
Iron King, Utah, report 573
Iron lands law suit, Mich. 1026
Iron making, Economies in 104
Iron, Mex.—Las Truchas 717
Iron, Mich.—Crystal Falls dist. 1020
Iron, Mich., lands taxation 108, 1264
—A note and denial 105, 204
—J. R. Finlay's remarks 780, 1238
—Assessments lowered 1212, 1242
—Various notes, etc. 138, 189, 329, 427, 571
Iron, Mich., mining and furnace production 837
Iron, Mich., ore reserves 799
Iron, Microbe feeding on 871
Iron, Mississippi, ore 1142
Iron, Newfoundland, ore 917
Iron nodulizing, Grondal process 790
Iron, Norwegian, ore 930, 1025, 1038
Iron, Ont., and ore 73, 563
Iron ore, Chromiferious, Smelting 547
Iron-ore deposit, Penn., New? 632, 678, 683
Iron-ore developments, American...... 173
Iron ore, Gt. Northern ...31, 286, 383, 632, 660, 859, 1052, 1188, 1293
Iron ore—Jones step process.. 223, 400, 470, 1055
Iron ore, Lake Sup. dist. 26, 31
—Shipments, 1911, corrected report ... 652

PAGE
Iron ore, Lake, prices 104, 344
Iron ore, Lake rates three seasons...... 527
Iron ore, Mesabi, openpit mining costs.. 938
Iron ore, Mining or buying? 922
Iron ore R.R.'s, Lake Sup. 1188
Iron ore, etc., sintering 43, 50, 105, 155, 705
Iron-ore smelting, Elec. 51, 62, 378, 762, 971, 1025, 1038, 1054, 1244
Iron ores, Lake, Beneficating 222
Iron ores, Lake, East and West 725
Iron ores—Ocean freights 341
Iron, Pig, consumption, Ratio to copper 776
Iron, Rack for storing *112
Iron range, Cuyuna 1025
—The ores 1284
—Minor mention: shipments; railroads 32, 652, 1102, 1188
Iron ranges, Lake Sup. 1116
Iron ranges, Rescue car wanted 684
Iron rates, Southern 248
Iron River dist., Mich., with map, ore analysis, etc. *210
—Season's shipments 138
—New railroad proposed 470
—State report: Finlay's tonnage......1264
Iron River Steel Co. 285, 376, 521
Iron, Russia 91, 1074
—Ornamental mine in Urals *487
Iron sands, Vanadium bearing, Use for 347, 633
Iron separation from manganese 885
Iron Silver Mg. Co. report 700
Iron slag, Roman 847
Iron, Sulphide—Pyritic smelting.. 113, 797
Iron, Sweden, and ore 479, 625, 1217
Iron tariff 166, 199, 213, 346, 390, 953, 1218
Iron, Texas, ore 146, 765
Iron, United Kingdom—Ore mining 123
—Iron, steel, ore trade 291, 385
—Furnace statistics 625
—Ore production 648
—Iron, steel production 1061, 1086
Iron, U. S., and steel and ore 1, 26
—Wrought-iron production 229
—Pig-iron production 289, 296
By states 307
—Foreign trade 338, 385
—Blast-furnace changes 596
—Steel production in 1911 ....830, 870
—Rail production in 1911 ....718, 991
—Titanium and vanadium alloys 652
—Pig in 1909—Various census figures..1225
Iron, Utah, ore 909
Iron, Venezuela, ore 200, 291
Iron works in Transvaal 536
Isabella mine, Colo. 236, 331
Island Copper Co. 1245
Isle Royale Co. 12, 332, 427, 534, 568, 571, 712, 714, 1105, 1154
Italy, Detinning in 1082
Ivanhoe, Australia, costs 1225
Ivanhoe mine, Ariz. 283, 857
Ives, H. 422
Ives, L. E. Safety devices for inclines 485, 826, 926

J

Jackling, D. C. 422
Jacobs, E. Brit. Col., mining 75
Jacoby, James 1148
Jacquier's aluminum alloy 1076
Jadot, M. J. Katanga copper....1164, 1168
Jagger, T. A., Jr. 280, 1194
Jalisco mining in 1911 125
James water blast for dust *1219
Jamison, C. E. Casper oil field 1277
Janin, C. Gold recovery, dredging 214
—Hyd. mining and dredging plant 742
Janin, L., Jr. History of cyanide process 1119
—Physical chemistry and cyanidation .1165
Japan, Ashio smeltery, etc. 206, 537
Japan copper 8, 680, 728, 1044
Japan gold size for joints 1270
Japan iron and coal 978
Jarbidge dist., Nev. 798
—Geology 890
Jarman, A. 422
Jed mine explosion 680
Jennings, Sidney J. 1017
Jersey Valley Mines Co. *796
Jessup, D. W. Vertical stadia wires.... 637
Jig, Hand, Joplin *1079
Jig practice, Progress in 545
Jig types, Joplin dist. 409, *459
Jigs, Hancock, Steel tray and support for *1177
Jigs, Tailing gate for *692
Jigging practice, Joplin 983
—Cast-iron screen frames *1080
Jim Butler mine, Nev. 68, 380
Jobe, W. H. 374
Johns, Henry, early copper refiner. By B. S. Johns 1183
Johns, L. W., Death of 422
Johnson, F. L. Splicing wire rope .. *784
Johnson, Herbert 1194
Johnson, J. P. Rhodesia Mineral Industry ....†183
Johnson, R. D. O. Flume construction in Columbia *649
—Santa Rita pressure box *880
—College man underground 778

PAGE
Joint, Pipe-line expansion *1029
Joint for drift timbers under side pressure *1127
Joint for steel pipe *1026
Joints, Japan gold size for 1270
Joliet, Ill., oil well ....115[illegible]
Jones, Capt. Bill 153
Jones, E. R. Concrete in shafts 1221
Jones, H. C. Physical chemistry. .582, 597
—Electrolytic dissociation and solvation 655
—Studies in solution 696, 774, 800
—Electricity and chemical action. 987, 1041
—Kremann's "Physical Chemistry" reviewed 865
—Mass action and reaction velocity 1087, 1214
—Discussion of radio-chemistry 1137
Jones & Laughlin Ore Co. 105, 204, 138, 141, 189, 329, 586, *1237
Jones & Laughlin Steel Products Co. . 336
Jones step process 400
—Notes 223, 470, 1055
Joplin cars *690, *788, *979
Joplin dist. in 1911 ....24, 1039
Joplin dist. ore dressing... *405, *459, *501, 553
Joplin hoisting-bucket hooks *1075
Joplin jigging practice....983, *1079, *1080
Joplin ore-bin construction *1222
Joplin scraper and loading stick......*1030
Joplin Separating Co. 191
Joplin trommels *836
Joplin—Wilfley table kinks *1129
Jordan, F. E., Death of 1888
Julian, H. F., Death of 827, 1119
Julien G. M. & Dredging Co. 555, 556
Julihn, C. E. 1288
Juniper dist., N. M. 1106
Junk, Metallic, Treatment of *452
Jupiter mine, Ont. ..144, 288, 670, 717, *891, 1010, 1102

K

Kane, David C., Death of 184
Kane, J. I. 758
Kansas oil and gas 93, 95
Kansas, Okla., Zinc smelting 849
Kansas stock vending law 297, 1117
Kaolin—Clay mining 266, 485
Kaolin development, Mex. 524
Karabash smeltery, Russia *1231
Karr, C. Powell 1194
Katanga. See also "Congo."
Katanga copper 14, 162, 366, 729, 1164, 1168
Katy Lou mine, Mo. 715
Keating Gold Mg. Co......... 64, 111, 1293
Keeley mine, Ont. 335
Keene, Joseph P. 516
Keffer, J. W. 1194
Keith, W. S. 907
Keller, E. Copper sampling *703, 729, 1213
Kelly, A. Generator and motor maintenance 688
Kemp, J. F., on Stutzer's "Nonmetallic Minerals" *565
—New iron-ore deposit, Penn.? 632
—"Barite Deposits of Germany" 757
Kemper, H. W., Death of 1002
Kenai Peninsula, Alaska 56
Kendall's iodide copper assay 326, 1021, 1166, 1214
Kennedy, J. E. Zinc, Wis. 25
Kennedy, John H. 1194
Kennedy, Julian 614
Kenny, Alvin R. 374
Kensico crushing plant, N. Y. *450
Kentucky barytes and calcite 458
Kentucky, etc., petroleum 93, 97
Kentucky mineral resources 164
Kern Co. Oil Men's Protective Asso..... 644
Kerr Lake Mine, Ont. 376
Keweenaw Cop. Co. 11
Keys, Cannon for loosening *834
Keystone, Ariz. See "New Keystone."
Keystone Dredging Co., Ore. 63
Keystone-Hill Cy. dist., S. D. 856
Keystone Mines, Amador Co., Calif. 163, 330, 425
Kiddie, John 282
Kilgalian, T. S., Death of 232
Killik, F. A. Separating rock from clay *304, 778
King, D. F. 1240
King, F. C. 614
King Solomon Co., Colo. 236, 619
Kinkead, J. H., Death of 1288
Klamath River, Calif., dredging *607
Kloman iron mine...... 223, 400, 470, 1055
Klugh, J. A. Dwight-Lloyd process 705
Knight, C. W. 479
Knight Consol. Power Co. 422
Knopf, A. Sitka dist. .... [illegible]
Knox, S. L. G. 1194
Kolar field water power 392
Koochiching-Vermilion, Minn. 817
Kooteaay Gold 1262
Kremann, R. "Physical Chemistry" 865
Kreuzpointner, Paul 778
Krug, Karl, Death of 184
Knodelunga-Lulaba Co. *268, 315
Kunz, G. F. Precious stones in 1911 [illegible]
Kyshtim, Copper smelting at *1231

L

PAGE
La Dicha Mg. Co. 126
La France, Mont. 620
La Luz y Los Angeles 81
La Republica, Mex. 914, 973
La Rose, Ont.... 73, 106, 192, 239, 335, 376, 476, 814, 861, 914, 1033, 1202
—Report 1026
La Unión mill, Mex. 259, 260, 393
Labor. See also "Eight-hour," "Cost."
Labor and U. S. Steel Corp. 782, 823
Labor costs, Porcupine 1033
Labor costs, Unit, Brazil 838
Labor costs, Unit, Cop. Queen 741
Labor costs, Mich. cement 1132
Labor—German miners' ages 705
Labor—Miners' wages 869
Labor output, U. S. Steel Corp.; Republic I. & S. Co. 789
Labor report, Daily, Ohio cop. mine 702
Labor, Russia 92
Labor, Smeltery, racial distribution 106
Labor, Transvaal ...85, 86, 357, 1238, 1264
Labor troubles, Colliery, American 532, 582, 678, 815
—British.. 300, 390, 484, 678, 718, 767, 970
—Continental 484, 779
Labor, Underground—Race efficiency .. 974
Laboratory Guide, Qualitative Analysis..†373
Laboratory motion study 344
Lace Proprietary 1128, *1176, *1220
Lackawanna Steel Co. report 1136
Lactic acid for filter leaves 742
Ladenburg, Thalmann & Co. 379
Lady Gladys Co., Australia 605
Lagging, Cord, for pulley *1077
Laing & Hamilton 806
Lake, Changes at the 484
Lake City, Colo., Geology and Ore Deposits near ....†183
Lake, E. F. 854, 1148
Lake Fortin reservoir, Que. *1084
Lake milling plans 531, 534
Lake ores, East and West 725
Lake Sup. cop. dist. in 1911 11
Lake Sup. Corp. 223, 1004, *1090
Lake Sup. 8-hour shift 586, 760
Lake Sup. Iron & Chem. Co.... 237, 470, 838
Lake Sup. iron ore 26, 31, 104, 344
—Beneficating 222
—Rates, three seasons 527
—Shipments, 1911, corrected report 652
—Railroads 1188
Lake Sup. iron ranges 1116
Lake Sup. Mg. Inst. 1240
Lake View gusher 93, 94
Lakes, Arthur, Jr. 1050
Lamps, Acetylene, Advantages of 165
Land, Coal, withdrawals, etc., Utah 568, 615, 1101
Land, Mineral leasing, Pres. urges 300
Land, Mineral, Southern Pac. ..281, 908, 1067, 1149
Land, Phosphate, bills 174, 213, 1183
Lands held for protection, Use of 1271
Lands, Oil and gas, Agricultural entries on 634
Lander, Experiment station for 153
Landing chairs *257, *589
Landing stage, Movable 540
Landslide, Frank, Alberta 686, 962
Lane, H. M. First aid to mining machinery *224, *321
Lang, H. "Metallurgy" ....†757
Lang, Sidney 1240
Langi Logan mine, Australia *738
Laramie tunnel, Colo., Driving....933, 982
Las Truchas iron deposit 717
Lass, W. P. Purifying air for agitating pulp *692
—Flexible decanting hose 787
Latest Out mine, Idaho 69
Lathe, F. E. Volatile matter in coal.. 639
—Copper determinations at Granby ...1071
Lathrop, W. A., Death of 781
Laufer & Davis property, Idaho 70
Laurium-Montana 332, 428
Lavery, H. H. 566
Law. See also "Congress," etc.
"Law, Am. Mining, Manual of" ....†373
Law—East Tintic claim decision 1163, 1167, 1289
Law, Mining, Discussion of 493
Law of apex, To abolish 728, 773, 777
Laws, Ariz., Proposed 922, 969
Lawrence, B. B. Fighting at Cobre....1213
Lawrence, Willis 1240
Lawton's chilled stamp shoe *640
Le Roi No. 2 ....76, 143
Lea Water flow recorder *1089
Leaching methods, Gahl's 885, *1046
Leaching process, Sulphate 986
Lead and ore markets and prices *13, *15, *20, 25
Lead Atomizing 778
Lead, Canada 561, 562
Lead, Australasia 88, 1068
Lead, Brit. Col. 76
Lead, Colo. 60, 773
Lead determination as oxalate 885
Lead determination, Rapid methods . 1143
Lead furnace fume utilization 985
Lead, Great Britain 123, 340, 648

PAGE
Lead, Idaho 16, 69, 772
—Development 329
Lead in 1911 .... *15, 773
Lead junk, Treatment 453, *454
Lead, Joplin dist., ore dressing *405, *459, *501, 553
Lead kettle, Molding *321
Lead managers, S. W. Mo. 1100
Lead market, Mystery, etc. 483, 629
Lead metallurgy in 1911.......... 43
Lead metasilicate Note 131
Lead, Missouri 15, 17, 773
Lead, Okla. 23, 773
Lead ore production, S. W. Mo., Okl., Kan. 406
Lead, Scrap, refining flux 1271
Lead smeltery, Austrian, for Broken Hill ores 1280
Lead, The cut in 296
Lead, U. S. 1, *15, 340, 773
Lead, Utah 329, 773
Lead, Utah smelters' production 234
Lead, White, combination rumored.... 386
Lead, White, in 1911 16
Lead, White, process, Amino 1082
Leadville, Colo. district 185
Leadville Mines Pumping Co. 1004
Leadville tunnel proposed 1149
Leaks, Air-receiver, Stopping *351
Leasing system, President urges 300
Leckie, William 1240
Leese, J. S. Buying pumps 352
Legislation. See "Congress," "Law," "Land," etc.
Lehigh Coal & Nav. elec. plant 992
Lehigh Val. Coal Sales Co. 193
Leighton, Henry 954
Leith, C. K. Mich. ore reserves 799
Lena labor trouble 862, 992
Leschen, A., & Sons 1175
Letcher, O. South Af. power projects..1235
Leucite Hills, Wyoming 423, 651
Leuschner flotation process 924
Levant mine, Cornwall 488
Leveling rod, Four-sided 588
Levit, Morris 662
Lewis-Bartlett process 127
Lewis, S. J. Cyanide poisoning 1179
Lewis, S. P., Death of 1240
Lewisohn, Julius A. 907
Lexington Mines Co. 620
Libby Placer Mg. Co. 65, 715, 812
Liberty mine, Idaho 141
Liberty Bell, Colo. 1210, 1241
Liddell, D. M. Wet assay of copper mattes 262
—Treatment of metallic junk *452
—Copper sampling *703, 729, 1213
Lighting trough for drafting tables...*205
Lightner mine, Calif. ... 235, 378, 858, 908, 910
Lima oilfield in 1911 .... 93, 97
Lime determination, Rapid methods...1143
Lime in cyaniding 869
Lime, Settling slime with *411
Limestone, Burning temperatures for.. 610
Linares, Spain, Ankylostomiasis at 513
Lincoln Gold Mg. Co. 668
Lindberg, C. O. 136
Linderfelt, T. C. Stratton's Independence mill *311, 442
Lindgren, Waldemar 1194
Lindhorst's dust arrester *540
Lindmueller, Charles 184
Link-Belt elevators *308
Linke, H. A. 758
Linton, Robert 136
Lion Hill Consol. 191, 568, 669
Literary taste of miners 348
Little Nipissing mine, Ont. 430, 475, 1156
Live Oak, Ariz. ... 118, *122, 187, 283, 330, 377, 425, 569
Livermore, Robert 374
Llano Gold & Rare Met. Mg. Co. 475
Lluvia de Oro practice.. *591, *1189, 1164
Loading, Skip, devices *301, *446
Loading stick, Joplin *1030
Lobitos Oilfields, Ltd. 563
Lochgelly Iron & Coal Co. 736
Locomotive, Gasoline, C. & H. 786
Locomotive, Otto internal combustion..*657
Locomotive supplies, Costs of 938
Locomotives, Storage-battery, in tunnels.*942
Londevan mine, Alaska 377
London & Am. Sapphire Co. 233
London copper market 9, *13
London gold market 166
London lead market *15
London mica market 500
London silver market 229
London spelter market *13, 22
London tin market in 1911 135
Longitudinal Ry. of Chile 415
Longyear, J. M. 1026
Los Angeles Mining Soc. 136
Lott, B. G. 758
Louisiana oil, Peculiar 1118
Louisiana petroleum 93
Low grade ore mining during periods of high price 1115
Lowden on continuous cyanidation 46
Lower Mammoth 191, 1057
Lowering crusher bottom plate *398
Lubrication, Air-compressor 1125

PAGE
Lubrication, roller bearing cars 1046
Lucky Bill mine, N. M. 812
Lucky Boy mine, N. M. 428
Lucky Tiger report 1212
Lührmann, F. W. Oxygen additions to iron blast furnace 1180
Luty, B. E. V. Pittsburg iron market 28

M

MacArthur Forrest cyanide patent 1119
McClure, Wilbur F. 468
McConnell mine, Nev. 828, 1136
McCormick oil tank *489
McCoy, F. El Oro dist. 81
—Turning large sheave *352
McDonald, Joseph A. 280
McDonald, A. J. 1288
McDonald, D. F. 685
McDonald, P. B. Taxation of mineral rights in Mich. 108
—Sheaves for balanced hoisting 158
—Iron River dist., Mich. *210
—Elec. hoist, Negaunee mine *395
—Injured workmen's compensation, Mich. 463
—Elec. signal device *537
—Rolling Mill No. 2 shaft *1237, 1210
McDonald, R. G. Cyaniding Cripple Creek ores 155
McEnaney mine, Ont. 1296
McGovern, Frank 280
McGraw-Hill Book Co. 373
McGreevy Iron Co. 285
McGregor, A. G. 516
McIntyre mine, Porcupine 192, 335, 430, 523, 622, 670, 680, 717, 766, 814, 875, 914, *895, 1010, 1156, 1296
Mackay gifts, Nev. Univ.....201, 1018, 1050
McKee, F. W., Death of 662
McKennan, J. D., Death of 327
Mackenzie & Mann 329
McKiernan Terry "Wizard" drill *416
McKinlay, E. S., Death of 136
McKinley-Darragh, Ont. 574, 717, 814, 1156
McKittrick, T. Atomizing metals 778
McLaughlin, Warren J. 806
McLean, D., on tank volumes 591
McLeish, J. Mineral production of Canada 561
McMillan, C. H. 710
McMillan, J. C. 1171
McMillen-Stonewall Co. 1005
McNair, S. S. Determination of sulphur in sulphide ores 536, 633
MacNamara mine, Nev. 812, 1056
McNeill's mining code 825, 1069
Macoun, James M. 1240
Maas mine power plant *274
Machado, M. R. Chile petroleum 756
Machinery, Heavy, Hauling.......... 157
Machinery, Mining, First aid to ...*224 *321, *353
Madagascar gold 3
Madero, Julio, Statements of 234
Maffett, Robt., Death of 758
Magistral-Ameca Cop. Co 126
Magma mine, Ariz. 235
Magnesia for floorings 886
Magnesia, Properties of 1081, 1082
Magnesian limes, Properties of 297
Magnesite deposits, Venezuela 794
Magnesite in 1911 324
Magnesite, Kern Co., Calif. 618
Magnetic bronzes, The 1081
Majestic, Utah 142, 813
Malachite Cop. Co. 1135, 1136
Malay tin 19, 244, 560, 600, 918, 1048
Malay struverite 886
Mammoth mine, Maricopa Co., Ariz..... 569
Mammoth mine, Pinal Co., Ariz. 66
Mammoth, Calif. ..44, 49, 378, 618, 685, 711, 759, 1006
Mance, F. S. Australasia mining 87
Manganese, Duty on 829
Manganese in the Caucasus 985
Manganese, Iron separation from 885
Manganese steel properties 297, 345
Manifold and Poole. "Straight Line Engineering Diagrams" ....†1001
Manipulation and methods 390
Manitoba gold rush 201, 258
Mann mine, Ont. 1073
Mansfeld Co., Germany 124
Manunta, L. S. Ore gate *256
Manzanita, Colo. 472
Maps, Filing small mine 1032
Marble, Ariz. 66
Marble Bay mine 488
Marble, White, in Colo. 648
Marriott, H. F. Transvaal in 1911 84
Rhodesia mining in 1911 86
Martin, C. Stanley 1100
Martin, H. J. Byproduct coke ovens... 778
Marwick, James 1050
Mary Charlotte shaft No. 2 158
Mary McKinney mine, Colo. ..284, 328, 472, 618, 1104, 1199
Maryland copper 1218
Marysville alunite deposit ....226, †565
Mason & Barry, Ltd. 1026
Mason, V. L., Death of 1002

PAGE
Mason Valley Mines Co. report . 613. 828, 1135
Mason Valley smeltery, Nev. *410
—Notes 47, 68, 142, 812
Mass action and reaction velocity 1087
Mass Consol., Mich. ..12, 189, 571, 763, 811
— Costs 1225
Mather, M. W., Death of 1288
Matheson pipe joint *1026
Mathewson, E. P. Sticking to the job..1261
Matthiesen-Hegeler furnace *559
May Day mine, Utah 475, 621, 765, 808, 861, 1054, 1107, 1201, 1295
Mayflower mine, Mich...141, 149, 189, 332, 379, 472, 667
Mazata, Cia. Minera de 144
Measuring—Estimating irregular areas..*587
Measuring pocket, Inclined shaft *446
Megraw on chilean milling 259, 260, 393
Mein, W. W. 280
Melones mine, Calif. 663, 713, 810
Mendelsohn, A. Drill post collar *979
Mendenhall, A. D. Settling pond dam..*491
Mentzel, C. Pumps work after long submergence 831
Mercur mine, Utah 733
Mercury. See "Quicksilver."
Merrill Met. Co.'s feeder *1095
Merrill's zinc-dust precipitation 1081
Merton blende-roasting furnace *558
Merton, H. R., & Co. 202, 728, 1044
Merz, A. R. 392
Mesabi, Mining dangerous ground on...*1219
Messina (Transvaal) Devel. Co. ..532, 556, 1238
Metal index numbers, 1911 2
Metal prices, 1910, 1911 ....*13, *15
Metal prices since 1878 .... *20
Metal tariff bill 953, 1218
Metal, White, in N. Z. 1019
Metals, Atomizing 778
Metals, British foreign trade 340
Metals, Diffusion of 790
Metals, How they are sold 887, 939
Metals, The—Business situation 629
Metals, U. S. foreign trade 240
Metallic junk, Treatment of *452
Metallics 105, 249, 297, 345, 391, 439
—Screening ore samples 439, 533, 633
Metallurgical patents, Respecting 343
Metallurgical records, Cyanide mill *791
"Métallurgie des Métaux autres de Fer" †373
"Metallurgy of Iron and Steel" ......†1001
"Metallurgy." H. Lang ....†757
Metallurgy, Rand's new 1123
Methane, Geometry of 698
Meunicke's electrolytic detinning 702
Mexican mine, Comstock, Nev...142, 167, *169, 170, *172, 522, 572
Mexican Mines of El Oro 81
Mexico.
—Bat guano 514, 584
—Chilean mills, Slow-speed 259, 393
—Copper 7, 8, 728, 1044
—Copper district, New, Sonora 717
—Dynamite shortage in Mex. 734
—Gold 3
—Graphite 622
—Iron deposit, Las Truchas 717
—Kaolin development 524
—"Mexico"—Pan-American Union .....†373
—Mining in 1911 ....77, 125, 442
—"Mining Industry of Mexico" ....†183
—Mocorito dist., Sinaloa 1092
—Petroleum discovery, Sonora 524
—Petroleum export tax 1024
—Platinum discovery 476
—Situation, Political 389, 484, 686, 751
Notes 712, 775
—Smelting in Mexico 734
—Tin development, Zacatecas 524
—Vanadium 1093
—Zinc 78
Meyer, E. J., Death of 827, 876
Miami Cop. Co. ..13, 187, 235, 283, 330, 377, 471, 695, 857, 1118, 1151
—General observations *119
—Report 821
—J. P. Channing's views 877
Miami district, Ariz. *119
Miami zinc-lead dist. *1146
Miami, Okla., production 23
Mica in 1911 1192
Mica market, London 500
Mica, Pennington County, S. D. 1009
Mica, Texas, discovery 522
Michigan cement labor costs 1132
Mich. College of Mines *205
—Technical writing 1046
Mich. copper 7, 11, 1044
Mich., Crystal Falls dist. 1020
Mich., Gold in 3, 1000
Mich., Injured workmen's compensation 463
Mich. Iron lands suit 1026
Mich. Iron mining and furnace production costs 837
Mich. iron ore reserves 799
Mich. Iron River district ..138, *210, 470, 1264
Mich. mine inspection 103
Mich. mineral rights taxation ..108, 204, 1264
—A note and denial 105, 204
—J. R. Finlay's remark's 780, 1238

PAGE
Mich. mineral rights taxation
—Iron mines assessments lowered 1212, 1242
—Various notes 138, 189, 329, 427, 571
Mich. mine, Utah 191
Mich., Mineral Resources of 1264
Mich. silver 3
Mich.-Utah Consol. ..138, 239, 334, 517, 961, 1107, 1202, 1247
Michillas copper mines' wharf *981
Michipicoten range, Eastern *1090
Mickle, G. R. Cobalt's production 992
Mid-Continental oil and gas 93, 95
Midway Gas Co. 425
Midwest Oil Co. 1277
Migration of miners, Rand 1141
Mill. See "Stamp," "Chilean," "Cyanidation," "Amalgamation," "Concentration," "Slime," "Filter," "Sample," "Chute," "Gate," "Feeder," "Jig," proper names, etc.
Mill, Colburn-Ajax *753
Mill design, Progress in 543
Mill holes, Cop. Range *899, 900
Mills, etc., Gold absorption by..513, 541, 740
Mills, Charles E. 1240
Miller, J. F. Pattinson desilverizing process 1120
Miller-Lake-O'Brien 476, 909, 1073
Miller, W. G. Patricia dist. 1172
Miller's sample reducing machine......*444
Milleret mine, Ont. 1074
Milling changes at Lake 484
Milling, Joplin dist. ..*405, *459, *501, 553
Milling plans, Lake 531, 534
Milling—Rand's new metallurgy 1123
Milling—Wilfley table kinks *1129
Mina Grande Co. 126
Mine la Motte Co. 18
Mine sampling and valuation 1276
Mine valuation 780, 1238
Mines Co. of Am. 914
Mines, World's principal, Data of: tonnage costs 132, 250, 298, 393
Miners, Race efficiency of 974
Miners' lien law, Ariz. 1196
Miners' phthisis, South Af. ..564, 1102, 1150
Mining Index ..99, 276, 464, 706, 903, 1097
Mining inquiry, Bill for 644
Mining languishes, Why 1017, 1119
Mining law. See "Law," "Congress," "Land," etc.
Mining & Met. Soc. 151, 154, 184, 1276
Mining news via daily papers 258
Mining students, Suggestions to 220
"Mining without Timber" ....†373
Mineral Farm mine, Colo. 1199
Mineral Point Zinc Co. 22, 191
Minerals Separation plant 88
"Mineralogy." F. H. Hatch ....†757
Minn. University library gift 1288
Mint, British, Melting at 399
Mint law changes proposed 930, 978
Minturn, J. E. Underground labor 974
Mississippi iron ore 1142
Missouri lead 15, 17, 773
Missouri, S. E., in 1911 17
Missouri, S. W., hydro-elec. plant...... 776
Missouri, S. W., lead managers 1100
Missouri Univ. drilling instruction *1227
Missouri zinc 21, 24, 1039
Mitchell's drill-dust disposer 855
Mitsui, S., Death of 1050
Mizpah Extension, Nev. .238, 812, 1258, 1294
Mocorito dist., Sinaloa 1092
Moctezuma Cop. Co. 12, 1023
Modoc mine, Colo. 570
Moffet James, Death of 1194
Mogollon G. & C. Co. 1106, 1247
Mogul mill, S. D. 616, 621
Mohawk mine, Mich. ..11, *157, 206, *396, *397, 667, 811, 1221
—Costs 1034
Moir, J. Testing mine air 641
Moise, B. C. 907
Molds for repair castings ..*224, *321, *353
Mololoa, Mex. 125, 144, 288
Molybdenite ores, Concentration of *227
Molybdenum in steel 1171
Molybdenum in 1911 126
Molybdenum, New applications of 211
Molybdenum Ores of Canada ....†373
Monazite in 1911 1230
Mond Nickel Co. 73, 186, 382, 524, 1108
Monel metal, Electric properties 439
Monell, Ambrose 1194
Mono-Baltic Mg. Co. 1292
Montague, S., & Co. 212, 385
Montana-Bingham 813, 1107, 1155
Montana copper 7, 10, 63, 550, 1044
Montana gold and silver 3, 64
Montana Gold mines, Mont. 238, 1154
Montana in 1911 63
Montana Merger Mines Co. 380
"Montana, Mining Laws of" ....†805
Montana relief map 1117
Montana School of Mines 1261
Montana Smg. Co.; Snowshoe mine .65, 474, 620, 1008
Montana Soc. of Engineers 1002
Montana States Mg. Corp............. 859
Montana Tonopah ...66, 68, 142, 522, 572, 621, 764, 812, 860, 1106, 1258, 1294
Montana tuberculosis sanitarium 1289

PAGE
Montana zinc production, concentration, etc. 10, 21 41, 137, 1039, 1289
Monte Cristo mine, Ariz 569
Monte Cristo mine, Calif. 188
Monte Mayor G. & S. Mg. Co. 814
Montgomery-Shoshone, Nev. 428
Monuments, Survey, Concrete 1268
Monuments, Survey, Replacing *537
Moore-Clancy process 45, *753
Moore filter litigation 440
Moore, L. D. 710
Moore Filter Co. 742
Moore property, Idaho 79
Moose Mtn. Co. 222, 1108
Morin's safety crosshead 588
Morris, M. C. 327
Morrison, E. Chicago iron market..... 29
Morrison, W. L. Determining carbon in steel *1285
Mortality, tropical natives, Rand 953
Moscow, Ida., experiment station 1026
Mosquito bars, Length of 156
Mosquito group, Colo. 810
Mosquito Range tunnel proposed 1149
Motherlode Sheep Creek Mg. Co. 1058
Motion study, Laboratory 344
Motor trucks for mines *796
Mount Bischoff mine 89
Mount Franklin Lime & Stone Co. *1040
Mount Lyell Co. 89
—Reports 154, 261, 1284
Mount Morgan G. M. Co. 89
—Report 404
Mount Shasta Power Corp. 618
Mozambique petroleum 766
Muffler, Movable gas-engine exhaust *984
Munich technical museum 758
Munroe, H. S. Mine sampling and valuation 1276
Munroe Iron Mg. Co.; Rogers mine..138, 189, *210, 332
Murdock, C. R. 566
Murex process 1272
Murray, M. T. Zinc dust as precipitant 641, 946
Murry mine, Ont. 192
Mussen, H. W., Death of 854
Myles Mineral Co. 1118

N

Nason, A. A. Bat guano 584
—Cañon Diablo crater 730, 974
Natal coal 671
National Borax Co. 1101
National Lead Co. 18, 380, 386, 631
National mine, Colo. 188, 236
National Mines & Smelters Co. 717
National pipe protective coating 560
National Zinc Co. 22, 850
Natividad mine fire 574
Natividad, Sierra Juarez, Oaxaca 80
Natomas Consol. 214, 555, 713, 761
Natural gas. See "Gas."
Naulty Smg. & Ref. Co. 985
Naumkeag Cop. Co. 189, 440, 763, 775, 811
Needles group, Ariz. 1005
Negaunee mine, Electric hoist *395
—Litigation over interest 616
Nelson, John Harland 1002
Neutralizing towers, Ashio smeltery ... 206
Nevada-Calif. Power Co. 1003
Nevada Consol. ..8, 36, 67, 94, 286, 380, 474, 812, 860, 913, 1057
—Reports 262, 895, 952
Nevada copper 7, 8, 1044
Nevada-Douglas 333, 764, 828, 1136
Nevada gold and silver 3, *67
Nevada gold strike near Paradise valley 1291
Nevada Hills Mg. Co. 68, 812, 912
—Report 1072
Nevada Jarbidge, Contact, Elk Mtn. 798, 890
Nevada mining in 1911 67
Nevada-United 1057
Nevada University fund 201, 1018, 1050
Nevada Utah M. & S. Corp. *68, 69, 333
—Plans 611
Nevada Wonder 53
Nevins, J. N. Gate for skip-loading bins *254
New Atlas Mg. Co. 1197
New Baltic, Mich. 11, 237, 521 1007
New Caledonia exports 579, 1301
New construction 972
—Correction 1067
New Jersey iron production 307
New Jersey Zinc Co. 22, 1154, 1284
New Keystone Cop. Co. *121, 957
—Report 1258
New Kleinfontein Co. 1123, 1124
New London mine, Md. 1218
New Mex. copper 7, 8, 61, 1044
New Mex. gold and silver 3
New Mex. in 1911 61
New Mex. Oil & Ref. Co. 23
New Mex. vanadium 40, 238, 716
New Modderfontein 85, 796
New Pine Creek, Calif. 1103
New Publications ..183, 373, 565, 757, 805, 1001, 1193
New Rambler, Wyo. .. .. .1107
New South Wales. See also "Australasia," "Opals"
New South Wales mining 88, 774, 1068

PAGE
New State mine, Ariz. 350
New Yerington, Nev. 960
New York cement production 308
New York Central's drilling 783
New York & Honduras Rosario 82, 680
New York iron production 307
New York Metal Exchange 720
New York mineral output 1262
New York petroleum 93, 97, 1262
New York reservoir—Crushing plant ..*450
—Aqueduct work 512, *942
New York State Steel Co. 138, 1105
New Zealand. See also "Australasia."
New Zealand mineral production ..542, 774
New Zealand type dredge *359
Newberry, A. W. 758
—Pumps for fire protection *1075
Newhouse tunnel, Colo. 59
Newland, D. H. Adirondack gold schemes 392
Newlin's Gulch dist. 1195, 1211, 1212
Newman, M. A. 566, 1050
Newport mine, Mich. 153, 189, 473, 959
Newsom, J. F., on prospecting 678, 926, 1069
Nicaragua in 1911 81
Nichols Cop. Co. 8
Nickel Alloys Co. 192
Nickel and silver nonmiscible 1045
Nickel, Canada 561, 562
Nickel determination as oxalate 885
Nickel in cyanide bullion 733
Nickel in Norway 886
Nickel in zinc assay 826
Nickel, Metallurgy of 442
Nickel, New Caledonia 579, 1301
Nickel, Ont. 73, 186
—Frederickhouse Riv. discovery 856
Nickel, U. S. 1
—Foreign trade 340
Nicol, J. M. Vertical vs. inclined shafts 985, 1119
Nigerian tin, Pure 885
Nipissing, Ont. ..73, 106, 143, 191, 240, 335, 381, 523, 574, 588, 766, 814, 861, 914, 970, 1010, 1033, 1058, 1108, 1156, 1248
—Cost of trenching 741
—Prospecting by hydraulicking ...882, 1052
—Report 978
Nissen stamps 52, 84, 354
Niter assay; niter balance *347
Nitrate, Chile 83, 197
Nitrate of ammonia explosives 271
Nitrate consumption, 11 months 547
Nitrate of soda, 1911 ....37, 197
Nitrate prospecting, etc. 678, 926, 1069
Nitrate, Tex., discovery reported 475
Nitrates, Foreign trade in 340
Nitrogen fixation 275, 1088
Nixon, G. S., Death of 1194
Noble Elec. Steel Co. ..62, 378, 762, 971, 1054, 1244
Nodulizing by Grondal process 790
"Nonmetallic Minerals, Most Important Deposits of" ....†565
Nordberg, B. V. Mine hoisting systems compared 970, 993, 1035
Norrie mine, Mich. 1007, 1055
Norse Power & Smg. Co. 314
North America, Map of ....†972
North Am, Smelter & Mines Co. 472
North Butte, Mont. ..10, 286, 521, 811, 960
—Costs 1033
—Report 1045
North Car. gold and silver 3
North Dome mine, Ont. 144, 240, 282, 329, 382, 670, 680, 914, *891, 962, 1296
North Lake, Mich., report 763
North Pole mine, Ore. 63
North Star Mines Co. ..61, 140, 250, 298, 378, 1022, 1244
—Annual report 779
—Amalgamation tables *1270
Northern Calif. Dredging Co. *609
Northern Calif. Gold Mg. Co. 762
Northern Calif. Mg. Co. *607
Northern Customs Concentrator, Ont. .. 956
Northern Mex. Power Co. 717
Northern Ont. Exploration Co. 616
Northwestern Iron Co., Wis. 223
Northwestern Metals process 1258
Northwestern Mining Convention 232
Norway, Lost gold mine in 439
Norway mining in 1909 930
Norway, Nickel in 886
Norwegian iron ore and electrometallurgy 930, 1025, 1038
Norwood, C. J. Ky. barytes, etc. 458
Notes, Engineering, Filing 112
Nova Scotia coal 336, 563
Nova Scotia labor law 616
Nova Scotia production 562, 563
Nova Scotia Steel Co. 195, 670
Nava Scotia, Ont., mine and mill ..1020, 1156, 1296
Cyaniding at mill 1133
Nurses, Iron mining company 153
Nuts, Tie rod, Locking 439

O

O'Brien mine, Gowganda, Ont. 382
O'Sullivan, H., Death of 710
Oates, J. H. Lowering bottom plate of gyratory crusher *398

PAGE
Oaxaca, Mining in..................79, 142
Oehman's borehole surveying instrument *980
Ogan, J. M., on firebrick.............. 354
Oglebay, Norton & Co......980, 1119, 1212
Ohern, D. W......................... 566
Ohio Cop. Co. ..143, 186, 429, 523, 711, 961, 1247, 1295
—Caving system *701
Ohio Creek, Colo., mines............. 426
Ohio petroleum 93, 97
Oil, See also "Petroleum," "Whale."
Oil burners, Inventing................1022
Oil engine, Fuel used in.............. 691
Oil equivalency with coal.............1226
"Oil Fuel" ....†1001
Oil, Shale, Joliet, Ill..................1055
Oil tank, Wagon *489
Ojibway, Mich. 11, 332
Oke, A. L. Temporary scaffold *111
—Portable desk *150
Okla. lead and zinc 21, 23, 773
Okla., Miami dist. *1146
Okla. petroleum and gas 93, 95
Okla. zinc and smelting 849, 1039
Old Dominion, Gila Co., Ariz. 13, 187, 235, 300, 377, 809,.1023, 1053, 1067, 1197
—Report 1230
Old Dominion-Bigelow case 1067
Old Dominion, Santa Cruz Co., Ariz. .. 283
Old Dominion Sulphur Co. 765
Oliver Iron Mg. Co. 32, 105, 204, 138, 141, 153, 222, 282, 329, 349, 379, 383, 427, 470, 568, 571, 586, 652, 684, *880, 1055, 1075
Olson, C. R. Solution clarifier *158
Olsson-Seffer, P., Death of 468
Ontario bills, 8-hour, etc. 470, 568, 664
Ontario gravel and sand 1004
Ontario, Milton, petroleum 523
Ontario mining accidents 585
Ontario, Northern, explorations 760, 856, 1196
Ontario output in 1911: map *73, 562
Ontario petroleum ..*75, 523, 563, 574, 622
Ontario quicksilver discoveries........ 144
Ontario silver 73, 562
Ontario mine, Utah ...281, 716, 961, 1107
Ooregum Gold Mg. Co. 741
Opals, New South Wales 369
Openpit mining costs, Mesabi.......... 938
Ophir, Cobalt, Ont. 962, 1248
Ophir Consol., Ont. 288
Ophir Gold Mines, Colo. 959, 1007
Ophir mine, Mont. See "Butte Central."
Ophir mine, Nev. 137, 142, *167, *169, 170, 172, 190, 238, 474, 620, 860, 1106
Ore. See also "Car," "Chute," "Gate," "Bin," "Feeder," "Skip," "Sample," "Sorting," "Separating," "Concentration," etc.
Ore and waste plant, Cripple Creek ..*1173
Ore, Cost of mining ton of 1023
Ore crushing plant underground.......1265
Ore deposits, Superficial examination.. 695
"Ore Deposits, Types of" ....†1193
Ore dressing, Joplin dist. ..*405, *459, *501, 553
Ore extraction costs, Detroit.......... 741
Ore, Fine dry, Sizing *1281
Ore, Low-grade, Mining during periods of high price 1115
Ore, Mining or buying? 922
Ore reserves, Estimation of 1021
Ore reserves, Method of showing *505
Ore stealing, Colo. 137
Ore testing stations, Govt., proposed 103, 107, 151, 154, 185, 203, 295, 310, 328, 348, 394, 1026
Ore treatment, Progress in 543
Ore wharf in Chile *981
Ores—Secondary sulphide enrichment 364, 729
Oregon gold and silver 3, 62
Oregon mining in 1911 62
Orem, Archie J. 374
Oriental Consol. 240, 335, 382, 430, 766, 962, 1296
—Unit costs 1131
Oro Fino, Mont. 141
Oro Grande mine, N. M.......764, 812, 913
Oro Vista dredge, Gardella's......281, 306
Oronogo Circle mine, Mo. *835
Oroville Exposition Asso. 1244
Orozco, Gen. Pascual 710
Orphan, Ariz. 139
Orr, Wm., cyaniding patents 973, 974
Osceola Consol., Mich. 11, 424, 427, *446, 571, 619, 667, 680, 712, 811, 911, 1036, 1105, 1153, 1245, 1293
—Report 486
—Costs 1033
Osmiridium in Urals 886
Otto internal combustion locomotive . *657
Ouro Preto mines, Brazil 838
Overwind prevention gear, Walker *736
Overwind prevention gear, Whitmore....*145
Oxides, Rare, Reduction of 420
Oxyacetylene cutting, Effect of, on steel 513
Oxygen additions, iron furnace 1180
Oxygen in copper, Determining 1179
Oxygen, Influence of, on arsenical copper 1081

PAGE
Ozark Smg. & Mg. Co. 1057
Ozark Smg. & Ref. Co. 1281

P

Pachuca tank, The 45
Pachuca tank support, Chispas *218
Pacific Asso. Consulting Engineers..... 516
Pacific Coast Borax Co. 975
Pacific Crude Oil Co. 1124, 1244
Pacific G. & E. Co. costs 937
Pacific Gold Dredging Co. 316, *396
Packard, G. A. Why mining languishes 1119
—Food supply for miners 1259
Pagan, W. D. Company stores 1022
Pahasa Mg. Co. 19
Paint and varnish removal 397
Paint minerals used unchanged 705
Palmarito mine, Mex. 1092
Palmer, C. H., Death of 184
Palmer Union Oil Co. 713, 1101
Panama Canal, Heated areas 685
Panama, Cement-gun concrete 833
Panama, Dipper trips at *447
Panama excavation, Progress on 249
Panama in 1911 82
Panuco, Mex. 476
Paparoa Iron Ore Co. 1019
Pape, H. Desulphurizing zinc sulphate 1180
Paralysis of mining districts 248
Parral freights, taxes, etc. 297
Pasadena property, Mex. 80
Pastora Mira mill, Colombia 499
Patea sands, Use for 347, 633
Patents, Metallurgical, Respecting 343
Patents, Mining and metallurgical ..231, 421, 661, 853, 1049, 1287
Patina, Simon Itura 1100
Patricia district, Ont. 1172
Patronite 1093
Pattinson, John, Death of............ 907
—Desilverizing process 1120
Pattison, W. B. 1148
Paul, J. Overwind prevention gear....*736
Pauley, A. K., on hoisting 993, 1035
Payne, C. Q. Crushing roll impvts. 370, 394
—Electrostatic separator 324
Payne, Henry M. 1002
—Evolution of the cableway *1278
Payne-Gallwey, A. *980, 1176
Pearl Lake mine, Ont. 1156, 1202
Pearson, B. F., Death of 327
Peck adjustable elbow union *367
Pedrazzini Co., Chispas plant 200, *215
Peirce-Smith converters 48, *1234, 1286
Pelter, Frederick A. 1194
Pelton wheel horsepower 1080
Pender, J. W. 374
Penman, A. P. Estimation of ore reserves 1021
Penn Mg. Co., Calif. 235, 284, 807, 810, 855, *873, 1003
Penn.-Canadian mine, Ont. 1102, 1248
Penn., Carnotite in 1179
Penn. Coal Co. 1211
Penn. Consol., Calif. 1103
Penn. copper 1218
Penn. forestry circular .... .1218, 1260
Penn. iron-ore deposit, New? ..632, 678, 683
Penn. petroleum 93, 97
Penn. R. R. coal traffic 289
Pennington, J. M., Jr. 136
Peregrina M. & M. Co. 80
Perkins, Walter G. 516
Perkins' slag heat utilization *267
Permanganate iron titrations 439
Permanganate solution, Standardizing..1277
Perry dredge, Oroville 316, *396
Perry, R. W. Cyaniding tailings in Colombia *498
Peru asphaltite deposits 1094
Peru copper 8, 728, 930, 1044
Peru emerald discovery 914
Peru mining 83, 862
Peru sulphur discovery 240
Peru petroleum 563
Peruvian mineral production 930
Petersen furnace *559
Peterson Lake mine, Ont. 430, 475, 1156
Petroleum, Advance in 391
Petroleum, Argentina 83, 648
Petroleum, Ariz. 66
Petroleum, Calif., item 1054
—Production, etc., in 1911 ....93, 387
—Production, months 258, 878, 1135
Land suits 281, 908, 1067, 1149
—Deep drilling rig 301
—Dividends 392, 852, 1026
—Prospecting, Los Angeles lots 420
—Water in fields 469, 644
—Marketing Calif. oil 644, 728
—Calif. Oil Producers' Agency 828
—Oil gushers 823, 1124, 1244
Petroleum, Canada 561, 563
Petroleum, Chile, deposits 756
Petroleum, Colo. 93
Petroleum company, Dutch Indies 1253
Petroleum fields, Depreciation of 319
Petroleum, Illinois 93, 96
—Well at Joliet 1153
Petroleum lands, Agricultural entries.. 634
Petroleum, Louisiana, Peculiar 1118
Petroleum, Mex., discovery, Sonora 524
—Export tax 1024
Petroleum, Mozambique 766

PAGE
Petroleum, New Mex. 333
Petroleum, N. Y. 93, 97, 1262
Petroleum—"Oil Fuel" ....†1001
Petroleum, Ont. *75
—Discovery at Milton 523, 574, 622
Petroleum, Peru 563
Petroleum pipe lines common corriers ..1216
Petroleum, Roumania 1272
Petroleum, Russia 978
Petroleum, South America 83
Petroleum, Texas 93, 95, 97
Petroleum, U. S. 1, 93
—Exports, mineral oils 197
Petroleum used in smelting 49
Petroleum, Utah 470, 475, 1057
Petroleum, Wyo. 93, 790, 1229, 1277
Phelps, Dodge & Co. report 593
Phila. Mines & Tunnel Co. 567
Philbin, D. M. 566
Philippines gold and silver 3
Phillips, W. B. Quicksilver, Tex....... 38
—Petroleum in Texas 97
Phosphate deposits, Southern States.... 924
Phosphate, Field test for 883
Phosphate, Florida, production 798
Phosphate, Idaho, deposits 70
Phosphate land laws, Proposed 174, 213, 1183
Phosphate mining, Hydraulic, Tenn. 600
Phosphate production, U. S. 1142
Phosphate railroad rates 1263
Phosphate, Utah, discovery 239
Phosphates, Foreign trade in 340
Phosphates, Stutzer on ....†565
Photographic reproduction of tracings .. 539
Photographing mounted plans 353
Phthisis, Miners', South Af 564 1102, 1150
Physical chemistry ..597, 653, 696, 800, 987, 1041, 1087, 1137
—And cyanidation 1165
—Editorials and discussion ..582, 774, 1214
"Physical Chemistry" (in German) ....†805
Picard, Byron O. 1100
Picard, H. K. Graphic method of illustrating extraction tests *639
Pieher Lead Co. 196, 245, 300
Pickands, Mather & Co. 138, 1242
Piedmont Manganese Corp. 861
Pig iron. See "Iron."
Pigments, Composition of various 851
Pillar mining method, Baltic *947
Pilot-Butte, Mont. 238, 668, 960, 1200, 1246, 1293
Pinguico Mines Co. 81
Pioche dist., Nev.; map *68
Pioche, Nev., Notes on 604
Pioneer smelting, Ariz. 877
—Notes 519, 761
Pipe elbow union, Adjustable *367
Pipe flanges without gasket *1128
Pipe-line expansion joint *1029
Pipe lines common carriers 1216
Pipe protection from corrosion 560
Pipe, Sand-filled, Bending 931
Pipe, Steel, Joint for *1026
Pipe trench, Concrete *350
Pipes, Air, Hanging; placing *735, 786
Pipes, Coloring different 345
Pipes, Frozen water, Thawing 349
Pipes, Steam, Tunnel for *785
Piping for continuous agitation *591
Pittsburg hillside houses 463
Pittsburg-Idaho mine 69
Pittsburg iron and steel markets...... 28
Pittsburg mine, Colo. 188
Pittsburg mine, Mont. 380
Pixley & Abell 166, 229
Placer. See also "Dredge."
Placer law, Alaskan, proposed 202
Placer mining apparatus, Clark.......1180
Placer prospecting, Water conservation *1266
Plans, Mounted, Reproducing 353
Plans, Old mine, Copying 589
Plane. See also "Incline."
Plane, Gravity, New type 726, *743, 826
Plane, Gravity, with auxiliary hoist ..*933
Planes, Gravity, Draining *160
Plate, H. R. 806
Platinum, Colombia 83, 917
Platinum, Determination of 515
Platinum, Early uses of 790
Platinum, M. & M. Co. 1107
Platinum, gold, in Urals 1179
Platinum, gold, silver assay 1280
Platinum in 1911 4
—Foreign trade 340
Platinum, Mex., discovery 476
Platinum & Gold Extraction Co. 1155
Platinum prices *13
Platinum, Russia 4, 91, 433, 1074, 1179
Platinum silver alloys, Parting 228
Plugging furnace taps, Device for 788
Plymouth Consol. Mines; Calif. Explo. Co. 181, 187, 519, 618, 809
—Preparations for re-opening *682
Poderosa mine landing chair *257
Poisoning, Cyanide 642, 1179
Poland spelter 202
Poland, Tin ore in 1082
Pole Creek section, Colo. 520
Pole treatment, Experiments in 513
Ponupo property reported burned 1296
Ponupo Manganese Co. 195
Poole, Cecil P. 907

PAGE
"Poor's Manual of Industrials" ....†1001
Popper, E. Iodide cop. assays 1021, 1166, 1214
Porcupine dist.—Review of 1911...... *73
—Sale of options 153
—Editorial 200
—The outlook 252
—Visit to Porcupine *645
—Notes on Porcupine 594
—Mines and ores *891
—Minor notes 138, 249, 664, 956, 1150
Porcupine and Gowganda, Geology between 1171
Porcupine Gold; Vipond mine 144, 288, 430, 574, 670, 862, *893, 1010
Porter, J. N. 614
Porter, John Jermain 954
Porter on coal storage 315
Portland Canal Mg. Co. 76
Portland cement. See "Cement."
Portland G. M. Co.....45, 59, 60, 542, 727, 810, 1055, 1293
—Report 379
Porto Rico gold and silver 3
Postoffice fraud campaign 201
Potash deposit, Searles Lake, Calif. 643, 975
—Notes; prospecting, etc. 678, 870, 926, 1069
Potash exportation, German 1911 782
Potash, Foreign trade in 340
Potash, Galicia, exploitation 1113
Potash minerals, Laboratory to test ... 392
Potash resources, Investigating 151
Potash salts, German statistics 387, 1024
Potash settlement, Last word 262
Potash situation, Germany 125, 1082
Potash, Survey's work on 1263
Potash, Utah, Piute Co. 475
Potash works, U. S. 660
Potash—Wyo. leucite hills 423, 651
Potassium, Qualitative reagent for 1271
Potosi Mines Co. 18
Powder. See also "Explosive," "Blasting."
Powder, Careless use of 1165
Powder fumes, Neutralizing 255
Powder house, concrete roof *490
Powder trust dissolved 1212
Power installations, Cost of 367
Power projects, South Af. 742, 804, 1235, 1264
Power system, Cleveland-Cliffs *274
Precious stones in 1911 5
Precipitation in cyanidation 46
Premier Diamond Mg. Co. 85, 86, 1277
—Report 612
Pressure box Santa Rita *880
Preston-East Dome 192, 814
Price, David J. 1050
Price, R. Skip-loading device *301
Price, W. B. "Technical Analysis of Brass and the Non-Ferrous Alloys" †757
Primer go, Where should the?..347, 441, 533, 584, 633, 681, 730, 825, 872, 1165
Primos Chem. Co. 40, 60, 667, 911, 955, 1003, 1104, 1171, 1241
Prince Consol., Nev. *68, 69, 604
Prior, A. W. 374
Probert, Frank H. 758
Promoter, The 448
Promoters, Liability of 1019
Prospecting, As to 678, 926, 1069
Prospecting by hydraulicking 882, 1052
Prospecting, Colo. 60, 807, 1289
Prospecting encouragement, Mont. 65
Prospecting for alunite 511
Prospecting for asbestos 1283
Prospecting on city lots 420
Prospectors, Aiding South Australia 1066, 1117
Prospectors, Hints for *1174
Prosser, W. C. Tramway tower in path of snowslide 933
Prost, E. "Metallurgie" ....†373
Proust, G. "Gold Mines," etc. ....†805
Providence mine, Stacking boulders....*882
Providencia M. & M. Co. 80
Proximate analyses, Rapid 1143, 1166
Prussian 1910 mineral production 752
Pulley, Cord lagging for *1077
Pullman, J. W., Death of 954
Pulmotor in lead mine 1267
Pulp samples, Device for splitting *109
Pulp distributor, New *1269
Pulsator classifier, Richards improved ..*896
Pulsator jigs and classifiers 546
Pump, Air-lift 986
Pump columns, Small, Air escape 1030
Pump Cylinder, Cracked, Repairing 1267
Pump, Frenier sand, note 1177
Pump, Mill, Standpipe on *883
Pump, Sand, Abbe-Frenier *1172
Pump valve protector *884
Pumps, Deane elec. mine, Calif. 934
Pumps, Elec. turbine sinking, Unwatering Tresavean mine with 397, 446, 489, *538
—Valve box, similar purpose *786
—Unwatering Columbus Consol. 1027
Pumps, Elec. mine, Germany *174
Pumps, Fire protection, Belen mine ...*1075
Pumps, Hints on buying 352
Pumps work after long submergence .. 831
Pumping diagrams *934
Pumping machinery, Electric 111
Pumping on Comstock *168

PAGE
Pumping plant, Brazilian gold mine..*851
Pumping plant, Sloss iron mines......*550
Pumping through drill hole 491
Pumping—V-notch weir *832
Purdue, A. H. 566
Purington, C. W. 614, 907
Puzzolan cement 953
Pyrite mines of world 886, 1120
Pyrite, Va., New mine 1202
Pyrites burner gases, Cooling 326
Pyrites, Ont. 75
Pyritic smelting, Air in 797
Pyritic smelting, Notes on 113
Pyritic tailing, Weathered, Cyaniding .. 605
Pyrometers, Seger cones as 514
Pyrophoric alloy 1082

Q

Qualitative Analysis, Laboratory Guide †373
Quarrie, B. D. 232
Quartette mine, Nev. 668, 1008
Quartz Creek dist., Colo. 1051
Quebec, Beauce Co., Hydraulicking ...*1083
Quebec exploring expeditions 808, 1188
Quebec production 562, 563, 612
Queensland mineral production 744, 951
Queneau, A. L. 907
—His carbon determination discussed *1285
Quicksilver, Calif., Tex. 38
Quicksilver, Ont., discoveries 144
Quicksilver prices *13
Quicksilver shares, Advance in 727
Quicksilver, U. S. 1, 38, 1234
Quincy Mg. Co. 12, 105, 521, 822, 1007, 1293
—Report 536

R

R. R. R. mine, Ariz. 761, 830
Rack for storing iron *112
Radio-active minerals, Testing for 1082
Radio-chemistry, Discussion of 1137
Radium Co., St. Joachimsthal 1146
Radium Extraction Co., Australia 1257
Radium industry, American 6
Radium monopoly, Austrian 790
Rahilly, H. J. Temperature correction chart for tapes *982, 1128, 1260
Rail bonds and electrolysis 1230
Rail production in 1911 ....718, 991
Rail Steel Bar Mfrs.' Asso. 575
Rail, Steel, question 390
Railroad rate decision 477
Railroad Valley Saline Co. 1106
Railroads, Elec., in Calif. 250
Railroads, Lake iron ore 1188
Raise, A long 1210, *1237
Raleigh tunnel, Colo. 571
Ralli, G. Heat balance, blast furnace.. 986
Rambo-Bignell Engineering Co. 758
Ramsay, Sir W. Artificial gold 647
Rand. See also "Transvaal," "South Af."
Rand Collieries gold mines *301
Rand, Gloomy outlook on 795
—Changing design on stamps 1032
Rand, Gold discoveries on 204
"Rand Metallurgical Practice" ....†1193
Rand mines blacklisted 644
Rand, Migration of miners and accidents on 1052, 1141
Rand, Mortality tropical natives 953
Rand, Rapid sinking on 1073
Rand tailings retreatment 660
Rand Mines Power Supply Co. 85, 804, 1235, 1264
Rand's new metallurgy 1123
Randfontein Central 84, 612
Rare oxides, Reduction of 420
Raritan Cop. Wks. 8
Raven, Mont. 1105
Rawley Mg. Co., Colo. 60, 911, 1153
Ray, Ariz., camp map ....†606
Ray Central, Ariz. 346, 330, 486, 1021
Ray Consol., Ariz. 346, 486, 857, 1291
—Methods 208, 257
—Notes 13, 330
—Quarterly report 404
—Report 929
Raymond, R. W. What's in a name? .. 299
—Piece of practical forestry 1218, 1260
Rea mine, Ont. 144, 335, 574, 717, *895, 962, 1010, 1108
Reaction velocity, etc. 1087, 1214
Read, J. 1288
Reardan, Wash., gold discovery 813
"Recherches Pratiques et Exploitation des Mines d'Or" ....†805
Records, Metallurgical Cyanide mill ..*791
Red Cliff Mg. Co. 1202
Red Cross powders 270
Red Mtn. R., R. & S. Co. 762
Redwood Cop. Co. 1295
Reed, V. Z. 1229
Reed Zinc Co. 140
Refining bullion, Lluvia de Oro *1189
Refining, etc., with titanium 886, 986
Refractory materials, Rare, Properties ..1081
Regina Mg. Co. 126
Reheating air for drills *350
Reichenbach on atmospheric effects.... 852
Reinholt, Oscar H. 614
Reliance, S. D. 65

PAGE
Repairing mining machinery *224, *321, *353
Repath, Charles H. 516
Republic Iron & Steel Co. 209, 438
—Report 315
—Labor output—Tons per man 789
Republica mine, Chihuahua *832
Requa, M. L. Petroleum, Calif. 93
Rescue car wanted, iron ranges........ 684
Rescue work—Dräger pulmotor 1267
Research in analytical methods 872, 974
Research work, Co-operation in 298, 729
Research work, tech. schools ..203, 584, 730
Respiration apparatus, Synchron *548
Revenue Co., Colo. 236, 520, 714
Rhead on carbon combustion 1272
Rhenania blende-roasting furnace *558
Rhodes, Henry, Death of 1288
Rhodesia diamonds 87, 357
Rhodesia gold 3, 86, 335, 555
Rhodesia, Mineral Industry of ....†183
Rhodesia mining 213, 555, 612, 829, 1150, 1239, 1264
Rhodesian Explo. & Devel. Co. 555
Rice, C. T. Shovel handle length 155
—Feeding boulders to crushers, C. & H. *159
—Shaft station in inclined foot wall shaft *206
—Calument & Hecla timbering ..*255, *302
—Chute gate, Baltic mine.............*351
—Support at bottom of stope 443
—Powder house, concrete roof *490
—Joplin car for boulders *690
—Hanging air pipes *735
—Guy rope tightener *832
—Baltic mining method *843, *897, *947
—Safety appliances in inclines....826, 926
—Joplin jigging practice 983, *1080
—Joplin hoisting-bucket hooks *1075
—Pipe flanges without gasket 1128
—Wilfley table kinks *1129
—Stationery dewatering screen *1177
—Pulmotor in lead mine 1267
Rice, George Graham, guilty 542
Richard, L. M. Gold dredge, Ga. *848
Richards, G. M. 806
Richards, J. W. Neutralizing towers, Ashio smeltery 206
—Copper mine water treatment 537
—Schumacher briquetting process 642
—Reduction of zinc oxide 1214
Richards, R. H., at Quincy mine 536
—Pulsator jig 546
Richards pulsator classifier, Improved .*896
Richardson, R. R., mine 761, 830
Ricketts & Banks 854
Ricketts, A. H. "Mining Law" ....†373
Rigaud Vaudreuil, Champs d'Or *1083
Right-of-Way Co., ... 862
Riley, Lewis A. 1050
Rio Plata Mg. Co. 574, 842
Rio Tinto, Ltd., report 734, 824, 929
Riveting dolly, Handy *936
Road, Mine, Cheap 785
Roaster gases, Neutralization of 610
Roasting, Blast ..43, 50, 105, 155, 175, 705
Roasting, Blast, of galena *750
Roasting, Blende, practice *557
Roasting furnaces, Zinc 42
Roasting ores for wet processes 885
Roberts, N. Swimming pool disinfection 253
Roberts Victor Diamond Mg. Co. 1277
Robertson asbestos mines, Que. 862
Robins bucket elevator chart *592
Robins, Raymond 1019
Robinson, P. A. Cyanidation in 1911 .. 45
Robinson, Elisha, Death of 758
Robinson, George T. 1100
Robinson, Lyman, Death of 184
Robinson mine, Transvaal, costs 1132
Robinson Deep 53
Rock. See also "Drill," "Crusher."
Rock breaking without powder *1047
Rock, Separating, from clay *304, 738
"Rocks in Road to Fortune" ....†183
Rocker for placer prospecting *1266
Roessler & Hasslacher Chem. Co. 126
Rogers, Alexander P. 727
Rogers, A. W. Migration of miners and accidents on Rand..................1141
Rogers, I. Sulphur in steel 1272
Rogers mine, Mich. *210
—Notes 138, 189, 332
Rogers-Brown interests 32, 162, 859
Rolls, Crushing, Improvements in ..370, 394
Roller bearing car lubrication 1046
Roller bearings on mine cars 320
Roller frame for inclined shafts *157
Rolling Mill No. 2 shaft *1237, 1210
[illegible] Co., N. M. 573
Rood, N. P. Cartridges for tamping . 1021
Rooney, T. H., Death of 232
Roosevelt tunnel, 60, 185, 281, 325, 472, 663, 1001
Rope break, Gold Cliff hoist *952
Rope, Guy, tightener *832
Rope [illegible] for inclines *254, *250
Rope, Old hoisting, Uses for 253
Rope, Wire, Gov't tests 1259
Rope, Wire, Splicing *784
Ropes, Hoisting, Remarks on 1268
Ro[illegible], I. S. Prospecting 1069
—Vertical vs. inclined shafts 1119
Ro[illegible] 1093

PAGE
Rosecrans, Wreck of 593
Roslyn Fuel Co.'s plane *933
Rossi's refining with titanium 886, 986
Roswag desulphurizing apparatus *750
Rothwell's continuous-cyanidation system 46
Roumanian petroleum production 1272
Round Mtn. Mg. Co. 333, 1265
—Report 1216
Round Mtn. Tungsten M. & M. Co....... 286
Rowland, Ebenezer, Death of 854
Rowland, R. H. Estimating irregular areas *587
Royal School's Bessemer laboratory.... 642
Ruby Company, Mont. 427
Ruggles-Coles evaporation chart.......*354
Rushmore, D. B. Elec. pumping machinery 111
Russell borax mine, Calif. 284
Russell, H. Y. Notes on Porcupine 594
—Surveying raise connection with transit 1125
Russia, Amber in 824
Russia copper ...8, 91, 292, 1014, 1024, 1044, 1074
—Smelting at Kyshtim *1231
Russia gold 3, 90, 1074
Russia—Manganese in Caucausus 985
Russia, Mineral production of 1074
Russia petroleum 978
Russia platinum 4, 91, 433, 1074
Russia—Siberian railway lines........ 439
Russia—Siberian tin 1180
Russia—Slow chileans, Siberia 260
Russia—Urals—Asbestos; osmiridium .. 886
Russia—Urals—platinum; gold 1179
Russia Vladivostok dist. mines 1236
Russian Empire in 1911.............. 90
Russian iron mine, Ornamental *487
Rust, Pipe protection from 560
Rust proofing, Bradley process 538
Rust, Removing, from steel 506
Rust-resisting steel 879
Ryan, Thomas F. *268

S

Safe Harbor Iron & Steel Co. 1057
Safeguarding ore chutes 257
Safety appliances, Republic iron mines.. 209
Safety catch, Cage *636
Safety catches, Cripple Creek *1173
Safety catches, Cage, Testing 588
Safety crossheads for buckets *588
Safety device, Traveling crane *740
Safety devices for inclines ...485, 826, 926
Safety gate for cages *161
Safety gates, Shaft station *1175
Safety guards, shaft stations *109
Safety hook for hoists *783
Safety—Overwind prevention gear *445, *736
St. Anthony mine, Ont. 73, 914, 1058
St. Eugene mine, Ont. 76
St. John & Ophir R. R. 568
St. Joseph Lead Co. 17, 18, 1031, 1177, *1178
St. Louis Cop. Co. 424, 475, 1007
St. Louis Smg. & Ref. Co..... 245, 631, 1267, 1269
St. Marys Min. Land Co. 427, 583
Saklatwalla's vanadium extraction.....1082
Salas, L. E. Tin in Gay-Lussac silver determination 974, 986
Salt, Gt. Salt Lake, etc. 105
Salt Lake mineral production 1117
Salt Lake Pressed Brick Co. 691
Salt Lake Stock Exchange 388
Salvador mining 82, 814
Sample reducing machine *444
Samples, Ore, Screening 439, 533, 633
Samples, Pulp, Device for splitting *109
Sampler, Tailing, Automatic *112
Sampler, Todd, for cyanide plants *541
Sampling and valuation, Mine 1276
Sampling at Hollinger mine 470
Sampling, Automatic 543
Sampling, Copper, Mathematics of *703, 729, 1213
Sampling furnace gases 11
Sampling plant, Colburn-Ajax *753
Samson mill flow sheet *503
San Bois mine explosion 680
San Domingos mine, Portugal 1026
San Francisco Chemical Co. 70
San Francisco gold and silver movement 385
San Francisco mill, Colombia 499
San Francisco mine, Oaxaca 442
San Joaquin mine, Calif. 188
San Juan mine, Oaxaca 79, 382
San Juan oilfield 470
San Patricio, Mex. 1156
San Ramon mill, Colombia 499
San Toy, Mex. 288, 766
Sand for hot bearings 445
Sand pump, Abbe-Frenier *1172
Sands, Concrete, Defective 1180
Sands Limited—Tailings retreatment.. 660
Sanders, Wilbur E. 806
Santa Elena mill, Mex. 259, 260, 393
Santa Fé G. & C. Co. 287, 913, 1057
Santa Gertrudis, Mex 16, 670
Santa Reyes mine, Mex. 382
Santa Rita flume construction *649
—Pressure box *880
Sapphire mining, Mont. 233

PAGE
Sargeson's safety crosshead *588
Sault Ste. Marie canal traffic 291
Saunders, W. L. 1066
Savage Co., Comstock, Nev. 238
Saxman, C. W. 422
Scaffold, Temporary *111
Schaller on alunite 511, 564
Scheftels and Rice guilty 542
Schneider, Herman L. 232, 280, 516
School, Training, for miners 582
Schrader, F. C. Nev. dists. 798, 890
Schramm, A. Heraeus thermometer . 355
Schumacher briquetting process 642
Schütz, E. Blende roasting *557
Schwartz's alunite treatment 564
"Schwerspathlagerstaetten Deutschlands"†757
Schwerin, M., & Co. 1050
Schwindler, F. P. 1194
Scientific management, Laboratory 344
Scofield, F. W. Oregon mining 62
Sconce, Surveyor's backsight *1125
Scott, Arthur 374
Scott, Arthur 758
Scott, A. L. Pioche dist. *68
Scott, D. M., Death of 954
Scott River Dredging Co. 610
Scranton Co., Utah 475, 716, 813
Scrap metal treatment *452
Scraper and loading stick, Joplin......*1030
Scraper for cleaning stopes *687
Scraper for loading tailings *835
Screen, Stationary dewatering *1177
Screens, Calif. gold dredge *455
Screens, Joplin dist. *461
—Cast-iron screen frames for jigs *1080
Screens, Vibromotor type, Using *1281
Screens, Wire, for stair treads 208
Screening ore samples 439, 533, 633
Screening, Wet, Wall's device 1082
Screw, Removable drill-post *395
Seager, J. A. Replacing survey monuments *527
Sealing off water, Catskill aqueduct 512
Searight, J. C., Death of 1240
Searles, L. W. 1194
Searles Lake potash deposit 643, 975
—Notes; prospecting, etc. 678, 870, 926, 1069, 1263
Seattle assay receipts, Alaskan 235
Seawell Dredging Co., Ga. *848
Secondary sulphide enrichment 364, 729
Seeber, R. R., on hoisting 1036
Seger cones as pyrometers 514
Selby, Charles C. 1195
Selby smelting works 44
Sellards, E. H. Fla. production ...782, 798
Semple, C. C. Steel arch supports in tunnels 107
—Basis of tonnage costs 298
—Where should the primer go? 441, 533, 584, 633, 681
—Tempering drill steel 931, 981
Separating. See also "Concentrating," "Sorting."
Separating blende and barite *929, 1120
Separating rock from clay *304, 738
Separation, Magnetic, Lake ores........ 222
Separation, Ore, by decrepitation 1184
Separator, Electrostatic, Payne 321
Separator, Treat centrifugal *1260
Serpek process, nitrogen fixation 275
Settling mill slimes 389, *411
Settling pond, Dam for *491
Severy, C. L. Landing chair for cage *257
Shaft, Choked, Lowering water in 489
—Skip for cleaning *538
—Valve box, etc. *786
Shaft draining through drill hole 491
Shaft, Rolling Mill No. 2 ......*1237, 1210
Shaft sinking, Boreholes in 1212
Shaft sinking by freezing 552
Shaft sinking, Copper Range *846
Shaft sinking costs, Wis. 938
Shaft sinking, Elec. hoist 205
Shaft sinking, Rapid, on Rand 1073
Shaft station in inclined foot-wall shaft *206
Shaft station safety gates *1175
Shaft stations, Concrete 1221
Shaft stations, Guards at............ *109
Shaft timbering, Cal. & Hec. *302
Shafts, Catskill aqueduct, Sealing off water 512
Shafts, Inclined, Roller frame for *157
Shafts, Vertical vs. inclined 985, 1119
Shafts, Wet, Blasting in 1077
Shakelford, W. B. 516
Shale oil, Joliet, Ill. 1055
Shamel, C. H. 566
Shamva Mines, Ltd. 87, 829, 1150, 1264
Shannon Cop. Co. report 732
Sharwood, W. J. Tests of zinc dust for cyaniding *943
Shattuck-Ariz. 12, 47
Shaw, C. T., Death of 232
Shaw, S. F. 710
Data of world's principal mines; tonnage costs 132, 250, 298, 348, 393
Sheave, Large, Turning, on small lathe *352
Sheaves for balanced hoisting 158
Sheet zinc, Gage for 463
Sheldon, G. L. Yellow Jacket mine 221
—As to prospecting 926, 1069
—Mocorito dist. in Sinaloa 1092

PAGE
Shell Transport & Trading Co. 683
Shepard, F. E. Progress in mill design 543
Sheridan, Jas., Death of 1288
Sho Me group, Ariz. 665
Shockley, W. H. Food for miners 1022
Shovel, Bucyrus, record, Panama 735
Shovel, Steam, dipper trips *447
Shovels, Long and short handle 155
Shubert, B. Link-Belt elevators *308
Siberia. See "Russia," "Lena," etc.
Sierra Mg. Co. pumps *1075
Signal device, Cage, Bayer's *1076
Signal devices, German electric *537
Signals, Elec., Underground tramways ..1030
Silica determination, Rapid methods ..1143
Silver, Alaska 3, *55
Silver, Arizona 3, 66
Silver, Australasia 88, 542, 596, 1068
Silver, Brit. Col. 75, 562
Silver, Canada 561, 562
Silver Cell mines, N. M. 961
Silver, China 229, 230, 727
Silver Cliff, mine, Ont. 856
Silver, Colo. 3, 59
Silver determination, Gay-Lussac, Tin in 986
Silver, gold, platinum assay 1280
Silver, Idaho 3, 69
Silver in 1911 3
Silver, India 212, 229, 230
Silver King Coalition ..329, 1107, 1155, 1247
Silver King Consol. 191, 669, 1107, 1295
Silver market, London 229
Silver, Montana 3, 64
Silver movement 4, 104, 152, 243, 390, 433, 582, 673, 727
Silver, Nevada 3, *67
Silver, Ont. 73, 562
Silver Pick M. & M. Co. 67
Silver platinum alloys, Parting 228
Silver price and prospects 1256
Silver prices 4, *13
Silver, Regeneration by precipitating .. 841
Silver, Rhodesia 87
Silver, South America 83
Silver Spoon Mine, Colo. 140
Silver, Transvaal 86
Silver, U. S. 1
—By states 3
Silver, Utah 3, 71, 72, 234
Simmer Deep-Jupiter 53, 795, 796
Simmer and Jack filling 1264
Sinking, Shaft. See "Shaft."
Sintering process, etc., Dwight-Lloyd 43, 50, 105, 155, 705, 750
Sioux Consol., Utah 239, 287
Siskiyou Dredging Co. *609, 610
Sitka district, Alaska 308
Sixtymile River strikes, Alaska 377
Sizing fine dry ore *1281
Sjostedt, Ernst A. 280, 806, 827
Skeele, John W. 422
Sketching board for use underground ..*834
Skewes, E. Mining, Gt. Brit., in 1911 123, 310
Skip and dump plate for vertical shaft *1221
Skip for cleaning choked shaft *538
Skip, Incline, landing chair *589
Skip loads, Graphic solution *982
Skip-loading device, 6-ton *301
Skip-loading device, Osceola mine *446
Skip, Ore, Copper Range *1265
Skip, 10-ton, Franklin *635
Slag analyses, Rapid methods 1143
Slag analysis—Manipulation, methods .. 390
Slag, Broken, Handling with clam-shell buckets *1032
Slag disposal, Granby smeltery *935
Slag, Roman iron 847
Slag test—Silicious; aluminous 345
Slag waste-heat utilization *267
Slags, Furnace, Wet concentration 1262
Slaughter, B. G., Jr. 136
Sleeves for worn elevator pulley shafts 936
Slime problem, The 821
—Trent centrifugal separator *1259
Slimes, Mill, Settling 389, *411
Sloan, S., on electrolysis 1165
Sloss iron mines pumping plant *550
Sludge, Storage-battery, Utilizing 742
Slumbering Hills Mg. Co. 190
Smeltery. See also "Furnace," "Converting," "Roasting," "Electric," "Stack," metals by name, etc.
Smeltery, Ashio, neutralizing towers .. 206
Smeltery, Calumet & Ariz. 682
Smeltery smoke, Calif.; thiogen process, etc. 44, 49, 331, 711, 759, 807, 810, 855, *873, 954, 1003
Smeltery smoke in 1911 .... ④④, ㊾
Smeltery smoke, Mont. 680
Smeltery smoke neutralization, Sprague's 610
Smeltery smoke, Penn Mg. Co. 235, 284
Smelteries, Western, racial distribution . 106
Smelters, Western Sulphuric acid 151
Smelting, British Columbia 1096
Smelting Co.'s report 581, 585
Smelting copper at Kyshtim *1231
Smelting costs, Copperhill, Tenn. 1034
Smelting in bond—Zinc duty 325
Smelting metallic junk *452
Smelting, Pyritic, Air in 797
Smelting, Pyritic, Notes on 113
PAGE
Smelting trust, Alleged, inquiries ..440, 613, 632
—Is there one? 630
Smelting, Zinc, Kan. and Okla. 849
Smith, Eugene A. 1148
Smith, E. F. "Electro-Analysis" ....†1001
Smith, F. Highgrade camp 974
Smith, F. W. Ore-bin chute gate *157
Smith, H. C., Death of 280
Smith, J. J. Gravity plane ..726, *743, 826
Smith's, J. K., vanadium method 1094
Smith, T. G., Death of 516
Smoke investigation 394
Smoke, Smeltery. See "Smeltery."
Smokey Development Co. 1008
Smoot, A. M. Copper sampling 1213
Smoot's, Senator, bill 773, 777
Smuggler-Union, Colo. ..59, 520, 1210, 1241, 1245
Snake Creek tunnel, Lining 109, *1273
Snedaker, J. A., Death of 422
Government aid to mining 203
Snowshoe mine, Mont. 65, 474, 620, 1008
Snowslide, Tramway tower in path of 933
Snowslides 567, 615, 663, 680
Snowstorm mine, Idaho 667, 1293
Société Internationale Forestière et Minière du Congo 268, 310
Socorro, N. M. 716, 913
Sodium cyanide, Making 885
Sodium peroxide, Danger of 258
Sodium sulphide as cyanide precipitant.. 973
Soldering aluminum 441
Solid solutions 802
Solution, Studies in 653, 696, 774, 800, 987, 1041, 1165
Solution clarifiers *158, 739, 936
Solvation, Electrolytic 653
Sombrerete Mg. Co. gate *254
Something for nothing 678
Sonoma Magnesite Co. 284
Sonora, Mining in 78
Sonora Mg. & Smg. Co. 1108
Soper, E. K. Geology and mining of clay 263, 485
Sorauer on smeltery smoke 44
Sorting, Hand 152, 543, 1225
Sorting ore, Cop. Range *901
South Africa. See also "Transvaal," "Rand," "Rhodesia," "Diamonds," etc.
South Africa coal production 671
South Af. miners' phthisis ..564, 1102, 1150
South Af. power projects 1235, 742, 804, 1264
South Af. notes 612, 1264
South Af. sulphur 497
South Amador Mg. Co. ..235, 519, 910, 1005
South America in 1911 .... 82, 173, 680
South America, Old mines in 727
South Australia. See "Australia."
South Car. gold and silver 3
South Crofty crushing, etc. 174, 488
South Dak. gold and silver 3, 65
South Dak. mining in 1911 .... 65, 186
South Dak. tin 19, 66
South Eureka practice 934, 1127, 1241, 1289
South Lake, Mich. 521, 1007
South Live Oak, Ariz. 519, 665, 809, 957, 1103, 1151
Southern Aluminum Co. 1212
Southern Calcium Phosphate Co. 913
Southern Cross mine, Mont. 663
Southern Cross Extension 380
Southern Iron rates 248
Southern Ore. & Northern Calif. Mg. Congress 280
Southern Pacific Co. 94, 281, 908, 1067, 1149
Southern Pacific Land Co. 469, 1051
Southwestern Miami 235, 377, 425, 617, 713, 761, 857
Southwestern Mg. & Smg. Co. 283
Southwestern Mo. See "Missouri," "Joplin."
Spain metal exports 674
Spain and Portugal, copper 8, 671, 728, 1014
Spaulding, Morril B. 136
Speiss treatment experiments 1096
Spelter. See also "Zinc."
Spelter, Germany, and zinc ..202, 480, 1024, 1095
Spelter, Grades of 41
Spelter market and prices *13, *20, 22
Spelter situation 104, 531, 629, 1255
Spelter statistics for 1911 1039
Spelter, United Kingdom 202, 340
Spelter, U. S. 21, 202, 1039
Spelter, World's production 202
Sperr, F. W. Sublevel stoping method *1181
Spiro turbine, Buffalo *319
Splicing wire rope *784
Spontaneous combustion—Coal storage . 315
Sprague flue-dust process 44
Sprague's roaster-gas neutralization ... 610
Springer, J. F. Sealing off water, Catskill aqueduct shafts 512
Sprinkling against ankylostomiasis 1271
Spuds, Calif. dredge *507, *511
Stack, Steel, Erecting 692
Stack, Structural and corrugated steel *303
Stacking boulders *882
Stadia wires, Vertical 637
Stadler, H., on Nissen stamps 354
—Grinding analyses 681
—Rand's new metallurgy 1123
PAGE
Stag Cañon Fuel Co. 594
Staging, Temporary, Staple for *880
Stair treads, Wire screens for 208
Stallforth, Federico, Death of 614
Stamp milling in 1911 .... 52, 84
Stamp milling, Rand, troubles 795
Changing design of stamps 1032
Stamp shoe, Chilled iron *640
Stamps vs. chilean mills 260
Stamps, Gravity, High-duty 354
Standard, B. C. 1107
Standard Consol., Calif. 951, 1103
Standard Oil Co. 94, 391, 858, 923, 1046, 1054
—Division of trade 176
Standpipe on mill pump *883
Stanislaus Gravel Mg. Co. 472
Stanley, G. H. Gold absorption by retorts 513, 533
By amalgamation plates 541
Stanley committee investigation 152, 153, 166, 200, 262, 344, 596, 909
Stanley's hydraulic classification 660
Stanthorpe Prop. Dredging Co. 540
Staple for temporary staging *880
State mine, Mont. 1105
Statz, B. A. Vanadium test 872
Steam in blende roasting 560
Steel. See also under "Iron."
Steel, Canada 563
Steel Co. of Canada 143
Steel Corp. See "U. S."
Steel corrosion, prevention, etc. 506, 538, 560
Steel, Corrosion-resisting 879
Steel data, Senate wants 1258
Steel, Determining carbon in *1285
Steel, Effect of oxyacetylene cutting on.. 513
Steel investigation, Congressional...152, 153, 166, 200, 262, 344, 596, 909
Steel, Leigislative definition of 213
Steel making in 1911 870
Steel, Manganese, properties 297, 345
Steel metallurgy, etc. 50, 155
"Steel, Metallurgy of" .... †1193
Steel, Molybdenum in 1171
Steel profits 438
Steel rail question 390
Steel, Sulphur in 1272
Steel tariff 166, 199, 213, 346, 390, 953, 1218
Steel trade situation 1256
Steel, U. S. 27
—Foreign trade 338
—Production in 1911 .... 830, 870
—Rail production 991
Steel used in drilling 778
Steels, Alloy, Production of 52
Steele, H. Utah Cop. Co. costs 925, 921
—Cost of mining ton of ore 1023
Steinem, C. Wagon oil tank *489
—Valve protector *884
—Clarifying cyanide solutions 739, 936
Steinmann's platinum silver partition .. 228
Stereochemistry 698
Sterling air heater *350
Stevens, H. J., Death of 854, 877
Stevens, W. A. 327
Stevenson, E. W. Damage by electrolysis 1229
Stewart, J. K. Stratton's Independence mill *311, 442
Stewart, L. 758
Stewart, N. L. 566
Crushing frozen concentrate 691
Stewart, W. J. Wheel face taper...... *159
Stewart mine, Idaho 237, 760, 1105
Sticking to the job 1261
Stickney, A. W. 516
Still, Alfred 1050
Stillman, F. H., Death of 422
Stock fraud liability, N. Y. 1019
Stock frauds, Alleged 105, 392, 437, 448, 542
Stock frauds—Postal work 201, 439, 823
Stock offerings from Boston 345
Stock vending law, Kan. 297, 1117
Stockholders, Minority, at meetings 679
Stocktonia graphite mine, Calif. 957
Stokes, R. Rand Metallurgy .... †1193
Stolberg furnace *559
Stone, C. J. Gravity filter plant *368
Stone, R. W. Cambria Fuel Co. 775
Stope filling, Baltic *845, *902, *949
Stope filling, Train car for *443
Stope, Support at bottom of 443
Stopes, Scraper for cleaning *687
Stopes, Wide, Scaffolding for drills in .... *[illegible]
Stoping method, Sublevel *1181
Stoping at Calamon mine *637
Stora Kopparbergs Bergslags Aktiebolaget 1217
Storage battery sludge, Utilizing 742
Storing iron and rails—Rack *112
Storms, W. H. Highgrade boom 974
Stoughton, B. 854
—Metallurgy of iron and steel 50, 155, †1001
—American iron ore developments 173
—Wrought iron production 229
—Harbord's "Metallurgy of Steel" .... †1193
"Straight Line Engineering Diagrams" †1001
Stratified rock, What is? 1214
Stratton's Estate, Colo. 236
Stratton's Independence ..59, 140, 185, 249, 331, 542, 570, 714
—The mill 296, *311, 442

PAGE
Stratton's Independence
—Link Belt elevators *308
—Developments 643
Streams, Measuring flow of 399
Strike. See "Labor."
Stroke counter for compressors 1269
Struverite in Perak 886
Students, Mining, Suggestions to 220
Stull timbering, Battery method *255
Stutzer, O. "Nonmetallic Minerals" ..†565
—Copper ores of Katanga 729
Sublevel stoping method *1181
Success mine, Porcupine, Ont. 476
Sudbury dist., Ont. 760
Sulitjelma Aktiebolag. Pyrite mines ..1120
Sullivan, C. P. C. Stoping at Calamon mine *637
Sullivan, S. F., Death of 710
Sulphate leaching process 986
Sulphide enrichment, Secondary 364, 729
Sulphide ore treatment, Northwestern ..1258
Sulphur and Herman Frasch 152, 184
Sulphur determination in sulphide ores 536, 633
Sulphur, Effect on firebrick 369
Sulphur in steel 1272
Sulphur in 1911 ....14, 1168
Sulphur, Mexico 524
Sulphur mine, N. C. 1295
Sulphur, Peru, discovery 240
Sulphur, Sicily 435
Sulphur, South African 497
Sulphur, Texas, development 239, 245
Sulphur utilization, blende roasting *557
Sulphuric-acid freight rates 627
Sulphuric-acid manufacture 175
Sulphuric acid—Western smelters 151
Sumatra, Gold 313
Summit Cop. Co. 139, 471, 617
Sunday work, Transvaal 86
Sunnyside mines, Colo. ..236, 520, 933, 1104
Superficial examination, ore deposits ... 695
Superior Co., Mich. 12, 571, 714
Superior & Boston, Ariz. ..330, 377, 617, 1053, 1291
Superior & Pittsburg report 634
Support at bottom of stope 443
Surface tension 699
Surial, Antonio, Death of 280
Survey, Geological
—Bulletin on alunite 511, 564
—Paralysis of mining districts 248
—Study of Sitka district 308
—Measuring flow of streams 399
—Leucite hills, Wyo. 423, 651
—Penn. iron deposit 632, 678, 683
—Potash, Searles Lake 643, 870, 975
—Potash, Work on—Statement 1263
—Potash works, U. S. ....†660
—Map of North America ....†972
—Appropriations 1168
—Prospecting for asbestos 1283
Survey monuments, Concrete 1268
Survey monuments, Replacing *537
Survey, Winze, Back sighting in *687
Surveying new cross sections for embankments *1076
Surveying—4-sided leveling rod 588
Surveying instrument, etc., Borehole, *980, 1128, *1176, *1220
Surveying, Mine, Target for *783
Surveying raise connection with transit 1125
Surveying—Use of spad 105
Surveying—Vertical stadia wires 637
Surveyor's backsight sconce *1125
Susquehanna Coal Co. *492
Svimonoff, V. C. Caucasus Cop. Co. .. 348
Swank, James M. 1066
Swansea Consol. 1295
Swastika mine, Ont. 144, 240, 574, 622, 862, 1248, 1296
Swaziland tin and gold 358
Sweden iron and ore 479, 625, 1217
Sweden, Metallurgy in 42, 51, 314
Swent, James W. 923
Swimming pools, Disinfection of 253
Switch, Crossover, Calculating *1128
Switch—Double gage turnout *1266
Swoboda, H. O. 1100
Synchron respiration apparatus *548

T

Tables, Gold saving *396, *456
Tacoma Smelting Co. 8
Taft, President, at Homestake 204
—Urges leasing system 300
Tahoma mill, Separation *929, 1120
Tailing gate for jigs *692
Tailing sampler, Hudson Bay *112
Tailing, Weathered pyritic, Cyaniding.. 605
Tailings, Cyaniding, in Colombia *498
Tailings disposition, Calif. 1241, 1289
Tailings, piles, Flat River 1031
Tailings, Rand, Retreatment of 660
Tailings, Scraper for loading *835
Tajo Mg Co., Jalisco 126
Tajo, Sinaloa, milling costs 1226
Tamarack, Mich. 11 532, 534
Talc production in 1911 996
Talc, Ont 75
Talisman mine, N. Z. 105
Tamarack mine, Idaho 714
PAGE
Tamarack mine, Mich. 571, 714
—Costs 1131
Tamping dynamite, Cartridges for *879, 1021, 1127, 1175
Tanana Quartz Hydraulic Co. 56
Tanganyika Concessions, Ltd., etc. ..87, 162, *268, 310, 612, 1164, 1168
Tank, Wagon oil *489
Tanks, Built up wooden water *1031
Tanks, Cast-iron, Repairing 1266
Tanks, Prismoidal, Volumes of 591
Tantalum in U. S. 201, 250
Tantalum, Melting point of 874
Tape temperature correction chart *982, 1128, 1260
Target for mine surveying *783
Tariff legislation... 166, 199, 213, 346, 390, 953, 1218
Tariff, Manganese and ferromanganese.. 829
Tariff, The chemical 404
Tariff, Zinc 329, 375
Tariff, Zinc, from imported ores 325
Tarr, R. S., Death of 662
Tarr Mg. Co. 331, 742, 1104
Tasmania mineral production 648, 774, 796
Tasmanian hydro-elec. development 886
Tasmanian Metal Extraction Co. 230
Tasmanian Smelting Co. 88
Taxation in Arizona 500
Taxation, Colo., decision 542
Taxation, Mich. mineral rights ...108, 780, 1212, 1238, 1264
—Jones & Laughlin taxes, etc....204, 105
—Notes..... 138, 189, 329, 427, 571, 1242
Taxation, Nipissing, decision 970
Tays, E. A. H. 136
Technical education, On 1066
Technical schools' research work.. 203, 298, 584, 729, 730
Technical writing, Mich. Coll. of Mines.1046
Tehuantepec Silver Mines Co. 442
Telephone, Drying air in 1127
Telephone saves shot firers 583
Telluride case, The 1210, 1241
Temiskaming mine, Ont. 73, 144, 192, 282, 329, 430, 518, 240, 523, 670, 680, 1296
—Costs 1034
—Report 1045
Temiskaming & Nor. Ont. Ry.: miners' food supplies 837, 974, 1022, 1259
Temperature correction chart, Tape *982, 1128, 1260
Temperature effects on miners 852
Temperature measuring pendants 158
Temperatures, Burning, for limestone.. 610
Temperatures, Metal, Finding, by salts fusion 439
Tempering drill steel 931, 981
Tenn. Cop. Co. 49, 474, 627, 913, 926, 961, 1271
—Report 952
—Unit production costs 937
—Smelting costs 1034
Tenn. Exploration Co. 813
Tests, Extraction, Graphic method of illustrating *639
Testing Materials, International Soc. ..1148
Texas Co. "Oil fuel" ....†1001
Texas copper explorations 621
Texas gold and silver 3
Texas iron ore 146, 765
Texas mica discovery 522
Texas oil and gas 93, 95, 97, 913
Texas quicksilver 38
Texas sulphur development 239, 245
Texas University mineral map 1264
Tezuitland Cop. Co. 79
Tharsis dividends; report 1116, 1283
Thawing frozen water pipes 349
Thayer, B. B. Butte in 1911....... 10
Thermometer, Heraeus resistance 355
Thiogen process, Young's.. 45, 49, 284, 807, 810, 855
—Demonstrations *873, 1003
Thirty-Acre Mg. Co. 23
Thomas, Kirby... 614, 758, 954, 1050, 1194
—Mining in Mex. in 1911 77
Thompson Falls power project 955
Thompson-Quincy, Utah ..334, 475, 716, 765, 861, 913
Thyssen, August 1148
Tibbals, W. H., Death of 136
Tightner Mines Co., Calif. 106
—Notes 61, 284, 472, 911, 1152
Tigre Mg. Co. report 1212
Timber Butte Milling Co. 1003
Timber dam *161
Timber framing for side pressures *396
Timber, Mining without *373
Timber—Pole treatment experiments... 513
Timbers, Drift, under side pressure, Joint for *1127
Timbers, Mine, Preservation of 1271
Timbering, Cal. & Hec.—Battery stulls. *255
Post and set in shafts *302
Timbering, Finger pin, in swelling ground *349
Timbering—Sealed drift *738
Timbering—Steel arch supports in tunnels 107
Timbering, Stull, Battery method *255
Timbering—Temporary staging staple.. *880
PAGE
Timbering, Triangular Tonopah Belmont *931
Timbering, etc.—Support at bottom of stope 443
Timiskaming. See "Temiskaming."
Tin, Alaska, dredging 19, 57
Tin, Australia 19, 89, 596, 1068
Tin, Billiton, production 1252
Tin, Bolivian 83, 244, 1168
Tin, Chinese 1239
Tin, Commercial, Analyses of 131
Tin Detinning 702, 1082, 1129
Tin, Dutch East Indies 244
Tin, Electrometallurgy of 410
Tin, Germany 125
Tin, Great Britain 124
—Foreign trade 241, 340
—Ore imports 14, 340, 556
—Ore production 648
Tin in Gay Lussac silver determination.. 986
Tin industry, 1911 19
Tin, Malay 19, 244, 918, 1048
—New discovery 560
Peculiar mine 600
Tin market and prices *13, 19, *20
Tin market, London, in 1911 135
Tin, Mex., development, Zacatecas 524
Tin mining notes, Cornwall 488
Tin, Nigerian, Pure 885
Tin ore in Poland 1082
Tin scrap plant, Australian 790
Tin scrap treatment 454
Tin, Siberian 1180
Tin, South Dakota 19, 66
Tin, Swaziland, etc. 358, 612
Tin, Tasmania, ore 648, 796, 842
Tin, Transvaal 86, 924, 1238
Tin, U. S., foreign trade 340
Tinplate exports, Brit., to U. S....... 291
Tinplate mfrs.' association 336
Tipuani, Bolivia, rush 971, 1069
"Titanic" victims 822, 827, 876, 1119
Titanium alloys, Making 986
Titanium and vanadium alloy shipments 652
Titanium chloride test for gold....... 742
Titanium in blast furnace 1082
Titanium or zirconium glass 790
Titanium, Refining metals with 886
Todd, W. Parsons 1194
Todd sampler for cyaniding *541
Tolman, C. F., Jr. Ariz. in 1911 66
—"Graphical Solution, Fault Problems".†373
Tom Reed Mines report 1187
Tomahawk lode, The 777
Tomboy, Colo. 59, 140, 1153
Tonnage costs, Basis.... 247, 250, 298, 393
Tonopah-Belmont 36, 52, 68, 142, 238, 621, 668, 716, 764, 1056
—Filter litigation 440
—Report 830
—Mining and milling costs 937, 1033
—Triangular timbering *931
—App mine purchase report and denial 1006, 1054, 1152, 1244, 1292
—Extensions 1124
Tonopah, Conditions at 1258
Tonopah Extension.. 68, 238, 572, 669, 812, 860, 1056
Tonopah-Halifax 716, 1246
Tonopah-Liberty solution clarifier *158
Tonopah Merger Mg. Co. 669, 1008
Tonopah-Midway 1008
Tonopah Mg. Co. ..36, 52, 67, 68, 238, *253, 860, 1119, 1258
—Report 1040
Totok mine, Rock separation *304, 738
Track, Double-gage, turnout *1266
Tracings, Photograph reproduction of.. 539
Tracy, Norman T. 1194
Transvaal diamonds 85, 86, 612
Tram, Aërial, Argentine Govt.....*601, *693
Tram, Aërial, African 790
Tramway, Cable, Evolution of *1278
Tramway tower in path of snowslide... 933
Transbaikal Tin Smelting Wks. 1180
Transmutation of metals 647
Transvaal. See also "Rand," "South Af."
Transvaal, Ancient mine workings 1074
Transvaal coal 86, 671
Transvaal diamonds.. 85, 86, 612, 924, 1238, 1277
—New diggings 240, 657
Transvaal, Gloomy outlook in 795
—Changing design of stamps 1032
Transvaal gold 3, 84, 152, 195, 612
—Rand output 518
Discoveries 204
Transvaal, Iron works in 536
Transvaal, Migration of miners and accidents 1052, 1141
Transvaal milling practice 52, 84, 354, 681
Transvaal mining in 1911 84
Transvaal mining supplies 213
Transvaal mining notes, etc. 249, 357, 612, 642, 644, 660, 664, 804, 924, 1073, 1077 1184, 1235, 1238, 1264
Transvaal Tropical natives' mortality.. 953
Transvaal's new metallurgy 1123
Travers-Ewell, A. 1050
Tray, Steel, for jigs *1177
Traylor crushing plant, Kensico *450
Traz os-Montes wolfram mine 1038
Trench, Concrete, for pipes *350

PAGE
Trenching, Nipissing mine, Cobalt 741
Trenkner on assaying 1280
Trent, L. C. Slime problem *1259
Tresavean mine, Cornwall... 387, 446, 489, *538
Trethewey mine, Ont. 288, 381, 470, 523, 861, 1156, 1296
Trewartha-James, W. H. 327
Trevor, T. G. Ancient workings, Transvaal 1074
Triangles for drawing flanges *540
Tri-Bullion, N. M. 813
Trilby mine, Mont. 572
Trimountain. See "Copper Range."
Trinity Gold M. & R. Co. 570
—Report 586
Trips, Steam-shovel dipper *447
Trolley car, Mine, Westinghouse *1134
Trollhättan zinc smelting 314
—Zinc smelting notes 42, 43
—Iron ore smelting 751
Trommels, Joplin *836
Trust, Anti, proceedings. See "Aluminum" and other companies by name.
Tube-mill efficiency, Computing........ 681
Tube milling 677, 547, 1124
Tuberculosis sanitarium, Mont. 1289
Tulloch mine, Calif. 857
Tungsten, Ariz. 39
Tungsten, Australia 220
Tungsten, Calif. 39, 62
Tungsten, Colo....... 39, 60, 911, 955, 1104, 1292
Tungsten discoveries, Siberia 780
Tungsten, Melting point of 874
Tungsten mine, Traz-os-Montes 1038
Tungsten Mtn. Mines Co. 714
Tungsten, Nev. 1057
Tungsten, New applications of 211
Tungsten, New Mex. 573
Tungsten ore, French requirements....1082
Tungsten, U. S. 1, 39
Tungsten, Wash. 573
Tungsten—Wolfram, Great Brit. 123
Tungsten, Ferro-, production, Elec. 173
Tunnel for steam pipes *785
Tunnel, Hudson River, through 326
Tunnel, Snake Creek, Lining 109, *1273
Tunnels, Steel arch supports in 107
Tuolumne Cop. Co.... 10, 64, 237, 521, 567, 572, 620, 763, 1105
Tupper, C. A. Cleveland-Cliffs power system *274
—Pumping plant, Sloss mines *550
—Argentine aërial tram *601, *693
Turbine, Spiro, Buffalo *319
Turbines, Exhaust-steam *356
Turkey, Operating mines in 514
Turkish mineral production 930
Turnagain Arm Co. 283
Turner, G. H., Death of 614
Turner, H. W. Cañon Diablo crater ... 974
Turner, N. P. 710
Turner, T. Distilling alloys 642
Turning large sheave on small lathe ...*352
Turnout, Double-gage *1266
Turntable, Ball-bearing *397
Tuttle, Herbert L. 758
Tweedy, G. A. Tajo milling costs 1226
Tuyere, Homemade 1219
Twin City M. & M. Co. 1294
Tyee Cop. Co. 1202
Tyrrell, J. B. 854, 856, 1196
Tyssowski, J. Gold dredge installations during 1911 555

U

Uncle Sam, Utah ..475, 808, 861, 1201, 1295
Underground mining, Data on 838
Ungava, Gold searches in 583
Union Consol., Comstock, Nev. 142, *169, 170, *172, 238, 380, 764, 812, 860, 1200
Union Cop. Land & Milling Co. 763
Union Dredging Co. 555, 666
Union Hill mine, Calif. 137
Union Minière, Katanga 14, 162, 1164, 1168
Union Natural Gas Co. 191
Union Oil Co. 94, 644, 728
Union, Peck adjustable elbow *367
Union Steel Corp., South Af. 536
United Comstock Pumping Asso. 68, *168, 474
United Copper Co. 572
United Kingdom
—Accidents in Cornish mines 165
—Ammonium sulphate 293, 529
—Cement combination, British........ 273
—Coal statistics 241, 648
—Coal strike ..300, 390, 484, 532, 678, 718, 767, 970
—Copper 123, 310, 340, 728
—Copper market, London 9, *13, *20
—Cornish mining notes 488
—Explosives used—Table 310
—Gold and silver movement 433
—Gold market, London 166
—Iron, steel, ore 123, 291, 385, 625, 648, 1061, 1086
—Lead *15, 123, 340, 648
—Metals, Foreign trade in 340
—Mica market, London 500
—Mineral production 648
—Mining, Gt. Brit. in 1911 ......123, 310

PAGE
United Kingdom
—Mint, British, Melting at 399
—Patents, New 231, 421, 661, 853, 1049, 1287
—Silver market, London 229
—Spelter 202, 340
—Spelter market, London *13, 22
—Tin 124, 135, 244, 340, 648
—Tin-ore imports 14, 340, 556
United Mine Workers of Am. 201
United States
Chiefly productions. See also "Bureau of Mines," "Survey, Geological," "Government," etc.
—Aluminum 340, 1038
—Ammonium sulphate 1, 529
—Antimony 6, 340
—Arsenic 1, 83
—Asbestos 652
—Cement 41, 308
—Chemicals, etc., Foreign trade 340
—Chrome ore 1238
—Coal and coke 1, 98
Foreign trade 336
—Copper 1, 7, 8, 680, 728, 1044
Foreign trade 340, 346
—Copper sulphate 1, 40, 340
—Ferromanganese 1
—Foreign commerce 479
—Fuller's earth 1044
—Gold 1, 3
—Graphite 1024
—Immigration Commission research ... 106
—Iron 1, 26
—Iron blast-furnace changes 596
—Iron, Pig, production 289, 296
By states 307
—Iron ore 1, 26, 31
—Iron, steel, ore—Foreign trade ..338, 385
—Iron, Pig, in 1909—Various census figures 1225
—Law, Mining. Discussion; mineral wealth, etc. 493
—Lead 1, *15, 340
—Lead, White 16
—Metals, Foreign trade in 340
—Mica 1192
—Mineral oil exports 197
—Nickel 1 340
—Petroleum 1, 93
—Phosphates 1142
—Platinum 4, 340
—Quicksilver 1, 38, 1234
—Rails 718, 991
—Silver 1, 3,
—Steel 27, 830, 870
—Sulphur 1168
—Talc 996
—Tantalum 204, 250
—Tin, foreign trade 340
—Titanium and vanadium alloys 652
—Tungsten 1, 39
—Wrought-iron production 229
—Zinc, spelter, etc. 1, 21, 202, 1039
Foreign trade 340
—Zinc dust 122
—Zinc oxide 1
U. S. Diamond Mg. Co. 1005
U. S. Gold Corp. 666, 1054
U. S. Gypsum Co. 1294
U. S. Metals Ref. Co. 8, 48
U. S. Red. & Ref. Co. 45, 1293
U. S. Smg., Ref. & Mg. Co. 44, 49, 62, 72, 813, 961, 1195, 1294
—Extending Mexican operations 166
—Report 685, 726
—In Nevada coal fields 828
—Experiences in exploration 1017
U. S. Steel Corp (See also "Oliver") 27, 193, 282, 879, 1188, 1203
—Monthly reports of orders ..193, 383, 575, 815, 1011, 1203
—Quarterly reports 289, 915
—Iron ore 31, 383, 652, 660
—Earnings in 1911 248
—Iron and steel statistics, 1911 289
—Congressional investigation 152, 153, 166, 200, 262, 344, 596, 909
—Govt. suits 297, 660, 963, 971, 1034, 1203
—Large ore vessels ordered 249
—Stock offer to employees 234
—Report for 1911 ....631, 658
—Bond issue 718
—Labor conditions 782, 823
—Labor output—Tons per man 789
—Gary steel works cost 1048
U. S. Zinc Products Co. 140
United Verde 12, 47, 425, 519, 809
United Verde Extension 519, 1005
Unwatering Tresavean mine with elec. turbine pumps 397, 446, 489, *538
—Valve box, similar purpose *786
—Unwatering Columbus Consol. 1027
Urals. See "Russia."
Uranium, Colo.......60, 188, 226, 667, 1149
Uranium in 1911 226
Urbiter, W. H., on milling 260
Utah Apex Mg. Co. ..234, 282, 375, 470, 716
Utah coal fields, U. S. Smg. Co. in 813, 828, 1195
Utah Consol. ..36, 143, 334, 429, 716, 1023
—Report 734
Utah copper 7, 8, 71, 234, 1044

PAGE
Utah Cop. Co. 8, 36, 72, 143, 239, 300, 523, 680, 711, 716, 759, 855, 1102, 1242, 1247
—Reports 306, 913, 930
—Costs in "Lake Sup. figures" 921, 925
Utah discovery by vision 971
Utah dividends in 1911 500
Utah gold and silver 3, 71, 72, 234
Utah iron ore 909
Utah lead 329, 773
Utah Metal Mg. Co. 424
Utah mine, Fish Springs 191
Utah Mines Coalition 138, 429, 475, 517, 1202
Utah mining in 1911 71
Utah petroleum 470, 475, 1057
Utah phosphate discovery 239
Utah Rare Metals Co. 1057
Utah resource map ready 105
Utah smelting plants' production 234
Utah zinc 72, 234, 329, 1039
Utahnite safety explosive 416, *1039
Utica Mg. Co. 378, 908, *952

V

Valve protector, Pump *884
Van Brussel, J. B. Blast desiccation by calcium chloride *595
—Otto internal-comb. locomotive *657
Van Roi Mg. Co. 76, 962
Van't Hoff's researches... 598, 653, 698, 802
Vanadium alloys, U. S. 652
Vanadium bearing iron sands, Use for 347, 633
Vanadium, Colo. 40, 60, 140, 188, 226, 667, 1003, 1093, 1094, 1149, 1241
Vanadium extraction, Saklatwalla's ...1082
Vanadium—Its ores and uses 1093
Vanadium geology, Note on 652
Vanadium in South Am. coal 991, 1092
Vanadium industry in France 515
Vanadium Mines Co. 238, 716
Vanadium in 1911 49
Vanadium ores, Bleecker process for... 514
Vanadium, Test for 872
Vandergrift, J. W. 136
Varnish and paint removal 397
Vautin, C. Separating blende from barite 1120
Veatch, A. C. 374
Vein outcrop—Prospecting hint *1174
Venezuela iron ore 200, 291
Venezuela magnesite deposits 794
Ventilation—Collapsible air ducts *638
Ventilation—Effects of atmosphere 852
Ventilation—Moir's air test 641
Vibromotor type screens, Using *1281
Victor Power & Mg. 426
Victoria mine, B. C. 1248
Victoria mine, Mich. 12, 189, 619
Victoria mine, Utah.... 429, 913, 961, 1247
Victoria Falls & Transvaal Power Co. 86, 804, 1235, 1264
Victoria Falls project 742, 1264
Vieille Montagne company 971
Vieille Montagne furnace *558
Villars, J. R. Barker dist. 275
Vindicator, Colo. 328, 1101
Vipond. See "Porcupine Gold."
Virgin, J., on timber framing *396
Virginia City, Nev. *167
Virginia Iron, Coal & Coke Co. 1057
Virginia & Mex. M. & S. Corp. 125
Vladivostok dist. mines 1236
Von Bernewitz on firebrick 369
Voorspoed Diamond Mg. Co. 1277
Vortex classifier, Simple *787
Vulture mine, Ariz. *1044

W

W. S. M. K., Ont. 1156
Wages. See also "Labor," "Costs."
Wages, Miners' 869
Wahnapitae gold dist., Ont. 574, 1058
Waihi mine, N. Z. 88, 542, 774
Waldman mine, Ont. *588
Walker, A. L. Cop. metallurgy 47, *403, 533
Walker overwind prevention gear *736
Walker, T. L. Molybdenum Ores, Can...*373
Wall rolls in Ohio mill 186
Wall's wet-screening device 1082
Wallace, R. B. Safety gate...........*161
—Drinking water in mine *587
Wallaroo & Moonta 89
Wallich, A., on hoisting 1035
Walter, E. W. Air in pyritic smelting.. 717
Walters, Fred. P. 1148
Walters, T. Taxation, Mich. 204
Wanakah mine, Colo. 331
Wanderer mine, Rhodesia 87, 829
War Dance mine, Colo. 517
Ward shaft, Comstock, Nev. *167, *171, 716
Ward's lead determination, etc. 885
Warriner, S. D. 153, 1148, 1240
Warrior Cop.—Warrior Devel. 957
Wasa group, Mont 1294
Washington gold and silver 3
Washington, D. C., Gold near 298
Wasp No. 2, S. D. 65, 239, 1057
Water analysis after Homestake fire .. 985
Water blast for allaying dust *1219
Water conservation, placer prospecting.*1266
Water consumption, Detroit Cop. Co. ..1034

PAGE
Water, Copper-mine, treatment 537
Water, Drinking, in mine *587, 1075
Water ejectors 353, *539
Water equivalents, List of 444
Water flow recorder, Lea *1089
Water in Calif. oil fields 469, 644
Water lowering in choked shaft, etc, 397, 446, 489, *538, 1027
—Valve box, similar purpose *786
Water—Measuring stream flow 399
Water pipes, Frozen, Thawing 349
Water power, Kolar gold field 392
Water-power locations and commission, Calif. 233, 469, 1051
Water, Sealing off, Catskill aqueduct shafts 512
Water, Shaft, to drive fan 783
Water tanks, Built-up wooden *1031
Water—V-notch weir *832
Water wheel, Pelton, horsepower 1080
Waters, Albert L. 566
—Pioneer smeltery, Ariz. 877
Waters, Underground, and mining 156
Watson, Hugh C. 1050
Watson, William J. 327, 1050
Wawaitin Falls power system.... 909, 1150
Weatherbe, D'Arcy 614
Weber's alkaline detinning method 1129
Webster, E. H. Slowspeed chilean mill.. 393
—Cyanide mill metallurgical records ..*791
—The V-notch weir *832
—Sodium sulphide as cyaniding precipitant 973
"Wedge rock" 391
Wedges, Breaking ground by *1047
Weed, Walter Harvey 806, 1050
Weed & Probert 758
Weighing, Automatic, at Hedley 791
Weiller, P., Research of 131
Weir, V-notch *832
Welch Tunnel G. M. Co. 1245
Wellington Mines, Colo. 426, 667
Wellman, S. T., & Son 566
Wells, J. L. Centrifugal filter 974
Welsh, Norval J. 327
Wenceslaus Garcia mines, Mex. 80
Wentworth, H. A. Huff concentrators..1272
Wentworth Land & Mg. Co. 811
Wernher, Sir J. C., Death 1050, 1122
Wernher, Beit & Co. 152
West Africa gold 3, 92, 288
West Coast mines, Ore. 621
West Coast Smg. Co., Mex. 1108
West End, Tonopah 572, *639, 716, 764, 812, 1056
West Rand Consol. 324
—New electric hoist 924
West Shining Tree dist....... *73, 240, 670
West Va. petroleum 93, 97
Western Australia. See "Australia," "Australasia."
Western Coal & Mg. Co. 486
Western Gasoline Co. 958
Western Rand Estates 85
Westinghouse mica mines, S. D. 66
Westinghouse mine trolley car *1134
Westinghouse plant, scrap melting *453
Weston, E. M. Blasting in wet shafts 1077
—Hints for prospectors *1174
Weston, W. Cripple Creek drainage .. 325
—As to prospecting 1070
—Mining in Colo. 1118
Weston normal cell 890
Wetherill, W. C., Death of 410
Wetherill process, zinc ore 127
Wettlaufer Mg. Co. 335
Wettlaufer-Lorrain, Ont. 288, 914
Weyerhauser cop. property, Wis. ..669, 1058
Whale oil for dynamite glycerin 202
Wharf, Ore, in Chile *981
What's in a name? 299
Wheel, Car, face taper *159
Wheeler, C. G., Death of 327
Wheeler, H. A. S. E. Mo. lead 17
Wheeler, K. T. Miners' literary taste. .. 348
Wheelock, R. P. Self-filling burette attachment *1031
—Adjustable drafting board *1130
Wherry, E. T. Carnotite, Penn. 1179
Whiskey Lake gold rush 1102
White, A. E. Jones step process 400
White, E. M. 758
White, H. A. Gold absorption by mills. 740
White Iron Lake mine 1055
White-lead combination rumored 386

PAGE
White lead in 1911 16
White lead process, Amino 1082
White River power project 957
Whiting, H. L., Death of 566
Whitley, W. A., Death of 566
Whitmore brake and overwind prevention gear *445
Whittuck, J. C. S. Simplified Challenge feeder *209
Wichman shovel dipper trip *447
"Wichtigsten Lagerstätten der Nichterze" ....†565
Wick, Geo. D., Death of 827
Wickes-Corbin Cop. Co. 64
Wilbert mine, Idaho 70
Wilcox, H. P., Death of 614
Wilcox, L. L. Safety appliances 209
—Skip and dump plate *1221
Wild Boy M. & M. Co. 956
Wildman-Mahoney 139, 187, 425
Wile electric dross furnace 514
Wilfley table kinks, Joplin *1129
Williams & Bradley sulphate leaching . 986
Williams shaft, England 124
Williams, W., Death of 662
Willow Ranch, Calif. 1103
Wilson, Jack 1102
Wilson, J. B., on missing zinc at Broken Hill 415
Wilson, Jack S. 374
Wilson, N. V. F. 1002
Wilson & Mathiesons, Ltd. *177
Winch head for lifting mill machinery .. 935
Winchell, H. V. Secondary sulphide enrichment 364, 729
—Discussion of mining law 493
—To abolish law of apex 777
Winchell, N. H., library 1288
Wingfield, George 1194
Winnemucca Mtn., Nev., discovery 333
Winona-King Philip 12, 332, 472, 1055
Winthrop Gold Mg. Co. 911
Winton-Vermillion Iron Co. 237
Wire. See also "Rope," "Cable."
Wire, Copper, drawing cost 1034
Wires, Elec., Tube joint for *660
Wisconsin Engineering Society 516
Wisconsin Mg. Co. 619
Wisconsin Steel Co. 1154
Wisconsin, Upper, Geology of 1192
Wisconsin zinc 25, 1039
Wisconsin Zinc Co. 334, 669, 1155
Wislicenus smoke-stack 44
Witherbee-Sherman dams burst 876
Wittich, L. L. Draining shaft through drill hole 491
Wizard rock drill *416
Wolcott, G. E. Breaking ground without powder *1047
Wolfram. See "Tungsten."
Wolverine, Mich. ..11, 141, *206, *397, 1023
Wood, H. E. Concentration of molybdenite ores. *227
—Ore separation by decrepitation 1184
Wood, H. E., Ore Testing Co. 203
Woodbridge, D. E. Lake iron ore..... 31
—Beneficating Lake iron ores 222
Woodman, H. Screening ore samples.. 633
Woodruff, E. G. San Juan oilfield 470
Woodruff, G. B. Roller-bearing car lubrication 1046
Worcester, S. A. Colburn-Ajax mill ..*753
—Grizzly crusher-feeder *883
—Air-driven side-dump car *932
—Underground hoisting station *1027
—Cripple Creek ore and waste plant ..*1173
Work M. & M. Co. 542
World's Fair mine, Ariz. 283
Wort, W. E. Pumping diagrams *934
Wrench for stuck drills *396
Wrought-iron production 229
Wyoming-Ervay Oil Co. 717
Wyoming gold and silver 3
Wyoming, Leucite Hills 423, 651
Wyoming oil men's association 1155
Wyoming petroleum 93, 790, 1229, 1277
Wysor, R. J. 854

Y

Yankee Consol. 334, 621, 808
Yarmony dist., Colo. 1153
Yeandle, W. H. 232

PAGE
Yellow Jacket mine, Idaho 221
Yellow Jacket mine, Nev... *168, *170, *171, 380
Yellow Pine mine, Nev. 912
Yellowstone Portland Cement Co....... 427
Yerington dist., Nev. 828, 1135
York, Ernest H. 954
York Dredging Co. 19, 556
Young, George J. 392
—On slime filtration 46
—Position on the Comstock *167
Young, J. W., Death of 232
Young, L. E. Teaching drilling *1227
Young, S. W. Neutralizing powder fumes 255
—His thiogen process 45, 49, 284, 807, 810, 855, *873, 1003
Yuba placer mine, Calif. 331
Yukon Gold Co. 36, 1243

Z

Zalinski, E. R. Utah mining 71
—Notes on Pioche, Nev. 604
Zelaya, C. Petroleum, Chile 756
Zelewski blende-roasting furnace *558
Zern, E. N. 1050
Ziegfield, F. Research in analytical methods 974
Zinc. See also "Spelter."
Zinc and ore market and prices.... *13, 24
Zinc assay, Nickel in 826
Zinc, Australasia 88, 1068
Zinc blende, Separating, from barite *929, 1120, 1184
Zinc, Canada 561
Zinc, Colo. 21, 59, 60, 1003, 1039
Zinc Corp. 88
Zinc determination as oxalate 885
Zinc determination, Rapid methods ...1143
Zinc, Ductility of 402
Zinc dust as precipitant 641, 946
Zinc-dust feeder, Bosqui *1095
Zinc-dust feeder, Colburn-Ajax mill ...*755
Zinc dust for cyaniding, Tests of *943
Zinc dust in 1911 122
Zinc dust, Metallic zinc in *165
Zinc dust precipitation, Merrill's......1081
Zinc, Germany 125, 752, 1024, 1095
Zinc, Illinois 21, 1039
Zinc industry in 1911 21
Zinc, Joplin dist. 74, 1039
—Ore dressing *405, *459, *501, 553
Zinc-lead dist., Okla. *1146
Zinc, Metallurgy of 41
Zinc, Mex. 78
Zinc, Missing, at Broken Hill 415
Zinc, Mont., production, concentration, etc. 10, 21, 41, 137, 1039, 1289
Zinc, New Jersey 1284
Zinc, Okla. 21, 23, 1039
Zinc-ore contracts, Joplin 24
Zinc ore higher than lead 970
Zinc ore, Igneous concentration 127
Zinc ore production S. W. Mo., Okla., Kan. 406, 1039
Zinc oxide, reduction 1087, 1214
Zinc oxide, U. S. 1
Zinc Producers' Asso. 24
Zinc, Rolled, Strength of 513
Zinc scrap treatment 454
Zinc, Sheet, Gage for 463
Zinc, Siberia 1236
Zinc smelting, Blue powder prevention.. 320
Zinc smelting capacity, U. S. 22
Zinc smelting, Kan. and Okla. 849
Zinc smelting, Origin of 1164, *1185
Zinc smelting, Trollhättan 314
—Notes 42, 43
Zinc sulphate, Desulphurizing 1180
Zinc tariff 329, 375
Zinc, Tariff on, from imported ores ... 325
Zinc, Transvaal 86
Zinc, U. S. 1, 21
—Foreign trade 340
—Spelter and zinc ore, by states 1039
Zinc, Utah 72, 234, 329, 1039
Zinc, Wis. 25
Zink, R. J. Aluminum dust explosions.. 308
Zinn Iron Mining Co. 1247
Zircon production in 1911 1230
Zirconium glass 790
Zirconium, Uses of 610
Zook, J. A. Joplin dist. 24
Zopilote mines, Mex. 240, 766

The Engineering and Mining Journal

Vol. 93. JANUARY 6, 1912. No. 1.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT
Of this issue 12,000 copies are printed. None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Gold, Silver and Platinum..F. Hobart 3
Precious Stones......George F. Kunz 5
Arkansas Diamond Fields. John T. Fuller 6
Antimony 6
Copper 7
Mines of Butte..........B. B. Thayer 10
Lake Superior Copper..C. L. C. Fichtel 11
Copper in Arizona.....James Douglas 12
Lead 15
Southeast Missouri....H. A. Wheeler 17
Tin 19
Zinc 21
Oklahoma Lead and Zinc Mining. George W. Bigham 23
Joplin District.........Jesse A. Zook 24
Zinc in Wisconsin......J. E. Kennedy 25
Iron and Steel.............F. Hobart 26
Iron Ore in Lake Superior District. Dwight E. Woodridge 31
Chronology of Mining in 1911........ 33
Mining Company Dividends.......... 35
Nitrate of Soda.........W. J. Dwyer 37
Quicksilver in the United States..... 38
Quicksilver in California. Lewis H. Eddy 38
Quicksilver in Texas. William B. Phillips 38
Bismuth 39
Tungsten 39
Vanadium 40
Cement Industry 40
Zinc Metallurgy........W. R. Ingalls 41
Lead Metallurgy.......H. O. Hofman 43
Cyanidation........Burr A. Robinson 45
Copper Metallurgy..Arthur L. Walker 47
Iron and Steel Metallurgy Bradley Stoughton 50
Stamp Milling......Louis D Huntoon 52
Mining in the United States..Alfred H. Brooks, George E. Collins, Lewis H. Eddy, Frederick W. Scofield, F. L. Fisher, C. F. Tolman, Robert N. Bell, Edward R. Zalinski 55
Ontario..........Thomas W. Gibson 73
British Columbia..........E. Jacobs 75
Mexico....Kirby Thomas, Austin C. Brady, Frederick MacCoy 77
Nicaragua............T. Lane Carter 81
Central America 82
South America 82
Arsenic 83
Transvaal-Rhodesia...H. F. Marriott 84
Australasia...............F. S. Mance 87
Russia.........John Power Hutchins 90
Petroleum....M. L. Requa, Erasmus Haworth, Raymond S. Blatchley, H. C. George, William B. Phillips 93
Coal and Coke......................... 98
Mining Index 99

Introduction

This annual statistical number of the JOURNAL is laid out on the same plan as its predecessors, but as has always been the case it comprises some new features that are important, as to which we can fittingly repeat the substance of our preface last year. Besides a comprehensive treatment of many of the minor minerals and metals, there is presented again a valuable series of metallurgical articles, reviewing the progress of 1911 in the various departments of metallurgy. Also there are numerous articles upon mining developments by leaders of the industry, many of those that are unsigned being fully as responsible as those that are. No one can turn over the following pages without a recognition of the impressive list of contributors and the authoritativeness of their summaries. To all of these contributors, who have collaborated in this number, we tender our thanks, and also to the many persons who have assisted in the collection of statistical information. Our thanks are due also to the producers of copper, lead, spelter and other substances, who have communicated to us the amount of their output in 1911 and have thereby enabled close approximations to the actual production in 1911 to be made by Jan. 4, our date of going to press.

PRODUCTION OF METALS IN THE UNITED STATES

Metal	Unit	1910	1911
Copper (*a*)..	Lb.	1,086,249,983	1,101,291,290
Ferromanganese..	L. tons	224,431	175,595
Gold (*b*)....	$	96,269,100	96,233,528
Iron	L. tons	27,074,114	23,647,451
Lead (*c*)..	S. tons	392,704	402,281
Nickel (*e*)..	Lb.	25,359,544	26,716,643
Quicksilver.	flasks	22,418	21,500
Silver (*b*)..	Tr. oz.	57,137,900	57,796,117
Zinc (*d*)...	S. tons	277,065	292,700

(*a*) Production from ore originating in the United States. (*b*) The statistics for 1910 are the final and those for 1911 are the preliminary statistics reported by the director of the Mint. (*c*) Production of refined lead from ore and scrap originating in the United States; antimonial lead is included. (*d*) Total production of smelters, except those treating dross and junk exclusively; includes spelter derived from imported ore. (*e*) Imports for first 11 months of each year. This nickel is smelted in the United States for the production of metal, oxide and salts.

PRODUCTION OF MINERAL AND CHEMICAL SUBSTANCES

Substance	Unit	1910	1911
Ammonium sulphate.......	S. tons	116,000	127,000
Arsenic. ...	Lb.	2,652,000	6,162,000
Coal, anthracite	S. tons	82,670,235	86,896,065
Coal, bituminous ..	S. tons	411,126,408	396,296,823
Coke (*b*). ..	S. tons	36,056,059	29,338,214
Copper sulphate	Lb.	26,356,788	33,454,000
Iron ore.......	L. tons	53,267,397	41,815,471
Petroleum	Bbl.	210,588,308	209,931,884
Tungsten ore...	S. tons	2,130	(*a*) 1,125
Zinc oxide ...	S. tons	78,000	65,000

(*a*) Preliminary estimate of U. S. Geological Survey. (*b*) All coal and coke statistics are the estimates of *Coal Age*.

The production of the more important minerals and metals is summarized in the table on this page. The details appear in subsequent pages. It will be found that in some cases our contributors give figures that do not agree with our own. The explanation of such differences will generally be that the articles of outside contributors were necessarily written and put into type before our own statistics were available. The necessity of handling the great mass of material in this huge number in a few days leaves no time for leisurely comparison and revision to effect a careful coördination of all the data. We fell sure that no one, in the light of this explanation, will be misled by any discrepancies that may be discovered. This number of 102 pages, if made up in the form of ordinary technical treatise, would constitute a book of upward of 360 pages.

The reader of these pages will obtain the idea that 1911 was fairly prosperous in the mining industry and will, perhaps, find it difficult to understand the pessimism that prevailed. Many of the important substances show increased production. In many cases the outputs were the largest on record, that having occurred in the cases of copper, lead and spelter. On the other hand there were decreases in the production of coal, petroleum and iron, but they were not large. Consumption was generally large; there were some increases and some decreases. The reasons for such variations in the returns are not yet easy to understand. Prices ranged a little lower in 1911 than in 1910, our index number for the metals having been 112 in 1911 against 115 in 1910 and 115 in 1909.

METAL MARKETS

New York, Jan. 3—The metal markets have been rather quiet over the end of the year, with no developments of especial importance.

MONTHLY INDEX NUMBERS

Month	1910	1911	Month	1910	1911
January....	127	110	July........	112	112
February ..	124	115	August.....	113	117
March......	118	112	September.	114	111
April.......	118	114	October	111	112
May........	113	118	November .	117	111
June........	107	115	December..	115	110

Year 1909, 115; 1910, 115; 1911, 112.

Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Nov. 1911..	$13,941,093	$ 3,458,321	Exp. $10,482,772
" 1910..	1,376,011	4,313,500	Imp. 2,937,489
Year 1911..	36 188,397	52,737,854	Imp. 16,549,457
" 1910..	57,444,422	54,245,886	Exp. 3,198,536
Silver:			
Nov. 1911..	5,052,238	3,338,956	Exp. 1,713,282
" 1910..	5,265,595	4,827,254	Exp. 438,341
Year 1911..	59,667,286	40,439,844	Exp. 19,227,442
" 1910..	51,299,913	41,479,718	Exp. 9,820,195

Exports from the port of New York, week ended Dec. 30: Gold, $217,076; silver, $1,328,153, chiefly to London. Imports: Gold, $787,605; silver, $121,600, principally from Mexico and South America.

Gold—Prices of gold on the open market in London were at the normal level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Some gold was taken for India and a little for Egypt; but most of the supplies went to the Bank of England.

Iridium—The price remains unchanged, at $64 per oz. for pure metal.

Platinum—The market is rather quiet, as is usual at the end of the year. Prices are unchanged. Dealers ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal.

SILVER AND STERLING EXCHANGE

Dec.-Jan.	28	29	30	1	2	3
New York....	54⅜	64⅜	64¼	....	54⅝	54¾
London ..	25⅛	25⅛	25¼	25 3/16	25¼	25¼
Sterling Ex.	4.8580	4.8600	4.8620	....	4.8620	4.8635

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—The market is steady and shows a slight improvement since the holiday suspension of business. There are no new features in the situation.

Aluminum—Little business is reported at the close of the year, though dealers look for an improvement this month. Prices are unchanged. Quotations are 18¾@19c. per lb. for No. 1 ingots, New York delivery.

Copper, Tin, Lead and Zinc

NEW YORK

Dec.-Jan.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
28	14⅛ @14⅜	13.95 @14.10	45	4.45	4.32½ @4.35	6.20 @6.35	6.05 @6.20
29	14⅛ @14⅜	13.95 @14.10	44⅞	4.45	4.32½ @4.35	6.25 @6.35	6.10 @6.20
30	14⅛ @14⅜	13.95 @14.10	44⅞	4.45	4.32½ @4.35	6.25 @6.35	6.10 @6.20
1	......	......	......	......	......	......	......
2	14⅛ @14⅜	14.00 @14.10	44¼	4.45	4.32½ @4.35	6.25 @6.40	6.10 @6.25
3	14⅛ @14⅜	14.00 @14.10	42	4.45	4.32½ @4.35	6.25 @6.40	6.10 @6.25

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Dec.-Jan.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
28	63⅝	64½	67¾	206	191¼	15¾	26¾
29	63	63⅞	67¾	205	190	15⅝	26¾
30	......	......	......	......	......	......	....
1	......	......	......	......	......	......	....
2	63 7/16	64¼	67¾	201	188½	15⅝	26¾
3	63 9/16	64⅜	67¾	191	184¾	15⅝	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The holidays have had the usual retarding influence upon business. Transactions have been in relatively small volume, but in view of the heavy sales of previous weeks producers have been able to look on complacently. There has been some realizing of speculative copper, influenced by the erratic London quotations, but as a whole, the market shows a firm front in anticipation of the December statistics. The close is steady at 14⅛ to 14⅜c. for Lake copper, and 14 to 14.10c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 13¾ to 14c. as the average for the week.

The standard market has been subject to various dips during the few days on which business was done in London, the close being somewhat lower at £63 11s. 3d. for spot, and £64 7s. 6d. for three months.

European visible stocks on Jan. 1 are reported as follows: In England, 42,100; France, 5250; Rotterdam, 5300; Hamburg, 8100; afloat from Chile, 1580; afloat from Australia, 8350; total, 70,680 long tons, an increase of 710 tons over the Dec. 15 report.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 15¼c. base, carload lots at mill.

Tin—Contrary to all expectations, the London market opened the new year with a considerable decline. It was understood among the trade that the London Syndicate was practically in control of such tin as has to be delivered under contract in January, and the decline came therefore as a great surprise. As December statistics were favorable, no reason for the weakness can be discovered.

A fair business took place among dealers in this market during the last week of the old year at prices somewhat below the importation point. Holders, however, do not seem willing to follow to the full extent the decline of the London market, and are now asking a premium of about ½c. per lb. for spot and January tin. The market closes in London at £191 for spot, and £184 15s. for three months, and in New York at 42c. for January.

Visible stocks of tin on Dec. 30 were: London, 10,998; Holland, 2764; United States, excluding Pacific ports, 2868; total, 16,630 long tons, an increase of 116 tons over Nov. 30.

Lead—The market is unchanged at 4.45c. New York, and 4.32½@4.35c. St. Louis.

The London market is rather easier, the close being cabled at £15 12s. 6d. for Spanish, and £15 15s. for English lead.

Spelter—Business has been dull in consequence of the holidays. Consumers persist in buying from hand-to-mouth, even though future deliveries are offered at a considerable discount from the prices at which near-by spelter is being sold. This condition produces a wide spread in quotations. The close is quoted at 6.10@6.25c. St. Louis, and 6.25@6.40c. New York.

The London market has remained steady throughout the week at £26 15s. for good ordinaries, and £27 for specials.

Antimony—Business has been fair, and prices are unchanged. Cookson's is quoted at 7¾@7⅞c. per lb., and Hallett's at 7⅜@7⅝c., while 6¾@7c. is named for Chinese, Hungarian and other outside brands.

Gold, Silver and Platinum in 1911

By Frederick Hobart

The gold production of the world in 1911 again exceeded that of any previous year, though the increase over 1910 was small, only 0.9 per cent., according to the preliminary figures so far collected. This was entirely due to the increase of over $15,750,000 in the Transvaal. There were fair gains also in Rhodesia, in Canada and in West Africa. The United States production was about stationary. The important decreases were in Australia, the causes of which are explained elsewhere; in Russia, where unusual drought interfered with operations in the Siberian placers during the first half of the year; in Mexico, where revolutionary disturbances affected mining and mine labor; and in India, where two of the important Kolar mines are still in a zone of lean ore. These decreases, however, were not sufficient to overcome the large gain in the Transvaal and the other increases.

In Table I herewith, the approximate returns for 1911 are given in comparison with the corrected figures for 1910. The total for 1911 is $473,383,543, showing an increase over the previous year of $4,017,933, or 0.9 per cent. In this table the statements for the United States are the preliminary estimates compiled by the director of the Mint. For nearly all the important producers reports are for 11 months of the year, the month of December being estimated. Our estimates have been made on a conservative basis, so that revisions later may slightly increase the total; but the difference will not be great.

1. GOLD PRODUCTION OF THE WORLD

	1910	1911
Transvaal	$155,730,260	$170,487,900
United States	96,269,100	96,233,528
Australia	65,634,340	61,072,409
Russia	43,168,389	40,600,000
Mexico	24,073,100	19,500,000
Rhodesia	12,607,791	13,045,100
India	12,089,400	10,505,506
Canada	10,224,910	10,646,000
China	10,102,300	10,000,000
Japan, East Indies, etc.	10,522,437	10,600,000
West Africa	3,674,087	5,268,100
Madagascar	2,149,721	1,900,000
France	1,114,700	1,275,000
Central and So. America	14,886,234	15,000,000
Other countries	7,118,841	7,250,000
Total	$469,365,610	$473,383,543

Table II shows the course of the world's production for 20 years past. While we cannot here discuss the full effect of increased gold output on prices and prosperity, it is clearly evident that the gain has been at least contemporaneous with the extraordinary increase in production and commerce of the last two decades; and that it must at least be considered one of the important causes contributing to that development. The table shows that the production last year was more than three times that of 1892; twice that of 1897, and nearly 60 per cent. greater than in 1902, or 10 years ago. The chief factors in the last decade have been the new developments in the Transvaal, in Alaska and the Yukon, in the Lena country and the Transbaikal in Siberia; and the advances in gold metallurgy.

II. GOLD PRODUCTION OF THE WORLD FOR 20 YEARS

1892	$146,292,600	1902	$298,812,493
1893	158,437,551	1903	329,475,401
1894	182,509,283	1904	349,088,293
1895	198,995,741	1905	378,411,054
1896	211,242,081	1906	405,551,022
1897	237,833,984	1907	411,294,458
1898	287,327,833	1908	443,434,527
1899	311,505,947	1909	459,927,482
1900	258,829,703	1910	469,365,110
1901	260,877,429	1911	473,383,543

In 1911, as in 1910, there were no great or important new districts open. For the future the prospect is rather uncertain. The Transvaal has, perhaps, reached almost its highest development, though it will continue a large producer. It is possible that important mining fields may be opened in the Congo; and South America is, in large part, an unexplored country. From these countries and perhaps from Manchuria and Mongolia the future gains are to be expected.

AMERICAN PRODUCTION

Table III shows the gold production of the United States, the figures being furnished by the Director of the United States Mint. The year showed no important changes. California took the first place, its small decrease being exceeded by the larger loss in Colorado, which held the first rank in 1910. Of the other important producers Nevada and Alaska showed only small changes, but South Dakota reports a very considerable gain. Utah and Idaho also gained in production, but Montana and Arizona decreased. The larger states are treated fully on other pages.

III. UNITED STATES GOLD PRODUCTION
(In Value)

	1910	1911
Alabama	$32,900	$18,335
Alaska	16,271,800	16,002,976
Arizona	3,413,200	2,954,790
California	20,441,400	20,310,987
Colorado	20,526,500	19,153,860
Georgia	24,000	30,532
Idaho	1,035,000	1,169,261
Illinois	......	5,788
Michigan	......	20
Maryland	......	20
Montana	3,720,400	3,169,840
Nevada	18,783,700	18,968,578
New Mexico	477,200	639,897
N. Carolina	64,500	76,693
Oklahoma	......	30,698
Oregon	681,400	599,235
Pennsylvania	5,900	7,814
So. Carolina	37,800	13,437
S. Dakota	5,380,200	7,430,367
Tennessee	2,800	14,140
Texas	400	1,178
Utah	4,312,700	4,709,747
Virginia	900	4,300
Washington	806,000	504,537
Wyoming	4,100	18,791
Porto Rico	1,000	2,191
Philippines	154,400	130,501
Miscellaneous	......	265,013
Total	$96,269,100	$96,233,528

The total gold production showed a decrease in 1911 of only $35,572; that is, it was practically the same in both years.

Table IV gives the silver production of the United States for two years past, in fine ounces. For these figures we are indebted to the courtesy of the Director of the United States Mint. The miscellaneous line includes silver reported which it was not possible, at this early date, to apportion exactly to the several states. It will be seen that in 1911 Utah, with an increase of 2,233,733 oz., attained the first rank as a producer, passing Montana and Nevada, which held second and third ranks, as they were first and second in 1910. Utah, Idaho and California were the only states making notable gains in 1911; Colorado, Nevada and Montana showing decreases.

IV. UNITED STATES SILVER PRODUCTION
(In Fine Ounces)

	1910	1911
Alabama	300	174
Alaska	153,900	275,691
Arizona	2,655,700	1,594,428
California	1,791,600	2,727,336
Colorado	8,523,000	7,530,940
Georgia	300	174
Idaho	7,027,000	7,507,802
Illinois	2,100	4,648
Michigan	262,200	507,234
Maryland	.....	87
Missouri	32,200	56,228
Montana	12,282,900	11,116,778
Nevada	12,366,000	10,651,571
N. Mexico	779,000	1,142,335
N. Carolina	8,300	2,227
Oklahoma	.....	168,245
Oregon	43,800	69,116
Pennsylvania	700	13,262
S. Carolina	.....	14
S. Dakota	120,600	206,188
Tennessee	69,800	126,683
Texas	364,400	442,480
Utah	10,445,900	12,679,633
Virginia	200	45
Washington	204,900	142,196
Wyoming	1,300	1,009
Porto Rico	.....	51
Philippines	1,800	3,383
Miscellaneous	.....	826,102
Total	57,137,900	57,796,117

The total production of silver in 1911 increased by 658,277 oz. over that of 1910. As in previous years nearly all this silver was produced in connection with other metals, chiefly lead, copper and gold.

The production of silver in the world cannot fairly be reported at this date. In all probability, it did not differ greatly from that of 1910; and was, therefore, about 222,000,000 oz. A decrease in Mexico, due to disturbed political conditions, was almost made up by considerable increases in Canada and Australia.

THE SILVER MARKET

The silver market was affected chiefly, as usual, by the conditions in the East; last year also by the great speculation carried on by Indian and Chinese capitalists. This speculation forced the price up in the latter part of the year to a point considerably above the nearly uniform level of the earlier months.

Table V shows the exports of silver from London to the East from Jan. 1 to Dec. 21 for two years past. Table VII gives the average prices of silver in New York and London, by months.

The exports of silver from the United States direct to China in the 10 months ended Oct. 31 were valued at $4,218,735 in 1910, and $7,081,056 in 1911; an increase of $2,826,321. These exports in 1911 were approximately 13,360,000 oz. The largest item of silver exports from the United States in the 10 months was $42,097,655—approximately 79,450,000 oz.—to Great Britain. London still remains the great market for silver, especially for the East.

V. SHIPMENTS OF SILVER TO THE EAST

	1910	1911	Changes	
India........	£6,858,000	£8,702,500	I.	£1,844,500
China........	1,424,000	990,300	D.	433,700
Total......	£8,282,000	£9,692,800	I.	£1,410,800

VI. MONTHLY AVERAGE PRICES OF SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January.....	51.750	52.375	53 795	23.843	24.154	24 865
February....	51.472	51.534	52 222	23.706	23.794	24.081
March.......	50.468	51.454	52 745	23.227	23.690	24 324
April........	51.428	53.221	53 325	23.708	24.483	24 595
May.........	52.905	53.870	53.308	24.343	24.797	24 583
June.........	52.538	53.462	53 043	24.166	24.651	24 486
July.........	51.043	54.150	52 630	23.519	25 034	24 286
August......	51.125	52.912	52 171	23.588	24.428	24 082
September ..	51.440	53.295	52 440	23.743	24.567	24 209
October......	50.923	55.490	53.340	23.502	25.596	24.594
November...	50.703	55 635	55.719	23.351	25 680	25.649
December. .	52.226	54.428	54.905	24.030	25.160	25 349
Total......	51.502	53.486	53.304	23.706	24.670	24.592

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Coined silver in the United States, Dec. 1, as estimated by the Treasury Department: Silver dollars, $565,168,367; subsidiary silver, $164,080,387; total, $729,248,754. Of the silver dollars $490,453,000 are held in the Treasury against silver certificates outstanding.

THE COMMERCIAL MOVEMENT OF GOLD

Space will not permit us here to go into details of the movement of gold in 1911. It is sufficient to say that the great production of the year was absorbed largely in the channels of commerce without any of the commotion which has marked some recent years. At one period political complications in Europe caused a demand for gold from Germany, but this quickly passed over. France and England, as usual, imported more gold than they exported. The United States also imported $16,550,000 more gold than it exported; this, with its own production, making an increase in the stock of gold in the country of $112,800,000—less the amount used in the arts. It is rather remarkable that the gold holdings of the great European banks at the close of 1911 show practically no change from those at the end of 1910. If the proportion of the gold produced which was used in the arts was the same as in previous years, about 25 to 30 per cent., there must have been some $340,000,000 of the yellow metal added to the world's circulating medium; but it does not appear in the public records. It is in private hands or in circulation.

Foreign commerce of the United States, 11 months ended Nov. 30, as valued by the Bureau of Statistics of the Department of Commerce and Labor:

Merchandise	1910	1911
Exports.................	$1,637,256,221	$1,867,605,414
Imports...................	1,426,194,277	1,392,550,517
Excess, exports......	$211,061,944	$ 475,054,897
Add excess of exports, silver..........		19,227,442
Total..................................		$ 494,282,339
Deduct excess of imports, gold.......		16,549,457
Net export balance...................		$ 477,732,882

Gold held by United States Treasury, Dec. 1, was: Reserve for redemption of treasury notes, $150,000,000; held against gold certificates, $1,002,579,669; in current balances, $28,364,250; total, $1,180,943,919. The gold in banks and circulation is estimated at $616,777,641; making a total of $1,797,721,560 in the United States.

Platinum in 1911

During 1911 the production of platinum continued to be chiefly from the Ural placers in Russia. The Russian output, which was estimated at 300,000 oz. in 1910, was a little less—about 280,000 oz.—in 1911, on account of the working out of some of the older placers, and to a short supply of labor in the early part of the year. Later short crops in Eastern Russia sent many laborers back to the mines, and a number of *starateli* prospectors and tributors—in the placers increased.

From Colombia, the next producer, the output continued small and irregular. The operation of two dredges in the Choco district is reported to be successful, but does not seem to have resulted in any large increase in the production, which may be estimated at about 10,000 oz. for the year.

In the United States about 350 oz. is produced yearly, chiefly parted from placer gold obtained in northern California and Oregon. The Rambler mine, in Wyoming, from which some production was promised, was not in operation during the year. There was only a small quantity saved in British Columbia. The only other producer is Australia, but there also the quantity is small.

The imports of platinum into the United States in the 11 months ended Nov. 30, were 112,948 oz. in 1910, and 110,937 oz. in 1911; a decrease of 1111 oz. Of the imports in 1911 there were 51,310 oz. crude metal, and 59,627 oz. in refined and manufactured form.

THE MARKETS

The course of the platinum market in 1911 is shown in the accompanying table, in which are given the prices at New York, at Ekaterinburg and St. Petersburg, in Russia. Ekaterinburg is the primary market where purchases are made from the small miners; metal from the large estates is shipped direct to St. Petersburg, which is the wholesale market. The final collection and distribution of Russian platinum remains in the hands of two or three large companies in Paris and St. Petersburg, which entirely control the trade.

AVERAGE PRICES OF PLATINUM.
IN DOLLARS PER OUNCE TROY.

	New York, Refined Platinum.	Russia, Crude Metal—83 Per Cent. Platinum.	
		St. Petersburg.	Ekaterinburg.
January....	$39.06	$31.57	$31.90
February....	39.31	31.96	31.85
March......	41.00	32.43	32.25
April.......	41.35	34.69	34.27
May.... ...	42.81	34.55	35.25
June....	42.88	34.71	35.06
July........	42.95	35.47	34.71
August . ..	44.38	36.78	35.44
September...	45.31	37.02	37.23
October....	46.25	37.39	37.60
November..	46.13	37.98	37.89
December...	46.00	37.78	37.60
Average for the year	$43.12	$35 21	$35.09
Av. for 1910	32 70	26.96	26.37

The record for the year is of a steady and almost unchecked advance through the year. The lowest monthly average of refined platinum in New York was $39.06 per oz. in January; the highest was $46.25, in October. From that point the decline to December was only 25c. per oz. The average for 1911 was $10.42 above that of the previous year. The strong point in the market was the large demand for the jewelry trade, fashion having established the use of platinum in jewelry quite firmly, at least for the present. This, combined with the limited production, resulted in the firmness of the market.

The Russian prices, which have been reduced to American weights and currency in the table, are for crude metal, 83 per cent. platinum; the New York prices are for refined metal. Hard metal, which contains from 7 to 10 per cent. iridium, is usually quoted about $2.50 per oz. higher than refined platinum. Iridium ranged in 1911 between $60 and $65 per oz. for pure metal.

Precious Stones in 1911

By George F. Kunz*

It seems remarkable that in the face of a universal financial depression the price of diamonds and pearls should have advanced considerably since 1906, and this after only one year's shutdown of the great group of diamond mines and with no attempt to regulate the price of pearls. The imports of precious stones have remained constant, for, although the imports in 1908 were less than in 1906, a banner year, this was partly the result of overbuying, and the effect of the small importation in 1908 was the selling down of the old stocks, which in turn led to the greater imports of 1909, 1910 and 1911.

That the sale of precious stones does not always fluctuate with financial conditions was never more apparent than this year, which was marked by a financial slump in September, by threatening war clouds between Germany and France, Russia and Japan, by the revolution in China, and, finally, by the war between Italy and Turkey. But it will invariably happen that when people are assured of the permanent worth of an investment they will not hesitate to buy even when the financial situation appears to be less favorable than usual, or else they buy because they will buy under all circumstances.

Steady Advance in Diamond Prices

However, the upward trend of prices, especially that of the diamond output, has steadily continued, in spite of occasional setbacks; this is clearly apparent when we compare the average prices of the uncut, rough diamonds for five-year periods for the last 20 years: 1891 to 1895, average price per carat, 26s. 9.45d.; 1896 to 1900, 29s. 1.15d. per carat, increase in price, 8.6%; 1901 to 1905, 47s. 3.36d. per carat, increase, 62.5%; 1906 to 1910, 55s. 7.93d. per carat, increase, 17.7%. The diamond syndicate advances on the price of rough diamonds when sold to the diamond cutters have been as follows: June, 1906, 4%; May, 1907, 3; June, 1909, 5; June, 1910, 2%.

Greater Cost of De Beers Diamonds

That the advances in diamonds are justifiable may be seen after a study of the report of the De Beers Consolidated Mines for the year ended June 30, 1911. The amount of production was £4,938,086, the total revenue being £5,928,830. Deducting from this £2,930,213 for mining expenses, depreciation, interest on debentures, etc., there remained a balance of £2,998,616. From this £310,137 was paid to the Union of South Africa for taxes on profits for the year ended June 30, 1910, and £265,458 was set aside to cover the taxes on profits to June 30, 1911. This shows the increased cost of mining at greater depth. Preferred dividends to the amount of £800,000 and deferred dividends amounting to £1,000,000 were paid and provided for. After subtracting these items there remained a balance of £623,019 on the year's operations. On January 1, 1911, the balance of the first mortgage debentures of the company, bearing interest at 5%, to the amount of £1,216,120 were redeemed, as were also £27,080 of Bultfontein obligations at 4½%. The reserve fund was increased from £968,905 to £1,374,766 during the year, and the company was relieved of a contingent liability of £630,000 for the Klerksdrop-Fourteen-Streams Ry. Co. by the Union government's settlement of that company's debentures.

The following average results were attained in the different mines of the De Beers group during the year ended June 30, 1911:

	Carats per load	Value per carat	Value per load
De Beers & Kimberley	.28	51s 6.29d	14s 5.12 d
Wesselton	.27	37s 9.6 d	10s 2.47 d
Bultfontein	.38	35s 0.52d	13s 3.79 d
Dutoitspan	.21	73s 6.5 d	15s 5.325d

At the same time even with the advances in the price there was a decrease of £476,800 in income as compared with 1910, due to the decreased production, although the price rose steadily. This decrease represents fully one-half the amount of the value of the German Southwest Africa deposits, and with the increased demand all over the world, a larger diamond yield would not glut the market and continued advances are not improbable, clearly proving that the bourses do not always dictate the prices of commodities which have an international status.

The value of the precious stones, cut and uncut, brought into the port of New York in 1911, the figures for December being estimated, is about $40,854,088, as against $40,566,489 for 1910, thus showing a slight increase in the imports of these articles. As the conditions prevailing during the year were distinctly unfavorable, it is evident that under normal conditions there would have been a considerable increase over the figures of the previous year. As it is, only in the record year of 1906 were more precious stones imported into New York than in 1911, the difference between these two years being $2,719,400 only.

The total importations into the United States for 10 months of 1911 are, from official figures, $36,413,685, and the amount for the whole year may safely be put at about $$42,500,000. This would be about $1,000,000 less than in 1909, $1,750,000 less than in 1906, and a small increase over the figures for 1910. It is noteworthy that in no triennial period were so many precious stones imported into our country as in the years 1909, 1910 and 1911, during which time precious stones worth nearly $128,500,000 were brought in. The nearest approximation of these figures was in 1905, 1906 and 1907, when the imports totaled $114,306,458.

De Beers Production to Date 67,000,000 Carats

We can gain some idea of the enormous production of diamonds in the South African fields from the fact that the De Beers group of mines has furnished diamonds weighing at least 67,000,000 carats and worth more than £100,000,000, or $500,000,000. If to this immense sum we add the value of the diamonds extracted from the Premier mine, from a number of smaller independent mines and from those in German Southwest Africa, we would probably have a total of nearly, if not quite, $600,000,000. The great and consistent demand for diamonds is strikingly shown by the rising prices, notwithstanding this enormous production. Before these reach the final customer, when all the costs of cutting and handling are added, the value will amount to about $1,200,000,000.

When we consider that in 1906 the German-African mines had not yet been developed, and that there has been an average annual yield of about $4,500,000 from this source during the last three years, in addition to the South African supply, it is not surprising that the diamond mines of New South Wales should receive the encouragement they do. However, there is as yet considerable doubt as to the likelihood of their ever equaling the African mines in richness, or their ever becoming dividend-payers. There has not been any important development of the Arkansas deposits, which, in their present condition, are awaiting the placing of extensive machinery for working them. Some small diamonds have been found in the Belgian Congo at a point 1500 miles north of the Kimberley mines, and there is only a nominal supply from British Guiana. The East Indian yield is less than £2000, less than a day's African output, and the Brazilian not over £50,000 or about a week's output.

---

*Gem expert, 401 Fifth Ave., New York.

The diamond, the pearl, the emerald and the sapphire are now enjoying public favor to the full. There has been a material advance in the price of these gems from the figures of four years ago, when I predicted that the sapphire in particular, which had not been the subject of fashion's favor, was soon likely to become so.

The Fergus County, Mont., mines, were more productive than ever before; however, in general, and larger blue stones are included, colored stones are not so well favored as they were formerly.

Cameos, which have not been in vogue for over 20 years, are being revived to some extent, although not enough to enable the dealers to sell out their old stocks. Coral is now in great favor. Many necklaces are imported at a wide range of prices, the cost varying from 5c. to $2000. Pearls are higher in value, this being due both to the decreasing fisheries and to the universally accepted edict that the pearl is one of the richest and at the same time one of the most modest of jewels; therefore the price has steadily advanced since 1895, notwithstanding the depressions of 1907 and 1910. One of the principal discoveries of gems was that by Schaller of turquoise in minute triclinic crystals in Campbell County, Virginia.

A series of combinations is now sold of vari-colored square, round or oblong stones, or caliber-cut stones, such as the emerald and the sapphire, demantoid, peridot, sapphire, kunzite, aquamarine, etc. In this way marked contrasts are produced, but the effect is often quite harmonious when a number of these stones are skillfully grouped together by the jeweler.

Two-thirds of all fine jewels are now mounted in platinum. Whether it is due to this demand or not, platinum, which sold at $18 per oz. in 1881, and at $24 in 1891, brings in 1911 over $50 per oz. when combined with 5 or 10% of iridium.

An American Radium Industry

Extensive experiments with the treatment of uranium ores to produce radium and radio-active compounds, were carried on during 1911 by a private American syndicate, at Pittsburgh. Satisfactory results are reported, but no definite plans are announced.

The Arkansas Diamond Field

By John T. Fuller*

Five years have now elapsed since the finding of the first diamond on these fields. During this period one "pipe" has been proved to contain diamonds in payable quantity, the "washings" to date having shown 28 carats per 100 loads of 16 cu. ft. A second "pipe" has been proved to contain diamonds but whether or not in payable quantities has yet to be determined, while a third "pipe" is still in the anticipatory state.

The year 1911 saw but little development and practically no work on the mines, as all the companies in the field were hampered by lack of capital.

The Arkansas Diamond Co. which owns the greater part of the "pipe" in sections 21 and 28—T. 98.—R. 25W., is making, quiet but determined efforts to raise the capital necessary to equip and develop its mine. It does not seem possible that a property of such great promise can remain unproductive for an indefinite time.

The Mauney tract, and a portion of the Ozark company's holdings lie on this same "pipe." The most important event of the year was the finding of an 8⅛-carat white stone on the Mauney tract. This is the largest stone found to date on these fields. A white stone weighing 3¹¹⁄₁₆ carats was also found on the "pipe" in section 14 owned by the American Diamond Mining Co.; the stone is the largest yet found on its property.

It is impossible to forecast the year 1912, as everything depends on what success the various companies may have in raising the required capital.

Antimony in 1911

Antimony in the United States continues to be distinctly a minor metal. There is no antimony ore smelted in this country, and it is believed the entire ore production, only used for experimental purposes, will not exceed 50 tons. The American Smelting & Refining Co., the United States Metals Refining Co., and the Balbach Smelting & Refining Co. are producers of antimonial lead, all of which finds a ready market, without the necessity of separating the metals. There is also a small production in secondary alloys by the scrap smelters.

About 70% of all metallic antimony imported, on which, incidentally, there is a duty of 1½c. per lb., is the well known Cookson's brand, and the largest users of it say that it is distinctly economical to use only the purest metal, both from the standpoint of drossing, and of exact knowledge of the composition of the resultant alloys. There is also a considerable importation of needle antimony from China, of which the production so far has not been interfered with by the revolution. This needle antimony is exclusively an Oriental product, depending for its production apparently on pure ores and cheap labor.

AVERAGE PRICES OF ANTIMONY
(In Cents per Pound)

	1910			1911		
	Cookson's	U. S.	Ordinaries	Cookson's	U. S.	Ordinaries
January	8.500	7.988	7.738	8.25	7.74	7 .5
February	8.469	7.969	7.578	8.38	8.02	7.65
March	8.359	7.938	7.313	9.56	9.13	9.00
April	8.438	7.938	7.438	9.54	9.13	8.52
May	8.438	7.938	7.438	9.50	8.97	7.99
June	8.241	7.938	7.438	8.75	.....	7.42
July	8.175	7.938	7.400	8.50	.....	7.35
August	8.278	7.938	7.328	8.44	7.94	7.36
September	8.313	7.938	7.313	8.31	7.84	7.26
October	8.263	7.900	7.400	8.14	7.71	6.96
November	7.922	7.656	7.188	7.97	7.61	6.92
December	7.625	7.438	7.063	7.78	7.50	6.82
Year	8.252	7.876	7.386	8.59	8.16	7.54

As seen by the accompanying table of prices, the market was dull and lifeless through the year. The international antimony syndicate put prices to an artificial level for a little while, but the so called collapse of the syndicate in September was merely the tardy recognition by a pricked bubble that it had already ceased to exist.

There continues to be a crop of suggestions for a simple metallurgy of antimony, which would be good, if they would only work. Pending the arrival of some workable improved process, the old-fashioned method of smelting sulphides to a regulus, and its sale as such, or reduction by iron or similar agents, and the reduction of oxides previously volatilized and collected, continues to be standard practice. The anti-phosphorus bill, which will increase antimony consumption, is still unsettled by Congress.

Antimony Oxide

The use of antimony oxide as a substitute for the oxide of tin in the ceramic and enamel industries, has been favored by the high price of tin during 1911. The Harshaw, Fuller & Goodwin Co. was, until recently, the sole manufacturer, but owing to increased demand, a larger plant became necessary, and the Enamel Co. of America, interested in the product, bought up and enlarged the Elyria plant of the Harshaw-Fuller company. The Enamel Co. of America has appointed as its joint selling agents the Roessler & Hasslacher Chemical Co. and the Harshaw, Fuller & Goodwin Co. It is understood that this plant operates chiefly on Chinese regulus. The imports of antimony oxide are small. The price of this product in 1911 was about 7¾@8c. per pound.

---

*Consulting mining engineer, 505 Park St., Honesdale, Penn.

The Copper Industry in 1911

The history of 1911 is told concisely in the accompanying statistics and in the following special articles, wherefore no great elaboration is necessary in this introduction. The statistics of smelters' production are based uniformly upon the fine-copper content of blister copper, plus the production of the Michigan smelteries, and the small amount of copper scrap and precipitate that is put directly into anodes. The comparison between refiners' and smelters' production throws light upon the matter of stocks of crude copper. In making this comparison, it is to be borne in mind that a small part of the smelters' production, possibly about 6,000,000 lb. in 1911, passed into bluestone rather than refined metal.

SMELTERS' PRODUCTION

(In Pounds)

Source	1910	1911
North American ore	1,284,339,246	1,288,243,875
Foreign ore (*a*)	41,976,733	34,883,713
Scrap (*b*)	10,962,099	18,603,084
Totals	1,337,278,078	1,341,730,672
To foreign refiners	33,855,800	32,467,440
To American refiners	1,303,422,278	1,309,263,232
Blister copper imported ( )	146,185,104	148,000,000
Total crude copper	1,449,607,382	1,457,263,232

(*a*) Exclusive of Canadian and Mexican ore (*b*) Inclusive only of scrap treated by primary smelters. (*c*) Exclusive of blister copper imported from Canada and Mexico.

PRODUCTION OF COPPER IN THE UNITED STATES

(In Pounds)

State	1910	1911
Alaska	5,008,171	16,200,000
Arizona	299,606,971	316,933,756
California	45,793,894	37,085,315
Colorado	10,127,012	8,400,000
Idaho	6,216,461	1,830,666
Michigan	221,400,864	217,270,000
Montana	286,242,403	273,438,879
Nevada	63,877,500	65,800,000
New Mexico	3,632,351	2,288,288
Utah	125,042,381	140,293,198
East and South	18,195,450	19,147,761
Other states (*a*)	1,106,525	2,603,427
	1,086,249,983	1,101,291,290

(*a*) Includes copper of which it is impossible to determine the origin.

PRODUCTION OF COPPER IN NORTH AMERICA

(In Pounds)

Country	1910	1911
United States	1,086,249,983	1,101,291,290
Canada	52,492,282	55,945,498
Mexico	137,797,217	121,025,747
Cuba	7,799,764	9,981,340
Totals	1,281,339,246	1,288,243,875

In the above tables, the production credited to Alaska and to the United States is doubtless a little too low, and that credited to Canada correspondingly too high, it having been impossible at this time to trace back to Alaska the copper produced in the United States from some Canadian matte, which resulted from the smelting of Alaskan ore. Such copper is therefore credited temporarily to Canada.

There is, moreover, a considerable production of blister copper at the refineries from their own byproducts, which may amount to as much as 20,000,000 lb. per annum. This is to be considered as a working stock, continually locked up, and such production is excluded from our statistics.

Making all of the above allowances, it appears that the production of blister copper and its analogues was larger in 1911 than the production of refined copper. It is probable also that a surplus of ore accumulated at the smelteries or in transit thereto.

Upon the basis of the smelters' statistics we have distributed the production according to states and countries of origin, all of the smelters having courteously coöperated in this by an itemization of the production so far as possible. As in previous years, this preliminary distribution is only approximate. It can never be precise; and no closer indication of the mine production than what is based on the smeltery figures can ever be made, other statisticians to the contrary notwithstanding. This consideration does not affect the total. It means simply that some copper credited to one state may really belong to another.

REFINERY STATISTICS

Month	United States Product'n	Deliveries Domestic	Deliveries for Export
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,567
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	69,936,364	69,855,660
IX	115,588,950	57,311,584	60,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII ( )	115,000,000	65,000,000	67,000,000
Year, 1911	1,424,041,641	708,624,141	742,663,617

VISIBLE STOCKS

	United States	Europe	Total
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912 ( )	94,784,178	158,323,200	253,107,378

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe. (*c*) Estimated.

In 1911 the mine production was doubtless larger than the smeltery production in certain states, particularly Alaska, Arizona and New Mexico, where important new mines began to produce. Attention may be drawn to the smallness of the total credited to New Mexico. The explanation of this is that but very little of the Chino copper had been turned out as blister copper up to the end of the year, although the smelters had been receiving the concentrates for several weeks. For the same reason the amount of blister copper reported as actually produced from Miami and Ray is less than the copper in concentrates reported by those companies.

Review by States

Alaska—The large increase in the production of this territory was due to the inauguration of shipments from Copper River. The mine production was probably larger than our figure, A. H. Brooks, of the U. S. Geological Survey, having estimated 22,900,000 lb. Such an amount, however, had not passed through the smelting works up to the end of the year.

The shipment of copper ore from Alaska to the United States in December, 1911, was 9935 long tons, containing 5,258,956 lb. of copper, against 1,274,655 lb. in November. Of course the December ore had not been smelted previous to the close of the year. However, the figure that we credit to Alaska for 1911 is undoubtedly low for the reason stated in the foot-note to the previous table.

Arizona—The situation in this state is reviewed by Doctor Douglas in a subsequent article. We need say only that its increased production is ascribable chiefly to Miami and Ray. The latter company has reported to us its monthly production as follows: April, 704,261 lb.; May, 1,006,922; June, 1,167,463; July, 1,689,124; August, 1,833,083; September, 1,876,904; October, 2,069,287; November, 2,517,000; December (estimated), 2,660,000; total, 15,524,044.

California—The decrease in the production of this state was due especially to smoke troubles, causing the Balaklala works to be closed during the year, and reducing the Mammoth output.

Idaho—The Snowstorm mine was closed during part of the year, wherefore the reduced output of this state.

Michigan—The small reduction in output reflects the curtailment by the principal producer.

Montana—East Butte made an increased output but Anaconda curtailed, wherefore the less total for this state. Anaconda is now to produce at full rate.

Nevada—Nevada Consolidated contributed the total credited to this state. Mason Valley and perhaps Giroux will become producers in 1912.

New Mexico—Chino will make a large output in 1912. In 1911 but little of its concentrate was smelted.

Utah—Utah Copper Co., Utah Consolidated and South Utah were the chief producers. The output of Utah Copper Co. alone was 99,000,000 lb. This company ceased curtailment in September, since when it has been producing at full capacity. A further increase may be expected in the latter part of 1912.

East and South—The production of Vermont and Virginia became insignificant in 1911. The smeltery at Norfolk was idle. Tennessee made an increased output.

OTHER NORTH AMERICAN COUNTRIES

Canada—The output of this country was diminished by the closing of the Granby mine and smeltery during part of the year, owing to the colliery strike. Smelting was resumed in December. The deficiency of Granby output was partly made good by resumption of mining by the Britannia company, which shipped its ore to Tacoma. The Tacoma Steel Co. shipped ore from Texada Island. Production in the Sudbury district, Ontario, was about as usual.

Cuba—The Cuba Copper Co. is the principal producer.

Mexico—Curtailment by certain of the large producers and the revolutionary disturbances explain the decrease in the output of this country.

World's Production of Copper

Statistics of the world's production of copper are likely to differ on account of variations in the systems of computation adopted by individual statisticians. In our own statistics we adopt the production of anodes and pig copper as the base and refer the metallurgical production of the several countries back to the country of origin. Thus, Cuba produces no pig copper, but figures as a copper producer through Cuban ore smelted in the United States. Some copper doubtless escapes enumeration by this system, wherefore our statistics are more likely to be low than high.

The statistics that we have used for Chile in the above table are much larger than is commonly credited to that country. We have included the copper derived from the large amount of Chilean ore that is smelted in the United States

WORLD'S PRODUCTION OF COPPER
(In Metric Tons)

Country		1910		1911
United States		492,712		499,542
Mexico		62,504		54,897
Canada		23,810		25,377
Cuba		3,538		4,528
Australasia		40,962		42,500
Chile	(b)	41,374	(b)	37,156
Peru	(f)	26,000	(c)	28,500
Japan		46,700	(e)	46,000
Russia	(a)	22,700	(d)	26,000
Germany	(a)	25,100	(d)	25,700
Africa	(a)	15,100	(d)	18,500
Spain and Portugal	(a)	51,100	(e)	52,000
Other countries	(a)	28,100	(e)	29,000
Totals		883,000		890,000

(a) As reported by the Metallgesellschaft, Frankfurt am Main (b) Exports of Chile bars, plus contents of ore imported from Chile into the United States. (c) Based chiefly upon imports of pig copper and ore into the United states. (d) Partially estimated. (e) Wholly estimated, no precise data being available (f) As reported by Aron Hirsch & Sohn.

The New York Copper Market in 1911

The apprehensions entertained for the copper market at the outset of the year and the hopefulness which prevails as the year is drawing to a close form a contrast, which, retrospectively, it is difficult to reconcile. And yet the explanation is to be found in factors so simple that it seems strange they did not receive recognition earlier in the year. A deluge of copper; an increase of stocks to unwieldy proportions; the necessity of enlarging operations at the low-grade copper mines in order to keep up the dividends; these were the arguments advanced by those who could see no remedy other than a fall in prices, which would automatically check production. But the reality proved otherwise. Producers exercised a commendable restraint; instead of forcing the output of their mines, it was, in most cases, decided that a curtailment would serve the industry best. The low level of the market stimulated consumption throughout the world. Copper replaced other metals for the most varied uses. The growth of consumption for miscellaneous purposes was so gradual as to evade observation from the standpoint of its effect upon prices. Stocks of pig copper which had accumulated at the refineries were gradually worked off. Upon their disappearance, the figures of production published by the Copper Producers' Association showed a shrinkage. This reduction in the output of the refineries was expected much earlier than was actually the case, the delay being due to accumulations of furnace material, which had served as a working stock, and which were first of all consumed before the refineries allowed their tanks to stand idle. Nothing would disturb the trade at large in its preconceived views. The market backed and filled for 10 months of the year within a range of not more than $10 per ton, due largely to a persistent policy of hand-to-mouth buying, prompted by the expectation of a much lower level of prices.

ELECTROLYTIC COPPER REFINERIES OF THE UNITED STATES

Works	Location	1910 Capacity, Pounds	1911 Capacity, Pounds
Nichols Copper Co.	Laurel Hill, N. Y.	†330,000,000	†330,000,000
Raritan Copper Works	Perth Amboy, N. J.	*310,000,000	*320,000,000
Baltimore Copper Smelting and Rolling Company	Canton, Md.	*264,000,000	†288,000,000
American Smelting and Refining Co.	Perth Amboy, N. J.	*180,000,000	†180,000,000
U. S. Metals Refining Co	Chrome, N. J.	*180,000,000	*180,000,000
Balbach Smelting and Refining Co	Newark, N. J.	*41,000,000	*48,000,000
Anaconda Copper Mining Co.	Great Falls, Mont.	*65,000,000	*65,000,000
Tacoma Smelting Co.	Tacoma, Wash.	†28,000,000	†28,000,000
Calumet & Hecla Mining Co	Buffalo, N. Y.	*50,000,000	*55,000,000
Total		1,418,000,000	1,494,000,000

*Official figures furnished by the respective companies. †Estimated from previous records.

PRICE OF COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.368
July	12.215	12.463	12.570	12.720	54.194	56.670
August	12.490	12.405	12.715	12.634	55.733	56.264
September	12.379	12.201	12.668	12.508	55.207	55.253
October	12.553	12.189	12.788	12.370	56.722	55.176
November	12.742	12.616	12.914	12.769	57.634	57.253
December	12.581	13.552	12.863	13.768	56.769	62.063
Year	12.738	12.376	13.039	12.634	57.054	55.973

New York, cents per pound. London, pounds sterling per long ton of standard copper.

In January, the market was dull. Sales took place at between 12.40 and 12.50c. early in the month. Competitive selling brought prices down to 12⅛c. by the beginning of February, when there was a recovery, due to heavy purchases for foreign account, which resulted in an advance to 12.25@12.30c. The better tendency was short-lived. Prices sagged slowly, but the market showed resistance whenever it sank to the neighborhood of 12c. This was the situation up to May, when unfavorable statistics caused a break through 12c., and about the middle of that month the lowest point of the year was reached with 11.80@11.90c. The Standard Oil decision, handed down about that time, produced a change of sentiment. Europe took the lead with heavy purchases, and followed by a more liberal demand for home trade, quotations climbed steadily until 12.50@12.60c. was realized toward the end of June. Not long thereafter, the Morocco difficulty began to cloud Europe's political horizon, and an urgent liquidation started in all speculative markets. However, the unsettlement of the stock exchanges had a relatively slight effect upon the price of copper, notwithstanding the fear of a serious contraction in the absorbing power of Europe and correspondingly smaller exports. Early in October, the quotation stood at 12.05@12.10c., the low point. Conservatism reigned supreme. Consumers on both sides of the Atlantic had allowed their stocks to run down to a minimum. Buying on a large scale could no longer be put off. Another shock caused by the filing of the suit against the Steel Corporation brought about a temporary setback toward the end of October, but aside from this short interim, the movement had started, which took the market out of the rut in which it had stuck practically since the panic of 1907. Favorable statistics in November and December helped to accelerate the pace, and by the end of the year prices had advanced to 14c., under the influence of an enormous volume of orders.

AVERAGE MONTHLY PRICES OF COPPER MANUFACTURES

(In Cents per Pound)

	1910		1911	
	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper
Jan.	15.35	18.50	14.06	18.50
Feb.	15.25	18.75	13.50	18.50
Mar.	14.75	19.50	13.25	18.50
Apr.	14.75	19.50	13.75	18.50
May	14.10	18.50	13.75	18.50
June	14.19	18.50	13.75	18.50
July	14.00	18.50	13.90	18.50
Aug.	14.00	18.50	13.81	18.50
Sept	14.00	18.50	13.75	18.50
Oct.	14.00	18.50	13.50	18.50
Nov	14.25	18.50	13.75	18.63
Dec.	14.25	18.50	14.94	19.13
Year..	14.41	18.69	13.81	18.56

While European buyers have regained sufficient confidence in the future to anticipate their requirements a few months ahead, the domestic consumers have followed the market only reluctantly. A buying power is therefore in reserve, which, whenever it makes itself felt, may tax the resources of producers, some of whom have hardly a working stock of refined copper left on their hands. Whatever tension may be created ought, however, to be temporary only, since the output from the new porphyry mines of Arizona is gradually coming into the market, while the Anaconda company has announced that it will increase its production in January, and other producers are likely to do the same thing.

During 1911 there was a reduction of about 100,000,000 lb. in the world's visible supply of copper. In 1912 a new production of about 150,000,000 lb. is anticipated, besides which there will be whatever the older producers choose to add.

The London Copper Market

Special Correspondence

The year opened with optimism which was reflected in an initial improvement of 5s. per ton, the value of cash standard rising to £56 6s. 3d. per ton, and three months to £57 2s. 6d. Statistics showed a substantial decrease in the European visible supply. The improvement, however, was quickly lost, mainly under the influence of American statistics which disclosed an unwelcome increase in the output of the refineries during December, coinciding with a decrease in consumption, and the immense quantities shipped from America to Europe. A decline continued for 12 days, when there followed a gradual improvement, due mainly to the absorption of large quantities for consumption in both hemispheres. With trade requirements covered, prices again relapsed until the close, when selling pressure subsided under generally improved conditions; and the month closed with values £54 17s. 6d. and £55 13s. 9d. respectively.

The upward trend of prices which marked the closing days of January was manifest in the early part of February. European statistics were satisfactory, selling pressure had ceased, trade requirements were large, and speculative interest was encouraged. Later the market was disquieted by rumors of adverse American statistics for January, whereby buyers were intimidated and short selling was encouraged; the result being a decline of £1 10s. per ton. Further decline was arrested by persistent renewal of trade demand; prices advanced sharply to £55 and £55 15s. Thereafter fluctuations were within narrow limits, but tending downward toward the close, influenced partly by liquidation by tired holders and partly by apprehension as to the effect of a decision of the Railroad Commissioners in the United States on the freight-rate question. Closing prices were £54 15s. per ton for prompt standard, and £55 8s. 9d. for three months.

March opened with a fractional decline in prices. Statistics disclosed a decrease of 422 tons in the European visible supply, which was insufficient to counteract the downward trend. Throughout the month fluctuations were within narrow limits, the market being supported by trade demand rather than by interest displayed by speculators. Dullness supervened and was relieved only by a temporary manifestation of activity on Mar. 15, when a general covering of "bear" commitments coincided with some important sales of refined copper to consumers. The month closed with a market devoid of animation; cash standard being quoted £54 8s. 9d., and three months £55 per ton.

April opened with a fractional advance in prices, but this was followed by a gradual and persistent decline, due partly to lack of speculative enterprice; to the forced sale of old purchases as they fell due, and to the hesitation of American consumers. In Europe the volume of business with manufacturers was moderate and seldom extending far forward. American statistics for the preceding month were regarded as unfavorable. On the other hand, European statistics for first half of April disclosed a reduction of 2664 tons in the visible supply, which tended to check the decline. The Amalgamated Copper Co.—after long abstention—entered the market at the reduced price of £56 10s. for Europe. London closing prices were £54 and £54 12s. 6d. for spot and three months.

In May some buoyancy on the Stock Exchange, and a reduction of 1535 tons in the visible supply combined to infuse some speculative interest into the market, and resulted in an advance; but it was of short duration. The improvement brought out fair orders, but manufacturers were reluctant to cover orders unless at substantial concessions. The American Producers' statistics were regarded unfavorably. Standard copper gradually fell till May 17, when a recovery set in, prompted by the fortnightly European statistics. Speculative business revived and trade demand followed to some extent. There was some revival of gossip in regard to a possible consolidation of the leading interests in America. Thereafter the trend of prices was upward; and the month closed with spot warrants £55 3s. 9d., three months £55 16s. 3d., and with European trade brisk.

In June the market opened at a fractional decline which, however, was recovered. The expansion in European consumption and evidence of increasing consumption in America were followed by enhanced prices. There was general suspension of business in the United Kingdom on June 22 and 23 in connection with the Coronation, but the strength of the market was in no way impaired. The absorbing power in the market did not allow prices to dip much, and the month closed with cash standard £57, and three months £57 11s. 3d. per ton.

In July, business opened with a decline of 5s. per ton, mainly induced by international complications coinciding with crop scares in the United States. Later support was forthcoming. A small decrease in the European visible supply, a calmer aspect in the political world, and better reports from Wall Street, combined to induce a rally in prices. Again, demand was more readily satisfied by disappointed speculative holders than by the leading producers whose accumulation of stock was an element of weakness in the market. Manufacturers were consequently cautious in entering the market. Even the mid-monthly statistics, showing a decrease of 2273 tons in the European visible supply, failed to dispel the prevading apathy. The lowest prices recorded in London were on July 20, when good quantities were taken over. With improved demand and a brighter general outlook values improved somewhat, and the month closed with cash standard at £56 5s. per ton, and £56 17s. 6d. for three months.

August opened with a fractional decline in prices, and buyers were not encouraged by statistics, the American statistics showing a decrease of 8739 tons during July. The favorable impression which was created by these figures as well as by the continued activity in the consuming industries was counter-balanced by the political outlook, weakness in the security markets, and by the paralysis of trade in the United Kingdom brought about by serious labor troubles. Throughout the month the consuming industries were well employed, but sellers were always found ready to supply the metal at current values, which moved within narrow limits.

September opened with a fractional advance in prices, and the market remained fairly steady for a week or more. The peace of Europe was gravely threatened by international dispute, and the stock markets sustained great and persistent depression. Declining values caused heavy losses, wherein copper-mining securities participated largely. There are, however, little pressure on the part of dealers and speculators to sell, nor would the leading producers make any concessions in price. The lowest recorded price was on Sept. 22, when it became evident that there were few speculative holdings to be liquidated and numerous short sales to be covered. With some improvement in American finance the copper market quickly responded to a revival in demand, and improved by 15s.

October opened with a fractional decline in prices. Statistics showed a decrease of 837 tons in the European visible supply during second half of September, and the consuming industries were everywhere well employed; but these favorable factors were counterbalanced by the tardy reappearance of the Amalgamated group of American producers as sellers of the refined metal at prices which were not sufficiently low to tempt the trade. Prices drifted gradually downward. Thereafter, surrounding conditions improved, and the confidence thus imparted resulted in a great expansion of business and an improvement in prices. Demand being temporarily satisfied, prices relapsed somewhat. Trade requirements, however, were sufficient to arrest any serious decline, the electrical industries being particularly active, as also the manufacture of sulphate. Closing prices were £55 7s. 6d. for cash standard, and £56 2s. 6d. for three months.

In November the market opened with an advance, due in some measure to the statistics. There was evidence of notable expansion in trade generally, and values consequently advanced almost uninterruptedly throughout the month, with comparatively little speculative aid. Nov. 22 the price of standard copper suddenly rose more than £1 per ton; a succeeding reaction was only temporary. Meantime American producers had sold largely in both hemispheres, but the volume of trade showed no sign of diminution, and the close of the month found the market very firm, cash standard being quoted £59 2s. 6d. with £59 16s. 3d. for three months.

December gave little promise of improved markets at the outset. Standard copper drifted gradually downward. At the lower level there was a sharp recovery of about 10s. per ton, due partly to some of the leading producers having raised their prices after making large sales to consumers, but more particularly to the hasty covering of short sales. In the latter part of the month there was feverish activity and a quick advance, spot standard going at the close to £63 per ton.

The Mines of Butte in 1911

By B. B. Thayer*

The properties of the North Butte, East Butte, Butte & Superior, Tuolumne and Anaconda Copper Mining Co., together with the zinc properties owned by W. A. Clark, were operated continuously in 1911, and while the business depression which existed throughout the United States during that period was felt in a certain degree in the Butte district, it was not felt to the same extent as at other points in this country, for while the mines were operated under somewhat curtailed conditions, advantage was taken of the lull by all of the operating companies to make extraordinary repairs in their different working shafts, and the amount of development work was normal, so that the decrease in the number of men employed was not proportionate to the decrease in output. Notwithstanding the conditions mentioned above, it is generally understood that the year 1911 was one of lower costs in the Butte district, several factors having entered into this question, the most prominent being the benefits derived from the consolidation of certain properties now forming the property of the Anaconda Copper Mining Co., and also the more general use of electric power by all companies.

Early in the year 1911, the copper-producing mines owned by W. A. Clark were purchased by the Anaconda Copper Mining Co., and have since that time been operated under its direction.

The different companies that have operated in the Butte district since its beginning have always been noted as having been the pioneers in the investigation and adoption of new processes and methods, and the year 1911 will stand as one in which experimentation promising excellent results was most active.

There has been developed on the Missouri River and its tributary streams a large amount of electric power, and the hydro-electric plants are capable of still greater development. All of this power is available at Butte, and, in fact, in all of the mining districts in Montana. A large amount of this power is being used in Butte for a variety of operations, and the Anaconda company is much pleased with the success which it has thus far attained in applying compressed air, generated by electric power, to its hoisting operations, in place of steam.

The zinc output of the camp, while large, would have been much greater had the producing companies been thoroughly satisfied with their methods of concentration. They have been trying out different processes and seem to have arrived at a satisfactory solution, and it has been rumored that both the Butte & Superior and W. A. Clark intend to erect concentrating plants in the near future.

It is the opinion of the engineers in charge of the different mines in Butte, both copper and zinc, that there has never been a time in the history of the Butte camp when the mines have looked so well, or when developments were more satisfactory than during the year 1911.

---

*President, Anaconda Copper Mining Company, 42 Broadway, New York.

The Lake Superior District in 1911

By Carl L. C. Fichtel *

The year 1911 was rather eventful for the Lake Superior district, inasmuch as it received much publicity through the report of J. R. Finlay of New York, who was appointed by the State of Michigan to place a valuation on the various properties for taxation purposes; and through the contentions and affidavits of the minority interests of the Ahmeek and Osceola companies in the suits against the proposed consolidation of the Calumet & Hecla and its subsidary companies. Mr. Finlay's estimated life of the district was comparatively short, but as his report was for taxation purposes only, it dwelt upon the apparent conditions and did not take into consideration the possibilities of the unexplored and undeveloped territority. Diamond drilling along the eastern side of the known trend of mineralization has shown that the sandstone contact is farther east than it was originally supposed to lie, and in the Arcadian drilling a trap formation was reached underlying the sandstone. These results have aroused interest in this region and may be the forerunner of developments of the utmost importance. The Michigan legislature passed a law making the position of mine inspector an elective office and Governor Osborn appointed a commission to look into the Employers' Liability Act and report at the next session.

Most of the producing companies operated under about the same conditions as in 1910, although advantage was taken of the condition of the metal market to make any needed repairs or alterations towards greater efficiency in the handling of the product. Owing to the continued low price of copper nearly all of the dividend-paying companies had to reduce the dividend rate, while some of the smaller companies curtailed on development work so that there was a slight falling off from 1910 figures in the amount of labor employed.

Keweenaw County

Development work was carried on at the Keweenaw Copper Co. in sinking and drifting on the Kearsarge lode up to about Dec. 1, when operations were suspended; some copper was opened but the ground was of an inconsistent nature. The Calumet & Hecla company opened a shaft on the Kearsarge lode at the Cliff property and did some drifting at the 300-ft. level where the ground was rather encouraging. Ojibway did a large amount of development work in its two shafts, opening 19 stopes for production. Towards the end of the year rock shipments were made to the Tamarack mill, starting with about 150 tons daily and gradually increasing the amount, the rock coming from the various openings. At this writing no official returns have been given out on the copper contents of the rock.

The Gratiot property suspended operations, after an extended mill test. Mohawk operated under about normal conditions and a betterment was noted in the shafts at the south end of the property. Shafts Nos. 3 and 4 of the Ahmeek were established in the lode and a large amount of development work done in these shafts, so that when conditions warrant, a decided increase can be made in the rock tonnage. At the stamp mill the two remaining heads were put in commission. This company entered the list of dividend payers, paying its initial dividend of $2 on Nov. 1, 1911. At No. 2 shaft of the Allouez a new structural-steel shaft house and engine house are in the course of erection and will be completed early in 1912. The two shafts were put in shape to handle a large rock tonnage.

Houghton County

Wolverine continued its exploratory work on the Osceola lode and in driving a crosscut from the drift at the 28th level between shafts Nos. 3 and 4 eastward to open the territory in that direction. About normal production was maintained at the old workings and the physical conditions of the property are first class. Centennial's underground conditions were improved in the northern extension of the drifts towards the Wolverine ground. No. 1 shaft was used for the hoisting of all the rock and No. 2 for men and timber. The Mayflower and Old Colony carried on systematic drill operations and succeeded in extracting some good drill cores of a lode supposed to be the same as that opened by the Calumet & Hecla on the St. Louis tract both by drilling and shaft sinking.

Early in the year the Calumet & Hecla directors announced a plan of consolidation with other companies in which it held stock control, which met with bitter opposition by some of the minority holders of the Ahmeek and Osceola companies with the result that the plan was abandoned in the autumn with five suits pending. On the conglomerate lode, all the shafts, with the exception of No. 11 which was shut down for a few months owing to the destruction of the shaft house by fire, were worked at about normal capacity. The shafts on the Osceola lode were opened extensively and put in shape to handle a large tonnage, looking towards an ultimate tonnage of about 2000 tons per shaft per day. At some of these shafts enlarged engines were installed and alterations were made to No. 16 shaft house and a 24x48-inch. Blake crusher installed. No. 21 shaft on the Kearsarge lode was operated throughout the year.

New Installations

Plans were about completed for the enlarging of the company's electric plant and the installing of a 7500-k.w. exhaust-steam turbine to be operated by the exhaust from the mill steam stamps, and for the erection of a new regrinding mill of twice the capacity of the present mill, half of the mill to be used for the treating of tailings from the Hecla mill and the second portion to retreat the old tailing piles. John Knox, Jr., in charge of the underground work was promoted to the position of general superintendent of the Calumet & Hecla and its subsidiaries.

Fire broke out in No. 5 shaft of the Tamarack and the shaft was closed for some months during the summer, but little damage was done. Towards the end of the year all development work was curtailed and attention given to breaking developed ground, resulting in the reduction of the operating force. Nos. 5 and 6 shafts of the Osceola were put in shape to handle a large tonnage, but operations were not resumed awaiting a more opportune time in metal conditions. The North and South Kearsarge branches were operated normally and alterations to the mill were started, changing it to a system along the lines of the Calumet & Hecla mills. Laurium continued development work throughout the year and succeeded in opening a large amount of ground on the Kearsarge lode.

Operations at the LaSalle property were suspended towards the end of the year. Developments at the Tecumseh tract were encouraging and No. 1 shaft was equipped to handle a large tonnage, but conditions did not warrant continuance. New Arcadian and New Baltic carried on exploratory work throughout the year, Arcadian getting some good drill cores and the New Baltic opening a series of two beds of a formation believed to be the northern extension of the Baltic lode, at a depth of 360 ft.

---

*Electric department, Calumet & Hecla Mining Co., Calumet, Mich.

Oneco opened the shaft on the Oneco lode to about 1000 ft. to develop this formation at depth, and a rich drill core was taken at 1200 ft. The Franklin erected on the site of its No. 1 Pewabic shaft a steel shaft house, which had been formerly used on the conglomerate workings, and about completed the erection of a new hoisting plant, which is an innovation, insomuch that the descending skip will be used to compress air to be used to help bring the loaded skip to the surface. The shaft was widened and put in shape to accommodate a 10-ton skip. Developments on the Pewabic lode at depth were satisfactory.

The Quincy operated about normally throughout the year. Its new No. 9 shaft was put down to a depth of about 1400 ft. with indifferent results, although drifts from the lower workings of No. 8 towards this ground showed an improvement over that opened in the shaft. Hancock put down its large vertical shaft to about 3100 ft. and at that point a copper-bearing formation was cut, showing a large amount of copper. A large amount of opening was done on the Hancock lodes and a mill test covering a period of six months was made at the Allouez-Centennial mill showing an average yield of 18.21 lb. copper to the ton.

The Isle Royale Co. resumed development work in its southern shafts, Nos. 4, 5 and 6 and the property was put on a paying basis. Exploratory work was suspended on the Baltic lode, nothing of a consistent nature being developed. The Houghton Copper Co. put down its shaft on the Superior-Baltic lode to a depth of about 650 ft. and opened the lode by means of crosscuts the results being most satisfactory.

The Superior company continued the use of the Atlantic mill for the stamping of its rock. Both shafts were opened and at No. 1 the drifts were extended to the boundary to allow the working of the ground from the far ends. No. 1 shaft was equipped with a hoisting plant bought from the Tamarack company. The Copper Range Consolidated acquired control of the Atlantic property through a stock exchange. Conditions at the three properties comprising the original group were about normal, with possibly a slight betterment in the lower levels of the Tri-Mountain. The company completed plans for the installation of a low-pressure turbine generating set at the Baltic mill and the contract will probably be closed early in 1912. The Winona and King Philip properties consolidated during the year and the first head of the stamp mill was put into service, handling about 450 tons of rock daily. After the mill had been in commission a short time it was decided to replace the chilean mill with a conical tube mill for grinding the coarser sands.

Development work has been carried on throughout the year by the various companies which were successful in their previous drilling. South Lake and Indiana started shaft sinking to open the formations and the North Lake cleared a shaft site. Algomah developed the largest body of copper ore other than native, that has ever been exposed in the district, although sinking below 104 ft. has exposed some native copper, which may indicate that the ore will lead in to the characteristic formation of the district. The new Lake shaft was completed below the eighth level and the permanent hoisting equipment is about ready to go into commission. The property will undoubtedly enter the producing list in the near future.

Adventure encountered the first of the series of lodes which the new No. 5 vertical shaft was put down to intersect; some drifting was done on this formation but the results were not satisfactory. At a depth of about 1525 ft. a crosscut was started from the shaft to cut the other two formations. The Mass company opened the Butler lode through shaft C and the Evergreen lode through its B shaft; results for the year were satisfactory. Victoria carried its new shaft down several hundred feet and succeeded in opening a good run of ground at the 19th and 22nd levels of its producing shaft. Calumet & Hecla carried on operations at the White Pine property in shaft sinking and drifting.

Copper in Arizona in 1911

By James Douglas *

The last year was one of activity in building new and remodeling old works in Arizona. The porphyry mines progressed beyond the development stage, and two of them, the Miami and the Ray Consolidated, commenced to produce, while the increased quantity of concentrates, and the decreasing quantity of lump ore in the older districts, necessitated the addition of reverberatories to the cupola plants.

Increase in Reverberatory Smelting

In the case of the Arizona Copper Co. a decision was reached to abandon the old and to erect new smelting works exclusively on the reverberatory system. It is understood that the new works will be designed, not so much for increased production, as for greater economy in smelting. Along these lines the Copper Queen, which now receives from 300 to 400 tons of concentrates daily from the Moctezuma Copper Co., and which makes between 100 and 200 tons of flue dust daily, will put two reverberatories into operation in March or April. The Calumet & Arizona Co. is remodeling the old works at Douglas, increasing the capacity and adding roasting and reverberatory furnaces. At the United Verde, Mr. Clark is planning new works in a more central situation to the ore production of the district.

Production Exceeded That of 1910

However, production in the older camps was well maintained, while the new mines probably brought the production of the state to a somewhat higher figure than the maximum of any previous year. The Copper Queen produced slightly less copper than in 1910. Its production for the year will probably approximate 75,000,000 lb. No startling developments were made underground, but new discoveries more than kept pace with extraction. The total production of the Douglas smeltery is estimated at 111,000,000 lb., of which about 26,000,000 lb. was contributed by the Moctezuma Copper Co. The combination of the Calumet & Arizona with the Superior & Pittsburg cannot but prove beneficial to both companies, and it is already reflected in a notable increase in the output of copper. The combined companies will probably make a production of about 50,000,000 lb. The only other notable producer in the district was the Shattuck-Arizona, with an output of copper in its ores—which were smelted at the Copper Queen smeltery, at Douglas—of between four and five million pounds. The Courtland camp, in the Dragoon Mountains, which, three years ago, promised to be a prominent producer, did not realize expectations. Its copper output has probably been 2,000,000 pounds.

Important Discoveries of Secondary Ore

In the Clifton district the most promising development was the discovery of

---

*99 John St., New York.

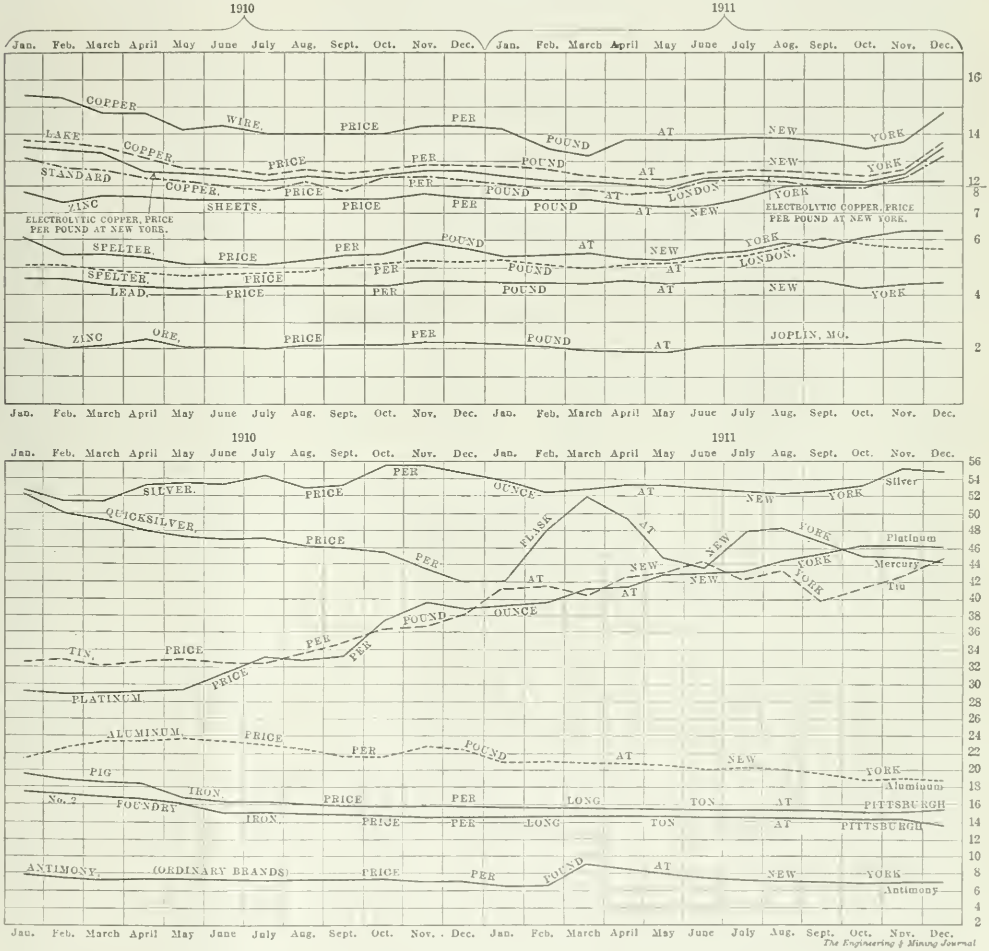
profitable secondary ores at considerably greater depth than was theretofore assigned as the limit in depth of the altered zone. These deeper ores occur along certain fault planes in the Humbolt mine of the Arizona Copper Co., and the West Yankee of the Detroit Copper Co., and encourage the hope that the district may possess resources heretofore unsuspected. The production of the district, including the Shannon, and small quantities of ore from outside companies, will probably, when the annual statistics are completed, amount to about 70,000,000 pounds.

In the Globe district the Old Dominion smeltery turned out about five million pounds more of copper than in 1910. The total output will probably foot up to 25,000,000 lb. or over. This was almost exclusively from the ores of the Old Dominion and the United Globe mines, there being less custom ore in the Globe market than formerly. A notable feature of development during the last two years was the depth to which secondary enrichment extended along the main Old Dominion fissure and the size of the orebodies at a depth of even 1600 ft. from surface. At the Old Dominion, as elsewhere, the increased quantity of concentrates and the decreased quantity of lump ore points to modifications in the company's smelting methods.

The Imperial Copper Co. mines were idle. Little copper was mined in the northern part of the territory.

Porphyry Mines

In regard to the so called porphyry mines, the Miami took the lead as a producer, and began shipping actively in April, and will probably show a production from the sections of the mill which are as yet in operation of probably over 12,000,000 lb. It is currently estimated that its production will reach about 3,000,000 lb. per month, but that consummation will not be reached until the current year has partially expired. Its neighbors, the Live Oak and the Inspiration, confined energies to underground development and to planning large concentrating works. The Ray Consolidated is reported to be treating 7000 tons per day, securing 18% concentrates. It expects to treat ultimately 13,000 tons per day. The Hayden plant of the American Smelting & Refining Co. on the Gila River will have two reverberatory furnaces and two basic converters in operation in April, 1912.



The Engineering & Mining Journal

Metal Prices in 1910 and 1911

SOUTHWEST COPPER PRODUCTION

Outside of Arizona the development on the Chino deposits of Santa Rita is the only important one worthy of recording. At Chino, 1500 tons per day are being put through the concentrator, making 20% concentrates. It is expected that four sections will be in operation by the middle of 1912, and ultimately to treat 8000 tons per day. The mines in the Burro Mountains, including the Chemung, the Burro Mountain, and the Savannah, were rather sluggishly explored, and no steps were taken toward producing.

Mexico's production suffered slightly from the revolution, but very slightly, both combatants, the government forces as well as the revolutionary leaders, having treated the American operations and American property with the most exemplary consideration. The output from the Greene-Cananea will probably exceed 50,000,000 lb., but from this, the estimated production of the Miami company must be deducted. The Greene-Cananea showed great skill in successfully smelting the Miama concentrates directly in the converters. It is an interesting feature of recent operations in the Southwest that probably none of the so called porphyry companies will smelt their own copper, but will confine themselves to making high-grade concentrates and turning these over for reduction to one or another of the smelting establishments.

Katanga Copper

The shipments of pig copper and copper in ore from Katanga in 1911 were 3000 long tons. The recent annual meetings of the proprietary and operating companies have been chiefly devoted to excuses for disappointed hopes. A correspondent communicates the following: On Dec. 4, 1911, the annual meeting of the Union Minière was held at Brussels. At this meeting the annual report was submitted, and it was stated that the company owned 10 of the principal copper mines, containing 10,000,000 tons of copper ore. Three years ago it was predicted that these mines would produce 30,000 tons in 1911 of copper. Inasmuch, however, as the mines have not yet passed beyond the experimental stage, some years will have to elapse before they can become regular producers. The ores are principally fines and this explains the large consumption of coke. The coke is being imported from Rhodesia, and costs about $26 per ton. It is claimed that some coal mines have been discovered in Rhodesia, near the border line of Belgium-Congo, and that this coal would be a great advantage for the Katanga mine. The cost of producing copper in September was 1120 francs per ton, to which has to be added £9 freight to Antwerp, making a total price of about £65, c.i.f. Antwerp. This indicates a loss at present prices for this metal.

The ores are not as fabulously rich as was once stated. The ores treated since September average 12 to 13%. It is claimed that in view of the improvements that have been introduced by the new management, the cost of production will be reduced to about £34, plus £9 freight to Antwerp, say about £43, c.i.f. Antwerp. This would indicate that after the improvements have been introduced, the Union Minière is going to operate at a profit, but so far it has not reached that point. There does not seem to be an appreciable amount of precious metals in the ore. Of the 200,000 shares outstanding, 184,000 shares are still in the hands of the original subscribers, and only 16,000 shares are in circulation.

Sulphur

The Consorzio's annual report to producers contains the following statistics covering its first five financial years:—

Year. Aug. 1—July 31.	Production. Tons.	Sales. Tons	Shipments. Tons	Stocks at end of year. Tons.
1906—7	427,719	161,318	322,000	529,896
1907—8	407,277	441,055	384,000	546,399
1908—9	396,295	300,552	349,000	593,461
1909—10	396,737	409,645	397,000	586,627
1910—11	391,978	816,818	445,500	523,141

The small quantity sold during the first year is explained by the circumstance that the law of 1906 conceded to the respective owners the free disposal of the sulphur produced previously; the heavy sales of last year comprise quantities sold for future years.

PRODUCTION

The above figures show that the production has been constantly declining. The causes of this are: The exhaustion of old deposits, not compensated by the opening of new ones; diminished labor, owing to the increased emigration during late years; and the difficulty of the small mines in obtaining credit. For the last two reasons the number of mines has decreased rapidly. During the last year of the Anglo-Sicilian Sulphur Co., there were working 720, and during the first year of the Consorzio there were 637, during the second year 603, the third 541, and the fourth and fifth 476. It was at first estimated that production during the next financial year would not exceed that of last year; since then, the Trabonella mine, which of late, has produced about 20,000 tons of sulphur per annum, has shut down, owing to an explosion, and, it is believed, will produce nothing for a year or longer.

The great increase last year was primarily owing to larger consumption for the vines, due to the high prices that have continued to rule for wine in consequence of last year's small vintages. The vintages having this year again been under the average in the principal countries, prices of wine are keeping up, and the consumption of sulphur for the vines will probably be brisk next spring. Consumption for industrial purposes has also shown progress as evidence by larger shipments to Sweden and Russia.

MARKET

Under the circumstances here set forth, the Consorzio has increased prices a little, especially at Catania, where the local industry annually consumes about 180,000 tons of sulphur. Prices of refined and ground sulphur are dearer than last year, also on account of dearer coal, higher salaries, and increased cost of bagging.

In the United States, the production of sulphur is almost entirely confined to Calcasieu parish, in Louisiana, although Arizona, Nevada, Utah and Wyoming produce small quantities.

British Imports of Tin Ores in 1911

Reported by *The Mining Journal*

IN TONS OF 2240 LB.

Source	11 Months 1911	11 Months 1910
AFRICA		
Cape of Good Hope	6	68
Natal	......	1
Nigeria	......	457
Portuguese East Africa	10	79
Southern Nigeria	1,077	371
Transvaal	2,119	2,784
Swazieland	1,088	328
Rhodesia	......	1
AMERICA		
Canada	7	4
United States	228	63
Mexico	14	......
Argentina	18	9
Bolivia	14,913	14,339
Chile	4,034	3,072
Peru	769	486
ASIA		
British India	......	9
Burmah	......	..
Japan	55	110
Straits Settlements	6	10
AUSTRALIA		
South Australia	......	....
Tasmania	......	1
Victoria	......	15
New South Wales	14	
EUROPE		
Austria-Hungary	2	
Belgium	54	24
Denmark	......	2
France	805	723
Germany	773	278
Italy	65	128
Netherlands	104	93
Portugal	31	16
Russia	167	153
Spain	115	118
Sweden	6	.
Totals	26,501	23,774

The Production of Lead in 1911

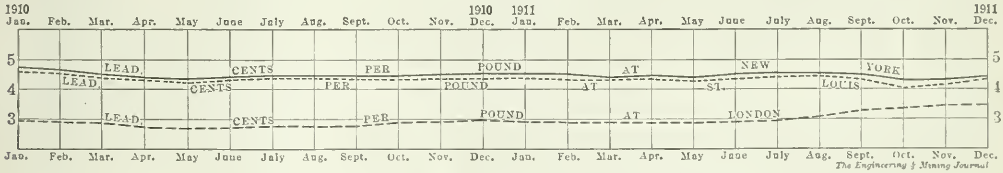
The production of lead in the United States in 1911 is given in the accompanying tables, which are compiled from returns made by all of the refiners. It is to be remarked that these figures represent the refinery production of lead in final marketable form. It appears that there was a small decrease in the output of what we class as desilverized, which was offset by the increased production of the Kansas, Missouri and Illinois refiners. Certain of the latter now desilverize a portion of their lead, but adhering to the old industrial classification we include under desilverized only the production of Omaha, Chicago, Pittsburg, New Jersey and the Pacific Coast.

PRODUCTION OF REFINED LEAD IN THE UNITED STATES

(In Tons of 2000 Lb.)

Class	1910	1911
Desilverized	217,490	213,548
Antimonial	9,098	8,822
Southeast Missouri (*a*)	145,387	153,915
Southwest Missouri	20,729	25,996
Total domestic	392,704	402,281
Foreign, desilverized	90,473	89,758
Foreign, antimonial	4,892	4,738
Total foreign	95,365	94,496
Grand total	488,069	496,777

(*a*) Includes the total production of works in southern Illinois.



Lead Prices in 1911, Plotted from Monthly Averages

It is impossible at this early date to report the production of crude lead or trace it to the mines of origin.

U. S. IMPORTS AND EXPORTS OF LEAD

(In Tons of 2000 Lb.)

Imports	1910	1911 (*b*
In ore	47,192	17,183
In base bullion	57,741	64,164
Refined	3,490	2,203
Totals	108 423	83,550
Exports:		
In ore (*a*)	11,253	16,208
In bullion (*a*)	58,852	71,815
Totals	67,105	88,023

(*a*) All of foreign origin. (*b*) 11 months.

The production of lead by the mines may have increased in 1911 more than the refinery statistics show, a rather large supply of lead ore having been accumulated at the Tooele smeltery, in Utah.

The refinery statistics indicate that the output of lead in Missouri experienced another large increase in 1911, while that of the Cœur d'Alene was probably about the same as in the previous year.

The production of lead in Colorado appears to have increased; also that of Idaho outside of the Cœur d'Alene; and probably there was a small increase in Utah.

The New York Lead Market in 1911

Conditions in this market have not changed from those of previous years. In view of the fact that the largest producer and seller of this metal tries to maintain the market as steady as possible, no wide fluctuations have occurred. The largest consumers obtain their requirements on basis of average prices; so that they are forced to enter the market only at times when an unexpected expansion in business compels them to increase their consumption of lead to such an extent that the regular supplies which they receive under contract are not sufficient. Production of the metal has remained on about the same level as during last year, and as no new mines of consequence have been discovered in this country, any increased smelting and refining capacity would not in itself mean an increased supply of lead.

From the first of the year until the beginning of October no change was made in the quotations of the largest producer, which were 4.42½c., East St. Louis, and 4.50c., New York, for desilverized lead. Only at such times when lead produced in Missouri accumulated and was offered very freely were these quotations shaded by outside sellers; so at the end of March and the beginning of April lead was offered in St. Louis down to 4.22½c. and could, therefore, be sold in the New York market at about 4.37½ cents.

When the usual spring business did not develop, a disappointment was felt in the trade, and the lead which had been held for the expected improvement was pressed for sale, so that at the beginning of June outside quotations were lowered to 4.20c. and 4.35c., St. Louis and New York respectively. The belated spring business, however, came during June, and this demand quickly took care of the supplies that were pressing on and demoralizing the market. From the end of July and all through the month of August there was no difference between the quotations of the largest and outside sellers.

PRICES OF LEAD

Month	New York		St. Louis		London	
	1910.	1911	1910.	1911.	1910.	1911.
January	4 700	4 483	4.582	4 334	13.650	13 009
February	4 613	4 440	4 445	4 266	13.328	13 043
March	4 459	4 394	4.307	4 238	13.063	13 122
April	4 376	4 412	4 225	4 262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12 984
June	4.343	4 435	4 207	4 292	12.688	13.260
July	4.404	4.499	4 291	4.397	12.531	13 530
August	4.400	4 500	4 290	4 406	12.513	14 260
September	4 400	4 485	4 289	4 356	12.582	14 744
October	4 400	4.265	4 271	4.139	13.091	15.332
November	4 442	4.298	4 314	4.181	13 217	15.821
December	4 500	4.450	4.363	4.332	13 197	15 648
Year	4.446	4.420	4.312	4.286	12 920	13.970

New York and St. Louis, cents per pound
London, pounds sterling per long ton.

The market eased up somewhat during the month of September. At the beginning of October the leading interest suddenly reduced its price by $3 per ton which was quickly followed by an additional cut of $2 per ton, and the outsiders promptly followed suit. At this lower level, which was maintained until the middle of November, a very heavy demand developed and large purchases were made. In consequence thereof, prices were advanced to the extent of 10c. twice in quick succession during the latter part of November, thus establishing a price of 4.37½c., East St. Louis, and 4.45c., New York. Business continued satisfactory, and the year closed on that basis.

The London Lead Market

SPECIAL CORRESPONDENCE

In January there was active business during the first 10 days, the market being rather bare of offers. Then followed a period of comparative slackness due to heavy arrivals. Opening at £ 13 per ton for soft foreign, the price improved to £ 13 5s., and finished at £ 12 15s. or £ 13 according to time of delivery. English brands rule about 5s. per ton higher than Spanish lead.

February opened with a dull market and prices unchanged, incoming supplies being sufficient to meet all demand.

Gradually a stronger tone prevailed in view of improved trade requirements. The market strengthened further toward the close of the month by reason of reduced supplies. Final quotations were £13 5s. for foreign brands, and £13 7s. 6d. to £13 8s. 9d. for English.

March found an improved inquiry both for home trade and for export; prompt arrivals were insufficient to satisfy demand, and in many cases metal had to be supplied from the public warehouses. A fair volume of business was transacted on the whole, but a downward trend of prices was not arrested till quite at the end of the month.

In April an active business prevailed both for home and export almost to the close of the month and with little or no variation in prices; the low range of values being an encouragement to buyers in general. A fractional decline toward the end of the month was due to realization of some speculative purchases; and closing prices were £12 17s. 6d. for soft foreign.

May opened with some appearance of weakness due to pressure of second-hand parcels of foreign, for which £12 15s. was reported taken: but when buyers came forward it was found that no appreciable quantity was obtainable. A gradual improvement followed on good trade demand, and £13 was the ruling price for the greater part of the month, supplies being somewhat restricted by hindrances in shipment owing to strikes in Spain.

June opened with no alteration in quotations but with increasing evidence of short supply, so that the trade had to draw on American sources to redress the balance. The month saw a gradual but persistent improvement in values, closing @ £13 7s. 6d. to £13 8s. 9d. for foreign.

In July values were unaltered for a fortnight or more, the market being sufficiently supplied by incoming lots: and home consumers remained indifferent. Meanwhile continental demand had made inroads on stocks and by July 19 it was found that little was on offer in London and that advanced prices were asked. These were readily paid and a persistent advance was in progress for the rest of the month. Closing prices were £14 per ton for foreign brands.

In August the recent advance continued. In the second half after labor trouble had subsided manufacturers were keen to replenish their stocks. Closing prices were £14 7s. 6d. for foreign brands.

In September the continued dwindling of supplies was more seriously regarded on the continent than in the United Kingdom, but English consumers began to appreciate the situation. Prices advanced persistently. This brought out some speculative parcels for sale, and dealers promptly lowered their bids. This episode, however, was of short duration, as demand was constant and supplies short and irregular. Closing values were £15 for foreign brands.

In October the underlying strength of the market was not generally appreciated till the latter half of the month, and business was mostly restricted to the supplying of immediate wants. Later demand increased and the trend of prices was upward for the rest of the month. Closing prices were £15 10s. for foreign lead.

In November the upward movement was early manifest, prompt supplies commanding £15 15s., and the demand for extended delivery also improved in view of a strike of wharf laborers in Australia. As the month advanced the undertone remained firm, and purchases extending into 1912 were freely made, particularly in view of political unrest in Mexico and possible curtailment of supplies thence. The above was at £15 15s. for Spanish lead.

December opened with no alteration in prices but with increased volume of business, large quantities changing hands at £15 17s. 6d. for delivery extending into 1910. The buying slackened after a few days and prices eased in consequence down to £15 10s. for foreign, and £15 17s. 6d. for British lead.

Mining in the Coeur d' Alene

SPECIAL CORRESPONDENCE

The mining industry of the Coeur d'Alene during 1911 enjoyed a period of quiet prosperity. The output of the district was slightly greater than for 1910. The lead production will probably total 235,000,000 lb. None of the 1910 producers dropped out and an increased production was made from the Hercules Mining Co. and a slightly increased production from the Federal Mining & Smelting Co. This, together with the production from the Stewart Mining Co. makes a greater yield than for 1910. The zinc production was materially increased. The Federal Mining & Smelting Co., from the Macquisten-tube installation, at the Morning plant, produced over a million pounds of zinc and the Success Mining Co. operated several months during 1911, with a heavy output. Dividend disbursements in 1911 are impossible to get with accuracy, but they were not far from $2,400,000 for the mines of the district. Industrial conditions were satisfactory and at no time were there less than 2200 miners at work.

ZINC NOW SAVED

Much development was made in the concentrator practice of the district. The new Hercules Mining Co. concentrator was put in commission at the town of Wallace and the Federal Mining & Smelting Co. made extensive improvements and extensions to its concentrator at the Morning mine, at Mullan. These improvements were along the line of finer grinding in ball mills and the use of Macquisten tubes for recovering zinc which heretofore went to waste in the fine tailings. The picking of clean shipping ore from the mill feed was extended and an elaborate picking plant was erected by the Federal Mining & Smelting Co. at the mouth of the Arizona tunnel, of their Wardner mine. The disastrous fires and snow slides, which caused such appalling loss of life and destruction of property, during 1910, were in 1911 fortunately entirely absent. Much careful prospecting was done by development companies with more or less success, but no new producer of importance came into the field. Few, if any, new companies were floated in the district and while the trading in the stocks of the mines, both productive and prospective, was light, there seems to have been plenty of money available for legitimate development schemes. The steady grind of production went right along and fortunately there were no calamities or remarkable occurrences, either of litigation or physical catastrophe to chronicle.

White Lead in 1911

The consumption of all paints in 1911 was appreciably below that of 1910, the reduction being estimated at about 25%. This is attributed chiefly to the high cost of linseed oil, the price of which averaged higher than for any year since the era of high values following the Civil War. While the difference between this average and that of the last 10 years would not represent a material addition to the cost of painting an ordinary house, the effect of practically doubling what had come to be regarded as a normal price for oil, was to make property owners defer painting to such an extent as to cause the deficiency in consumption already noted. This effect extended to the ready-made paints in the same degree, by reason of the advance in prices which manufacturers were compelled to make. With a prospect for lower prices of oil, as a result of a larger crop of flaxseed, both here and in the foreign producing countries, notably in the Argentine, the outlook for 1912 is regarded as more encouraging.

LEAD CARBONATE

In addition to the retarding influence of the high cost of oil, the white-lead industry has had to meet a growing competition in the lower grades of paint made from lithopone, a chemical product containing zinc and barium. This pigment seems to possess some advantages in the manufacture of cheap paints over mechanical combinations of white lead, zinc and barytes or gypsum. It cannot be used in combination with lead, because the presence of the zinc sulphide causes the lead to turn black, and it does not appear to be a serious competitor of white lead except in the cheapest grade of paints.

The steadiness of pig lead which was practically unchanged in price from late in November, 1910, until the early part of October, 1911, was reflected in white lead which was without change from the list in force from the close of 1910 until the last of October, 1911, when a reduction of ¼c. was made in the price of dry lead, following a decline of the same fraction in pig lead. This brought the price down to 5c., at which contracts with paint manufacturers and other large consumers were made, covering a good share of their requirements for 1912. The advances of pig lead covering 20c. of the previous decline of 25c. per cwt., which occurred within a month after white lead had been reduced, made these contracts favorable for the buyers, and correspondingly disastrous to the sellers, who had had no opportunity to accumulate any considerable stock of lower-cost metal.

The reduction in the price of dry white lead left the margin between the pigment dry and in oil wider than has prevailed for many years, and with an accumulation of stocks in the hands of some of the corroders the temptation to break prices in the hope of getting a portion of the stock into the hands of distributors proved irresistible and following some special inducements by one of the smaller Western companies came a break of ½c. in the card price by another company which was speedily followed by all corroders. This made the closing price 6¾c. for lead in oil in packages of 100 lb. and upward, with a differential on the smaller sizes, with dry lead at 5c. to large buyers.

Lead Oxide

Red lead was irregular in price during 1911; the bulk of the business was at 6½c. for large packages and some at 6¼c. There was even more irregularity in the price of litharge, on which there is a keener competition than on red lead. Large consumers were paying 5¾c. during the early part of 1911 but during the later months they were able to buy as low as 5¼c. and at the close that appeared to be the quotable price to carload buyers, and large packages in less than carload lots were not quoted above 5½c. As a whole the oxide business is not on a profitable basis to the manufacturer.

Southeastern Missouri in 1911

By H. A. Wheeler *

The southeastern Missouri lead district produced about 138,500 tons of pig lead in 1911 (the December output is estimated), which had a value at St. Louis of approximately $12,000,000. This magnificent production maintains the prestige of this district as the world's greatest lead producer. The output in 1911 only lacks about 1% of being up to the record-breaking output of 1910.

St. Francois County has been preëminently the leader as well as the center of this district since the discovery of the deeper or disseminated lead about 40 years ago at Bonne Terre. In 1911 St. Francois County contributed about 97% of the output, which is furnished by the mining camps about Bone Terre, Desloge, Flat River, Leadwood and Doe Run.

Further Prospecting Necessary

As the disseminated deposits in St. Francois and Madison Counties are always associated with the old shallow diggings, and as Washington County has been by far the largest and richest producer of lead from the latter source, it seems quite probable that it, and also Jefferson County are underlain by the disseminated deposits.

The large mills are drawing heavily on the reserves of St. Francois County, and it is going to require energetic prospecting to open up new orebodies to maintain the present heavy production than has been pursued since the panic of 1907. Important interests were beginning to prospect in Washington County just prior to the panic, but since then no further drilling has been attempted. Some quiet investigations were made by Bostonians last year but it was directed towards property investments rather than development work.

Debris Troubles Experienced

One or two labor agitators, whose actions suggest blackmail, have induced some of the farmers along Big River to bring an injunction suit to restrain the mills along the Big River and its tributaries, from operating, on the grounds of the slimes injuring the land and destroying the fish. As regards the slimes damaging the land, this can only happen during flood stages, when the current is so swift that the deposit is utterly insignificant, if not imaginary, and the farmers did not complain until the fire-eaters recently broke loose.

Madison County, at the southern end of the lead belt, made the smallest output in many years, as only one property was operated. The North American Lead property, at Fredericktown, formerly controlled by Columbus, Ohio, capitalists was taken over by the bondholders under a foreclosure sale and is now held by the Dominion Nickel Co. of Sudbury, Canada. As it changed in recent years from lead to a producer of copper, nickel and cobalt, with lead as a byproduct, it will probably be kept closed, to prevent disturbing the nickel market. The Catherine mine was examined under a lease and bond by prominent interests and preparations are being made to reopen this property, as also the adjoining Fleming land, on a royalty basis.

Railroading A Profitable Side Line

The St. Joe company had a successful year in 1911, and through its affiliation with and control of the output of the Doe Run Lead Co., its smeltery at Herculaneum is the largest producer of pig lead in the country. While this old and successful company has been known to the trade for years as the largest and strongest independent producer of lead in the country, few are aware of its success in building up one of the snuggest and most profitable railroad enterprises that has thus far escaped the maws of the big railroad magnates. After struggling for years with bad roads, poor teams and wretched service at a continuous loss, it built, in 1880, a narrow gauge road from its mine at Bonne Terre to Summit, on the Iron Mountain Railroad in conjunction with its adjoining neighbor, the Desloge Lead Co. (since absorbed). This 13-mile road solved the problem of changing an annual deficit into a profit; the line was gradually extended north and south, until at present it is about 64 miles long, including branches. Traffic arrangements have been made with other railroads, and the passenger business has become an important factor.

The old or No. 2 mill at Bonne Terre was continuously operated throughout 1911 as also the No. 3 mill at Leadwood,

---

*Consulting mining engineer, 710 Pine St., St. Louis, Mo.

each of which has a capacity of 1500 tons per day. They were supplied by seven mines located at Bonne Terre (3), Flat River, Gumbo, Huntington and Leadwood. The smeltery at Herculaneum is now equipped with four Dwight-Lloyd sintering furnaces for roasting the concentrates, which have replaced the Savelsberg pot-roasting system. A MacDougal furnace has been erected for roasting matte, which replaces a Pierce turret roaster.

No increase has been made in the land holdings of the St. Joe company, which total about 20,000 acres, of which only about 160 acres have been exhausted. The usual 6% dividends were paid in 1911 on the $10,000,00 issued stock, which brings the total paid to $7,958,357.

Doe Run Lead Company

The year 1911 was the banner one in the history of the Doe Run Lead Co., as its lead production was about 32,000 tons. This was due to its new, or No. 3, mill at Rivermines being increased from 2000 to 3000 tons per day. The old, or No. 1 mill at Doe Run, of 1200 tons capacity, was operated on ore from the new or No. 12 shaft at Doe Run, and also from the No. 3 shaft at Flat River. The old No. 2 mill on the former Columbia property has not been operated since the erection of the No. 3 mill.

This large production was obtained from six mines, which are situated on spurs of the M. R. & B. T. R. R., as follows: Nos. 1 and 4 shafts at Flat River, No. 3 at Rivermines (formerly Central Station), No. 6 at Elvins, No. 8 at Mitchell, No. 9 at Columbia (Red Onion) and No. 12 at Doe Run. The No. 12 shaft is equipped with electric-driven machinery, driven by a 300-kw. generator, which is direct connected with a low-pressure turbine. The latter is supplied with the exhaust from two noncondensing corliss engines that drive the No. 1 or Doe Run mill.

The electric-power station at Rivermines supplies current for operating the six shafts and the 3000-ton mill in the Flat River district. It is equipped with four Snow twin-tandem 4-cycle gas engines of 800-hp. that furnish 900,000 kw. per month. The plant was equipped with the Loomis-Pettibone downdraught gas producers, which require frequent blowing out to remove the clinkers. Recently two 500-hp. independent Westinghouse continuous gas producers were installed which eliminate the shutdowns and have thus far proved satisfactory, after 115 days continuous operation. The No. 3 mill was increased from a daily capacity of 200 tons to 300 by adding two Hancock jigs and four sets of rolls, with the necessary auxiliaries. The plant at Doe Run was originally equipped with a small smeltery, but when the St. Joe company built the large smeltery at Herculaneum, the output of both properties have been smelted there. The concentrates were roasted at Doe Run until last year in a battery of Freiberg roasting furnaces, but these have been abandoned and salvage, as the concentrates are now sold to the St. Joe company. The company continued to pay 6% dividends on its capital of $6,578,200 ($10,000,000 authorized) during 1911 and the total dividends paid to date aggregate $2,941,858.

Desloge Consolidated Lead Co.

The Desloge property made the largest output in its history and had a successful year. The mill was enlarged to a daily capacity of 1500 tons, and typifies the steady growth of this company, as it was built as a 500-ton unit about 17 years ago. Although four Flintshire or small reverberatory furnaces have always been operated, and notwithstanding that a small water-jacket shaft furnace with three Freiberg roasters were subsequently added, most of the concentrates are smelted at either the large plant of the Federal Lead Co. at Alton, Ill., or the National Lead Co.'s smeltery at Collinsville, Ill., where the Scotch hearth and bag process are employed. The production was derived from three mines, or Nos. 3, 4 and 6 shafts and shipped over its own railroad to the mill, the latter being on Big River. Although No. 4 shaft is on Big River and the mine is working beneath it, the mine makes little water and is one of the dryest in the district.

National and Federal Lead Cos.

The National Lead Co., under its local operating company, the St. Louis Smelting & Refining Co., worked steadily throughout the year in its usual quiet, successful manner.

The important subsidiary of the Guggenheim Exploration Company known as the Federal Lead Co. had a very successful year and continued as the largest individual producer in the district, which position it has maintained since the completion of the Central mill. The latter is the largest in the district, as it has a capacity of 4000 tons per diem. A testing department has been added to the mill which is equipped with a complete series of concentration machinery that permits of the treatment of carload samples. This is at the service of all departments of the Guggenheim Exploration Co. and its numerous ramifications, which enables all tests to be made under its own auspices.

This company recently examined the Catherine mine at Fredericktown, in Madison County, under lease and bond, and has decided to reopen this property, which has 1540 acres. It has also leased the adjoining Flemming property, which is known to contain lead, and will operate it through the two shafts of the Catherine mine. As the Catherine property is equipped with a 300-ton mill, it should not take long to reënter the producing list. Like all the Madison County mines, the Catherine makes but little water and the deepest shaft is only 160 ft. The concentrates are shipped to its large smeltery at Alton, Ill., 80 miles north, where considerable custom work is also handled. This plant is on the Mississippi River and is favorably situated with reference to the cheap Illinois coal and the Eastern railroads.

Potosi Mines Co.

This is the new company under Boston auspices which acquired a large acreage two years ago about Potosi, in Washington County, which has produced large amounts of shallow lead and "tiff" or barite. About 25,000 acres were secured, but little effort has thus far been made to develop this promising tract beyond shipping considerable tiff that is gophered on a royalty basis by the tiff diggers. In 1910 the Jake Day tract of 357 acres was purchased on Big River, in St. Francois County, that lies in the heart of the disseminated lead belt. This property is now under the management of A. E. Stilwell, as president, who is famous for building the Kansas City, Mexico & Orient R. R. from Kansas City to the west coast of Mexico without obtaining a dollar from Wall Street. Plans are under consideration for erecting a 500-ton mill and for securing a spur from the M. R. & B. T. R. R. The company is capitalized for $5,000,000, of which $600,000 is 8% cumulative preferred stock and $4,400,000 is common.

Mine la Motte Co.

The Mine la Motte property was the only producer last year in Madison County. It was operated under the Pittsburg management that has controlled it since its metoric exploitation by Dougherty & Albers several years ago. It was under consideration by one of the large St. Francois County operators last year, but thus far no changes have occurred in the title. It has a large acreage, said to be in excess of 35,000, but much of it is timber, granite and sandstone land that does not contain the Bonne Terre or disseminated-lead-bearing limestone. It has a 500-ton mill that is supplied by five mines that are less than 150 ft. deep. It formerly operated its own smeltery, but in recent years the concentrates have been sold in the St. Louis market.

The Tin Industry in 1911

The tin-mining industry of the United States continued during 1911 to be insignificant. Little or nothing was done in connection with the deposits in the Black Hills. The Pahasa Mining Co. reported to us that it made no developments on its property during the year, and at present the stockholders have not yet decided what the future course of the company will be. In Texas, at the mines on Mt. Franklin, near El Paso, the mill and smelting furnace were operated intermittently from January to May, and about four tons of pig tin, 99.8 per cent. pure, were produced and shipped to market. The intermittent character of the operations was due to bad weather and other causes. The mine is now temporarily closed pending the consummation of new arrangements, presumably of a financial character. The engineers in charge of this property are optimistic with respect to the supply of tin existing there and their ability to treat the ore. The smelting furnace of the company was fired with crude oil and excellent results in smelting were obtained from the use of that fuel.

The experience in smelting with oil obtained at El Paso may be useful in the treatment of black tin from Alaska, if a considerable supply ever be obtained from that source. As to the latter, there seems now to be some real prospect, a shipment of 93 tons of concentrate having actually been made in October by the York Dredging Co. This company has installed a dredge (described in the JOURNAL of July 15 and Dec. 23, 1911) on Buck Creek, 14 miles north of York. Operations were begun on Sept. 10 and continued until Oct. 15. Its capacity is about 1000 cu.yd. per 24 hours. A recovery of 6 to 7 lb. of black tin per cubic yard is reported.

Estimating the world's production of tin in the usual way from the statements of imports, exports and stocks we get the following figures for the 12 months ended Nov. 31, 1911, in long tons: Straits, 53,670; Australia, 3825; Banka, 15,131; Bolivia, 22,064; China (exports only), 2600; England, 4500; South Africa, 2200; total, 103,990 tons. In a similar way deliveries were: United States, 40,485; London and Holland, 36,931; other Europe, 15,298; China and India (from the Straits), 3400; miscellaneous, 6350; total, 102,464 tons. This shows consumption as very close to production, and explains the comparative ease with which the metal was "cornered."

The production of tin in the Federated Malay States in 1911, estimating December, was 730,762 pikuls, or 43,486 long tons. This is classed as Straits tin. The output compares with 736,898 pikuls in 1910; 818,887 in 1909; 854,064 in 1908, and 813,636 pikuls in 1907. The decrease last year and in 1910 was due to the diversion of Chinese labor to other fields.

For the 11 months ended Nov. 30 the imports of tin into the United States were 98,526,628 lb. in 1910, and 97,561,923 lb. in 1911; a decrease of 966,705 lb. According to the customs returns the imports in 1911 were 33,910,736 lb. from the Straits; 50,979,569 lb. from Great Britain; 4,574,850 lb. from Germany; 8,096,768 lb. from other countries. The receipts from Great Britain were largely of Straits tin, which goes to that country in transit. Those from Germany were largely of Bolivian tin, which is smelted and refined in that country.

The New York Tin Market

The market for tin was entirely dominated by the Syndicate—consisting of London and continental firms—which, through its successful operations during the preceding years, has become very powerful. In describing the fluctuations of prices of this metal, one is therefore compelled to simply give a description of the manipulations of the Syndicate, which were but little disturbed by the quantities of the metal not under their control. An attempt is being made by dealers and traders on the London Metal Exchange, not belonging to the Syndicate, to wrest from it the control of the market by inaugurating a new contract on the London Metal Exchange under which so called standard tin can be delivered; that is to say, tin produced by the Dutch Government, and in China and Germany from Chinese and Bolivian ores, all of which brands were hitherto barred from delivery under the old Metal Exchange contract. This new contract will come into force on Feb. 1, and it remains to be seen what effect it will have on the activity of the Syndicate. The Syndicate was assisted in its bull operations throughout the year by the favorable statistics of the metal, which disclosed the fact that actual production has hardly come up to consumption, so that existing stocks had constantly to be drawn upon.

PRICE OF TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42 400
February	32 920	41 614	August	33.972	43 319
March	32 403	40.157	September	34 982	39 755
April	32 976	42 185	October	36.190	41.185
May	33 125	43.115	November	36.547	43.125
June	32.769	44 606	December	38.199	44.655
			Av. Year	34 123	42.281

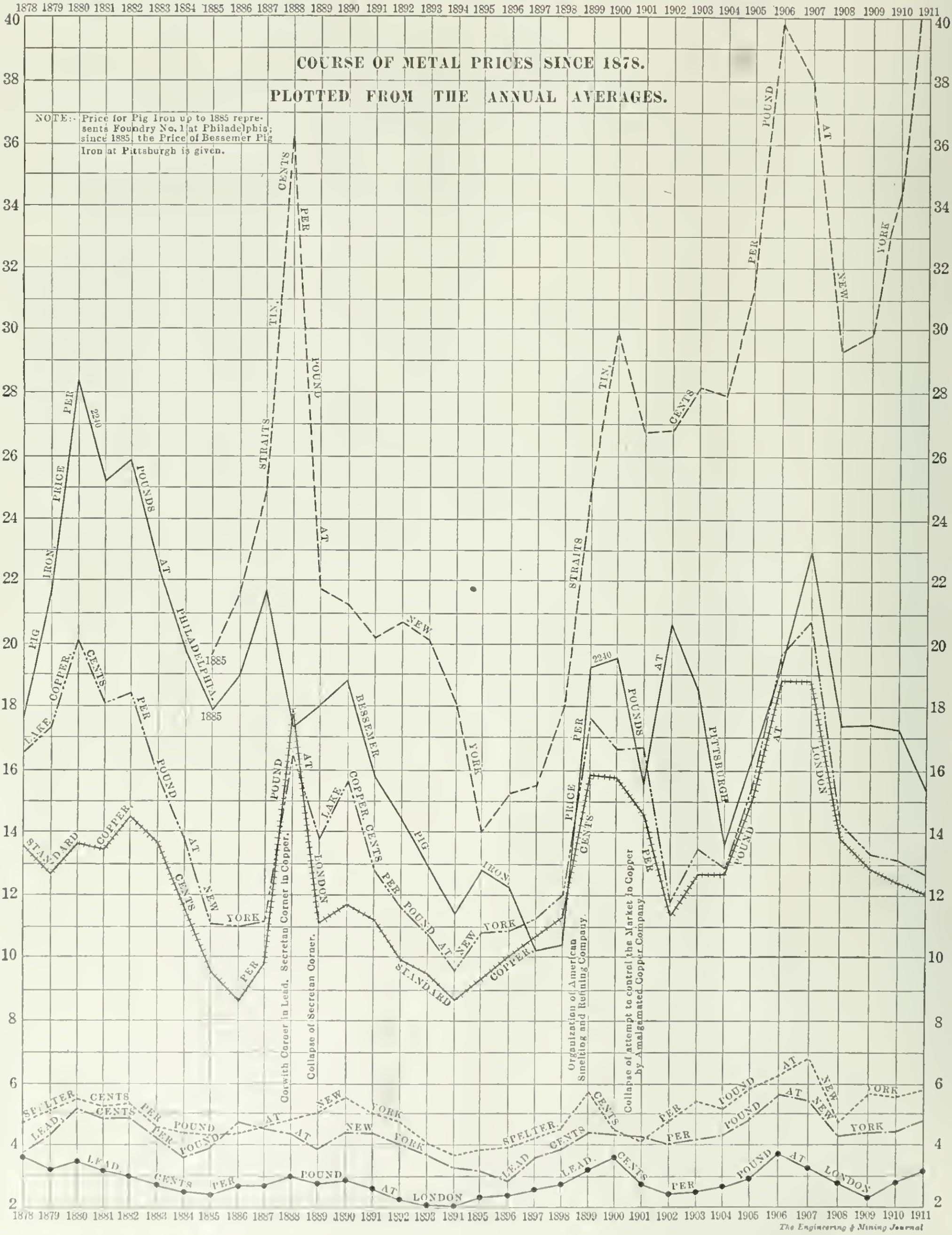
Prices are in cents per pound.

The New York market opened the beginning of the year strong at around 40c., advancing during the month of January to about 43¼c. Fluctuations in February became very violent, due to some urgent liquidation on part of a member of the Syndicate, which brought down prices during the first 10 days of the month to about 38c. After this liquidation was completed, the market advanced just as rapidly as it had declined, reaching 44c. by the middle of the month and remaining fairly steady until the end of February.

March showed a continuous decline to about 39½c., advancing again to about 42c. by the middle of April. From this level it moved irregularly during the next few weeks, without, however, displaying any violent fluctuations until the middle of May. Then a buying movement on part of the Syndicate, especially in spot tin, advanced the market rapidly in London, which was naturally reflected in the domestic market. The market advanced quickly to about 46c. early in June.

The corner in spot tin, which advanced the price thereof about £44 over the three-months quotation, thereby disclosing a very unhealthy condition of things, induced sellers in this market to liquidate their holdings of near-by material at about 3c. below the price at which it could be imported. The squeeze of the shorts lasted until the middle of June, when spot tin suddenly declined about £41, while three-months tin scored a small advance, thus bringing both quotations closely together. Spot tin was selling in this market at about 42¾c., advancing gradually from this level to 43¾c. by the middle of July. Some outside selling then appeared, which broke the price temporarily. After this selling had subsided, the market became strong again, and reached 45c. toward the latter part of August. This meant a premium of about 4c. for spot tin, of which supplies in this market were small and closely held. This premium disappeared almost entirely at the beginning of September, and the market declined further in sympathy with London, where the unsettled political situation had a disturbing effect.

At the end of September the market was established at about 38⅝c., New York. The market became firm again during October, and reached 42c. the latter part of the month, advancing further the beginning of November. In London, a considerable backwardation for three-months tin developed, which was due to the new Metal Exchange contract, to go into effect on Feb. 1, 1912, under which almost any brand of tin can be delivered, subject to certain rules and regulations. Therefore, the trade did not consider this backwardation as a sign of intrinsic weakness of the market.



COURSE OF METAL PRICES SINCE 1878.

PLOTTED FROM THE ANNUAL AVERAGES.

NOTE:—Price for Pig Iron up to 1885 represents Foundry No. 1 at Philadelphia; since 1885, the Price of Bessemer Pig Iron at Pittsburgh is given.

The Engineering & Mining Journal

The Zinc Industry in 1911

The zinc industry of the United States in 1911 was profitable both to miners and smelters, to the former because the price for spelter, and consequently of ore, was materially above what is considered to be a normal average; and to the latter because the margin between the value of zinc in crude and finished form was larger than usual. The latter condition was due, of course, to the bountiful supply of ore; because of this same fact the joy of the producers of ore was not unalloyed. The smelters are, however, entitled to have an inning now and then.

Production

The production of spelter in the United States in 1911 is reported in the following tables. We have not at this time attempted to collect the statistics of the dross smelters, respecting whom we draw the line at those who resmelt dross, scrap, etc., but not ore. Many of the ore smelters also treat dross and skimmings, the spelter obtained from which figures in their reports. All of the ore smelters have reported to us their production in 1911 up to Dec. 16, together with their own estimate of probable production in the last fortnight of the year, except the Edgar Zinc Co. In order to arrive at totals we have estimated the production of the Edgar Zinc Co. as 25,000 tons. All of the smelters with the exception of the Edgar Zinc Co. reported to us by telegraph their stock of spelter at the end of Dec. 31, 1911.

The U. S. Geological Survey reported the spelter statistics for the first half of the year. Using its figures we arrive at those for the second half by difference.

Five smelters reported to us a production of 9511 tons of bonded spelter in 1911 and exports of 9298 tons thereof up to Dec. 16, 1911. At the end of the year no bonded spelter was reported in stock.

Smelting Capacity

In spite of the fears that that were entertained in the latter part of 1910 that there would be a deficiency in smelting capacity in 1911, there appears to have been actually an increase.

At the end of 1910 the smelters reported to us a total of 91,291 retorts, of which 9740 (Lanyon Zinc Co.) were about to be permanently dismantled, leaving 81,551 available, of which 3208 were in works that were idle.

At the end of 1911 the total number of retorts was 87,800, of which 4744 were in works then idle, one of which was in operation during a part of 1911, and another of which was being made ready for operation in January, 1912.

PRODUCTION OF ZINC

(In Tons of 2000 Lb.)

By Ore Smelters

States	1910	1911
Colorado	6,564	7,250
Illinois	79,570	88,665
Kansas and Missouri	112,182	103,407
Oklahoma	34,760	45,963
East	43,989	47,415
Totals	277,065	292,700
By dross and scrap smelters	11,350	(e) 12,000

Total Production of Zinc

	1910	1911
Ore smelters	277,065	292,700
Dross smelters	11,350	(e) 12,000
	288,415	304,700

(e) Estimated.

SPELTER STATISTICS BY SEMESTERS

(In Tons of 2000 Lb.)

Production, first half	140,196
Production, second half (a)	152,504
Total production (a)	292,700
Stocks, Jan. 1, 1911	23,000
Stock, June 30, 1911	17,788
Stock, Dec. 31, 1911	8,700

(a) Of ore smelters only, but including spelter derived from dross, etc., treated by them.

DELIVERIES INTO CONSUMPTION

	1910	1911
Stock, Jan. 1	11,500	23,000
Production	288,415	304,700
Imports	3,452	(a) 300
	303,367	328,000
Exports, domestic	3,989	(a) 5,700
Exports, foreign	4,468	(a) 11,100
Stock, Dec. 31	23,000	8,700
Deliveries	271,892	302,500

(a) December estimated. These statistics, reported by the Bureau of Statistics, do not agree with those reported to us by the smelters. In both cases we exclude spelter derived from imported ore, and subsequently exported in manufactured form under drawback privilege, such manufacture being properly a domestic consumption.

The works that went permanently out of use in 1911 were those at Pulaski, Va., and Bethlehem, Penn. New works that went into operation were those of the Bartlesville Zinc Co. (five furnaces, 3200 retorts) at Collinsville, Okla.; Tulsa Fuel & Manufacturing Co. (six furnaces, 3320 retorts) at Collinsville, Okla.; and Grasselli Chemical Co. (six furnaces, 3456 retorts) at Meadowbrook, W. Va.

Additions to smelting capacity were made by the Bartlesville Zinc Co., at Bartlesville, Okla., Lanyon-Starr Smelting Co., National Zinc Co. and United Zinc & Chemical Company.

At the end of 1911, among operating smelteries, 5120 retorts were under construction at Collinsville, Okla., 2880 at Palmerton, Penn., 1800 at Danville, Ill., and 876 at Lasalle, Ill., a total of 10,676 comprised in 23 furnaces. New works under construction were those of the Granby Mining & Smelting Co., at East St. Louis, Ill., and of the American Zinc, Lead & Smelting Co. and the Robert Lanyon Zinc & Acid Co., at Hillsboro, Ill., with an aggregate of 8480 retorts projected. It does not appear that there will be any deficiency in smelting capacity in 1912.

Ore Supply

The production of blende in the Joplin district was about 250,000 tons; of calamine about 18,000 tons; a total of 268,000 tons, against 296,000 tons in 1910. Wisconsin produced about 75,000 tons of blende and calamine, chiefly the former, against a total of 63,000 tons in 1910. There was, consequently, a small deficiency in the output of these two districts, but it was much more than offset by the increased production west of the Rocky Mountains, especially at Leadville and Butte. The smelters received a large tonnage of Leadville calamine, which is relatively of low grade, and also of Butte blende, which is relatively of high grade. The Butte & Superior Copper Co., produced upward of 3000 tons, monthly, of concentrate assaying from 45 to 50 per cent. zinc; W. A. Clark produced a less amount from the Elm Orlu mine. The Butte production may be expected to increase further in 1912, inasmuch as the Butte & Superior company is erecting a new mill of capacity for about 200,000 tons of crude ore per annum, which ought to result in the production of about 50,000 tons of concentrate.

A new zinc production is expected to come before long from the Holston River district in Tennessee, where the American Zinc, Lead and Smelting Co. has become interested. This company claims to have developed 11,000,000 tons of ore and is now sinking a shaft to a depth of 1000 ft. for its extraction and is planning to erect a concentrating mill of 2500 tons daily capacity at Mascot. The chief production of zinc ore in this district in 1911 was made by the Grasselli Chemical Co., which erected a new mill there. Two other large enterprises for mine development are reported to be under consideration.

Germany

Germany's imports and exports during the first 10 months of 1911 were as follows (in metric tons):

Imports

	1910	1911
Spelter	32,241	40,547
Zinc sheets	190	405
Broken zinc	1,558	1,929
Zinc ores	207,911	221,253
Zinc dust	1,124	679
Sulphide of zinc	2,757	2,289
Zinc-white	3,823	4,208

Exports

	1910	1911
Spelter	65,140	61,935
Zinc sheets	18,601	31,171
Broken zinc	3,518	3,177
Zinc ores	45,090	41,035
Zinc dust	2,583	2,734
Sulphide of zinc	8,782	11,375
Zinc-white	18,290	17,161

The American Spelter Market in 1911

Among the commercial metals, spelter continues to be the only one whereof the market is not dominated by one paramount factor. The forces of supply and demand have free sway. Fluctuations, therefore, are apt to be frequent, indexing as it were changes in general sentiment and the vicissitudes of trade at large. The market is still gaged by the prices ruling in St. Louis, where quotations hovered around 5.35c. at the beginning of the year. After a temporary dip to 5.20@5.25c. toward the end of January, the demand improved in anticipation of a livelier spring business, which carried prices up to 5.50c. early in March. The ease in the ore market, and the consequently favorable smelting margins, caused smelters to realize freely. Under these offerings, recessions occurred, which brought about a gradual lowering in quotations to 5.15@5.20c. about the end of May and early June. As subsequent events have shown, this decline was hardly justified. The free selling of first hands was due to a desire to clinch not only a satisfactory current smelting profit, but also to dispose of stocks of spelter at the zinc works, as the metal could readily be replaced, at a profit, with ore. This opportunity continued to exist upon an increasingly attractive scale throughout the remainder of the year.

PRICE OF SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January.....	6.101	5.452	5.951	5.302	23.350	23.887
February....	5.569	5.518	5.419	5.368	23.188	23.276
March.......	5.637	5.563	5.487	5.413	23.031	23.016
April........	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	5.520	4.978	5.370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August......	5.279	5.953	5.129	5.803	22.800	26.801
September ..	5.514	5.869	5.364	5.719	23.165	27.750
October......	5.628	6.102	5.478	5.951	23.900	27.256
November...	5.976	6.380	5.826	6.223	24.083	26.795
December...	5.624	6.301	5.474	6.151	24.019	26.849
Year.......	5.520	5.758	5.370	5.608	23.050	25.281

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

The market had reached a point where it practically became dependent upon the current production, when previously the accumulation at the zinc works had, in addition, found its way into consumption. Whatever favorable development might occur, it was bound to have a pronounced effect upon prices. The European market furnished the incentive. Excepting that business was brisker and the initiative in consequence more to the fore, the situation there turned out to be not unlike that prevailing in this country. Supplies had been reduced to a minimum and consumption had reached a maximum rate. Quotations in London began to climb until they reached the export parity. The domestic market, not having a surplus to spare, was driven ahead. The advance was almost uninterrupted on both sides of the Atlantic until the market crossed 6c. during the closing days of October. Reports of large exports were current, but the statistics will probably show that the bulk of the quantities sent out of the country by Western smelters consisted of bonded spelter obtained from Mexican or British Columbia ore which had not been retained for domestic consumption since the Payne-Aldrich tariff became effective. Nevertheless, the foreign syndicate became frightened, and to keep out American spelter lowered its prices. This action had no effect on the home market, which proved its independence by a further advance during November and into the first days of December, when the market had climbed to 6¼@6½c. Coincidentally there prevailed an acute scarcity of spot spelter, for which premiums were realized by the few fortunate holders. By the middle of December, the tension was relieved. Spelter which had been held back from the market was offered for sale, and as the immediate demand had been satisfied, the market experienced a sudden decline to about 6c., and closes uncertain at 6.10@6.20c., St. Louis.

Stocks of spelter in first hands are practically nominal at the end of the year. Stocks of ore at the zinc works are larger than they have ever been before. New works in Oklahoma and Illinois now about completed, or in the course of construction, will eventually help to bring about the disappearance of the disparity between spelter and ore prices. Smelting interests least of all desire a continuance of a situation which, though it means for them a temporary advantage, contains the element of serious consequences to their industry. To what extent a lower level of spelter prices will contribute toward the solution, the future will reveal.

ZINC SMELTING CAPACITY OF THE UNITED STATES AT THE END OF 1911

Name	Location	Furnaces	Retorts
American Zinc, Lead and Smelting Co..........	Deering, Kan.	6	3,840
American Zinc, Lead and Smelting Co..........	Caney, Kan.	6	3,648
Bartlesville Zinc Co..........................	Bartlesville, Okla.	9	5,184
Bartlesville Zinc Co..........................	Collinsville, Okla	5	3.200
Chanute Zinc Co	Chanute, Kan.	4	1,280
Beer, Sondheimer & Co..........................	Altoona, Kan.	6	3,840
L. Vogelstein & Co..........................	Gas City, Kan.	4	(*a*) 2,560
L. Vogelstein & Co..........................	La Harpe, Kan.	3	1,856
Collinsville Zinc Co..........................	Collinsville, Ill.	6	(*b*) 1,536
Edgar Zinc Co..........................	St. Louis, Mo.	9	2,000
Edgar Zinc Co..........................	Cberryvale, Kan.	24	4,800
Granby Mining and Smelting Co..........................	Neodesha, Kan.	6	3,840
Grasselli Chemical Co..........................	Clarksburg, W. Va.	10	5,760
Grasselli Chemical Co..........................	Meadowbr'k, W. Va.	6	3,456
Hegeler Bros..........................	Danville, Ill.	2	1,800
Illinois Zinc Co..........................	Peru, Ill.	7	4,640
Lanyon-Starr Smelting Co..........................	Bartlesville, Okla.	7	3,456
Matthiesen & Hegeler..........................	Lasalle, Ill.	5	4,380
Mineral Point Zinc Co..........................	Depue, Ill.	6	4,520
National Zinc Co..........................	Bartlesville, Okla.	7	4,256
Nevada Zinc Co..........................	Nevada, Mo.	3	(*c*) 648
New Jersey Zinc Co..........................	Palmerton, Penn.	12	2,892
Pittsburg Zinc Co..........................	Pittsburg, Kan.	2	448
Prime Western Spelter Co..........................	Gas City, Kan.	9	5,384
Sandoval Zinc Co..........................	Sandoval, Ill.	4	896
Tulsa Fuel and Manufacturing Co..........................	Collinsville, Okla.	6	3,320
United States Zinc Co..........................	Pueblo, Colo.	7	1,680
United Zinc and Chemical Co..........................	Springfield, Ill.	.	3,680
		..	87,800

(*a*) Inactive. (*b*) Inactive during latter part of year. (*c*) Not operating in 1911, but preparing for production in 1912.

The London Spelter Market

Special Correspondence

In January the market opened firm, with rather improved consumptive demand, and ordinary brands ruling from £23 17s. 6d. @ £24 per ton. On Jan. 11 a small advance was established, and was in force until Jan. 23 when a restricted demand weakened the market, and "Producers" Syndicate made a drastic cut of 15s. in the price, whereby they were enabled to market their full output for the time being. The market was weakened also by the intermittent pressure of second-hand lots; and the closing price for ordinary brands was £23 5s. @ £23 7s. 6d. with Silesian "specials" about 10s.

In February the market opened with some appearance of strength owing to the complete absorption of all that had been offered by the Syndicate at the reduced price. Business, however was quiet in view of continued slackness in the demand for galvanized iron. Toward the middle of the month dealers had to make concessions, and a sharp rally of about 5s. per ton was of short duration. Official syndicate prices remained unchanged, but speculative lots in dealers' hands had to go at reduced prices.

March opened with some appearance of firmness and a slight improvement in values up to £23 being paid for ordinary brands. Nearly all the month the quotation was uniform at £22 17s. 6d. @ £23. Business with consumers was very quiet till toward the end of the month, when second-hand lots were scarce, and buyers had to apply either to the English producers or to the Producers' Syndicate abroad. On March 31 the underlying firmness of the market found expression in a sudden advance of 7s. 6d. per ton.

In April the market remained at unchanged quotations for some days, but with an increasing volume of business which soon absorbed all second-hand parcels and obliged consumers to pay the prices asked by the Producers' Syndicate. On April 7th the London quotation for ordinary brands advanced to £23 12s. @ £23 12s. 6d. Demand continued unabated, and a further advance of 5s. per ton was established. The upward movement continued gradual until the end of the month, it being manifest that trade requirements were quite abreast of production if not surpassing it.

In May a gradual advance in values was uninterrupted. Consumers were quite ready to contract for large quantities, but producers remained cautious and there was but little second-hand metal on offer. As the month advanced galvanizers found increasing demand for their wares, and sheet zinc also found ready sale: but little spelter could be had for later delivery than June. The close was £24 10s. for ordinary brands, and £25 for specials.

In June business was restricted more by the unwillingness of holders to offer than by the reluctance of consumers to buy. Those who had allowed their stocks to run low had to pay advanced prices in order to replenish; for all the consuming industries were fully employed and the small quantities of spelter which were offered from time to time were eagerly bought up. Prices varied only slightly throughout the month, but always upward.

In July the Syndicate reentered the market, but only with moderate quantities which were readily absorbed: there being no surplus supplies available. The pressure for supplies was persistent from all quarters. As the month advanced this pressure became more acute, particularly when it was known that the situation in America was very similar. Closing values in London were £25 2s. 6d. for ordinary brands, and £26 for Silesian "specials."

In August demand continued unabated, and an initial advance of 7s. 6d. per ton found buyers quite ready to take the little which the associated producers offered thereat. Sucessive advances followed with a like result. A few speculative lots of spelter found ready buyers, often at fancy prices. Closing prices were £27 7s. 6d. for ordinary brands, and £28 10s. for specials.

September opened with an appearance of weakness in the market, due to some speculative resales, which, however, were soon absorbed. Business was rather restricted, there being no surplus stocks in producers' hands. The Syndicate price was early advanced a few shillings and thereat only relatively small quantities were on offer. The London quotation for ordinary brands advanced to £27 15s., with £28 10s. for specials.

October opened with a firm but comparatively quiet market, and so remained for nearly a fortnight, one feature being the increasing American consumption. Ordinary brands were quoted £27 15s., and specials £28 10s. Thereafter came a reduction in prices for sheet zinc, due to decreased demand and consequent competition, and sellers of spelter—outside the Producers' Syndicate—pressed sales so far as to reduce the London quotation for ordinary brands to £27. The Syndicate abruptly reduced its selling prices by £1. Toward the close there was an improved consumptive demand with evidence of restricted supply: and prices improved, closing quotations being £26 13s. 9d. for ordinaries, and £27 10s. for specials.

In November values were almost stationary, the only variation being a little easing of the London quotation during the first fortnight under pressure of some supplies outside the Syndicate's control. British and Continental demand combined to absorb all that was in hand for sale on behalf of the Syndicate, whose prices were consequently advanced for further business. The London quotations remained at the end of the month the same as at the beginning, £26 15s. for ordinary brands, and £27 5s. for specials.

December found the consuming industries as busy as ever, many galvanizers being unable to accept orders for delivery earlier than February. Spelter outside the control of the Syndicate was readily absorbed and values were thus steadied.

Oklahoma Lead and Zinc Mining in 1911

By George W. Bigham*

On account of the high state royalty tax, 0.5% on the gross production, and the low prices of lead and zinc ore, the mills of the Miami and Quapaw camps have been idle the greater part of 1911. The water question also is retarding the development of this section, as unwatering the mines is proving a much longer and expensive matter than was anticipated.

The Oklahoma Lead & Zinc Mining & Milling Co. was busy for 14 months continuously with a 12-in. centrifugal pump, and only lowered the water to the 205-ft. level. Chapman & Lennan are now sinking a 7x12-ft. pump shaft and will install a double 10-in. steam pump on the 300-ft. level. Prospecting on this ground showed lead and zinc from 204 to 310 ft., and three mills will be erected in the next six months.

The Carson-Dodson Mining Co. has two shafts down to the 240-ft. level with an air shaft cut on each. The "dirt" in this mine is extraordinarily rich. On Oct. 27 and 28, 84 tons of "dirt" were trammed to the mill of the Oklahoma Lead & Zinc Mining & Milling Co., and 60,000 lb. of lead and 34,000 lb. of blende recovered. This company will build a mill as soon as it gets its drifts properly opened for steady running.

The 30-Acre Mining Co. has 13 drift holes, all showing a 30-ft. face of ore at 170 ft. It has two shafts down to the ore and will at once erect a mill. The Prairie Mining Co. developed some good prospects and will also erect a mill. The Miami Royalty Co., on the Wat-tah-noh-zhe land, has one of the best runs in the camp, on both the upper and lower levels. The Little Maxine lease is showing a good face of ore at the 170-ft. level. J. W. Barnes, who operates three drill rigs in the Miami mining camp, reports some good prospects, one mile north of the present camp.

Of the 20 mills in the Miami camp, five produced the bulk of the ore sold in 1911. There are 11 mills in the Quapaw camp. There are 15 drills in operation and from the showing made in the last of 1911 there seems no doubt but that the Quapaw field will soon extend the intervening four miles north to the Kansas state line, and south and west to the Neosho River. In an accompanying table is shown the production of lead and zinc concentrates from each mill In addition about 120,000 lb. of calamine, worth $1500, were produced in Peoria camp.

MIAMI PRODUCTION IN 1911

Company	Zinc Concentrate	Lead Concentrate
Emma Gordon	3,307,464	742,115
Sullivan	3,158,256	1,147,010
Turkey Fat	3,084,020	891,640
New State	2,108,285	627,035
Little Maxine	1,181,010	106,110
Buckeye	482,860	61,300
Index	464,620	27,070
Okmulgee	421,750	66,040
Midas Lead & Zinc	306,490	21,530
Golden Hen	251,395	14,880
Miami Yankee	11,770	.
Carson-Dodson	63,530	340,560
Tom Lawson	8,560	.....
Old Chief	6,210	.....
Neal	56,690	20,570
Sundry sales	768,540	6 3,500
Total	15,681,450	4,729,360
Total value	$200,496	$130,966

QUAPAW PRODUCTION IN 1911

Company	Zinc Concentrate	Lead Concentrate
Omaha Petersburg	811,790	61,375
J. R. Crowe	....	85,540
Good Luck	571,390	.....
Mission	251,520	35,600
Big Jack	136,620	.....
Ethel Miller	153,400	.....
K. C. Quapaw	121,280	77,160
M. K. & T	109,180	.....
Heap O'Brien	212,650	.....
Lincolnville	61,6[illegible]0	.
Craig & Co	80,110	.
Webb & Co	29,600	.
A. W. Abrahms	24,110	.
C. & P	5 ,170	.
Sundry sales	174,750	4,600
Total	2,822,190	261,275
Total value	$52,215	$8,679

---

*Miami, Okla.

The Joplin District in 1911

By Jesse A. Zook

The year 1911 began with severe cold, a light output and small shipments. The output increased more rapidly than the sales and by the end of March an accumulation of 14,000 tons was in the bins of mine owners. Through this period spelter ranged up from $5.35 to $5.55 per 100 lb., while zinc sulphide ore declined from an opening price of $47 down to $44 for choicest grades. At this time ore prices and spelter began a decline extending to the middle of June, then a reaction leading up to $6.40 for spelter and $51 for ore with the advent of December. Here spelter toppled over and decended to $6 before the end of the year, while ore prices declined a couple of dollars.

There was a decreased shipment of both sulphide and silicate ores. Missouri sustained a reduction of 19,000 tons zinc sulphide and 5000 tons zinc silicate: Kansas 4960 tons zinc sulphide and 80 tons zinc silicate; Oklahoma 4220 tons zinc sulphide and 24 tons zinc silicate.

In Jasper County, Joplin, Carl Junction and Cave Springs increased in zinc shipments during the year, while Webb City, Alba-Neck, Duenweg, Carthage and Sarcoxie made decreased shipments.

In Newton County, a decrease in zinc sulphide from Granby and Wentworth was more than offset by increased sales from Jackson and Spurgeon. An increase of zinc silicate from Granby and Saginaw was wiped out by decreased sales from Spurgeon, Wentworth and Senaca. In Lawrence, Dade and Green Counties the sales were decreased.

PRODUCERS' ASSOCIATION

Early in the year the Zinc Producers' Association adopted a contract selling base for zinc-sulphide ores grading 60 per cent and under. This created a dissention resulting in a disruption in which the opponents secured control of the association and denounced the contract plan. A crusade was inaugurated against contracting and many producers, who had looked favorably upon the plan, declined to sign the contracts. Along in midsummer the reorganized association began to talk of exporting ore. Later it was proposed to close down the mines and toward the end of the year there was talk of erecting a producers' smeltery. This talk undoubtedly assisted in boosting spelter prices, and while ore prices continued to rise the advance was meager in proportion to the metal advances. However, the collapse of metal at the year-end indicated that no higher level of ore prices was warranted.

THE CONTRACT PLAN

The old association offered to place contracts covering 4500 tons for each week's delivery, if there were sufficient sellers to accept that amount. At one time it was claimed that a weekly production of 3700 tons was ready to be sold on contract; then the disruption came, and less than 1000 tons weekly have been sold on contract. The contract placed the price of zinc-sulphide ore at $37 per ton on a St. Louis spelter market of 5c. per lb., with an advance or deduction of 8¼c. for each 1c. up or down in the metal market. Ores carrying under 2 per cent. iron were not penalized, from 2 to 4 per cent. were penalized $1 for each 1 per cent., and over 4 per cent. the penalty was 50c. per ton for each 1 per cent. of iron. A premium of $1 per ton for ore carrying under one-half of 1 per cent. of lead was paid.

JOPLIN DISTRICT ORE SHIPMENTS IN POUNDS, 11 MONTHS, 1911.

District.	Zinc Sulphide.	Zinc Silicate.	Lead.	Comb. Value.
Webb City—Carterville...	184,318,970	....	46,402,480	$5,045,484
Joplin	96,733,880	50,450	12,810,740	2,383,028
Alba-Neck	30,046,370	....	411,990	666,081
Duenweg	20,975,370	3,459,250	2,146,120	532,424
Oronogo	18,582,350	....	2,588,010	432,759
Carl Junction	7,942,600	....	32,440	177,586
Cave Springs	5,149,250	....	55,630	117,032
Carthage	3,386,770	215,580	87,300	71,677
Sarcoxie	2,789,070	752,650	26,380	63,783
Jasper County	369,924,630	4,477,930	64,561,090	$9,489,854
Granby	7,538,740	17,323,640	1,159,530	$377,053
Spurgeon	5,834,560	6,924,280	2,186,000	268,235
Jackson	9,087,740	....	1,666,750	229,541
Saginaw	....	540,740	188,910	13,699
Wentworth	451,040	....	....	8,937
Seneca	....	....	47,780	1,290
Newton County	22,912,080	24,788,660	5,248,970	$898,755
Aurora	5,577,310	2,718,950	192,850	$147,621
Stott City	1,093,930	....	15,000	22,277
Lawrence County	6,671,240	2,718,950	207,850	$169,898
Green County	....	....	74,980	$2,174
Dade County	....	77,270	....	$695
Galena	30,100,270	150,030	6,346,870	$785,627
Badger	2,621,620	....	134,510	55,948
Lawton	1,373,930	....	44,990	30,886
Cherokee County	34,095,820	150,030	6,526,370	$872,461
Miami	14,546,670	....	4,856,170	$352,872
Quapaw	4,024,820	18,010	585,310	88,269
Ottawa County	18,571,490	18,010	5,441,480	$441,141
Missouri	399,507,950	32,062,810	70,092,890	$10,561,376
Kansas	34,095,820	150,030	6,526,370	872,461
Oklahoma	18,571,490	18,010	5,441,480	441,141
11 Mo. Joplin District.....	452,175,260	32,230,850	82,060,740	$11,874,978
Approximate December ..	46,912,000	3,428,000	8,730,000	1,273,805
District Total 1911.......	499,087,260	35,658,850	90,790,740	$13,148,783
District Total 1910.......	541,068,120	47,748,720	87,413,610	14,129,022
Increase	....	....	3,377,130	....
Decrease	41,980,860	12,089,870	....	$980,239

The base was formulated on a recovery of 87 per cent. of the metallic contents shown by assay. The close of the year ended the life of these contracts. A substitute contract is offered, for six months, based on a metal recovery of 87 per cent. of the metallic contents shown by assay, with a smelting charge based at $21 per ton.

With very few exceptions contract prices ranged higher than the open market prices, while during the spelter skyrocketing period in November and early December ores carrying over 4 per cent. iron sold $2 to $6 per ton higher than open-market prices for like grades. No attempt was made to secure contracts on ores above 60 per cent. grades, the limited output and strong demand for these keeping the market firm.

NEW AND REMODELED MILLS

In the Thoms station area, northwest of Joplin, a dozen new and remodeled mills were in operation at the end of the year where four mills were standing and but two operating a year ago. New mills were erected in the Webb City, Carterville, Sarcoxie, Carl Junction and Jackson fields. Two were built west of Joplin, and several were built in Kansas, around Galena. During the year a number of mills were removed from one to another part of the district and remodeled.

Buyers uniformly agree that the assessing of penalties has had good effect on ore-concentrating methods, but the contract clause of $1 premium for zinc ores carrying less than one-half of 1 per cent. lead has brought better results than penalizing methods. It was a definite offer to producers in a form and manner so ever-present that it could not be ignored. Human nature prefers premiums to penalties, anyway.

PRICES OF ZINC AND LEAD ORES IN JOPLIN DISTRICT IN 1911.

	Zinc.		Lead.	
	High.	Aver.	High.	Aver.
Jan.	$47.00	$40.44	$58.00	$55.66
Feb.	46.00	39.16	58.00	55.38
Mar.	47.00	38.62	56.00	54.57
Apr.	44.00	37.54	59.00	56.21
May	43.00	37.04	58.00	55.37
June	45.00	37.15	58.00	55.91
July	45.00	38.32	63.00	58.46
Aug.	48.00	40.35	63.00	60.82
Sept.	48.00	41.53	61.00	59.56
Oct.	48.00	40.92	58.00	54.73
Nov.	50.00	42.61	61.00	56.45
Dec.	51.00	40.76	64.00	56.75
1911	$51.00	$39.90	$64.00	$56.76
1910	52.00	40.42	58.00	51.98
Inc.	.....	.....	$6.00	$4.78
Dec.	$1.00	$0.52	.....	.....

Shipment and Production

The shipment of zinc ores the past year was nearly 30,000 short tons less than 1910. At the beginning of the year the reserve stock was but a little over 3000 tons while at the close it approximated 11,000 tons. The year's production was, therefore, close to 8000 tons greater than the shipment.

ORE PRICES IN JOPLIN DISTRICT
(11 Years)

	Zinc Ore.		Lead Ore.	
Year.	High.	Aver.	High.	Aver.
1911	$51.00	$39.90	$64.00	$56.76
1910	52.00	40.42	58.00	51.98
1909	55.00	41.08	60.50	54.56
1908	47.00	34.36	66.00	54.66
1907	53.50	43.68	88.50	68.90
1906	54.00	43.30	87.00	77.78
1905	60.00	44.88	80.00	62.12
1904	53.00	35.92	62.00	54.80
1903	42.00	33.72	60.50	54.12
1902	42.00	30.33	50.00	46.10
1901	34.00	24.21	47.50	45.99

Lead Ore

Lead prices were less variable than in most preceding years. The advent of the Webb City smeltery into the field had no immediate effect on advancing lead prices, as local producers hold a large block of the stock and from their production the bulk of this smeltery's needs was drawn.

Lead shipments approximated 3000 tons in excess of 1910. The average monthly shipment was 3685 tons, or 921 tons per week.

Zinc Mining in Wisconsin

By J. E. Kennedy*

The net tonnage of zinc ore shipped to smelteries from the Wisconsin district in the first 11 months of 1911 was 138,331,489 lb.—including 24,076,110 lb. from Jo Davies County, Ill.—showing an increase of 26,477,525 lb. over the corresponding period of last year. The gross tonnage shipped by the mines was 196,257,791 lb., of which amount 82,325,529 lb. was sent direct to the smelteries—including 9,327,149 lb. of zinc carbonate—and 113,932,262 lb. went to the five local separating plants. The shipment of zinc ore out from the separating plants was 56,005,960 lb. showing a shrinkage in tonnage of 57,926,302 lb.; part of this weight was recovered in iron pyrites of which the district shipped 26,455,240 lb. The tonnage of lead ore shipped in the same period was 8,046,265 lb. The table below shows the shipment of zinc ore by camps for the first 11 months of 1910 and 1911. The stock of zinc ore in bins at the year end slightly exceeded 10,000 tons.

WISCONSIN ZINC ORE SHIPMENTS IN 1911

	Gross from Mines		Net to Smelteries	
	1910 lb.	1911 lb.	1910 lb.	1911 lb.
Highland	12,675,500	9,079,730	12,334,800	8,610,430
Harker	7,100,772	7,058,880	4,648,912	6,814,410
Linden	8,104,520	15,449,482	638,070	753,150
Mineral Point	5,514,780	2,285,359	28,635,505	35,002,319
Dodgeville	607,800	260,910	607,800	260,910
Montfort	2,572,000	2,865,060	434,790	1,008,120
Livingston	15,489,522	11,532,780	211,164	285,000
Rewey	5,738,990	5,650,540	812,800	1,391,000
Platteville	28,921,658	26,958,570	24,742,350	33,833,390
Cuba City	12,687,973	3,692,990	9,051,423	2,818,700
Benton	41,114,285	47,674,050	10,490,809	11,957,510
Hazel Green	23,073,500	36,231,420	78,000	10,042,220
Shullsburg	2,531,840	9,067,800	1,486,300	1,478,220
ILLINOIS				
Galena	18,474,861	18,450,220	16,906,241	24,076,110
Council Hill	475,000	....	400,000	....
IOWA				
Dubuque	375,000	....	375,000	....
Total	185,458,001	196,257,791	111,853,964	138,331,489

Ore Prices

The highest base price paid during the first six months of 1911 was $43.50 per ton of 60 per cent. zinc. The price steadily declined and remained at $39 to $40 during April, May and the early part of June. In the last six months of the year the base price worked up to $46 during November and December. The highest premium price paid was $47 per ton.

New Developments

Prospecting was generally quiet throughout the district except in the Benton camp. The Wisconsin Zinc Co., the Vinegar Hill Zinc Co. and the Frontier Mining Co. developed a number of good properties in this territory. Ten concentrating mills were constructed and rebuilt during the year, the Wilkinson, Rowley, New Eureka and Little Minnie, at Benton; the Cleveland at Hazel Green; the Winskell and Milwaukee-Shullsburg at Shullsburg; the Coker and Dodger at Mifflin and the Merry Widow at Galena.

The Wisconsin Zinc Ore Separating Co. constructed a two-kiln magnetic-roasting plant at Benton; the Peaceful Valley and Lucky Twelve mining companies also installed roasters. The Campbell Magnetic Ore Separating Co., at Cuba City, increased the capacity of its plant to 100 tons daily capacity. The American Zinc Ore Separating Co., at Platteville, also increased its plant to handle 100 tons of concentrates per day a short time before it was destroyed by fire on Oct. 21. The Joplin Separator Works at Galena, which was burned on Oct. 23, was under construction at the end of the year with added capacity of two more kilns. The Interstate Light & Power Co. extended its power transmission lines throughout the district.

Shipments of Ore

The accompanying table shows, in pounds, the shipments of zinc ores from the various camps of the district. In addition to these, the weekly returns up to Dec. 23, give totals of 8,817,815 lb. lead ore and 28,429,840 lb. sulphur ore or pyrites.

---

*Platteville, Wis.

The Iron and Steel Industry in 1911

By Frederick Hobart

Over production and too sanguine estimates of trade recovery in the latter part of 1910 left their ill effects to be worked out in 1911. The consequence was a half year of general depression and of efforts to work off accumulated stocks, which were only partially successful. In the second half, after a severe reduction of output had been made, there was a gradual recovery, slowly drawn out until November, when the trade began to wake up and there was a renewal of business which promises well for activity in the new year. Yet with all the vicissitudes of the year there was a large production; and in consumption the growth of population and of general industry began to assert itself. It still failed to come up to the capacity of the furnaces and mills, greatly enlarged as that was in 1907 and the two succeeding years. Averaging roughly, it may be said that the activity in finished steel, which is the final test, gradually increased from about 60 per cent. of the total productive capacity up to 75 per cent.; with the prospect that 1912 will open with nearly 85 per cent. employed.

It has often been said that every year in the iron trade has its parallel in the past; but we must go back 10 years or more to find a time when optimism received so severe a check. This resulted in undue pessimism, and that feeling persisted long after the causes for it had begun to wear away. A break in the curve of slow recovery led to a feeling that there was no recovery at all, and to a failure to recognize the great underlying volume of business which was done. This was, perhaps, natural; but the final statistics will show that while 1911 was not up to the preceding year, there was no such break as characterized 1908, for instance. If production decreased, it was in part because of using up the accumulated stocks of the previous year.

IRON ORE

The production and consumption of iron ore for two years past are estimated as in Table I herewith, the figures being in long tons.

The decrease in stocks in 1911 is chiefly in those visible, as on the Lake Erie docks; there are not statistics available for the exact determination of stocks in furnace yards. Imports and exports are estimated for the month of December. For the 11 months ended Nov. 30, for which we have full returns, the imports included 1,042,414 tons from Cuba; 202,362 from Sweden; 188,661 from Spain; 154,853 from Newfoundland; 50,424 from Canada; 24,116 tons from other countries. There was a considerable fall in imports, owing chiefly to the lesser activity of the furnaces. Some large contracts for delivery of foreign ores to eastern furnaces in 1912 were made, principally for Swedish ore.

I. IRON ORE PRODUCTION AND CONSUMPTION

	1910	1911
Lake Superior	42,442,397	36,680,471
Southern states	7,500,000	6,475,000
Other states	3,325,000	2,660,000
Production	53,267,397	41,815,471
Decrease in stocks	....	650,000
Imports	2,591,031	1,790,000
Total supplies	55,858,428	44,255,471
Deduct exports	644,875	780,000
Increase in stocks	950,000	....
Approximate consumption	53,263,563	44,467,471

Accurate statistics are available for the Lake Superior iron ore from which nearly 80 per cent. of our pig iron is made. Dock records are carefully kept and are compiled each year by the Cleveland *Iron Trade Review*. Table II herewith gives the shipments from the upper ports and Table III the receipts and dock stocks at Lake Erie ports, to which over 80 per cent. of the ore goes. The remainder goes to Lake Michigan ports—Chicago, Milwaukee and Gary.

III. RECEIPTS AND STOCKS, LAKE ERIE PORTS

Ports	Receipts			Stocks		
	1909	1910	1911	1909	1910	1911
Toledo	1,374,224	1,225,202	493,345	332,456	433,215	661,382
Sandusky	11,088	.....	....	39,557	17,728	2,471
Huron	243,082	197,951	223,947	477,333	375,118	344,371
Lorain	2,796,856	2,884,738	2,937,605	407,129	259,448	314,321
Cleveland	6,051,342	5,800,501	4,584,211	1,547,142	1,638,795	1,589,491
Fairport	1,734,277	1,516,434	666,365	867,640	839,970	636,566
Ashtabula	8,056,941	9,620,638	6,359,131	2,594,359	3,287,816	3,295,862
Conneaut	7,007,834	6,309,548	6,931,278	1,411,002	1,329,997	1,237,573
Erie	1,235,057	942,592	289,400	788,046	792,011	636,274
Buffalo	5,002,235	4,704,439	2,802,976	501,125	452,783	413,353
Detroit	159,889	296,412	243,292	....	....	....
Total	33,672,825	33,498,455	25,531,550	8,965,789	9,426,681	9,131,664

The season shipments to furnaces from Lake Erie ports, to which about 80 per cent. of the Lake ore goes, and from which it is distributed, were as shown in Table IV.

IV. SHIPMENTS TO FURNACES

	1910	1911
Stocks on docks, May 1	5,441,080	6,778,494
Receipts for the season	33,498,455	25,531,550
Total	38,912,535	32,310,044
Shipments to furnaces	29,515,654	23,178,380
Dock stocks, Dec. 1	9,426,881	9,131,664

The season prices of Lake Superior ore on Lake Erie docks were fixed as usual early in the year. They were 50c. per ton below those of 1910, being as follows: Bessemer ore—base 55 per cent. iron and under 0.45 phosphorus—$4.50 per ton for Old Range and $4.25 for Mesabi; nonbessemer—base 51.5 per cent. iron—$3.70 for Old Range and $3.50 for Mesabi. These prices apply to not more than 20 per cent. of the ore mined. The rest is from mines owned by the Steel Corporation and other large steel companies, and the price to them is a matter of bookkeeping, the real charge being the costs of mining and transportation. To the prices given above the cost of transportation from Lake docks must be added to get the cost of the ore at furnaces; this will run from 50c. to $1 per ton, according to the situation of the furnaces. Toward the end of the shipping season these prices were quietly cut about 25c. a ton.

II. SHIPMENTS OF LAKE SUPERIOR ORES

Port	1909	1910	1911
Escanaba	5,748,042	4,959,869	4,278,445
Marquette	2,909,578	3,248,930	2,200,380
Ashland	3,834,286	4,093,822	2,429,290
Two Harbors	9,181,132	8,271,169	6,367,587
Superior	6,540,505	8,437,261	9,920,490
Duluth	13,470,503	13,609,155	6,934,269
Total by water	41,683,599	42,620,206	32,130,471
By rail	903,270	822,391	550,000
Total	42,586,869	43,442,597	32,680,471

Prices of iron ore in the East are not controlled by any agreement or association of producers. Sales made through the year at New York mines showed a basis of 5½@6c. per unit of iron at mines. Newfoundland and Spanish ores sold at about 7¼@7½c. per unit of iron f.o.b. docks, Philadelphia. The furnaces using those ores, however, can generally get a low freight rate from Philadelphia, so that there is not much difference between them and domestic ores in cost at furnace.

Little or no Cuban ore is sold to outside furnaces, nearly all of it being used by the steel companies which control the mines.

The conditions in the Lake Superior region during the year are fully treated in a special article on another page.

In the South iron ore production is rather closely limited by the demands of the furnaces. The proximity of the mines to the points where the ore is needed and the fact that mining can continue without interruption through the year, render unnecessary the storage or accumulation of any large stocks of ore. Accordingly the decrease of about 15 per cent. in production correponds pretty closely to the decrease in the make of pig iron.

Eastern mines were fairly active through the year, though their production was to some extent limited by the lower requirements of furnaces. Most of these ores are sold on yearly contracts. The mines of the Lake Champlain district in New York were more steadily worked than any others.

In Table I the imports and exports of iron ore are given for the year, with the month of December estimated. Actual imports for the 11 months ended Nov. 30 were 2,417,321 long tons in 1910, and 1,662,830 in 1911; a decrease of 754,491 tons. About 55 per cent. of these imports in 1911 was from Cuba. Exports for the 11 months were 638,578 tons in 1910, and 752,931 in 1911; an increase of 114,353 tons. A large part of these exports goes to Canadian furnaces.

Imports of manganese ore for the 11 months were 235,834 tons in 1910, and 176,486 in 1911; a decrease of 59,348 tons.

Pig Iron

The production of pig iron during the first half of the year was at the average rate of 1,944,300 tons monthly, not varying greatly from month to month. From July to October there was a gradual increase, followed by a drop in November and then by a rapid gain in December. The average for the second half of the year was 2,026,200 tons monthly.

I. PIG IRON PRODUCTION

	1909	1910	1911
First half.....	11,022,346	14,978,738	11,665,796
Second half...	14,773,125	12,319,807	12,157,250
Total......	25,795,471	27,298,545	23,823,046

The accompanying table shows the production by half years for three years past. For the first half of 1911 the figures are those collected and published by the American Iron and Steel Association—as are the totals for 1909 and 1910; for the second half they are estimated on the basis of the monthly reports of the capacity of the active furnaces. The figures are in long tons. The production for 1911 was 3,475,499 tons less than in 1910; and—with the exception of the disastrous year 1908—was the smallest since 1905. The increase in the second half of 1911 was largely due to the blowing in of a number of furnaces early in December. At the close of the year there were 237 coke and anthracite furnaces in blast, the largest number active since October, 1910, 14 months previous.

Assuming that the production of the second half of the year was approximately on the same lines as that of the first half, the division of the output according to the uses for which the iron was intended was approximately as in Table II.

II. PIG IRON PRODUCTION CLASSIFIED

	1910	1911
Foundry and forge.....	6,350,605	5,623,300
Bessemer............	11,244,612	9,529,200
Basic..............	9,084,520	8,119,800
Charcoal..........	394,377	375,500
Spiegel and ferro.....	224,431	175,246
Total...............	27,298,515	23,823,046

It is probable that the final returns will make some changes in these figures; especially in the quantity of basic iron. The production of pig iron in the United States for 10 years has been as in Table III.

III. PIG IRON PRODUCTION FOR 10 YEARS

1902	17,821,307	1907	25,781,381
1903	18,009,259	1908	15,936,018
1904 ...	16,497,003	1909 ...	25,711,846
1905	22,992,380	1910	27,295,592
1906	25,307,391	1911	23,823,046

A year ago we noted a large increase in unsold or unused stock of pig iron at the furnaces. Those stocks were then estimated at 2,100,000 tons. During 1911 the stocks were gradually worked down, and at the close of the year, though no exact figures are available, it is estimated that they did not exceed 850,000 tons. We estimate the consumption of pig iron in the United States for two years past as in Table IV, in long tons.

IV. CONSUMPTION OF PIG IRON

	1910	1911
Production..........	27,298,545	23,823,046
Imports..........	237,233	143,000
Decrease in stocks.....	....	1,250,000
Total supplies......	27,535,778	25,216,046
Exports..........	127,385	119,000
Increase in stock..	1,700,000	....
Total deduction...	1,827,385	119,000
Consumption.....	25,708,393	25,097,046

This consumption for 1911 was approximately 594 lb. per capita, being 45 lb. less than in the preceding year.

Steel Production

There are no accurate data for the production of steel in 1911. An estimate can be based upon the production of pig iron and other known facts. These would give an output approximately as follows: Openhearth steel 14,400,000 tons; bessemer or converter steel, 7,950,000; crucible and electric, 150,000; total 22,500,000 tons. This compares with 26,094,919 tons in 1910, showing a decrease of 3,594,919 tons.

In the same way there are no absolute data for finished iron and steel; but upon the known basis it may be estimated that the finished output included about 1,500,000 tons of rolled and forged iron, 900,000 tons of steel castings and 16,900,000 tons of rolled and forged steel; a total of 19,300,000 tons of finished material. Structural steel held its own during the year and the quantity was pretty well up to that of 1910. In sheets and tinplates there was probably a small increase; but in other rolled products a decline in production.

Exports and Imports

The exports and imports of iron and steel and their products in the United States for the 11 months ended Nov. 30 are valued by the Bureau of Statistics of the Department of Commerce and Industry as in Table V.

V. IMPORTS AND EXPORTS

	1910	1911	Changes
Exports......	$182,971,193	$227,469,893	I. $44 498,700
Imports......	36,267,671	26,690,333	D. 9,577,338
Excess,exp.	$146,703,522	$200,779,560	1. $54,076,038

The exports include a large quantity of material for the Panama Canal. A noteworthy change was found in the imports and exports of tinplate, owing to changes in the trade and the transfer of large contracts for foreign tinplate which were formerly let by exporters of oil and of canned provisions to Welsh makers. For the 11 months in 1910 the imports of tinplate were 147,307,845 lb. and the exports 25,540,361 lb.; in 1911, the imports fell to 30,663,470 lb., and the exports rose to 122,594,674 lb.; almost a reversal of the figures.

Railroad buying was light until nearly the close of the year, when large orders for steel cars were placed. Renewals of track were generally kept down as much as possible. Building of new roads was not especially active. The *Railway Age-Gazette* reports the construction of new road in 1911 at 3067 miles, against 4122 in 1910. The same authority puts the number of new locomotives ordered at 2850, or 937 less than in 1910; of passenger cars at 2623, or 1258 less; of freight cars at 133,117, or 8087 less. Practically all the cars built in 1911 were of steel, or had steel frames.

United States Steel Corporation

The net earnings of the Steel Corporation for the nine months ended Sept. 30 were $81,150,448, being less than in 1910 and 1909, but greater than in 1908. No changes were made in dividends. The latest statement of the corporation showed that unfilled orders on the books on Nov. 30 amounted to 4,141,955 tons, being 1,031,036 tons more than in January. This increase is nearly equal to a month's production. The corporation early in the year was operating its mills to about 60 per cent. of their capacity. This rose gradually to 75 per cent. in November and December, with preparations made to work up to 85 per cent. after the New Years' stop for repairs and inventory. The corporation paid its regular dividends through the year, of 7 per cent. on preferred and 5 per cent. on common stock.

Iron and Steel Markets in 1911

By Frederick Hobart

The general course of the iron and steel markets showed in 1911 a business hampered in the first part of the year by the feeling of overproduction and large stocks carried over from 1911, and, by the persistent effort to maintain controlled prices at a certain level. This was followed by a gradual recovery from depression as the consumptive power of the country began to be felt; then by a general acceptance of the breaking of control and the establishment of an open market; and finally by a rapid extension of business as the full force of lower prices began to be felt.

The striking incidents of the year were the first break in prices in May, when the Republic Iron & Steel Co. announced its intention of cutting prices and pursuing an aggressive policy for business. This was followed by a general cut in quotations, which was not, however, sufficient to induce a full recovery. The next was the later abandonment of the long struggle to maintain prices and the virtual acceptance of the open market and free competition.

An unfavorable effect upon the markets was exerted by the investigation of the Steel Corporation by a Congressional committee. In September this was emphasized by the heavy fall in steel stocks in Wall Street and the rumors that the Administration would forestall Congress by bringing suit to dissolve the Corporation. The effect was largely sentimental, however, and did not much disturb the volume of trade. By the time the suit was actually filed, in October, the effect had been largely discounted, and the announcement did not greatly disturb the market. This was shown by the active buying of November, and the announcement that January will open with a large increase of active capacity at the mills.

The study of the market shows that great corporations may control production, but that they cannot yet entirely control the buyer. Conversely, that the time-honored rule of "boosting the market by getting under it" has not yet lost all of its truth and efficiency.

The letters which follow, give the history of the year at Pittsburg, the great primary market; at Birmingham, the primary market of the South; at Chicago, the great distributing center of the Northwest, and in the seaboard iron markets.

Pittsburgh Iron and Steel Markets

By B. E. V. Luty*

The steady decline in prices of all iron and steel commodities which characterized 1910 was arrested at the close of the year, apparently chiefly through the medium of a "Gary dinner" with a number of meetings in individual branches of the trade. The year 1911 opened with considerable promise, and as production had been greatly reduced a mild improvement occurred, sufficient to increase the pig-iron-producing rate of the country from about 21,000,000 tons per year at the beginning of January to nearly 26,000,000 tons in March. Chiefly for the sentimental effect which it was believed such action would have, wire products were advanced on Jan. 23, by $1 a ton, to a basis of $1.75 for nails. As there were but three advances in finished steel products during the first 10 months of the year the other two may be mentioned here: An advance of 10c. per box on tinplates to $3.70, base, effected at an informal meeting in Pittsburgh Feb. 3, and a second advance of $1 a ton, March 6, in wire products.

During the first two months of 1911 sentiment was fairly optimistic and buying was on a liberal scale, for early delivery. The iron trade was pleased with the improvement in general buying and looked forward to heavier buying by the railroads as soon as the "advanced rate cases" were decided. From what source it came no one seems to know, but word was passed around that the railroads would be permitted to make about half the total advances they had scheduled. The decisions were handed down Feb. 22 and disallowed all the advances. Then a chill seized the trade. The railroads were disgruntled, but before many months it was quietly admitted that the decision was a blessing in disguise forcing the railroads to find remedies in better ways for the conditions of which they complained.

On May 24, occurred a meeting of steel-bar manufacturers in New York and on the same day chairman Topping, of the Republic Iron & Steel Co., made public announcement that his company was not satisfied with market conditions, having lost business through the cutting of some of the smaller mills. Accordingly the company would adopt "a more aggressive sales policy" and a price of 1.25c. on steel bars was announced, $3 per ton under the nominal price at the time. This constituted a formal withdrawal of the company from the price-maintenance movement. On May 29, a general meeting of the steel manufacturers occurred, Republic not being represented. After the meeting it was announced that billets and sheet bars were reduced $2 per ton, sheets $4 per ton and plates and shapes $1 per ton, the cut in steel bars being ratified. The main purpose of the meeting was not known, whether to decide upon the extent of formal cuts which should be made, reaffirm allegiance to the agreement despite Republic's defection, or to arrange matters for a quiet and orderly abandonment of the whole coöperative movement. Prices were held for a time, but June 20 a reduction of $2 per ton occurred in wire products, restoring prices which prevailed at the opening of the year and at about the same time it developed that prices in other lines were being occasionally shaded. In July the Steel Corporation sought business very actively, at cut prices, but conducted its campaign so skillfully, making but slight cuts and then very quietly, that the independents did not, apparently, at first realize the extent to which the market had been opened. By the beginning of August it was universally recognized that there was an open market on finished steel products and that all semblance of coöperation or agreement had disappeared. Perhaps the trade was slow in recognizing the fact. The investigations of the

---

* 415 Oliver Building, Pittsburgh, Penn.

Stanley committee of the House, commenced June 1, unquestionably made the previous position untenable.

Barring the reductions specifically mentioned, steel prices did not openly decline until late in July, but from that time until the close of November there was a continued succession of declines embracing all finished steel products except rails. The declines in May and June represented an average of between $1.50 and $2 per ton in the average of finished steel products, outside of rails, while the declines from July 1 to Dec. 1 represented further declines averaging $4 to $5 per ton. This brought the average level of finished steel products outside of rails, to a point between $12 and $13 per net ton below the level prevailing at the close of 1907, which was the highest since 1902, and only about $1 per ton above the average at the lowest point in the history of the steel business, in 1897-8. Some products, particularly sheets and steel pipe, were materially lower than ever before. This price level was practically profitless. It is about $4 per ton lower than the average during the third quarter of the year, for which quarter the United States Steel Corporation reported earnings of $29,522,725, and those earnings were considerably larger than would have been expected from a comparison of earnings reported in 1906 and 1907, with allowance for the decline in prices and the change in tonnage output.

During the first half of the year the iron and steel market was subject to adverse political influences and the defection of the Republic Iron & Steel Co. with its attendant price declines. During the next four months it was subject to the disheartening influence of a constant decline in prices, prompting jobbers and consumers to withhold orders until the last moment and then buy in the smallest possible quantities. The fact that after a considerable decline production actually did increase, from a minimum rate of 21,400,000 tons of pig iron a year in July to 25,000,000 tons in October, did not create any confidence. The suit against the United States Steel Corporation sent a fresh chill over the market, and then the unexpected happened.

In about three weeks immediately following the bringing of the suit railroads placed orders for fully 40,000 cars, against only 20,000 in the preceding four months, and no more than 50,000 in the whole first half of the year. Prices continued to decline during November, but bookings were larger and at the close of the month prices began to advance. This encouraged still heavier buying in December. In both months the actual tonnages entered on mill books for rolling exceeded the shipments materially, while a very large tonnage was placed under contract for first-quarter and first-half delivery. Doubtless much of the business specified was placed with the clear knowledge on the part of buyers that delivery could not be made until after Jan. 1. While no definite increase occurred in production, plans for holiday closings were largely abandoned, and orders were issued for the starting of considerable idle capacity immediately after Jan. 1. The recovery in prices ran from $1 to $3 per ton in the products affected, and represented a general advance in the level of finished steel products, outside of rails, of between $1 and $1.50 per ton.

AVERAGE PRICES AT PITTSBURGH 1911

	Pig Iron.				Steel.					Nails.	
	Bessemer. $	Basic. $	No. 2 Foundry. $	Ferromanganese. $	Bessemer-Billets. $	Beams c.	Plates c.	Bars. c.	Black Sheets No. 28. c.	Wire per keg. $	Cut per keg $
Jan.	15.90	14.19	14.65	40.20	23.00	1.40	1.40	1.40	2.20	1.71	1.60
Feb.	15.90	14.50	14.75	39.70	23.00	1.40	1.40	1.40	2.20	1.75	1.60
Mar.	15.90	14.65	14.90	39.25	23.00	1.40	1.40	1.40	2.20	1.79	1.63
Apr.	15.90	14.65	14.90	38.70	23.00	1.40	1.40	1.40	2.20	1.80	1.70
May	15.90	14.30	14.66	38.45	22.92	1.40	1.40	1.37	2.20	1.80	1.60
June	15.90	13.96	14.49	38.45	21.00	1.35	1.35	1.25	2.00	1.76	1.60
July	15.90	13.96	14.40	38.80	21.00	1.35	1.34	1.24	2.00	1.70	1.60
August	15.90	13.90	14.40	38.95	21.00	1.35	1.30	1.20	1.91	1.69	1.60
Sept.	15.90	13.57	14.40	38.45	20.60	1.33	1.28	1.18	1.90	1.65	1.58
Oct.	15.44	13.41	14.31	38.95	20.00	1.23	1.19	1.13	1.85	1.61	1.55
Nov.	14.92	13.18	14.15	39.00	19.50	1.14	1.11	1.07	1.84	1.56	1.51
Dec.	15.15	13.10	13.90	41.50	19.00	1.13	1.13	1.12	1.85	1.54	1.50
Year ...	15.72	13.94	14.49	39.20	21.42	1.32	1.31	1.26	2.03	1.70	1.59
Yr., 1910	17.10	15.65	15.83	42.48	25.20	1.46	1.45	1.43	2.29	1.75	1.72

per pound ; of nails, per keg of 100 lb.

The Chicago Iron Market

By E. Morrison

Considered as a whole, the year 1911 was disappointing to Chicago dealers in pig iron and finished products.

In January pig iron sold lightly. The line between 1910 and 1911 was not marked by any change in buying conditions; melters bought in general for about three months ahead, preferring to contract for small lots—a carload to 500 tons—often and to make frequent inquiries for larger tonnage that showed their close watching for a return in the market.

Northern No. 2 pig iron sold for $15.50@16; Southern No. 2 for $11@11.50, Birmingham, or $14.35@14.85, Chicago. Lake Superior charcoal iron brought $18@18.50. Railroad supplies were in light demand and structural-material sales were confined to a few bridges. Plates, sheets and bars were in light demand. Buyers and sellers were in a waiting mood.

February saw the relation between production and consumption so improved as to cause the blowing in of four local furnaces and a demand of about 50c. more for Southern iron for last-half than for early delivery. The founders, however, increased their buying only slightly. Rails and track supplies became in better demand and the spring contracts for structural material showed improvement. Plate specifications increased in volume of material. Sheets had a better sale. Bars improved to the extent of becoming in fairly good demand for agricultural-machine needs. In the middle of the month the International Harvester Co. bought 100,000 tons on deliveries extending into the third quarter, of Northern and Southern pig iron, the price being said to be slightly below $10, Birmingham.

In March, pig iron became stronger, Northern in particular strengthening after a sale of 10,000 tons to a Milwaukee foundry. Prices, however, did not advance on coke foundry irons, and Lake Superior charcoal dropped off to $17.50@18. Both buyers and sellers were still in a waiting mood. Sales of railroad material and structural materials became better; plates, sheets and bars also showed improvement, but production continued large for the demand.

April saw pig iron in very light demand and unchanged conditions continuing in the finished-materials market. Plate, sheet and bar mills were running at about half capacity.

May showed no revival in the demand for pig iron; the sales were chiefly in carload lots. Founders bought very often but could not be induced to increase their contract time. Structural material became very quiet; the railroads bought reluctantly; plates, bars and sheets sagged in price.

June was a dull month in every line and the reduction in price of sheets had no stimulating effect. Everywhere buying was for immediate use. In July, sales of pig iron increased slightly, particularly of Southern, but the minimum price remained $10, Birmingham. Lake Superior charcoal dropped to $16.50@17. In finished lines only structural material had any fair demand.

August continued dull, with an effort by the Southern interests to obtain $10.50, Birmingham, but consumers refused to pay more than $10, at which price they obtained plenty of tonnage. Structural material sold well; other finished materials were in light demand and prices were slightly cut. In September the demand for pig iron dropped back to carload lots, with $10, Birmingham, on prompt shipments and $10.50 on more extended deliveries the rule. Prices of steel bars were cut very severely and remained low for the rest of the year.

Soft steel bars ranged from 1.58c. in January to 1.25c. in October, the price strengthening toward the end of the year. Plates sold at 1.58@1.63c. at the beginning of the year and sank to 1.33c. at the end. Sheets declined from 2.38c. in January to 2.03c. in December, for No. 28 black.

PRICES OF IRON AND STEEL IN CHICAGO

	1910		1911	
	Highest	Lowest	Highest	Lowest
Lake Superior charcoal.....	$20.00	$18.00	$18.50	$16.50
Northern No. 2 foundry.....	19.50	16.00	16.00	14.00
Southern No. 2 foundry.....	18.85	15.10	15.85	14.35
Bar iron.......	1.65c	1.35c	1.35c	1.15c
*Structural material........	1.88c	1.58c	1.63c	1.30c

*Beams and channels, 3 in. to 15 in., and angles, 3 in. to 6x¼ in. or heavier.

October developed a little better condition for pig iron, but the demand was still light and the efforts of Southern interests to advance prices from $10, Birmingham, met with failure. All finished lines were dull. November saw pig iron very weak, with the end of the year bringing a slackening of purchases of finished products and generally low prices for them.

December brought a general improvement. Several large purchases of pig iron were made, Southern bringing $10@10.50 and Northern $11@14.50 on first-quarter deliveries, while Lake Superior charcoal iron held to $16.50@17. The railroads began to buy more freely and good sales were made of plates and bars.

Alabama Iron Market

The year 1911 in pig iron and steel in Alabama was far from being satisfactory. The make was good, but the price record rather disastrous. The year opened with the market rather weak for pig iron, the average price around $11 per ton, No. 2 foundry. The sales were not active by any means and the make not pushed. There started early in the year an accumulation of iron; in other words the make was greater than the demand. Until the eleventh month of the year, the sales were a little under or near production from month to month. Then, after the quotations had dropped at least $1 per ton, some interests made concessions on the price and started a liberal buying movement. A little strength was found in the market during the first part of December and a recovery was secured up to $10.25@10.50 which was under that price that prevailed when the year opened.

The steel market was quite active during the better part of the year. However, toward the end of the year the market slacked off and there was a cry for orders.

The year witnessed a good and steady demand for fabricated steel; a single rolling mill in the Birmingham district continued in operation through the twelve months. The bulk of this product was used by Southern manufacturers.

Cast-iron pipe makers melted the larger part of the iron that was consumed in the home territory. There was a little setback during the year in the pipe trade, the Dimmick Pipe Co.'s plans shutting down and the property changing hands. For several months there was no work done at all at this plant, this having an effect on the year's melt in the home territory. The Dimmick plant was finally taken over by the United States Cast Iron Pipe & Foundry Co., extensive repairs made and it is promised that there will be a resumption on a large scale early in 1912. There was a steady demand for cast-iron pipe in 1911, and shipments were made long distances. Great quantities of pipe from the Birmingham district went to California points while the Middle West also looked to this section of the country for much cast-iron pipe.

Toward the end of the year stove makers in the Southern territory and in Alabama in particular took on some activity and bought some pig iron. Foundries and machine shops did not do a big business through the year, the consumption of iron on their part being under the previous year.

Charcoal-iron manufacturers in Alabama, with three and four small furnaces in operation from time to time, had a fairly good year in 1911. Despite the low prices prevailing in foundry iron, there was a good price maintained for charcoal pig, $22@22.50 per ton being asked right along. There was not much accumulation of stocks.

The pig-iron production during 1911 in Alabama fell short of the make in 1910. Estimating the production in December at 150,000 tons, the make in Alabama in 1911 is to be placed at 1,763,100 tons. The figures for 1910 show a production of 1,939,147 tons. There was a decrease in the production every month in 1911 as compared to the same month in 1910, with the exception of September. The total figures for 1911 may show a small increase in the revising that will take place by the middle or latter part of January, but in round numbers there will hardly be a change.

The year closes in an encouraging way with large sales. In the latter part of the year the Tennessee Coal, Iron & Railroad Co. was prominent as a seller of foundry iron, though most of its active furnaces ran on basic pig for the Ensley steel works.

The Seaboard Iron Market

SPECIAL CORRESPONDENCE

Philadelphia and New York are the central points of the seaboard market; Philadelphia being a primary market for a considerable district in Eastern Pennsylvania, while New York is a central point for a large contracting business. The eastern markets are large buyers of foundry iron, and also take a considerable quantity of basic pig, but comparatively little bessemer iron. They are also buyers of steel billets and of finished iron and steel, being especially the chief markets for structural material.

In pig iron the seaboard markets opened the year rather quietly. Buying, as in the latter part of 1910, was generally limited to immediate needs, few foundries caring to purchase far ahead. Stocks in foundry and mill yards were generally small and were kept so during the greater part of the year; users of iron, as a rule, left the burden of carrying stocks to the blast furnaces. This plan necessitated frequent purchases and at times gave the market an appearance of greater activity than total bulk of the transactions actually warranted. An effort was made to keep up prices of foundry iron, with some success during the first quarter; but by

---

*Birmingham, Ala.

April the weight of unsold stocks in furnace yards and the pressure of Southern iron began to be felt, and general concessions were made, which could not afterwards be recovered. By June the general level of foundry iron was 50 to 75c. a ton lower than the moderate prices which were asked in January. Forge iron dragged throughout the first part of the year, and in fact it was a buyers' market in this grade from January to November. It was impossible to ask advances, under the prevailing conditions of large stocks and idle capacity. In July some good buying by pipe foundries gave a little boost to the market, but it did not last long enough to have any great effect. Buyers continued to take mainly small lots for early delivery, and were inclined to haggle over small reductions in prices.

With all these adverse conditions the business done reached a pretty good total, and the unsold stocks at the opening of the year were gradually reduced. Nevertheless business had to be characterized as rather uncertain and no important change came until November, when many people began to think that the bottom had been reached, and that an upward turn might be expected. This feeling brought about increased buying and the placing of contracts for the first quarter of 1912. Some sales were made covering the first half, but users of iron for the most part were slow to give up the plan of short buying. Moreover, a special drive was made to sell Southern iron, and this was a weight upon the market. For some months $10 Birmingham had been the accepted rate for No. 2 foundry, but at this time some considerable orders were placed at $9.75 and even $9.50 for early delivery. The sales then made relieved the immediate necessities of sellers, and a restoration to $10, with $10.25 for 1912 business, soon followed. The year closed with prices generally a shade firmer on all classes of pig iron.

Cast-iron pipe makers were generally busy during the year, and had a good trade, though many contracts were taken at low figures. The low prices stimulated city and public utility work, and sales of pipe were large and steady.

In finished material structural steel was easily the leader in the eastern markets through the greater part of the year, and it was not until October or November that other lines caught up fully. The reduction in prices which followed the break made by the Republic Iron & Steel Co. in May brought some additional business but it was not until the controlled prices were definitely abandoned and the open market became general that sales began to increase. As has been the case several times, the large fabricating companies began to take contracts at a rate which involved cheaper steel some time before the general break in prices actually came, and this kept structural steel in the lead. On the fall movement, however, the buying of other materials gained rapidly and then there was a general disposition to take advantage of the lower prices. Small building was stimulated and the purchases of material for this class of work reached a large total. The small buyer is on the lookout for low prices, and has more than once helped out the market in a notable way, since the aggregate of his purchases may be large.

Perhaps the most important of these was for the bridge over the East River and approaches for the New York Connecting R.R., which involves some 65,000 tons of steel. The new subways in New York, terminal and transit improvements in Philadelphia and proposed improvements in Baltimore will require large quantities of steel.

The accompanying table gives average monthly prices of pig iron and finished material at seaboard points in 1911; also prices of some leading classes of old material.

Iron Ore in Lake Superior District

By Dwight E. Woodbridge*

Insofar as the comparative figures of Lake Superior iron-ore shipments show, the year 1911 has been a disappointing one, as its total has been surpassed by every season since 1904, with the exception of 1908. Total shipments for the last year will aggregate about 32,900,000 tons, when the figures for all-rail forwardings shall have been announced. This compares with recent preceding years as below:

1902.....	27,585,904	1907.....	42,266,268
1903.....	24,308,510	1908.....	26,014,987
1904.....	21,849,401	1909.....	42,586,869
1905.....	34,384,116	1910.....	43,442,397
1906.....	38,565,762	1911.....	32,900,000

Excessive production for preceding years, as well as the condition of the iron trade at the beginning of the last season, were responsible for this tremendous shrinkage; and while there has been a decrease of about 500,000 tons in stocks of ore on hand at lower lake docks and at furnaces during the year, there is no expectation that the figures for 1912 will be much higher than those of 1911. The various mining companies of the Lake region evidently take this view, for their preparations for the operations of next season are slight, and the winter is dull and quiet along the Lake. Many concerns are having difficulty in holding their organizations, much as they may wish to do so. The cessation of operation at mines, the lessened need of development work, both in underground and open-pit properties, and the lack of money with which to do much, have compelled the scaling down of both administrative and operative forces.

THE GREAT NORTHERN LEASES

Only in one direction has there been noteworthy activity, i.e., in the matter of taking ore from the lands under lease to the United States Steel Corporation by the Great Northern company. The contingencies of that lease were such as to demand as large shipments as possible, that minima already paid for but not mined should be forwarded, in order that interest charges on these advances might be saved. That this was no small item is evident from the fact that, at the commencement of 1911, there had been paid the Great Northern in advances on ore not yet mined, considerably more than $5,000,000, while the deficiency in tonnage moved was, of course, even greater. By concentrating its efforts on Great Northern lands the Steel Corporation has taken therefrom during the year nearly 5,500,000 tons. This is a most remarkable record; for not only must there be developed properties on Great Northern lands to permit such shipments, but there were difficulties of a physical nature—those due to contracts with other fee owners than the Great Northern, other minima aggregating enormous totals, all of which were to be met, and the requirements of furnaces, which demanded certain classes of ore, some of which could not be secured from Great Northern mines. Total shipments of ore for the year by the mines operated by the Steel Corporation have amounted to 13,943,000 tons, of which almost 40 per cent. was under the Great Northern lease. This total, be it remembered, is not alone from the Mesabi range, where the Great Northern lands are situated, but from all the ranges on Lake Superior on which the Steel Corporation has mines.

---

*Mining engineer, Duluth, Minn.

PORT SHIPMENTS

Shipments from the various Lake ports and by railroads, as given below, show the changes that have been forced by this necessity on the part of the Steel Corporation:

	1910	1911
Superior, Wis.	8,437,261	9,935,000
Duluth, Minn.	13,609,155	6,934,269
Two Harbors, Minn.	8,826,545	6,417,523
Escanaba, Mich.	4,959,869	4,278,445
Ashland, Wis.	3,248,930	2,429,290
Marquette, Mich.	3,248,930	2,200,380
Michipicoten, Ont.	115,700	130,000
Key Harbor, Ont.	....	6,645
All rail (1911 est.)	822,000	550,000
Total	43,568,532	32,881,552

While the Baraboo and Mayville districts have not been included in the Lake Superior region, their ores come in direct competition with it. For the year Baraboo has shipped but a few hundred tons, and Mayville the usual small amount, all rail to furnaces.

The abrogation of the Great Northern lease, assured now for the close of 1914, means that the Corporation will mine from those lands as much as possible of the minimum of 27,000,000 tons that will then have accrued. To mine it all will require the shipment of a little more than 6,000,000 tons for each of the three years, or but a trifle more than was produced therefrom during 1911. Doubtless all will be mined, and the corporation will retire from the Great Northern lands with a clean balance sheet. There is speculation in financial circles as to what effect the abrogation of this lease will have upon the Great Northern holdings. No doubt the exploration of these lands and the opening and development of mines, will enhance their value, though it will eliminate the element of speculative statement as to the tonnages existing thereon, an element that has been much in evidence the last few years. The purpose of withdrawing from this lease seems to have been to diminish the force of the allegation of monopolistic character of the Steel Corporation's ore holdings. In point of fact, and with the broad and general view of the situation that is the proper one, the ownership or loss of these lands is a matter of little importance, when viewed in connection with the reserves of available iron ore in the United States.

PROGRESS IN MINING METHODS

Progress of the year in the matter of engineering science, improvements in equipment, power, etc., has been marked. Of the items of advance in this line these stand preëminent: Electric utilization of water powers; the sinking of permanent concrete shafts, of which a dozen or more have gone down; the inauguration of scientific management and the inauguration of many plans for practical conservation of ore deposits by the dressing of lean ores and low-grade ferruginous materials.

While a first glance at the operations of the year lead one to the opinion that abrogation of the Great Northern lease by the Steel Corporation and the reduction of ore freights from the Minnesota districts were all-important events, this is far from the truth. To the steps taken for the beneficiation of low-grade ores one should assign first place.

Space is lacking in this review to elucidate the remarkable change that has come over the iron trade in the matter of dressing and otherwise enriching Lake Superior ores.

EXPLORATION WORK

The exigencies of space forbid anything more than a passing glance at other features of an unusually interesting year. Explorations for additions to ore supplies have been more active than might have been expected, considering the practical impossibility of selling ore. But little new ore has been added to Mesabi totals, and this little was foreshadowed by work done in 1910. The tonnages near the northwest corner of T 58 R 15 have been more accurately defined, and it is now well known that a large deposit exists there, the mining of which will present some new and difficult problems in the diverting and handling of water in quantity. The runoff from a watershed of several hundreds of square miles must be diverted before this ore can be taken out. Certain arrangements of a private nature between the Oliver Iron Mining Co. and the estate of Henry Stephens resulted, toward the end of the year, in great activity in T 59 R 15, and some addition to known ore reserves may result. Throughout the year there has been active exploration by this company on its lands along the range, lands previously explored but the results on which were, for one reason or another, considered questionable.

Exploration on the Vermillion, very active a year ago, has diminished; the pace was too hot for most of those concerned. Four or five companies are working, and the prospects are excellent for an addition to known reserves in that most alluring and difficult field. On the Michigan ranges there has been little addition to former reserves, excepting around Iron River, where a great amount of work is underway, and where the tonnages known have been materially enlarged and the number of mines increased.

On the new Cuyuna range results have been encouraging. More is known of the formation, and exploration can be done more scientifically and accurately than earlier. Estimates of tonnage differ so widely that no attempt will be made to give figures, but it is unquestionable that the tonnage of merchantable ores actually measurable is still comparatively trifling. This is in part for the reason that it is extremely difficult to connect and correlate drill holes in a district whose orebodies dip deeply, may be narrow and short, and where no rule has yet been adduced for their appearance. An enormous amount of drilling has been done; single interests have spent, and unsuccessfully, too, as much as $150,000, and the formations are such that holes must be frequent to prove anything definite. The district has entered upon its career as a shipper, with the forwarding of 149,000 tons by the Kennedy mine of the Rogers-Brown Ore Co. Several concrete shafts have gone down, good plants have been installed and half a dozen mines will be shipping in 1912. Most of these are bunched in the north center and northeast part of T 46 R 29, though Kennedy mine is in T 47 R 28, Adams mine in T 46 R 28 and Barrows in T 44 R 31. It is 25 miles from Kennedy to Barrows, these being the most widely separated developments of importance. But while the known tonnage of good ores is slight, there are large possibilities in the Cuyuna. Much of the ore drilled the last year is manganiferous, carrying, in rare instances, as much as 30 and 40 per cent. manganic oxide. Whether these ores exist in quantity is not yet known. Many drills are at work throughout the district, and a year from now more will be known of its deposits.

Indications are now for the shipment during 1912 from this district of not far from 400,000 tons, which is expected to come from the Kennedy and Armour mines of the Rogers-Brown interests and from the Thompson of the Inland Steel Company.

FREIGHT RATE AND ORE PRICES

Late in the year a reduction of ore freight rates from Minnesota districts to Lake Superior was made by all the railways operating there. This reduced Mesabi range costs, effective in 1912, by 20c. and Ely rates 40c. per ton. The Cuyuna, which had a differential in its favor of 15c., is now 5c. above Mesabi rates, and the combined freight charge for a ton of Menominee range ore, delivered Lake Erie, which was formerly 55c. under Mesabi and 40c. under Cuyuna, is now but 35c. under Mesabi, though still 40c. under Cuyuna. Unless the rate from Cuyuna is modified this will affect shipments and values there unfavorably. Indeed, it is easy enough to see that the Iron River region of the Menominee has advantages that will be difficult to overcome. The Cuyuna rate will be lowered to 60c. soon.

Iron-ore prices were reduced a year ago by 50c. per ton, practically 1c. per unit, and now range from $4.50 for Old Range bessemers down to $3.50 for a Mesabi range nonbessemer. Notwithstanding the decline in pig-iron values since these rates were put in force there is a feeling that they are low enough, and any effort to reduce them further will be met with resistance.

Chronology of Mining for 1911

The following is a summary of the important events recorded by the JOURNAL in 1911. In some cases the dates represent the time of publicity rather than of occurrence:

JANUARY

Jan. 3—Explosion in No. 3 colliery of Nova Scotia Steel & Coal Co., at Sydney, N. S., imprisoned six men.—Fire at Rawhide mine of British Columbia Copper Company.

Jan. 4—Strike of 12,000 coal miners in Belgium.

Jan. 5—Stockholders of American Smelting & Refining Co. voted to increase capital stock by $15,000,000, to provide for the conversion of bonds of the American Smelting Securities Company.

Jan. 10—Standard Oil 10,000-bbl. gusher in Kern oil field, California, took fire.

Jan. 14—Underground fire broke out in the workings between the Modoc and Butte & Ballaklava mines, at Butte, Mont., two men being smothered.

Jan. 15—Boston & Montana smeltery at Great Falls, Mont., shut down temporarily on account of ore freezing in bins.

Jan. 16—Announcement of phosphate discoveries near Butte, Mont.

Jan. 17—Powder explosion in Keating mine, Broadwater County, Mont., killed six, injured two and wrecked shaft.

Jan. 20—Forty miners killed in fire in Casimir colliery, Sosnowice, Russian Poland.—Five killed, seven injured by explosion in Gayton mines, about 15 miles west of Richmond, Va.—Executive Council of American Federation of Labor granted charter to Western Federation of Miners on same basis as United Mine Workers of America.

Jan. 25—Explosion at the Hughestown No. 10 colliery of Pennsylvania Coal Co., at Pittston, Penn., killed six men and seriously injured five more.

Jan. 30—Arrival at Toronto of first bullion shipment from Porcupine.

FEBRUARY

Feb. 5—Entrance of Bewick, Moreing & Co. into the Porcupine district, Ont.

Feb. 6—Three men killed at the mine of the Independent Coal & Coke Co., at Kenilworth, Utah, by striking Greek miners.

Feb. 9—Explosion at Cokedale mine of American Smelting & Refining Co., near Trinidad. Colo., killed nine men. Organization of international antimony convention at Paris, embracing producers of all countries of the world, the purpose being to regulate production and prices, the agreement to continue for three years.

Feb. 14—The mill of the Veta Colorado company, at Parral, commenced crushing.

Feb. 18—The 40-stamp mill of the Tajo de Dolores mine of the Proprietary Mines Co. began crushing.

Feb. 23—Fire in the Belmont mine, Tonopah, Nev., resulted in the death of 17 men.

Feb. 26—Fire discovered in the Hazel mine of the Pittsburgh-Buffalo Coal Co., near Canonsburg, Penn.

MARCH

March 6—U. S. Circuit Court at San Francisco denied application for permanent injunction against the Montana smelteries on account of alleged smoke damages.

March 9—Calumet & Hecla merger approved by the companies that were to go into the consolidation.—Lehigh Coal & Navigation Co. announced plan to build large power plants for transmission of power to be generated at its anthracite mines.

March 11—Slide of bank at Norman mine of Oliver Iron Mining Co. at Virginia, Minn., killed 14 workmen.

March 13—Announcement that Amalgamated Copper Company planned to absorb United Metals Selling Co. by purchase at $12,300,000.

March 15—Miami mill went into operation with one section.

March 18—Explosion in mine No. 16 of M. K. & T. Ry. Co. at West Mineral, Kan., killed one man, and five men attempting to rescue him were killed. —David H. Moffat, of Denver, died in New York.

March 20—Ray Consolidated mill started first unit.

March 22—Nine men killed by fall of roof in Hazel mine, of Pittsburgh-Buffalo Coal Co., at East Canonsburg, Penn.

March 23—Ray Consolidated and Chino Copper Co. stocks listed on New York Stock Exchange.

March 28—S. F. Emmons died at Washington.

March 30 Completion of Copper River & Northwestern R.R. to Kennicott, Alaska.

March 31—Dr. Rossiter W. Raymond resigned secretaryship of the American Institute of Mining Engineers.

APRIL

April 1—Strike of coal miners in Alberta and British Columbia.

April 3—U. S. Supreme Court upheld commodity clause of the interstate commerce law which prevents a railroad from owning stock in a coal corporation along its lines.

April 6 First shipment of copper ore from Kennicott, Alaska, via Copper River & Northwestern Railway.

April 7—Seventy-three men killed in explosion in Pancoast coal mine at Throop, Penn.

April 8—Explosion at Banner Coal mine, Birmingham district, Ala.; 128 men killed.

April 11—U. S. Steel Corporation inaugurated its coke-oven plant at Gary, Indiana.

April 19—Strike of zinc smelters at Bartlesville, Okla.—Renewal of the Chilean Nitrate Association.

April 21—Cut of 50c. per ton in Lake iron-ore price.

April 24—Explosion in Ott mine, No. 20, of Davis Coal & Coke Company, near Elk Garden, W. Va., killed 10 men.

April 27—Settlement of zinc smelters' strike.

MAY

May 5—Seven men killed by fire in the Hartford mine of Republic Iron & Steel Co. at Negaunee, Mich.

May 8—Leaching plant of the Warrior Copper Co. in Gila County, Ariz., destroyed by fire.

May 11—Fire in the Boston colliery of the Delaware & Hudson company at Larksville, Penn., suffocated five men.

May 12—The mine tipple and buildings of the Pierson colliery near Jasonville, Ind., were destroyed by fire.

May 15—Supreme Court ordered dissolution of the Standard Oil Co. of New Jersey.

May 19—Bush fires at Porcupine destroyed surface plant of Hollinger and other mines in Pearl and Gilies Lake sections.

May 24—Cut in steel prices started by Republic Iron & Steel Company.

JUNE

June 1—Fire burns bunk and boarding house at Nevada Consolidated; loss, $100,000.

June 15—First payment on Hidden Creek mine, British Columbia, made by Granby company.

June 20—Reopening of the St. Louis mine in the Lake Superior copper country started by Calumet & Hecla company.

June 21—Dissolution of the E. I. du Pont de Nemours Powder Co. ordered because of violation of the Sherman anti-trust act.

June 26—Denial of injunction asked by G. M. Hyams against proposed Calumet & Hecla merger.

June 26—Cunningham coal claims cancelled by the General Land Office.

June 28—Dismissal of suit brought by minority stockholders against Greene Consolidated Copper Co., the Greene-Cananea Copper Co. and their officers and directors.

June 29—Eighty-four wire officials and employees indicted for illegal restraint of trade.

July

July 1—Opening of railway into Porcupine.

July 5—International meeting of representatives of the steel industry at Brussels, Belgium.

July 11—Forest fires in Porcupine district resulted in great loss of life and property.—Coniagas smeltery and coke building at Thorold, Ont., destroyed by fire.

July 15—Explosion in mine of Cascade Coal & Coke Co., at Sykesville, Penn., killed 21 men.

July 17—Government filed suit to compel separation of Reading railroad from Reading Coal Company.

July 21—Government filed suit against American Smelting & Refining Co. for $2,500,000 damages, in connection with Colorado coal lands.

July 22—Dismissal of charges against American Smelting & Refining Co., alleging a monopoly in restraint of trade.—Cessation of smelting at Balaklala works, owing to smoke trouble—Shafthouse and timbering No. 11, Calumet & Hecla, destroyed by fire.

July 25—Announcement of sale of Gold Road mine in Arizona to United States Smelting, Refining & Mining Co. for $1,600,000.

July 29—Strike of zinc smelters at Caney and Deering, Kan., and suspension of operations at those smelteries.

July 31—Temporary injunction granted to minority stockholders of Osceola Consolidated Mining Co., in Calumet & Hecla merger.

August

Aug. 1—Explosion in mine of Standard Pocahontas Coal Co. at Shannon, W. Va., killed three men.

Aug. 4—Suit filed by government at Columbus, Ohio, against six railroad companies and three coal-mining companies, charging combination in restraint of trade.

Aug. 10—A four-deck cage dropped in the Krupp-Hannibal mine near Bochum, Germany, killing 25 men.

Aug. 14—Announcement of purchase by the American Smelting & Refining Co. of the Tiro General mines at Los Charcos, San Luis Potosi, Mex., and of the Central Potosi R.R., for $800,000 gold.

Aug. 15—Granby smeltery in Boundary district, British Columbia, closed for lack of fuel due to strike.

Aug. 17—Collapse of strike at Caney and Deering, Kansas.

Aug. 19—Cave-in at the openpit of the Buffalo & Susquehanna mine on Mesabi range, buried 12 men and caused several fatalities.

Aug. 22—Contract executed for sale of Ray Consolidated smeltery to American Smelting & Refining Company.

Aug. 23—Explosion and fire at new shaft of Giroux Consolidated company resulted in seven deaths and damage to shaft.

Aug. 30—Confirmation of sale of Cleveland mine in Idaho to Federal Mining & Smelting Co.—Case of Fred J. Bliss against Anaconda Copper Co., based on smeltery fume troubles, reached United States Supreme Court.

September

Sept. 1—Dissolution of the international antimony syndicate, it having proved a fiasco.

Sept. 2—Hoisting accident at Calumet & Hecla mine destroyed hoist and enginehouse.

Sept. 3—Six men killed in a hoisting accident at Butte & Superior mine.—Fire caused total destruction of Hall smeltery at Nelson, B. C.

Sept. 4—Two miners were killed and several injured in hoisting accident at Red Jacket shaft of Calumet & Hecla mine.—Two men were killed in hoisting accident at Daly West mine.

Sept. 5—Second suit filed against Mason Valley Mines Co., to prevent operation of smeltery.—Butte & Ballaklava Copper Co. resumed ore shipments after a year's suspension due to litigation.

Sept. 16—Three men, imprisoned by a cave-in in Morning Star mine, Colorado, were rescued alive.

Sept. 23—Inauguration of strike at Mt. Lyell copper mines in Tasmania.

Sept. 30—Superior & Boston stockholders voted favorably on plan of consolidation with the Arizona Commercial Copper Company.

October

Oct. 2—Announcement of plan for reorganization of Arizona Commercial Copper Company.

Oct. 6—Calumet & Hecla company announced the abandonment of the merger plans.

Oct. 10—Opening of the 101st meeting of the American Institute of Mining Engineers in San Francisco.

Oct. 18—Explosion in Bardot coal mine, France, killed 26 men.

Oct. 19—Raritan Copper Works instituted suit against the government for recovery of platinum contained in gold delivered to New York Assay Office.

Oct. 20—New Langdon shaft of Wharton Steel Company at Hibernia, N. J., flooded and 12 men drowned.

Oct. 21—First section of Chino mill placed in operation.—Explosion in a mine at Trabonella, Italy, reported to have killed or injured 100 men.

Oct. 22—Fire damaged Kingdon shaft of Old Dominion company at Globe, Arizona.

Oct. 23—Explosion in O'Gara mine No. 9, at Harrisburg, Ill., killed 8 and injured 10 men.

Oct. 24—The 14th annual session of American Mining Congress opened in Chicago.—Fire destroyed Butte Reduction Works at Butte, Mont., entailing $350,000 loss, one-half insured.

Oct. 26—Steel Corporation officially announced intention to cancel Great Northern ore lease and to reduce freight rates 20c. per ton on its Minnesota range roads.—Government filed suit in Trenton, N. J., against Steel Corporation, its subsidiaries and officers, under Sherman anti-trust law.

November

Nov. 3—Waldemar Lindgren was appointed chief geologist of the U. S. Geological Survey.

Nov. 9—Explosion in Adrian mine, of Rochester & Pittsburg Coal & Iron Co., at Punxsutawney, Penn., killed eight men.

Nov. 11—Cripple Creek deep-drainage tunnel encountered a flow of water which resulted in draining the lower levels of several important mines.—Settlement of strike at Mt. Lyell copper mines in Tasmania.

Nov. 15—Freight reductions went into effect between Salt Lake City and Missouri River points.

Nov. 16—District court, at Colorado Springs, Colo., issued temporary injunction restraining the sale of 11 Cripple Creek properties for taxes.

Nov. 17—Canadian coal strike settled by agreement signed at Hosmer, B. C., under which the miners returned to work on Nov. 20.

Nov. 18—Explosion in mine of Bottom Creek Coal & Coke Co., at Vivian, W. Va., killed 18 men.

Nov. 22—Announcement that Consolidated Gold Fields of South Africa had acquired extensive interests in Alaskan dredging lands, through the operations of the Granville Mining Company.

Nov. 23—Bankruptcy proceedings were commenced in the United States Court, in New York, against the Nevada-Utah Mines & Smelters Corporation.

Nov. 24—John D. Ryan purchased control of Live Oak Development Co. at $30 per share, preliminary to merger of porphyry-copper properties in the Miami district, Arizona.

Nov. 25—Governor Johnson appointed William H. Storms as state mineralogist of California.

DECEMBER

Dec. 1—Fifth unit of Miami concentrator started.—Standard mill of United States Reduction & Refining Co., at Colorado City, Colo., closed.

Dec. 4—Mill of Florence-Goldfield Company, at Goldfield, Nev., destroyed by fire, entailing a $400,000 loss.

Dec. 10—Explosion in coal mine of Knoxville Iron Co., at Briceville, Tenn., killed 84 men.

Dec. 19—Announcement of formation of Inspiration Consolidated Copper Co., to include the Live Oak and Inspiration companies.—Litigation in connection with the attempted Calumet & Hecla merger was officially dismissed.—Directors of the Butte Coalition Mining Co., voted to dissolve the corporation and to distribute its assets.

Dec. 20—Arrangements completed to distribute the assets of the Alice Gold & Silver Mining Company.

Dec. 21—Production was resumed by the Granby company in British Columbia.

Dec. 22—Arrangements completed to distribute the assets of the Parrot Silver & Copper Company.

Dec. 23—The Cross Tetley coal mine at Wigan, England, was flooded, 200 miners escaping with difficulty.

Dec. 28—Fire destroyed a portion of Golden City, in the Porcupine district, Ontario.

Dec. 29—Allis-Chalmers company announced its intention to default interest due Jan. 1, 1912, on its bonds.

Dec. 31—The firm of Wernher, Beit & Co., of London and South Africa, was dissolved by mutual consent, the diamond branch being transferred to the firm of L. Breitmeyer & Company.

Mining Company Dividends in 1911

The tables published herewith show the dividends paid in 1911 and to date by a number of the principal mining, metallurgical, holding and industrial companies in the United States, and by mining companies in Canada, Mexico and in Central America. The foreign companies listed are mostly those in which American capital is heavily interested. Drawing this line is, of course, to some extent a matter of opinion, and as at the present done, excludes many of the most noted Mexican mines and mining companies, for instance: Boleo, Mexican, Mexico Mines of El Oro, Soledad, Santa Gertrudis, Santa Maria del Paz, and Teziutlan.

Totals of such a list necessarily cannot be regarded as complete, as there are many profitable close corporations, the dividends of which are not published, and other companies are omitted for various reasons. Moreover, there is unfortunately a certain amount of duplication. For instance, a portion of the dividends of Utah Copper is paid from dividends received from Nevada Consolidated, while Anaconda and Amalgamated Copper dividends are two payments with the same money. However, the figures serve to indicate the importance of the mining industry.

COMPARISON OF 1911 AND 1910 RECORDS

Direct comparison of the table published herewith and that of a year ago cannot be made. To a certain degree the policy of frankness is becoming more prevalent in mining circles, and data are available which were not in past years, consequently a few names appear, new to the table, which are those of old dividend payers. The disappearance of a few old names will also be noted. Some, like Cumberland-Ely, are the victims of absorption; others, such as Atlantic, Central Eureka, C. K & N., Creede United and Findley, seem to have no present place in a dividend table.

MINING COMPANIES—UNITED STATES

NAME OF COMPANY AND SITUATION		SHARES		DIVIDENDS PAID				
				1911		To Date	Latest	
		Issued	Par Value	Per Share	Total	Total	Date	Amt.
Acacia, g	Colo.	1,438,989	$ 1	$0.00½	$7,195	$122,004	Jan. '11	$0.00½
Adams, s.l.c	Colo.	80,000	10		....	778,000	Dec. '09	0.04
Ahmeek, c	Mich.	50,000	25	2.00	100,000	100,000	Nov. '11	2.00
Alaska Goldfields	Alas.	250,000	5		......	342,500	Jan. '10	0.15
Alaska Mexican, g	Alas.	180,000	5	0.70	126,000	2,868,381	Nov. '11	0.20
Alaska Treadwell, g	Alas.	200,000	25	2.00	400,000	12,135,000	Nov. '11	0.50
Alaska United, g	Alas.	180,200	5	0.45	81,009	738,689	Nov. '11	0.30
Am. Zinc, Lead & Sm	Kan.	80,120	25	2.00	160,240	560,420	Oct. '11	0.50
Anaconda, c	Mont.	6,000,000	25	2.00	12,000,000	66,900,000	Oct. '11	0.50
Argonaut, g	Cal.	200,000	5	.....	....	1,200,000	June '10	0.05
Arizona Copper, pf	Ariz.	1,266,120	1.20	*a*	119,221	1,943,780	Nov. '11	0.047
Arizona Copper, com	Ariz.	1,519,896	1.20	*b*	461,668	13,768,469	July '11	0.30
Bagdad-Chase, g., pf	Cal.	84,819	5	....	......	202,394	Jan. '09	0.10
Bald Butte, g.s	Mont.	250,000	1		.....	1,354,648	Oct. '07	0.04
Baltic, c	Mich.	100,000	25	10.00	1,000,000	7,500,000	June '11	5.00
Beck Tunnel, g.s.l	Utah	1,000,000	0.10	....	....	675,000	Oct. '07	0.02
Benton, z.l	Wis.	196,607	1	...	....	10,949	Oct. '08	0.01½
Bingham-New Haven, c	Utah	228,690	5	0.80	197,812	225,612	Dec. '11	0.10
Board of Trade, z	Wis.	120,000	1	0.05	6,000	60,000	Jan. '11	0.05
Bonanza Dev	Colo.	300,000	1	0.20	60,000	1,425,000	Oct. '11	0.20
Boston-Sunshine, g	Utah	150,200	1	0.03¾	5,632	27,261	Nov. '11	0.03¾
Boston & Montana, c	Mont.	150,000	25	4.00	600,000	71,825,000	Feb. '11	4.00
Bull., Beck & Champ., g	Utah	100,000	10	.....	....	2,728,400	July '08	0.10
Bunker Hill Con., g	Cal.	200,000	1	0.52½	105,000	511,000	Oct. '11	0.07½
Bunker Hill & Sull., l.s	Ida.	327,000	10	2.65	866,550	13,159,650	Dec. '11	0.20
Butte & Ballaklava, c	Mont.	250,000	10	..	...	125,000	Aug. '10	0.50
Caledonia, l.s.c	Ida.	1,300,000	1		......	52,000	June '10	0.01
Calumet & Arizona, c	Ariz.	650,000	10	4.00	2,150,000	*c* 13,850,000	Dec. '11	1.00
Calumet & Hecla, c	Mich.	100,000	25	24.00	2,400,000	115,850,000	Dec. '11	6.00
Camp Bird, g.s	Colo.	1,100,000	5	0.48	534,600	7,314,300	Sept. '11	0.24
Centennial-Eur., l.s.g.c	Utah	100,000	5	6.00	600,000	3,300,000	Oct. '11	3.00
Center Creek, l.z	Mo.	100,000	10	0.15	15,000	425,000	Oct. '11	0.05
Champion, c	Mich.	100,000	25	2.00	200,000	6,100,000	Sept. '11	1.00
Cliff, g	Alas.	100,000	1	0.50	50,000	155,000	Aug. '11	0.10
Cliff, s.l	Utah	300,000	1	0.20	60,000	60,000	Dec. '11	0.10
Colo. Gold Dredging	Colo.	160,000	10	0.25	25,000	125,000	Sept. '11	0.25
Colorado, l.s.g	Utah	1,000,000	0.20	0.12	120,000	2,450,000	Dec. '11	0.03
Columbus Con.l.g.s	Utah	285,540	5	....	......	226,832	Oct. '07	0.20
Commercial Gold	Ore.	1,750,000	1	....	...	43,750	Dec. '09	0.00½
Con. Mercur., g	Utah	1,000,000	1	.....	......	3,385,313	Dec. '06	0.02½
Continental, z.l	Mo.	22,000	25	0.50	11,000	242,000	Jan. '11	0.50
Copper Range Con., c	Mich.	384,185	100	3.50	1,347,500	12,104,216	Oct. '11	0.75
Daly-Judge, s.l	Utah	300,000	1	0.15	45,000	270,000	Dec. '11	0.15
Daly West, s.l	Utah	180,000	20	0.90	162,000	6,363,000	Oct. '11	0.30
De Lamar, g.s	Ida.	80,000	5	...	.	845,640	Sept. '08	0.30
Dr. Jack Pot Con., g	Colo.	3,000,000	0.10	0.00½	15,000	90,000	Mar. '11	0.00½
Doe Run, l	Mo.	65,782	100	6.00	394,698	2,941,849	Dec. '11	1.50
Elkton Con., g	Colo.	2,500,000	1	0.06	150,000	2,929,460	Dec. '11	0.01½
El Paso, g	Colo.	2,450,000	1	0.01	24,500	1,438,045	June '11	0.01
Federal M. & Sm., com	Ida.	60,000	100		.	2,708,750	Jan. '09	1.50
Federal M. & Sm., pf	Ida.	120,000	100	7.00	840,000	6,851,250	Dec. '11	1.75
Florence, g	Nev.	1,050,000	1	0.10	105,000	840,000	Apr. '11	0.10
Frances Mohawk, g	Nev.	912,000	1	...	..	546,000	Jan. '08	3.00
Free Coinage, g	Colo.	10,000	100	.		180,000	Dec. '09	1.00
Fremont Con., g	Cal.	200,000	2.50	0.02	40,000	110,000	Oct. '11	0.02
Frontier, z	Wis.	1,239	100	35.00	12,745	117,085	Dec. '11	3.00
Gemini-Keystone	Utah	5,000	100	6.00	130,030	2,130,000	Oct. '11	6.00
Gold Coin of Victor	Colo.	1,000,000	1	....	..	1,350,000	Feb. '09	0.02
Gold Dollar Con., g	Colo.	2,500,000	1	..	.	62,500	Oct. '09	0.00½
Gold King Con., g	Colo.	5,750,370	1	0.03	172,511	1,407,319	Dec. '11	0.03
Gold Roads	Ariz.	300,000	10	....	..	150,000	Nov. '06	0.25
Gold Sovereign	Colo.	1,800,000	1	..		30,000	Nov. '09	0.00½
Golden Cycle, g	Colo.	1,500,000	1	1.00	1,500,000	2,073,300	Oct. '11	1.00
Golden Star, g	Ariz.	100,000	5	.....	..	140,000	Mar. '10	0.05
Goldfield Alamo, s.l	Nev.	709,000	1	..	..	42,000	May '10	0.03
Goldfield Comb. Fra., g	Nev.	922,000	1	.		92,111	Nov. '09	0.10
Goldfield Con., g	Nev.	3,558,367	10	2.00	7,117,696	18,144,772	Oct. '11	0.50
Grand Central, g	Utah	250,000	1	0.05	12,500	1,570,000	Dec. '11	0.05
Granite, g	Colo.	1,650,000	1	....		263,000	Dec. '10	0.01
Hazel, g	Cal.	900,000	1	....		711,000	Dec. '10	0.00½
Hecla, l.s	Ida.	1,000,000	0.25	0.24	240,000	2,350,000	Dec. '11	0.02

Of the American mining companies, Ahmeek, Cliff (Utah), Insurgent, Jumbo Extension, Manhattan-Big Four, Moscow and Pittsburg-Idaho, entered the lists of dividend payers. The rejuvenated Mexican and Ophir on the Comstock lode also paid dividends, showing that there was more than sentiment behind the efforts to rehabilitate these old mines. The Comstock-Phoenix, a close corporation, also situated on the Comstock lode, likewise made returns to its shareholders. Possibly the most spectacular disbursement was the 100% dividend of the Golden Cycle, just before Christmas.

Alaska-Goldfields, Argonaut, Butte & Ballaklava, Caledonia, Golden Star, Goldfield-Alamo, Granite, Haze, Iowa, Kennedy, Liberty Bell, Little Bell, MacNamara, Mary McKinney, National, Pearl Consolidated, Pharmacist, Red Metals, Round Mountain, Tri-Mountain, United (Cripple Creek), Utah (silver-lead), Valley View, Victoria and Yak, all dropped from their position of dividend payers.

Excluding duplications of payment, so far as is possible, the Michigan copper mines in 1911 returned $5,576,000 to their stockholders, an amount fairly comparable with the $6,295,106 dividends paid by Utah Copper, Utah Consolidated, and by Nevada Consolidated (excluding payments to the Utah Copper Co). Unfortunately the Nevada-Utah district totals cannot be estimated as a whole, for the United States Smelting Co. dividends are not announced, and appear, merged with the totals from the refinery operations and the Mammoth smeltery and Real del Monte plant of the U. S. Smelting, Refining & Mining Co.

However, even including the total dividends paid by the last-named corporation, $2,703,000, the Nevada-Utah district makes a small showing before the total of $11,734,000 paid by Arizona companies to their shareholders, or to the $12,000,000 and over of the Butte district.

New Idria is the only quicksilver-mining company paying dividends regularly. The dividend paid by Napa Consolidated was in final liquidation of its assets, and consequently was more of a return of stock subscription than a true dividend.

The banner gold mine, for dividends, was again Goldfield Consolidated, with $7,117,696, the same as paid in 1910; Golden Cycle second, with $1,500,000; Yukon Gold third, with $1,312,000; and Homestake fourth, with $1,310,400. Golden Cycle paid no dividends in 1910, Homestake $1,092,000, and Yukon Gold $1,400,000. Tonopah-Belmont, and the Tonopah Mining Co. also gave fine results, with $1,350,000, and $1,600,000 respectively, both increases over 1910.

Among the foreign mines listed, the Cobalt district still challenges admiration with $5,813,000 in dividends, and earnings even greater. British Columbia

MINING COMPANIES—UNITED STATES—*(Continued)*

Name of Company and Situation		Shares		Dividends Paid				
				1911		To Date	Latest	
		Issued	Par Value	Per Share	Total	Total	Date	Amt.
Hercules, l.s.	Ida.	1,000,000	$1	$0.15	$150,000	$3,650,000	July '11	$0.06
Homestake, g.	S.D.	218,400	100	6.00	1,310,400	27,539,040	Dec. '11	0.50
Horn Silver, c., s.c.z.l.	Utah	400,000	25	.....	....	5,642,000	Sept. '07	0.05
Imperial Copper	Ariz.	500,000	10	.....	....	300,000	June '07	0.20
Insurgent, g.	Wash.	100,000	1	0.12½	12,500	12,500	Apr. '11	0.12½
Iowa-Tiger, g.s.l.	Colo.	12,655	1	.....	....	12,655	.... '09	1.00
Iowa, g.s.l.	Colo.	1,666,667	1	0.01	16,667	200,166	June '11	0.00½
Iron Blossom, s.l.g.	Utah	1,000,000	0.10	0.32	320,000	1,000,000	Dec. '11	0.03
Iron Silver, s.l.g.	Colo.	500,000	20	0.15	150,000	4,450,000	July '11	0.05
Jamison, g.	Cal.	390,000	10	0.02	7,800	378,300	Jan. 11	0.02
Jerry Johnson, g.	Colo.	2,500,000	0.10	0.10	25,000	150,000	Aug. '11	0.10
Jumbo Ext., g.s.	Nev.	971,657	1	0.10	97,166	97,166	July '11	0.10
Kendall, g.	Mont.	500,000	5	0.08	40,000	1,365,000	Oct. '11	0.02
Kennedy, g.	Cal.	100,000	100	.....	....	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	.....	....	396,000	Aug. '09	0.12
Klar-Piquette, z.l.	Wis.	20,000	1	3.62½	72,500	72,500	Oct. '11	0.25
Liberty Bell, g.	Colo.	130,551	5	.....	....	522,093	Oct. '10	1.00
Little Bell, l.s.	Utah	300,000	1	.....	....	60,000	Sept. '10	0.05
Little Florence, g.	Nev.	1,000,000	1	.....	....	430,000	Jan. '08	0.03
Lower Mammoth	Utah	250,000	1	.....	....	57,000	Sept. '07	0.07½
MacNamara, s.g.	Nev.	728,341	1	.....	....	40,213	May '10	0.02½
Mammoth, g.s.c.	Utah	400,000	25	.....	....	2,220,000	Mar. '08	0.05
Manhattan-Big Four, g	Nev.	762,000	1	0.04	30,480	30,480	Aug. '11	0.02
Mary McKinney, g.	Colo.	1,309,252	1	.....	....	894,363	June '10	0.01
May Day, g.s.l.	Utah	800,000	0.25	.....	....	108,000	Sept. '08	0.01½
Mexican, s.	Nev.	201,600	2.50	0.10	20,160	20,160	Aug. '11	0.10
Mohawk Min. Co.	Mich.	100,000	25	1.75	175,000	2,325,000	Aug. '11	0.75
Monarch-Madonna, g.s.l.	Colo.	1,000,000	1.00	0.02	20,000	40,000	May '11	0.01
Montana-Tonopah, s.g.	Nev.	921,865	1	0.12	120,000	330,000	Dec. '11	0.06
Moscow M. & M., g.s.l.	Utah	850,000	1.00	0.02	17,000	17,000	Dec. '11	0.01
Modoc, g.s.	Colo.	500,000	1.00	0.02	10,000	275,000	Dec. 11	0.01
Mountain, c.	Cal.	250,000	25	.....	....	4,216,250	May '08	0.44
Napa Con., q.	Cal.	100,000	7	0.40	40,000	1,840,000	July '11	0.40
National, g.	Nev.	750,000	1	.....	....	360,000	Sept. '10	0.05
Nevada Con., c.	Nev.	1,995,547	5	1.50	2,957,538	6,729,540	Dec. '11	0.37½
Nevada Hills, g.	Nev.	746,000	5	.....	....	373,000	Dec. '07	0.10
New Century, z.l.	Mo.	330,000	1	.....	....	237,600	Oct. '09	0.01
New Idria, q.	Cal.	100,000	5	1.60	160,000	1,450,000	Oct. '11	0.30
North Butte, c.	Mont.	410,000	15	1.20	492,000	9,758,000	Oct. '11	0.30
North Star, g.	Cal.	250,000	10	1.70	425,000	3,486,989	Dec. '11	0.80
Old Dominion M. & Sm.	Ariz.	162,000	25	3.00	486,000	1,822,000	Oct. '11	1.00
Ophir, s.g.	Nev.	201,600	3	0.10	20,160	2,048,260	Nov. '11	0.10
Opohongo, g.s.l.	Utah	898,978	0.25	0.01	8,990	8,990	June '11	0.01
Oroville Dredging	Cal.	700,000	5	.....	....	1,383,036	Dec. '09	0.12
Osceola, c.	Mich.	96,150	25	7.50	721,125	[illegible]679,775	July '11	3.50
Osceola, l.z.	Mo.	500,000	5	.....	....	245,000	June '07	0.10
Parrot, c.	Mont.	229,850	10	0.60	137,908	7,014,511	Nov. '11	0.15
Pearl Con., g.	Wash.	1,909,711	0.05	.....	....	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	.....	....	87,500	Feb. '10	0.01½
Pioneer, g.	Alas.	5,000,000	1	0.03	150,000	2,041,526	Oct. '11	0.03
Pittsburg-Idaho, l.	Ida.	1,000,000	1	0.08	80,000	80,000	Oct. '11	0.04
Platteville, l.z.	Wis.	500	40	.....	....	179,500	June '07	10.00
Portland, g.	Colo.	3,000,000	1	0.06	180,000	8,917,080	Oct. '11	0.02
Quartette, g.s.	Nev.	101,000	10	.....	....	430,000	Sept. '07	0.10
Quilp, g.	Wash.	1,500,000	1	0.02	30,000	52,500	June '11	0.01
Quincy, c.	Mich.	110,000	25	4.00	440,000	19,880,000	Dec. '11	1.00
Red Metals, c.	Mont.	110,000	100	.....	....	3,500,000	Dec. '10	2.27
Republic, g.	Wash.	1,000,000	1	.....	....	85,000	Nov. '10	0.01½
Rochester, l.z.	Mo.	4,900	100	.....	....	136,947	Jan. '09	1.00
Round Mt., g.	Nev.	866,426	1	.....	....	328,404	Sept. '10	0.04
St. Joseph, l.	Mo.	1,000,000	10	0.[illegible]	600,000	7,958,357	Dec. '11	0.15
Shannon, c.	Ariz.	300,000	10	.....	....	450,000	July '07	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	1.00	350,000	1,050,000	Jan. '11	1.00
Silver Hill, s.g.	Nev.	108,000	1	.....	....	81,000	June '07	0.05
Silver King Coal., l.s.	Utah	1,250,000	5	.....	....	1,659,885	Jan. '10	0.15
Sioux Con., l.s.g.	Utah	746,389	1	0.12	89,448	872,097	July '11	0.10
Skidoo, g.	Cal.	1,000,000	5	0.07½	75,000	175,000	July '11	0.07½
Snowstorm, c.g.	Ida.	1,500,000	1	.....	....	1,005,000	Aug. '10	0.01
Standard Con., g.s.	Cal.	178,394	10	.....	....	5,194,130	Dec. '08	0.01
Stratton's Ind., g.	Colo.	1,000,000	0.60	0.06	60,625	303,125	Nov. 11	0.06
Success	Ida.	1,000,000	1	0.02	30,000	685,000	Dec. '11	0.01
Swansea, s.l.	Utah	100,000	5	.....	....	329,500	Mar. '07	4.00
Tamarack, c.	Mich.	60,000	25	.....	....	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	1.50	300,000	2,606,250	Jan. '11	1.50
Tomboy, g.s.	Colo.	300,000	4.85	0.56	168,000	2,792,400	June '11	0.56
Tonopah-Belmont, s.g.	Nev.	1,500,000	1	0.90	1,350,000	2,093,003	Oct. '11	0.25
Tonopah of Nev., s.g.	Nev.	1,000,000	1	1.60	1,600,000	8,050,000	Oct. '11	0.40
Tonopah Midway, s.g.	Nev.	1,000,000	1	.....	....	250,000	Jan. '07	0.05
Tri-Mountain, c.	Mich.	100,000	25	.....	....	950,000	Dec. '10	1.00
Tuolumne, c.	Mont.	800,000	1	0.45	360,000	360,000	Aug. '11	0.15
Uncle Sam, g.s.l.	Utah	500,000	1	0.15	75,000	195,000	Sept. '11	0.05
United Copper, com.	Mont.	450,000	100	.....	....	5,962,500	Aug. '07	1.75
United Copper, pf.	Mont.	50,000	100	.....	....	1,500,000	May '07	3.00
United, z.l., com.	Mo.	92,403	5	.....	....	27,490	Oct. '08	0.05
United, z.l., pf.	Mo.	19,556	25	.....	....	312,782	Jan. '08	0.50
United (Crip. Ck.) g.	Colo.	4,000,100	1	.....	....	410,135	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	[illegible]	5.00	115,000	494,500	Dec. '11	5.00
United Verde, c.	Ariz.	300,000	10	8.25	2,475,000	29,422,000	Dec. '11	0.75
Utah, s.l.	Utah	100,000	10	.....	....	325,000	Dec. '10	0.02
Utah Copper, c.	Utah	1,526,599	10	3.00	4,687,788	11,497,238	Dec. '11	0.75
Utah Con., c.	Utah	300,000	5	0.50	150,000	7,050,000	Nov. '11	0.50
Valley View, g.	Colo.	1,000,000	1	.....	....	240,000	Dec. '10	0.01
Victoria, g.s.l.	Utah	251,000	1	.....	....	207,500	Mar. '10	0.01
Vindicator Con., g.	Colo.	1,500,000	1	0.09	35,000	2,407,500	Oct. '11	0.63
Wasp No. 2, g.	S.D.	447,900	1	0.05	25,000	265,595	Oct. '11	0.02
Wolverine, c.	Mich.	60,000	25	9.00	540,000	6,840,000	Oct. '11	4.00
Work, g.	Colo.	1,500,000	1	.....	....	172,500	July '08	0.00½
Yak, s.l.	Colo.	1,000,000	1	.....	....	1,417,685	Oct. '10	0.01
Yankee Con., s.l.g.	Utah	1,000,000	1	.....	....	182,500	Jan. '07	0.03
Yellow Aster, g.	Cal.	100,000	10	.....	....	1,061,879	Aug. '07	0.20
Yukon Gold, g.	Alas.	3,500,000	5	0.37½	1,312,500	3,412,500	Dec. '11	0.07½
Total....			...	.....	$57,564,832	....		.....

Copper made a 5% return, in spite of the Crow's nest Pass coal strike, while Hedley Gold paid 25% of its capitalization. None of the Porcupine stocks entered the list of dividend payers.

COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES

Name of Company and Situation		Shares		Dividends Paid				
				1911		To Date	Latest	
		Issued	Par Value	Per Share	Total	Total	Date	Amt.
Amalgamated, c.	Mont.	1,538,879	$100	$2.00	$3,077,757	$65,887,641	Nov. '11	$0.50
Am. Ag. Chem., pf.	U. S.	183,820	100	6.00	1,002,920	9,470,570	Oct. '11	3.00
Am. Cement	Penn.	200,000	10	....	....	1,388,000	July '10	0.10
Am. Coal	Md.	50,000	25	1.50	75,000	2,722,187	Sept. '11	0.75
Am. Sm. & Ref., com	U. S.	500,000	100	4.00	2,000,000	21,000,000	Oct. '11	1.00
Am. Sm. & Ref., pf	U. S.	500,000	100	7.00	3,000,000	38,875,000	Oct. '11	1.75
Am. Smelters, pf. A	U. S.	170,000	100	6.00	1,020,000	6,260,000	Dec. '11	1.50
Am. Smelters, pf. B	U. S.	300,000	100	5.00	1,500,000	9,357,000	Dec. '11	1.25
American Coal	Md.	50,000	25	1.50	75,000	2,722,187	Sept. '11	0.75
Butte Coalition, c.	Mont.	1,000,000	15	1.00	1,000,000	4,700,000	Nov. '11	0.25
Cambria Steel	Penn.	900,000	50	2.50	2,250,000	13,960,000	Nov. '11	0.62½
Central C. & C., com	Mo.	51,250	100	6.00	307,500	3,328,750	Oct. '11	1.50
Central C. & C., pf	Mo.	18,750	100	5.00	93,748	1,644,059	Oct. '11	1.25
Consolidation Coal	Md.	199,247	100	3.00	571,777	19,602,741	Dec. '11	1.50
Crucible Steel, pf	Penn.	241,365	100	7.00	1,710,552	11,607,333	Oct. '11	1.75
General Chem., com	U.S.	74,103	100	6.00	489,076	4,046,018	Dec. '11	1.50
General Chem., pf.	U.S.	100,000	100	6.00	600,000	7,755,000	Oct. '11	1.50
General Dev. Co	U.S.	26,000	100	....	....	2,769,000	Sept. '10	5.00
Guggenheim Expl.	U.S.	207,933	100	10.00	2,079,328	12,610,603	Oct. '11	2.50
Harbison-Walker, com.	U.S.	18[illegible],000	100	2.00	360,000	810,000	Dec. '11	0.50
Harbison-Walker, pf	U.S.	96,000	100	6.00	576,000	5,184,000	Oct. '11	1.50
Inter'l Nickel, com	U.S.	88,226	100	10.50	1,216,154	4,268,810	Dec. '11	4.00
Intern'l Nickel, pf	U.S.	89,126	100	6.00	534,756	3,268,433	Nov. '11	1.50
Intern'l Sm. & Ref.	U.S.	100,000	100	8.00	800,000	1,100,000	Dec. '11	2.00
Island Creek Coal	W. Va	50,000	100	6.00	300,000	300,000	Oct. '11	1.50
Jeff. & Clf. C. & I., pf.	Penn.	15,000	100	5.00	75,000	1,087,500	Aug. '11	2.50
Lehigh Coal & Nav.	Penn.	482,936	50	4.00	1,931,744	20,603,348	Oct. '11	1.00
National Carbon, com	U.S.	55,000	100	7.00	315,000	3,543,750	Nov. '11	1.75
National Carbon, pf.	U.S.	45,000	100	6.00	330,000	....	Oct. '11	1.50
National Lead, com	N. Y.	206,554	100	3.00	619,656	6,556,968	Dec. '11	0.75
National Lead, pf.	N. Y.	243,676	100	7.00	1,705,732	24,150,476	Dec. '11	1.75
Old Dominion, c.	Ariz.	293,245	25	1.50	439,866	2,040,311	Oct. '11	0.50
Penn. Salt	Penn.	60,000	50	3.00	180,000	15,458,000	Oct '11	3.00
Phelps, Dodge & Co.	U. S.	449,346	100	12.00	5,392,152	16,185,456	Dec. '11	4.50
Pittsburg Coal, pf.	Penn.	297,010	100	7.00	2,079,072	14,617,821	Oct. '11	1.75
Pittsburg Coal, com	Penn.	203,446	100	5.00	1,017,230	....	Oct. '11	1.25
Pocahontas C. C., pf.	W.Va.	28,000	100	6.00	168,000	588,000	July '11	1.75
Republic I. & S., pf	U.S.	204,169	100	7.00	1,429,184	11,457,816	Oct. '11	1.75
Sloss-Sheffield, com.	Ala.	100,000	100	...	....	2,608,000	Dec. '10	1.25
Sloss-Sheffield, pf	Ala.	67,000	100	7.00	469,000	5,158,650	Oct. '11	1.75
Standard Oil	U.S.	970,000	100	30.00	29,100,000	736,222,000	Sept. '11	6.00
Texas & Pacific Coal	Texas	25,000	100	6.00	150,000	1,970,030	Dec. '11	1.50
Uni. Metals Selling	U.S.	50,000	100	1.00	50,000	11,550,000	Jan. '11	1.00
U. S. Red. & Ref	Colo.	99,646	100		....	1,360,294	Oct. '07	.....
U. S. Steel Corp., com	U.S.	5,083,025	100	5.00	25,415,124	148,156,622	Dec. '11	1.25
U. S. Steel Corp., pf.	U.S.	3,602,811	100	7.00	25,311,497	274,719,539	Nov. '11	1.75
U.S.Sm.,Ref.&Min.,com.	U.S.	486,044	50	2.00	702,020	3,728,745	Oct. '11	0.50
U.S.Sm.,Ref.&Min., pf.	U.S.	351,010	50	3.50	1,701,114	9,559,997	Oct. '11	0.87½
Va.-Car. Chem., com	U.S.	279,844	100	3.25	909,753	1,609,563	Aug. '11	0.75
Va.-Car. Chem., pf	U.S.	180,000	100	8.00	1,440,000	17,940,000	Oct. '11	2.00
Vulcan Dettinning, pfd.	U.S.	15,000	100	5.50	82,500	682,500	Oct. '11	1.75
Warwick I. & S.	U.S.	148,671	10	0.80	118,936	750,744	Nov. '11	0.40
Westmoreland Coal	Penn.	60,000	50	5.00	300,000	9,240,000	Oct. '11	2.50
Total		....		....	126,072,178	....		

FOREIGN MINING COMPANIES

Name of Company and Situation		Issued	Par Value	Per Share	Total	To Date Total	Date	Amt.
Amparo, g.s.	Mex.	2,000,000	$1	$0.12	$240,000	$680,883	Nov. '11	$0.03
Batopilas, g.s.	N. Y.	446,496	20	....	....	*a* 55,870	Dec. '07	0.01½
Beaver Con., s.	Ont	1,996,490	1	0.08½	169,790	169,790	Dec. '11	0.03
B. C. Copper, c.	B.C.	591,709	5	0.25	147,928	384,611	June '11	0.12½
Buffalo, s.	Ont.	1,000,000	1	0.44	440,000	1,317,000	Dec. '11	0.10
Butter's Salvador	C.A.	150,000	4.86	.....	......	2,764,500	Dec. '10	0.17
City of Cobalt	Ont.	1,500,000	1	.....	......	139,385	Apr. '09	0.03
Cobalt Central	Ont.	5,000,000	1	....	......	188,460	Aug. '09	0.01
Coniagas, s	Ont.	800,000	5	1.80	1,440,000	2,840,000	Nov. '11	0.45
Crown Reserve, s.	Ont.	1,768,814	1	0.65	1,149,729	3,537,628	Dec. '11	0.05
Crow's Nest Pass	B.C.	...	.....	...	124,216	2,182,864	Mar. '11	..
Dolores, g.s.	Mex.	400,000	5	0.22½	90,000	1,134,866	Jan. '11	0.22½
Dominion Coal, com.	N.S.	150,000	100	2.00	300,000	4,650,000	Apr. '11	1.00
Dominion Coal, pf.	N.S.	50,000	100	7.00	350,000	4,390,000	Aug. '11	3.50
Dos Estrellas, g.s.	Mex.	300,000	0.50	2.50	750,000	6,780,000	Jan. '11	2.50
El Oro, g.s.	Mex.	1,147,500	4.85	0.72	1,652,200	9,211,486	Dec. '11	0.36
Esperanza, s.g.	Mex.	455,000	4.85	1.44	664,752	11,189,796	Oct. 11	0.36
Granby, s.l.c.	B.C.	135,000	100	1.00	135,000	4,183,630	June '11	1.00
Greene Con.,	Mex.	1,000,000	10.00	...	....	6,194,400	Mar. '07	0.40
Guanajuato D., pf., s	Mex.	10,000	1,000	3.00	30,000	274,356	Jan. '11	3.00
Hedley Gold	B.C.	120,000	10	2.50	300,000	501,000	Dec. '11	1.00
Kerr Lake, s.	Ont.	600,000	5	1.65	990,000	3,720,000	Dec. '11	0.25
La Rose Con., s.	Ont.	1,498,407	5	0.40	599,360	2,427,241	Oct. '11	0.10
Le Roi No. 2, g.	B.C.	120,000	24.25	1.92	116,61	1,399,680	Aug. '11	0.96
Lucky Tiger Com. g	Mex.	715,000	10	0.50	358,058	1,267,610	Dec. '11	0.05
McK.-Dar. Sav., s.	Ont	2,247,692	1	0.40	899,07[illegible]	1,933,013	Oct. '11	0.10
Mex. Mill. & Trans., pf	...	1,072,890	100	....	..	65,879	July '08	0.03
Mines Co. of Am.	Mex.	1,700,000	5	0.82½	742,500	*b* 742,500	Oct. '11	0.15
N. Y. & Hond. Ros	C.A.	150,000	10	0.30	45,000	3,060,000	Mar. '11	0.30
Nipissing, s.	Ont.	1,200,000	25	1.50	180,000	6,840,000	Oct. '11	0.37½
Nova Scotia C. & S., com	N.S.	60,000	100	6.00	360,000	3,150,000	Dec. '11	1.50
Nova Scotia C. & S., pf	N.S.	10,600	100	8.00	81,800	932,800	Dec. '11	2.00
Peñoles, s.l.g.	Mex.	80,000	25	[illegible]	200,000	5,461,688	Mar. '11	1.25
Peregrina M. & M., pf.	Mex.	10,000	100	.	....	328,656	Sept. '10	3.50
Pinguico, pf., s.	Mex.	20,000	100	...	....	420,000	Apr. '10	3.00
Right of Way Mines, s	Ont.	1,685,500	1	0.04	67,420	202,260	Dec. '11	0.02
Rio Plata	Mex.	373,437	5	0.10	149,372	289,409	Dec. '11	0.10
San Rafael, g.s.	Mex.	2,400	25	38.00	93,132	1,428,024	Oct. '11	18.00
San Toy	Mex.	6,000,000	[illegible]	0.05	300,000	300,000	Dec. '11	0.10
Silver Queen	Ont.	1,500,000	1	...	.....	315,000	Dec. '08	0.03
Sopresa, g.s.	Mex.	19,200	20	3 .00	652,800	1,517,438	Jan. '11	34.00
Temiskaming, s.	Ont.	2,500,000	1	0.17	125,000	1,009,155	Oct. '11	0.03
Tem. & Hud. Bay, s.	Ont.	7,761	1	18.00	139,698	1,474,590	Nov. '11	3.00
Tretheway, s.	Ont.	1,000,000	1	0.20	200,000	761,998	July '11	0.10
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	0.15	212,489	212,489	Oct. '11	0.05
Total					14,798,959			

a Not including dividends of antecedent companies. *b* New series on

Nitrate of Soda in 1911

By W. J. Dwyer*

The consumption of nitrate of soda in the United States in 1911 amounted to about 500,000 tons, or about 30,000 tons less than in 1910. During the latter year the total consumption was 529,172 tons, an increase of 106,679 tons, or about 20% over 1909. The decreased consumption occurred mostly in the autumn. The Southern states consume probably 85 per cent. of all fertilizers manufactured in the country, and as a result of the low price of cotton last autumn, they have not purchased fertilizers.

According to the figures of the Nitrate Propaganda Association, the 1911 production of nitrate in Chile up to the end of November amounted to 50,063,000 quintals, of 101.44 lb. each, a monthly average of 4,551,190 quintals, comparing with a total production in 1910 of 53,685,000 quintals, and a monthly average of 4,473,750 quintals. The shipments to Europe during the first 11 months of 1911 amounted to 1,578,290 tons; to the United States eastern ports, 415,651 tons; and to all other foreign ports, 89,682 tons. The shipments to Pacific Coast ports during the same period totaled 49,192 tons. Germany is the largest consumer of nitrate, with the United States second and France and Belgium third and fourth.

The average ruled about 5d. per quintal higher than at the close of 1910. The only regular American importers of nitrate are W. R. Grace & Co., Wessel, Duval & Co., and the Du Pont powder works. The Armour Fertilizer Works and the International Agricultural Corporation also brought in direct cargoes during the year.

The Norwegian artificial-nitrate industry has not influenced the European markets for the natural product, although the production of atmospheric nitrates has been a paying business in Norway for some time. There seems to be a sufficiently large market to take care of both products. A plant is being erected at Charlotte, N. C., to operate under the Frank and Caro patents, covering the fixation of atmospheric nitrogen. Nitric acid will be made, and combined with a base of limestone as nitrate of lime, will be placed on the market as a competitor with the Chilean sodium salt. The initial annual capacity will be 2000 tons. At least one company was formed in California during 1911 to exploit the nitrate beds there. The deposits in Texas also came in for some publicity. Operations on a commercial scale, however, have not apparently been undertaken in any portion of the United States.

---

*50 Pine St., New York.

Quicksilver in the United States

The production of quicksilver in the United States has been substantially stationary for many years. In 1911 there was a small decrease. The statistics of production for the last three years are given in the following table:

State	1909	1910	1911
California	16,217	18,536	17,000
Texas	4,188	3,382	4,000
Others	810	500	500
Total	21,215	22,118	21,500

The above figures represent flasks of 75 lb., which are now the standard of the trade.

Quicksilver in Calfornia in 1911

By Lewis H. Eddy*

Careful estimate places the production of quicksilver in California in 1911 at 17,000 flasks of 75 lb. Under normal conditions the 1911 output should have exceeded that of 1910 by 1200 to 1500 flasks instead of only approximately equaling it. The extraordinary floods in February and March, which washed out many miles of roads, both wagon and rail, and destroyed furnaces and buildings and caused delay in forwarding provisions and supplies, were responsible for a reduction in the quicksilver output of approximately 1000 flasks in San Benito and San Bernardino Counties. The New Idria resumed operation after being out of commission for about a month and having reduced the output by 800 or more flasks.

The production by the small furnaces in the various counties, that produced in 1910 a fair share of the total, made a smaller aggregate showing in 1911 than in any twelvemonth for the last 26 years. The cause for this decrease is accounted for by the steady decline in price in 1910 from $50 per flask in January to $41.50 in December and the fact that much of the ore extracted or developed in these smaller mines was of low grade. The impression obtained in the early part of the year that the dissolution in April of the Eureka company, of California, which had for many years been the selling agency for practically all the product of the state, might stimulate production in the smaller mines; but if it had any effect it was apparently to discourage production.

Whatever the cause in part or in whole, the result was that in 1911 the total output of these counties outside of San Benito and Santa Clara was not more than 500 flasks. Of the total production in the state 10,000 flasks came from the New Idria and 6500, approximately, from the New Guadalupe and the Almaden. In the former mine there has been steady advance in development and, with the exception of February and March, a steady production. In Santa Clara County there have been some new orebodies opened and progressive development and increased output; this is true particularly of the New Guadalupe. Besides this there were encouraging developments in the prospect known as El Dinero in the immediate neighborhood of the New Guadalupe. The Helen and the Great Western in Lake County and the Oceanic in San Luis Obispo County have produced the greater part of the output of the smaller mines. The Altoona in Trinity County, which has been a small producer under a leasing system, had made no report of production for the year.

AVERAGE MONTHLY PRICE OF QUICKSILVER
(Per Flask of 75 Lb.)

	1910			1911		
	New York	San Francisco		New York	San Francisco	
		Domestic	Export		Domestic	Export
January	$52.20	$50.90	$48.90	$42.00	$41.63	$39.63
February	50.00	49.50	47.50	48.69	48.00	46.00
March	49.25	48.75	46.75	52.00	51.00	49.00
April	48.00	47.56	45.56	49.40	48.90	46.40
May	47.60	47.15	45.15	45.00	44.50	42.00
June	47.00	46.25	44.25	43.75	43.44	40.94
July	47.00	46.25	44.25	48.00	47.60	45.10
August	46.00	45.88	43.88	48.25	47.63	45.13
September	46.00	45.50	43.50	46.88	46.50	44.00
October	45.80	45.40	43.40	45.20	44.70	42.20
November	43.88	43.50	41.50	45.00	44.50	42.00
December	42.00	41.50	39.50	44.25	43.75	41.25
Year	$47.06	$46.51	$44.51	$46.54	$46.01	$43.62

There are favorable indications of reopening of former producers and some new prospects and locations have been recorded. The Klau mine in San Luis Obispo County has produced no quicksilver in the last year, but the expectation is that the furnaces will be completed and other repairs necessitated by the fire which destroyed the plant will have been made in time to resume operations this winter. In Sonoma County the Cloverdale mine has been reopened and the furnace started. A company was formed in November for the taking over and reopening of the Mercy mine in Fresno County. The mine formerly operated by Alvinza Hayward in Stanislaus County has been taken over by a newly organized company. A good prospect and active development of claims located in Monterey County have been reported.

Altogether the outlook for new work both in the small and large mines and in new claims is encouraging, and the present indications are that 1912 will show a larger output of quicksilver than 1911, notwithstanding the decrease in the output of the former small producers. The fact that Santa Clara County mines increased their production and the normal output of the New Idria would have been an increase over 1910 offers an inducement to the prospector for new cinnabar deposits and is an encouragement to the owners and operators of the properties that have been idle during the last few years. While low prices seem to have had effect on the small mines that were in operation in 1910, that condition does not appear to be discouraging to the prospector or the prospective operator of old mines which have been a long time idle. The prices for 1911 did not vary greatly from 1910; the average was about $44 per flask for 1911, though there were some small lots that sold as high as $52, while the maximum for ordinary sales was about $50.

Quicksilver in Texas in 1911

By William B. Phillips*

In 1911, the quicksilver industry in Texas ran on an even keel, the estimated production for the year being 3400 flasks. about the same as for 1910. There was little or no exploitation of new ground and none of the companies that were idle in 1910 resumed operations.

The deep shaft of the Chisos Mining Co. should now be approaching the Buda limestone, if it has not already reached it, and it will be important to observe whether there is any material change in the character of the ore after it has left the overlying bituminous shales. No other shaft in that part of the district has reached so great a depth, 600 ft., nor have any workings in the entire region known as the Terlingua district yielded any better material. The furnace material continues to yield about 1½% of metal and it is likely that ore of this quality can be depended on for some years.

---

*2218 Peralta St., Oakland, Calif.

*Director, bureau of economic geology and technology, University of Texas, Austin, Tex.

The mining of the rich pockets in the hard limestones west of Vogel's Draw (western part of the district) has been discontinued and interest now centers around the eastern part of the district, between Vogel's Draw and Rough Run Creek.

I say interest advisedly, for it is probable that old operations will be resumed or new ones undertaken within the next few months. It is stated, on what appears to be good authority, that certain large holdings of land in the heart of the producing area will be prospected vigorously. These lands are not state lands and they do not come under the provisions of the state mining law which has been for years and still is a great obstacle in the development of west Texas. These lands can be bought or leased or secured under royalty without the necessity of considering the vexatious and uncertain clauses of the mining law. Some of these lands have already yielded excellent ore.

QUICKSILVER PRODUCTION OF TEXAS

1899	1,000	$42,000
1900	1,800	75,600
1901	2,932	132,438
1902	5,319	239,350
1903	5,029	211,218
1904	5,336	232,116
1905	4,723	172,362
1906	4,761	178,829
1907	3,686	148,387
1908	2,384	122,260
1909	4,188	194,084
1910	3,382	158,958
1911	4,000	166,000
13 years	48,540	$2,075,602

Additional supplies of good drinking water have been found in the sandstones west of Terlingua Creek and north of Cigar Mountain, an important contribution to the economic resources of the region. While the present supply of wood for furnace use seems to be sufficient for the operations now in hand, yet we would strongly advise the use of local coal in gas producers, if more extended work is to be undertaken. This coal (sub-bituminous) carries from 29 to 50% of volatile combustible matter, from 19 to 49% of fixed carbon and from 15 to 21% of ash. In heating power it varies from 8000 to 11,000 B.t.u. It is much better than lignite but not so good as ordinary soft coal. Under proper conditions it can be delivered at the furnace for $3.50 to $4 per ton and it would yield from 60,000 to 70,000 cu.ft. of producer gas per ton, with B.t.u. from 125 to 150 per thousand cubic feet.

The assertion that quicksilver furnaces must use wood has been made so often that some people, who should know better, are still of this opinion.

The accompanying table shows the production of quicksilver in Texas from 1899 to and including 1911 in flasks of 75 lb. net. The figures for 1911 are estimated.

The Tungsten Industry

In 1911 there was a marked decrease in the production of tungsten in the United States, due largely to the lack of a wide market for tool steel, in which tungsten finds it chief use. There were produced in the United States, according to preliminary figures collected by Frank L. Hess of the U. S. Geological Survey, about 1125 short tons of concentrates carrying 60% tungsten trioxide. This compares with 1821 tons marketed in 1910. The prices in 1911 ranged from $4.50 to $8.50 per unit depending on quantity, quality and individual bargaining. This unit is 20 lb. of tungsten trioxide per short ton of ore and at the close of the year $5 per unit was offered.

Colorado and California Chief Producers

As usual, the Boulder County region, Colorado, was first in importance and the Atolia deposits in California, second. Smaller amounts were produced in Arizona, Nevada, Idaho and Washington. Several new companies were formed to operate in the Boulder field where ferberite, iron tungstate, is obtained in larger quantities than anywhere else in the world. Two companies profitably worked over tailings left from former operations. Much of the ore mined here and elsewhere was not marketed.

The Atolia field carried on work through most of the year, but not so extensively as in 1910. Some work was done near Nipton, Calif., but most of the ore was left at the mines for better prices. New mills for treating tungsten ores were operated at Osceola, Nev., and in the Blue Wing district, on Patterson Creek, Idaho. At the close of the year, a new mill was being built at Round Mountain, Nev. The companies operating at Osceola, Nev., and in Washington, were beset by financial difficulties and little was done at those places. New discoveries of wolframite were reported from the vicinity of Oroville, Wash., and in silver-bearing veins in the Sonoma Range, south of Galconda, Nev. Hübnerite was found in veins once worked for silver in the Potosi district, nine miles from Pony, Mont., and scheelite was found in gold veins in the New Goldfield district, near Rebel Creek, Nevada.

Tungsten in Arizona

In Arizona operations at the close of the year were inactive in the Dragon Mountains, the region where wolframite was first found and which has produced most of the state's output. There were several reported sales of tungsten properties in the Guijas Mountains, in Pima County, where the ore occurs in strong quartz veins, up to 30 ft. wide, cutting an aplitic granite. These veins also carry some gold. The only deposit of scheelite yet uncovered in the state was in process of development by the Cody-Dyer Mining Co. This deposit is in the Catalina Mountains, 50 miles north of Tucson, and occurs as a lenticular quartz vein in shales, close to the margin of the intrusive Oracle granite. The oreshoot is small but has been opened to a depth of 200 feet.

Bismuth in 1911

By William J. Dwyer*

The amount of metallic bismuth consumed in the United States in 1911 varied little from that of previous years. The imports for the fiscal year amounted to 178,297.75 lb. valued at $321,360. This compares with 200,221.41 lb. valued at $316,838 imported in 1910 and 176,729 lb. valued at $274,662 in 1909. The average import price in 1911 was $1.80 per lb.; in 1910, $1.58; in 1909, $1.55 per pound.

The United States Metals Refining Co. has been a producer of this metal at its Grasselli, Ind., plant since 1908. The American Smelting & Refining Co. reported no production of the metal, but is said to have experimented extensively on the recovery. The electrolytic plant of the Monsanto Chemical Co. at St. Louis is understood to be dismantled. This plant was erected in 1906 to treat lead bullion from Mexico, but operations were suspended in 1908. The National Lead Co. is reported to have produced some of the metal from corroders' residues. Bismuth has been recovered in the reduction of tungsten ores, but the Primos Chemical Co. states that no material of this nature was treated by it in 1911. Domestic production is estimated at about 95,000 pounds.

Sixty-three per cent. of the 1911 import business was done through the port of New York. This trade is in the hands of eight houses. Of these, six are engaged in the manufacture of pharmaceutical preparations, while one company manufactures composition metals and the other is a metal broker. The high price of bismuth naturally tends to restrict its use in composition metals and according to the leading pharmaceutical importing houses fully 90% of the bismuth consumed in this country enters into the manufacture of medicinal preparations, such as face and toilet powders and other bismuth compounds. The consumption of these products appears to be more or less stationary and has shown but little variation during recent years.

Bismuth compounds were quoted as follows throughout the year; citrate, $2@2.05; salicylate, $1.60@1.65; subcarbonate, $2.10@2.15; subgallate, $1.65@1.70; subnitrate, $1.80@1.85 per pound.

Prices of metallic bismuth are controlled from London and all imports into this country come by the way of England. Saxony is an important producer but Bolivia still retains her lead in this field. The latest Bolivian custom returns record the exportation of 471,151 lb. of bismuth valued at 1,923,417 bolivianos or $748,209 in 1910. On this basis the export value was $1.58 per lb., equivalent to the 1910 import value into the United States from Europe.

---

*50 Pine St., New York.

Vanadium in 1911

Special Correspondence

Vanadium steel found many new applications and its use was greatly extended in 1911 as a result of scientific and practical demonstrations of its special advantages. Particular adaptations were in the fabrication of automobile frames and machinery parts. Vanadium also found more extended use in iron castings. Reported successful attempts were made to develop the therapeutic qualities of certain vanadium compounds. Interesting results are expected from experiments underway with the use of vanadium as an additive agent with other metals than steel.

An important source of vanadium ore supply continued to be the patronite mines of the American Vanadium Co. at Minasragra, Peru. Vanadium is also being obtained from carnotite deposits in western Colorado, and from eastern Utah. The principal operators of the carnotite ores in the Paradox Valley, Colorado, are the International Vanadium Co., of Liverpool, Eng., and the Standard Chemical Co., of Canonsburg, Penn. Some of these ores carry (besides vanadium) uranium and radium and the utilization of salts of these metals will give miners of carnotite ore a decided advantage over producers of straight vanadium ores.

The mill at Vanadium (Newmire), Colo., controlled by the Primos Chemical Co., treated about 30 tons of roscoelite ore daily throughout 1911 with reported satisfactory metallurgical results. Much development was carried on in this district but practically no ore shipments were made nor was any new treatment plant established. Plans for at least one new mill are underway and the district promises to continue an increasingly important producer of vanadium.

The vanadinite (lead vanadate) deposits at Cutter, New Mexico, were operated to some extent in 1911 by the Vanadium Mines Co. of Pittsburg but operations were limited by reason of metallurgical difficulties with this ore. Exepriments were made with the ore-treatment problem the results of which are not available. Satisfactory development of ore in the district was reported. Other vanadinite deposits in New Mexico, Arizona, California, and Chihuahua received some attention during 1911, but no important production resulted

The reported discoveries of rich deposits of vanadium in Russia apparently did not materialize, for at the close of the year the European consumers were still buying largely from the American producers and were increasingly concerned in acquiring vanadium supplies.

Discoveries of vanadium ore in Oklahoma, Virginia and elsewhere were reported, but so far these have not materialized in production. The fact is vanadium is found widely distributed but the deposits of commercial grade and of a character that can be treated by present methods are as yet few in number.

Satisfactory statistics of the vanadium trade are impossible to obtain. The consumption in a measure is controlled by the state of the steel trade, but by reason of the expanding uses of vanadium steel it is likely that the consumption for 1911 was greater than any previous year notwithstanding the lessened steel output.

The price of the vanadium product as usually marketed—ferro-vanadium—at the beginning of 1911 was $5 per lb. for the metallic vanadium content. During the year one of the large operators made price concessions and the alloy was openly quoted at $3.50 per lb. and sales were reported at $3 per pound.

The Cement Industry

As regards the Eastern states, at least, the cement business in 1911 was the most unusual in its history. Prices at the close of the year were down to 60c. in bulk at the mill, which is a low record mark for the industry. Lower prices have been reported in isolated places inland.

Over-production and a lack of coöperation among producers resulted in a most demoralized twelve months. Rumors of combinations and the absorption of smaller companies have been rife throughout the year, but in view of the stand the Government has taken regarding combinations of competing corporations, it is not presumed that the rumored absorptions actually occurred. Business has been so bad that notwithstanding the fact that any number of the smaller mills were eager to be taken over, the larger operators even with a more favorable interpretation of the anti-trust laws could hardly afford to assume control of a larger production and heavier finances than already in hand. The general consensus of opinion at the end of 1911 was that a number of the smaller mills are in financial straits, as it is hardly possible to produce cement and realize a profit at 60c. per bbl. of 375 lb. The sharp decline in the stocks of most cement companies tends to confirm this supposition.

Under the influence of low prices, however, the markets have broadened considerably and the production during 1911 was in all probability well in excess of that of 1910, which amounted to 77,785,141 bbl. The Western cities use much larger quantities of cement for structural purposes than the Eastern. The tendency in the East of late, in New York particularly, has been to an increased use of concrete for building purposes.

It was assumed that the taking over of the Atlas Portland Cement Co., by the Morgan interests, which are prominently identified with the Universal Cement Co., through the Steel Corporation of which it is a subsidiary, would gradually tend towards betterment. This, however, has not occurred, and each company to all intent is operating independently of the other. The Universal company, which manufactures cement from basic slag and limestone, entered the northern New York field more actively during 1911 through Pittsburgh.

Cement for the Panama canal is being furnished at the rate of about 1,000,000 bbl. annually and these withdrawals have had a slight stimulating effect on an otherwise depressed market. The contract with the Government averages about 68c. per barrel.

Imports of foreign cement are declining to a marked extent and with present low prices there is little likelihood of an increase. The imports for the fiscal year amounted to 46,648 tons comparing with 81,550 tons in 1910 and 96,187 tons in 1909. Germany is the largest shipper to this country, with Belgium second.

Cadmium

The chief supply of metallic cadmium continues to come from Upper Silesia, but we understand that there is now a considerable production in Great Britain. A small production is made in the United States by the Grasselli Chemical Co., at Cleveland, Ohio, and the United States Zinc Co., at Pueblo, Colo., the latter being a new producer in 1911. The price for metallic cadmium during 1911 varied from 70 to 85c. per lb., f.o.b. Cleveland, Ohio, the quotation varying according to quantity and quality.

Copper Sulphate

The production of copper sulphate as a byproduct was 33,454,000 lb. in 1911, against 26,356,788 lb. in 1910 and 45,000,000 in 1909. The decline in the output of this byproduct from 1909 to 1910 was due to improvements in the practice of some refiners, enabling them to avoid making this byproduct. Thus several refiners now report no copper sulphate at all. Our statistics include the bluestone recovered in the refining of base lead.

The Metallurgy of Zinc

By W. R. Ingalls

In the metallurgy of zinc there was no radical change in 1911. There seldom is in a single year, progress being naturally by small steps, the effect of which does not become apparent until they have been cumulative. It may be positively stated, however, that the metallurgy of zinc does not stand still. Many improvements in details have been made, and are constantly being made, with the results of decreased cost of operation, increased extraction of metal and ability to handle successfully ores of considerable impurity. High percentages of lead and iron have ceased to have terrors. Silver and lead contents can be recovered either by smelting the entire residue from zinc distillation or by subjecting it to mechanical concentration and smelting the concentrate. The choice between these alternatives depends simply upon commercial conditions. Available ore supplies are constantly being increased by improvements in the art of mechanical concentration.

In general, the zinc smelting business both in Europe and America was prosperous in 1911, the margin between the value of zinc in ore and in spelter having been unusually large. The experience of American zinc smelters is an alternation of periods of feast and famine, the latter being always longer than the former. In 1911 conditions were distinctly in favor of the smelters.

New Works

The construction of several new works in the coal field of Illinois was begun in 1911, bearing out my previous forecast respecting the destiny of that state as a zinc smelting center. Two new plants were also built in the gas field of Oklahoma. So long as a gas supply is obtainable there, new plants will, of course, be erected from time to time in that region. Smelteries to use natural gas as fuel are relatively cheap and quick to construct. Smelteries to use coal are more permanent, but are more costly in their construction, not only for zinc smelting proper, but also because a plant of this kind in order to compete successfully must be provided with an accessory sulphuric acid works. The relative cheapness and facility of construction of works to use natural gas are, of course, attractive to the smelting interests who are willing to take chances or have obtained contracts, etc., that permit of a quick writing off of the cost of plant. As to the point of facility of construction, it is interesting to note that the first furnace of the new works of the Bartlesville Zinc Co. at Collinsville, Okla., was put in operation on Dec. 18, just five months after the beginning of construction of the works. So far as I am aware, this is the shortest time on record.

Interesting events of 1911 were the inauguration of zinc smelting by the Broken Hill Proprietary Co. in New South Wales, which has erected at Port Pirie a plant of considerable capacity, equipped with furnaces of modern design; and the beginning of zinc smelting, on a small scale at Osaka in Japan, where the production of about 4000 tons of spelter in 1912 is projected. As is well known, Japan possesses fair resources of zinc ore, shipments from which have heretofore been made to Europe.

The operation of these new plants will be watched with interest. Zinc smelting is more dependent upon human factor than are many other branches of metallurgy, and for this reason it has heretofore been confined in the main to the districts in Silesia, Rheinland, Belgium, Great Britain and the United States where a working population trained in the art through several generations of practice has become established. The successful prosecution of zinc smelting at new and remote places has generally been a tedious development, although, of course, by no means impossible. The entry of the Japanese into this field of metallurgy is of peculiar interest from this standpoint.

Ore-Dressing

The enormous output of zinc ore at Broken Hill continues to be made by the oil-acid flotation process, the patent rights to which are the subject of bitter litigation. In 1911 this process was introduced by James M. Hyde at the mill of the Butte & Superior Copper Co. at Basin, Mont., where ore from Butte containing about 20% zinc is raised to a product assaying 45 to 50% zinc. The ore is first jigged, the tailings then being reground and floated. Mr. Atwater manager of the company, informed me that an extraction of 90% was being made, the cost of the process being about 75c. per ton. This company is paying no royalty. Suit on the ground of infringement has been brought against Mr. Hyde by Minerals Separation, Ltd. The Butte & Superior is engaged in the construction of a new mill at Butte, which will be of capacity of about 200,000 tons of ore per annum.

The Macquisten tubes have been introduced in the Morning mill at Mullan, Idaho, for the treatment of middlings, and it has been reported that an installation of them is to be made by the Grasselli Chemical Co. at Park City, Utah. Henry E. Wood operated the flotation separator of his invention in his testing works at Denver, Colo.

Pyrometallurgical Concentration

A good deal of attention was devoted in 1911 to what may be called the pyrometallurgical concentration of zinc ore by burning off the zinc after the fashion of the Wetherill process of zinc oxide manufacture, but without the refinements that are necessary when the oxide is to be collected for use as a pigment. Such a process of concentration may find a useful field in the treatment of ores and metallurgical products that are not amenable to mechanical concentration and consideration of this possibility has been inspired by the success of Pape in extracting zinc from the slags of Oker, in Germany. Among others who have been experimenting on this line are Babé, Blum, Hommel, Witter, and Huntington. Some useful developments may be expected under favorable conditions. In general the metallurgists who have been giving their attention to this subject have been endeavoring to improve mechanically the apparatus to be employed Huntington, however, presents a new idea in the application of the down-draft principle, while Blum is perhaps novel (Hommel contests this) in the idea of conducting the operation in a modification of the Huntington-Heberlein pot. Mr. Blum has informed me that he is erecting a small plant in Mexico for the trial of his process upon a commercial scale.

Grades of Spelter

At the annual meeting of the American Society for Testing Materials in June, 1911, Prof. William Campbell, of Columbia University, chairman of the committee on "Non-Ferrous Metals and Alloys" reported a classification of the grades of smelter as above, the figures representing the maximum percentages of impurities allowable.

Grade.	Pb.	Fe	Cd.	Total not over
A. High grade*..	0.07	0.03	0.05	0.10
B. Intermediate*	0.20	0.03	0.50	0.50
C. Brass special*	0.75	0.04	0.75	1.20
D. Prime Western	1.50	0.08		....

*To be free from aluminum.

This classification is rational. It corresponds substantially to the understanding among American zinc smelters, but it is useful to have an official pronouncement.

Roasting Furnaces

In the United States the furnaces in common use for blende roasting continue to be the Hegeler and the Zellweger, the former being employed invariably when it is desired to use the roast-gas for sulphuric manufacture, while in the natural gas field the Zellweger furnace is employed. At Cherryvale and Neodesha, where the supply of natural gas has seriously diminished, these furnaces are now, I understand, being fired with petroleum.

In Europe blende roasting continues to be done generally by hand. One reason for this is the relative cheapness of labor there, and another reason is the legal requirement in many countries that the roast-gas must be restrained, which practically means that it must be converted into sulphuric acid, a condition that bars out many forms of mechanical furnace.

Many of the zinc smelters in Germany have spent large sums of money in the trial of furnaces of their own design and construction, without arriving at any successful result. It is difficult to see why the European smelters have not seen fit to adopt the Hegeler furnace, which has been well proved in American practice, and although being far from perfect from the economical standpoint is, nevertheless, immensely superior to hand work.

At certain works in Swansea, Wales, the Merton furnace has found successful employment. With reference to hand-raked furnaces the Rhenania continues to be the standard, but in Belgium and France the new furnace of Delplace has found more or less use. This is an elaboration of the old Maletra shelf-burner. As to the results accomplished with it, some remarkable stories are told. It is said that in a furnace roasting 15,000 kg. of ore per 24 hours the consumption of coal is as low as 90 to 120 kg. per 1000 kg. of raw ore. This is better than is done in the best form of the Rhenania furnace, so far as I am aware, and indeed is lower than anything else whereof I know.

Distillation Furnaces

In all modern smelteries the distillation furnaces are of the regenerative type, either reversing or counter-current. In recent years the latter has increased in use. It has certain distinct advantages, but has not generally proved so economical of fuel as the other system. However, that particular, in either system, is governed largely by the proportions of the furnace, and some excellent results have been reported of counter-current furnaces.

The counter-current type of furnace is a favorite of the New Jersey Zinc Co., at whose Palmerton works the Convers & De Saulles furnace is employed. The Schmidt & Desgraz furnace, which has lately found rather extended employment in Europe, is also of the counter-current type. Furnaces of the Schmidt & Desgraz construction have been installed at the works of the Broken Hill Proprietary Co. in Australia.

As to the furnaces of the reversing-regenerative type, the Overpelt furnace is still, perhaps, most generally in use among European smelteries. Furnaces of this kind exist in the United States at the works of the United States Zinc Co. at Pueblo, Colo. A new design of reversing-regenerative furnace is that of Dor-Delattre, which is in use in Europe. This furnace is said to have been operated with a consumption of heating coal of only 900 kg. per 1000 kg. of ore, which figure is undoubtedly better than anybody else has been able to achieve. Heretofore a fuel consumption of 1000 to 1100 kg. has been considered extraordinary work in the case of reversing-regenerative furnaces, while in the case of the counter-current furnaces the figure is 1300 to 1400 kg. and upward.

At the Birkengang works, near Stolberg, Rhenish Prussia, experiments have been made with a new furnace containing vertical retorts. This furnace is reported to have been constructed upon a fairly large scale. The results attained have not yet been made public.

The tendency among European zinc smelters to drive their furnaces harder seems to increase. A furnace temperature of 1400 C. was once thought to be high, but now 1500 and upward is reported. Such high temperatures imply, of course, the necessity for much more substantial furnace construction and a high class of refractory material. Of course the average life of the retorts is reduced. In comparison with such figures the practice of American smelters is extremely moderate.

As to the arrangement of the retorts of the distillation furnace, European practice tends toward the Rhenish system; American toward the Belgian. Among American works using natural gas the Iola type of furnace still prevails, in spite of certain disadvantages. At Cherryvale, where furnaces of the Belgian type were originally installed, it was possible to adapt them to firing with petroleum when the supply of natural gas failed, but other smelters in Kansas have been able to use petroleum only in connection with their roasting furnaces.

Accessory Apparatus

Almost all zinc smelters now employ hydraulic presses for the manufacture of their retorts, all of these presses conforming to the original lines drawn by M. Dor, the inventor. There have been mechanical improvements in this apparatus, examples of which are to be noted in European works.

The subject of machine charging of the retorts is always engaging to inventors, but nothing of great practical value seems yet to have been developed on this line; certainly nothing that has come into general use. However, the charging machine of Dor-Delattre is said to be in use at Budel, Holland. In this machine the charge is thrown into the retort by centrifugal force. This is the simplest of the mechanical charging machines of which I have seen drawings. At Budel it is said to charge 72 retorts in 20 minutes, i.e., 16 to 17 seconds per retort. Another new charging machine that has been described is that of Rosdzin. The Saeger machine is in use at works of Giesche's Erben, in Silesia.

Electrothermic Smelting

Much attention was given in 1911 to the development of electric furnaces for zinc smelting, and some optimistic reports were made to the effect that previously baffling difficulties had been overcome. It was authentically reported that commercial ore smelting had been accomplished at Sarpsborg and Trollhättan, in Scandinavia, and that the capacity of those works is to be enlarged. Plans to finance the proposed extension were made in London and an elaborate report upon the works mentioned was made by F. W. Harbord.

At these Scandinavian works electric zinc smelting has been carried on after a fashion for five or six years back, the DeLaval arc furnace having been first adopted. The works at Sarpsborg still have those furnaces, but at Trollhättan a resistance furnace is now employed. Metallurgically both furnaces are said to behave in the same way, but the resistance furnace at Trollhättan is very much more economical of power than the arc furnace of Sarpsborg.

For many years it was impossible to smelt ore at these works and obtain spelter in one operation. The product of ore smelting was a metallic powder. By resmelting that powder a spelter containing a large percentage of lead was obtained. Finally by a third smelting spelter of high grade was produced. This sequence of processes did not seem to be commercially profitable, and such spelter as has come from these works has been chiefly derived from the treatment of dross, scrap, etc. The subject of ore smelting was not, however, abandoned, and lately this has been accomplished in a way, i.e., it has been succeeded in smelting a charge consisting mainly of powder, to which, however, a small proportion of ore is added. The product from this charge is partly a very leady spelter, and partly powder, the latter going back for resmelting, and thus going around and around in the process, probably cumulatively. The leady spelter is refined by redistillation. The recovery of metals is low and there would not be possibility of commercial success were it not for the extremely low cost of power available in Scandinavia.

In the smelting of 537 metric tons of ore at Trollhättan the consumption of electric power was 2078 kw.-hr. per ton of ore, this not including the refining of the leady spelter. At $10 per kw. per year (0.116 c. per hr.), which is approximately the rate at Trollhättan, the cost per ton of ore is $2.41. There is of course the prospect of reducing that figure if the necessity for resmelting blue powder can be avoided. The inability to condense a reasonably high percentage of the zinc as spelter, not as powder, has been a difficulty experienced by nearly all experimenters in this field; and this difficulty has not yet been solved.

In the United States experiments in electric zinc smelting were conducted in 1911 by W. McA. Johnson at Hartford, Conn. At Hohenlohehutte, Silesia, an experimental plant of Imbert-Thompson-Fitzgerald was erected and run with results that have not been publicly reported. These were the most ambitious attempts in 1911. Besides them, experimental work on a small scale has been done by numerous metallurgists.

In spite of all of the experimental work in electric zinc smelting that has so far been done, and the reports of success achieved, it must still be pronounced that this art is absolutely in its infancy and it is impossible yet to say definitely that certain metallurgical obstacles are surmounted, much less that the process will offer any commercial advantage.

HYDROMETALLURGICAL PROCESSES

Several hydrometallurgical processes for zinc extraction were exploited in 1911, but none of these commanded any very serious attention. Among them are the Malm process, (chlorination) for which a mill (not yet in operation) has been erected at Georgetown, Colo.; a chlorination-electrometallurgical process that is to be tried at Helena, Mont.; and the so-called bisulphite process that is being exploited in Great Britain. The bisulphite process consists essentially in dead-roasting the ore and then digesting it with water into which sulphur dioxide from the roasting is introduced in a special apparatus. The solution of zinc bisulphite thus obtained is separated, the residue going to lead-smelting furnaces and the solution to an apparatus in which the zinc is precipitated as monosulphite, the sulphur dioxide that is evolved at the same time being returned to the process. The zinc monosulphite is calcined to oxide, which is said to be of the density required for reduction and distillation in retorts in the ordinary way.

As thus described, the process possesses no features differing from the proposals of many metallurgists in the past, and it is to be supposed that the novelty of the present process lies in the methods of conducting the several operations and the design of the apparatus employed. The literature of this process is replete with estimates of profit to be expected in the treatment of certain ores, but has failed to give any real technical data. The process has been developed at a works in Swansea, and a plant for the treatment of the ore of the Roseberry mine is now reported to be in course of erection in Tasmania.

The Metallurgy of Lead in 1911

By H. O. Hofman*

In the last year no radical changes took place in the treatment of lead ores. Matters proceeded along well known paths, although changes were made here and there in details to meet local needs. The two main lines in which lead smelters are seeking for improvement are in blast roasting and in the collection of flue dust, combined with the disposal of sulphurous gases.

BLAST ROASTING

Blast roasting in some form or other has replaced other methods of roasting in hand and mechanical reverberatory furnaces. Its different phases in the treatment of Broken Hill ores have been reviewed by W. Poole,[1] who, however, omits the last, the replacement of the Carmichael-Bradford process by that of Dwight-Lloyd.

An interesting modification of the Savelsberg process was adopted at the silver-lead smeltery of Przibram, Bohemia,[2] where limestone was replaced by blue billy, the residue from treating burnt pyrite in the wet way by the Longmaid-Henderson process, and the work appears to be satisfactory as to the galena concentrate produced in the local ore-dressing plants.

At Trail, B. C.,[3] two 100-ton Dwight-Lloyd straight-line sintering machines with three men on a shift have been put in operation to work in competition with the Huntington-Heberlein plant consisting of seven mechanical reverberatory roasting furnaces and 24 converting pots.

A valuable development of the Dwight-Lloyd machine is its use in the sintering of fine iron-bearing materials.[4] Flue dust from the iron blast furnace containing: Fe, 46%; SiO_2, 9%; and C, 14 to 17% is treated without any addition, while magnetite concentrate with: Fe, 57%; and SiO_2, 9 to 10%, requires an addition of about 10% of coal to furnish a hard porous clinker. It may be added that Savelsberg developed a similar idea with the usual pot-roasting operation.

Blast roasting, which first started with galena concentrates, branched out into the treatment of various lead ores; later it was successfully applied to the treatment of fine sulphide copper ores and flue dust, to prepare them for blast-furnace work; the difficulties of blast roasting matte have been overcome; a start has been made in the working of speiss; now finely divided iron ore is being sintered in a cheap and effective way. Thus all the vexatious troubles of fine ore in the blast furnace are being met by blast roasting to the satisfaction of all concerned.

CONVERTING LEADY MATTES

In connection with the bringing forward of blast-furnace copper-lead matte in the basic converter to blister copper, the question of loss of precious metals due to the presence of lead has attained a fresh interest. The lead, of course, is slagged and volatilized in the process, the fume being collected in a chamber and baghouse. Some metallurgists have held that lead greatly increased the volatilization loss, others that it did not. The data published by C. C. Semple[5] about the converting at Aguascalientes seem to show that the loss in precious metal is proportional to that of copper and independent of that of lead.

---

*Professor of metallurgy, Massachusetts Institute of Technology, Boston, Mass.

[1] Mines and Minerals, 1911, XXXII, 315.

[2] O. H. Hahn, Eng. and Min. Journ., 1911, XCII, 1038.

[3] E. Jacobs, Met. and Chem. Eng., 1911, IX, 105.

[4] James Gayley, Trans. A. I. M. E., June, 1911.

CONDENSATION OF FLUE DUST

In the dry condensation of flue dust[6] the two leading steps are the cooling of the gas and the retardation of its velocity. As the mutual attraction of particles decreases with the square of the distance, cooling, which diminishes the volume of the gas, will bring the particles closer together and thereby increase the mutual attraction, when they form flakes and settle out; the reduced volume of gas will also have a smaller velocity which again favors settling. No decided improvements have been made in the devices for settling dust excepting that Freudenberg plates are being hung staggered instead of one back of the other. The Rösing wires at Great Falls, Mont., are giving much satisfaction.

The filtration of gases from blast-roasting and reverberatory-roasting appliances, as well as from converters, has been made possible by the Sprague process[7] used at the plants of the U. S. Smelting, Refining and Mining Company, e.g., the Mammoth smeltery[8] in which the sulphuric acid which corrodes all filter cloths is neutralized by feeding powdered lime into the flue carrying off the gases and by introducing zinc oxide produced from blende on a Wetherill grate. The neutralizing effect of zinc oxide apparently was the reason that the gases from the furnaces of the Bartlett process, Cañon City, Colo., treating sulphide concentrates of lead, copper, iron and zinc, could be readily filtered in spite of their richness in sulphurous and sulphuric acids, the sulphurous acid not attacking the filter cloth, and the corroding sulphuric acid being neutralized by zinc oxide.

COTTRELL'S ELECTRIC PRECIPITATION PROCESS

A radical departure from the ordinary methods of condensation is the electric precipitation process of F. G. Cottrell[9] in operation at the Selby lead works near San Francisco and tried at the Balaklala copper smeltery, Coram, Calif. Experiments of Lodge and Walker have shown that an alternating current will cause the agglomeration of particles suspended in a fairly quiescent atmosphere. In a moving gas current the agglomeration and settling are too slow to be effective. Cottrell, therefore, uses a high-potential direct current. If a needle-point be connected with one pole of such a current and a flat plate with the other, the air space between the two becomes highly charged with electricity of the same sign as the needle point, and any insulated body brought into this space receives a similar charge. If this body is free to move, as is the case with suspended flue dust and vapor, these will be attracted to the plate of the opposite charge; they will move, therefore, toward the plate and do this at a speed which is proportional to the charges and to the potential gradient between the point and the plate. Observation has shown that in a perfectly transparent gas there is a strong wind from point to plate.

In order to obtain a high-potential direct current, an alternating current from a lighting or power circuit of from 20,000 to 30,000 v. is connected by means of a special rotary contact maker driven by a synchronous motor.

For the needle point of the laboratory there was substituted at first a cotton-covered wire, the loose fiber of which furnished innumerable fine, sharp points for the discharge of the high-potential current, since it was sufficiently conductive from its natural hygroscopic water. The cotton, readily attacked by hot acid gas, was replaced by asbestos or mica, the fiber, resp., the edges of the scales furnishing the desired discharge points.

COTTRELL PROCESS FIRST USED ON SULPHURIC ACID

At the Selby works the first unit was introduced in a gas current of 5000 cu.ft. per min., to condense the fumes resulting from the sulphuric-acid parting plant. In a lead flue, 4x4 ft., there were placed rows of vertical lead plates 4 in. apart, alternating with suspended lead-covered iron rods carrying mica. A current of 460 volts and 60 cycles was transformed up to 17,000 v., and then passed through a rectifier to the electrodes. The power consumption was found to be only 2 kw.; the result attained was an elimination and collection of the sulphuric acid in the gas as a liquor of 40° Bé. The plant has been in operation for three years; the monthly outlay is $20; the acid recovered in this period has paid five times the cost of the installation.

The second unit was intended to handle 50,000 cu.ft. of gas per min. from the roasting and blast-furnace departments. It was thought at first that the suspended material would be precipitated in a reasonably dry form, which would permit brick and iron construction. Experience showed that this was not the case, and that lead was necessary as building material. A flue 6x6 ft. and 32 ft. long, containing 38 rows of 16 lead plates, each 6 ft. long and 4 in. wide, alternating with discharge electrodes, was sufficient to collect the sulphuric acid, arsenic, antimony, lead, etc., in the gases, provided these had been cooled to below 150° C. The collected material is a grayish mud, easily washed off the plates and run into settlers. For this purpose, every four to six hours the gases were turned into a bypass. For continuous work there would be erected two or three units, so that one could be cleaned at stated intervals. The power consumption was from 10 to 15 kw. A permanent installation has not yet been made.

EFFECT OF SULPHUROUS ACID ON VEGETATION

The effect of sulphurous acid upon vegetation continues to occupy investigators. Thus Sorauer[10] finds that chemical analysis and microscopical examination have to supplement one another in determining accurately in doubtful cases the effects of sulphurous acid. In considering the harm done a distinction has to be made between the clearly visible effect of a large volume of gas acting at intervals, and the slow but steady influence of gases containing but little acid. The question whether injury to plant life results from gas or infected soil can be solved only by experiment. This consists in placing in suspected ground a box of 1 cu.yd. capacity, filled with soil from a sulphur-free section, and doing the same with supposedly sulphur-tainted soil in a sulphur-free atmosphere and planting in both string or pole beans (*Phaseolus vulgaris*). If the plants in the first show signs of decay, the sulphurous acid in the air is the cause; in the second the soil is poisoned.

DISSIPATION OF SMOKE

An interesting development in connection with disposing of smoke is the Wislicenus smoke-stack.[11] The sulphurous smoke issuing from the stacks of lead and copper smelteries remains undispersed for a long distance, the dust falls out gradually, but the gases come down not sufficiently diluted to make them harmless to vegetation. In order to dilute the gas it is necessary that air be introduced at an early stage in such a manner as to divide the smoke column into strips surrounded by air. This is done by the Wislicenus stack, which consists briefly in placing a lattice-like extension on top of the ordinary chimney.

---

[5] Eng. and Min. Journ., 1911, XCI, 508.

[6] Pzehulka, Zeit. f. angew. Chem., 1911, XIV, 1803.

[7] U. S. Pat. Nos. 984,498, Feb. 11, 1911, and 992,391, May 16, 1911.

[8] Eng. and Min. Journ., 1911, XCI, 617-985.

[9] Journ. Ind. and Eng. Chem., 1911, III, 542; Eng. News, 1911, LXVI, 495; Min. and Sci. Press, 1911, CIII, 255-286; Min. Science, 1911, LXIII, 337; Eng. and Min. Journ., 1911, XCII, 763.

[10] Sammlung von Abhandlungen über Abgase und Rauchschäden, 1911, No. 7.

[11] Austin, Mines and Methods, 1911, II, 269; Hahn, Eng. and Min. Journ., 1911, XCII, 596.

Air will pass through the lattice from whatever direction the wind may be blowing, it will come in contact with the ascending smoke, divide it into bands and pass out with them at the opposite side. Thus, instead of a single column of smoke rising from the stack, strips of smoke, each surrounded by air, will pass off at the sides. The smoke of each band will readily diffuse into the inclosing air, and be dissipated so that when it finally comes down, the sulphurous acid will be sufficiently diluted to be harmless.

The reduction of sulphur dioxide with recovery of sulphur has been repeatedly suggested. S. W. Young[12] has taken up the matter and developed what he calls the thiogen process. This consists of the following steps: (1) Action of dry SO_2 upon warm CaS, as expressed by $2\,CaS + 3\,SO_2 = 2\,CaSO_3 + 3\,S$; (2) recovery of sulphur from the intermediary product by sublimation; (3) treatment of the latter with a hydrocarbon at an elevated temperature when $2\,CaSO_3 + CH_2 = 2\,CaS + 2\,CO_2 + H_2O$ takes place with the regeneration of the original reagent. It appears that the presence of pyrite is favorable, being decomposed according to $3\,FeS_2 + 2\,SO_2 = Fe_3O_4 + 8\,S$, although very slowly. Instead of the imaginary CH_2 given in the formula, there would be used C_2H_4, CH_4, petroleum vapor, etc. In this connection it may be noted that Kosmann[13] experimented with the action of H_2SO_3 upon a solution of CaS in H_2O, when $CaSO_3$, S and H_2O formed, but the process was not successful.

---

[12] Min. and Sci. Press, 1911, CIII, 375, 386.

[13] Glückauf, May 2, 1894.

Cyanidation in 1911

By Burr A. Robinson

The record of 1911 shows that cyanidation not only maintained but materially strengthened its position in the realm of gold and silver metallurgy. An old time rival abandoned the field; stubborn ores were whipped into submission and the potentialities of the process remain unfathomed.

In July, the Portland mill at Colorado City, which up to that time was a combination chlorination-cyanidation plant, was changed to an all-cyanide plant. This left the Standard plant of the United States Reduction & Refining Co. as the only chlorination plant in the state. The closing of the Standard plant in November, ended an interesting chapter in the metallurgy of Colorado. The chlorination process, which dominated the field for so many years, is dead, but who has the temerity to predict that conditions will never arise which will warrant its resuscitation?

Treatment of Refractory Ores

Colorado was again brought into the limelight, when a little over a month ago the Colburn mill at Victor was put into operation. This mill has the distinction of being the first to install the Moore-Clancy process about which so much was written in the last year. Considerable interest is naturally manifest as to the outcome of this undertaking, for the treatment of the highly refractory sulphotelluride ores of the district without preliminary roasting or concentration seemed like a daring venture when first proposed. It is a little early yet to pronounce judgment, but if the results reported by A. W. Warwick, metallurgist of the Moore Filter Co., can be maintained the ultimate verdict will undoubtedly be highly favorable. Mr. Warwick states that the total cost of operation is less than $1 and that the tailings assay 40c. per ton. Those familiar with metallurgical conditions in the Cripple Creek district, cannot but agree that these results are little short of phenomenal. With this process a demonstrated success, enormous quantities of low-grade ore will be available as a source of gold with which to swell the world's production.

The means by which the difficulties of treating an antimonial gold ore were abated is described[1] by H. T. Brett, metallurgist of the Globe & Phoenix mine, Rhodesia. The ore which carries from 1 to 3 per cent. of stibnite, is washed, sorted to remove massive stibnite, crushed by stamps, passed over amalgamated plates and blankets, and concentrated to remove as much of the pyrite and stibnite as possible, the tailings being reground, classified and cyanided as sand and slime. The concentrates are roasted, dropped into cyanide solution, partially ground and amalgamated in pans, slimed in tube mills, followed by agitation, washing and decantation. While the method has not yielded thoroughly satisfactory results, it is undoubtedly the best solution of a difficult problem so far advanced, and will serve as a stepping stone to the one best method which is bound to be reached eventually.

A notable triumph for the cyanide process was scored at the Alaska Treadwell. The concentrates, which were formerly shipped to the smeltery at Tacoma, Wash., are now cyanided at the company's mill on Douglas Island, the net saving by this change being reported by W. P. Lass, cyanide superintendent, as $6.22 per ton. The fact that the 100-ton plant operated smoothly from the start is a justification of the expenditure of $27,794 for the two years' experimental work. Such a far-sighted policy is greatly to be commended, and a more general adoption of it would result in fewer metallurgical monuments.

Slime Agitation

The Pachuca tank, which has always received first mention as an agitating device, was called upon to defend its right to this place and much interesting discussion was the result. The most important criticism was to the effect that while the pulp as a whole might be well circulated, the relative position of the ore particles and the surrounding solution remained practically unchanged. The result of such a condition would be that the solution in contact with the ore would become saturated and therefore ineffective as a solvent. As one of the aims of agitation is to provide means by which the above condition is avoided the charge was a serious one. A. Grothe became the champion of the Pachuca agitator and endeavored to discredit such criticism by giving figures to show that the velocity of the descending ore particles is much greater than the suspending solution and therefore meets the requirements of good agitation.

The Pachuca was further criticized on the ground that the air is not effectively utilized. While these objections may hold with the original Pachuca they seem to be largely eliminated in recent modifications. The use of the shortened central tube, whereby the air lift discharges below the surface, and the ingenious spreaders or baffles at Stratton's Independence mill tend to prevent the passage of the air from the tank before it accomplishes its work.

In the matter of economical use of air the Trent agitator seems to be particularly efficient. Since the air in a highly comminuted state is introduced at the bottom of the tank its passage upward through the pulp is slow. Further, the condition of the air is such that the oxygen is readily absorbed by the solution. Theoretically this agitator contains the essentials of an ideal device, and from all accounts it is giving good results in practice.

---

[1] Min. Mag., July, 1911.

Slime Filtration

Although the vacuum filter was introduced in South Africa no earlier than October, 1910, the use of this form of apparatus is already recognized as standard Rand practice. The Butters installations subsequent to the original one at the Crown Mines of 310 leaves were as follows: New Modderfontein, 350 leaves; Brakpan, 350 leaves; Bantjes, 250; Robinson, 460 leaves; South Randfontein, 84 leaves; New Modder, 235 leaves; Langlaagte, 112 leaves. The New Modder and Brakpan plants are on the gravity plan, while the others use the pumping system. That the Rand slime is especially suitable for this method of filtration is evidenced by the fact that while the Crown Mines' installation was designed to treat 500 tons it is regularly handling 900 tons per day. On Gold Coast, West Africa, four Butters plants are in operation using a total of 302 leaves. Butters plants are also to be installed in Japan, Russia and India.

It is interesting to note that at the old mill of the Santa Gertrudis Co., in the Pachuca district, Mexico, a Moore filter plant is being used, while at the new mill of the same company a 90-frame Merrill was installed. In the Porcupine district, Ontario, a somewhat similar condition prevails, for a 500-ton Moore plant is being installed at the Hollinger and a Merrill plant at the Dome. With these two types of filters operating under parallel conditions in the same districts a fine opportunity is offered for a comparison of the relative merits of the vacuum filter and the filter press.

The recent investigations of George J. Young[5] seem to point to the conclusion that in some instances each type of filter has a niche which it alone can best fill. For instance, with slimes containing a large proportion of clayey material vacuum filters should be used; with slimes containing a small proportion of clayey material and much fine sand both vacuum filters and pressure filters could be used with perhaps equally good results; while with slimes containing much coarse and fine sand the chamber filters with air agitation and high pressures would perhaps give the best results. The fact that each type of filter can claim at least one new installation is of interest in connection with the above statements.

In the realm of slime thickening the Dorr device seems to be answering the requirements of a simple and efficient thickener. A thickener, designed and patented by Mark R. Lamb, may possibly be open to the criticism of being more complicated than the Dorr without promising a corresponding increase in efficiency. I know of no installation of the latter machine so that a comparison of the two devices from a practical standpoint is impossible.

Continuous Cyanidation

Continuous cyanidation has reached the period where the installation of this system no longer is looked upon as a novelty. The possibility that in its present state of development this system is not adapted to all conditions, is suggested by the unsuccessful attempts to use a continuous system at the Oriental Consolidated, Chosen.

Of interest from the theoretical side is the discussion of the "phase rule" as applied to cyanidation and the advantages of continuous systems in avoiding equilibrium conditions. The phase rule in this connection, as presented by H. B. Lowden,[6] briefly is this: Gold in ores when in contact with cyanide solution dissolves at a decreasing rate as the solution increases in precious metal content and decreases in free cyanide. Dissolution will proceed until equilibrium is established between the undissolved metal, the metal in solution and the free cyanide. When this condition is approached only a slight additional extraction is obtained by prolonged treatment or the addition of free cyanide; the latter because the alkali auricyanide remaining in solution continues to exert an influence upon the velocity of dissolution. This suggests the advisability of the separation of ore from pregnant solution when the rate of dissolution slackens and the use of fresh, barren or low-grade cyanide solution for further treatment.

A continuous system aiming to apply the phase rule in practical operations is suggested by John E. Rothwell[7]. The essential operations of this system are the counter-current of continuous agitation, decantation and dilution. A series of agitators and corresponding thickeners are used. The pulp, previously thickened, passes to the first agitator then to the first thickener. The thickened pulp goes to the second agitator while the solution passes to the zinc boxes. The operations of agitating and decanting are repeated in the second set, the thickened pulp passing to the third agitator but the solution going to the first agitator instead of to the zinc boxes. These operations are repeated throughout the series, the thickened pulp passing to the following agitator and the solution going to the preceding agitator. Fresh low-grade cyanide solution is added at the last thickener. As indicated the solution passes in the opposite direction to the ore, gradually gaining in richness as it proceeds. By this use of counter-currents the richest ore and the richest solution are in contact; the solution lowest in precious metal content and highest in free cyanide being applied to the ore after the greatest part of the metal is dissolved. The system seems to offer many advantages not the least of which is its simplicity.

Precipitation

Zinc-dust precipitation has made rapid strides toward establishing itself as the preferred method in modern practice. The former objection to the process on the ground of the greater metallurgical skill required is no longer considered a valid reason for deciding against it.

A patented process recently announced for the manufacture of atomized lead and zinc for precipitation purposes directly from pig lead and spelter seems to promise many advantages. The atomized zinc has the appearance of zinc filings and can be used in the same manner as zinc dust in the precipitation process.

The apparatus for making atomized lead or zinc designed for cyanide mill requirements is said to produce 100 to 150 lb. per hour in one simple operation. This apparatus measures approximately 2 ft. in diameter by 4 ft. in hight and requires a collecting chamber approximately 3 ft. in diameter by 18 ft. long.

Zinc dust, besides containing appreciable quantities of inert zinc oxide, readily oxidizes and thus loses some of its precipitating power. The fact that atomized zinc can be made at the mill as required largely eliminates the above objection. Since both atomized lead and zinc can be produced separately, a proper mixture can be made to gain the required electro-galvanic action. Scrap zinc can be converted into atomized zinc. In short, all the arguments for zinc dust as a precipitant, with the additional ones given above, are urged for atomized zinc. Results from actual operations will soon be available as the process is to be given a trial at the Nova Scotia mill, Cobalt.

The directors of the East Rand Proprietary gave the metallurgical world somewhat of a start when, on Sept. 2, they made public announcement that a large amount of gold had been allowed to go to waste. No adequate explanation was given by the officials, but those who know something of the internal workings of the company have advanced opinions which in a measure clear up the mystery. Apparently an attempt was made to propitiate the evils of frenzied finance by making a scapegoat of the metallurgical process.

---

[5] Bull. 59, A I M E., November, 1911.

[6] Met. and Chem. Eng., May, 1911.

[7] Met. and Chem. Eng., September, 1911.

In an attempt to keep up the total profits when lower-grade ore was encountered, a suicidal increase in tonnage, far in excess of the efficient capacity of the mill was ordered. This naturally caused a greater loss in the tailings, but not enough to account for the total loss announced. The chief reason for the great discrepancy was probably that the directors upon finding that they still lacked funds sufficient to declare the customary 40% dividend borrowed on the future with the gambler's logic that they would have better luck next time. If the above is true we must not judge the metallurgical management too harshly, for it must have hurt to be compelled to follow a policy so diametrically opposed to the first principles of good milling practice.

We are likely soon to lose an old friend, the Consolidated Mercur, for President Dern has read the handwriting on the wall and his interpretation begins, "You have been a good servant" and ends "thy days are numbered." Consolidated Mercur enjoys the double distinction of being the "cradle" of the cyanide process in this country and the godfather of the Moore filter.

In this article I have endeavored merely to sketch the happenings of the year which appeal to me as being a little more prominent than the rest. New cyanide plants in most of the prominent fields together with mills in new districts are an indication that cyanidation widened its field of usefulness in a geographical sense; and in an economic sense, progress was made in the adaptation of the process to the treatment of refractory ores.

The Metallurgy of Copper in 1911

By Arthur L. Walker *

For the year 1911, but little can be recorded in regard to new construction for copper metallurgical plants—probably owing to the great depression in the copper market. The International company's smelting plant at Tooele, which was blown-in in the summer of 1910, is the last of the large plants put in commission, and this plant has been operating since then most successfully. At present, however, there promises to be extensive developments in construction work during the next 12 months, as several new plants are now being built in this country and the erection of more is contemplated.

IMPORTANT NEW WORKS

A smeltery is being erected at Hayden, Ariz., by the American Smelting & Refining Co., primarily for the purpose of smelting the concentrates from the Ray Consolidated mill. This plant will consist of reverberatory furnaces, roasters and converters, and will have a capacity of 400 tons of ore or concentrate, and is expected to output 80 tons of copper per day.

The United Verde Copper Co. is to build a new and modern copper smeltery at Jerome, Ariz. The present plant has been adversely affected by the condition of the ground, owing to caving-in of the mine and by the fact that large additions to the plant have been made from time to time, the result being an arrangement which is not conducive to the most economical metallurgical methods and the new plant is expected to reduce the cost of smelting very materially.

The Arizona Copper Co., Ltd., definitely decided to build a new smeltery to enable it satisfactorily to treat the large bodies of low-grade ore which cannot be smelted in its present plant. The new site selected[1] is near Clifton on the present line of the Arizona & New Mexico R. R. In constructing this plant it is contemplated to divide the ore into three classes, two of which will be treated in reverberatory furnaces and the third in converters. It is not intended to erect a blast furnace, but provision will be made so that one can be installed if it should be found necessary in the future. The capacity will be 1,000,000 tons of ore per year from which about 43,000,000 lb. copper will be produced annually.

The Shattuck-Arizona Copper Co. contemplates building a smeltery at Douglas, Ariz., for the purpose of treating its own ore instead of having it smelted at the Copper Queen smeltery, as in the past.

The smeltery of the Mason Valley Mines Co., in Mason Valley, south of Virginia City, Nev., is nearly completed and should be ready to treat ore in the near future. All of this indicates in a very decisive manner a much greater activity in copper operations during the coming year.

THE BRADLEY PROCESS

An elaborate undertaking in the hydrometallurgy of copper is being made at Anaconda, Mont., where a plant for the extraction of copper by the Bradley process is being erected by the Copper Extraction Process Co. This plant, which is expected to have capacity for the treatment of 250 tons of material per 24 hours, is situated below the slime pond of the Anaconda Copper Mining Co., and is intended to treat the slime of that accumulation, a waste product of the Anaconda concentrator from which it has been impossible to extract any additional copper by previously existing methods. The Bradley process, which is the invention of Charles S. Bradley, was developed in an experimental plant at Bayonne, N. J. As described in the patents just issued[2], the invention claims an economical method of dissolving the metals in copper ores by the use of a chlorine compound as a carrier and transformer by which means waste products are made insoluble and the metals taken in solution are removed from the gangue and other constituents of the ore, from which solution they are afterward recovered.

In the actual operation of the process the ore containing a sulphide is subjected to a carefully conducted roasting operation in what is known as an amphidizer in which operation the copper in the ore is roasted to a sulphate and most of the iron is converted into ferric oxide. This step involves heating the finely crushed ore in the amphidizer (which is a rotating roasting furnace) to a temperature of from 450 to 550° C., air being blown into the amphidizer to accelerate oxidation. The roasted ore is then brought into association with an excess of calcium-chloride solution in a reaction drum which is maintained at a temperature of about 100° C. Cupric chloride is produced by the reaction between copper sulphate and calcium chloride, while any ferric sulphate in the ore coming from the amphidizer reacts with calcium chloride to produce ferric chloride which is soluble. The calcium sulphate resulting from both these reactions is of course insoluble and is separated by filtration in the succeeding step. The production of ferric chloride at this point is advantageous in that it dissolves any copper oxide, copper sulphide or metal-

---

* Professor of metallurgy, Columbia University, New York.

[1] Eng. and Min. Journ., Dec. 16, 1911.

[2] U. S. Pat No. 1,011,562.

lic copper which was unaffected in the amphidizer, producing copper chloride, and this ferric chloride also maintains the copper chloride in the cupric state.

Gold and silver present in the ore is brought into solution by making all the copper into cupric chloride and then adding a small amount of chlorine, chlorous or chloric compounds. The chlorides of silver and gold being soluble in calcium-chloride solutions may afterwards be precipitated with the copper and subsequently separated. After leaving the reaction drum the mass of gangue, solutions and precipitates is subjected to filtration. The solid matter forms a cake which consists of the gangue in the ore except a small amount of iron and alumina which have been taken into solution and the calcium-sulphate precipitate already mentioned. The solution comprises a carrier in which has been dissolved the metals to be recovered, a small amount of iron and alumina and any zinc which may have been in the ore; the arsenic will have been separated by filtration as it has been rendered insoluble. The solution is then subjected, if necessary, to a further oxidizing operation in order to be sure that the metals are all combined at their highest valence.

Iron and Alumina Removed as Hydrates

The solution is then in condition for treatment for separation of the metals dissolved. The precipitation of iron and alumina may be made by cupric oxide, hydrate or calcium carbonate and as this precipitate will carry some copper it is returned to the amphidizer, after having been removed from the solution by filtration. In the amphidizer the iron and alumina in the precipitate are rendered insoluble, while the copper is left in a soluble condition and can be recovered. The solution from which the iron and alumina has been removed and which then contains the bulk of the copper is run to a second tank in which copper is precipitated by carbonate of lime as oxide of copper. This precipitate is filtered from the solution and the copper is recovered by further treatment such as by reduction in an ordinary smelting furnace.

Any silver and gold present in the solutions is carried down during the precipitation of the iron, aluminum and copper and finally recovered by separation from the latter metal. Zinc contained in the ore passes into the solution as chloride of zinc and accumulates. It is therefore necessary at stated times to run the solution, or part of it, after the final treatment and before returning it to the reaction drum, to a third precipitator in which the zinc is precipitated by means of burned lime. The regenerated solution from which the gangue and all metallic compounds has been removed and which contains calcium chloride is returned to the reaction drum for the treatment of additional ore from the amphidzer, thus completing the cycle.

While the above description may indicate rather a complicated process the actual operation is comparatively simple and involves novel features and apparatus for the design and construction of which the inventor and his assistants deserve a great deal of credit. By this process it is hoped to recover copper from material which cannot be satisfactorily treated in any other manner and possibly to even make a greater extraction from certain ores than is now accomplished by other processes. In actual operation the regeneration of the carrier solution is so complete that it can be used over and over again in a cyclic manner, there being practically no loss. On account of this a considerable excess of calcium-chloride solutions can be used and by means of this excess operations can be conducted in a very elastic manner and the exact balance required in the hydro-metallurgical process as heretofore tried is not absolutely necessary. The practically complete chloridizing of the metals takes place in a solution drum and not in a preliminary roasting process, and the reactions in this solution drum can be simply and easily regulated. The results obtained by the plant now being erected at Anaconda and which should be in operation early in the year of 1912 will be awaited with a great deal of interest.

Basic Copper Convertig

During 1911 the practice of using basic-lined instead of acid-lined converters increased to a remarkable degree, and the former are now almost entirely taking the place of the latter for converting copper matte. Many additional installations of the Peirce-Smith converters were made, not only in this country but in Canada, Peru, Chili and Russia, and in other cases the old acid-lined converters were changed to basic by the substitution of magnesite brick for the former acid lining material. The many advantages of the Peirce-Smith type of converter have been noted[3] and the claims for these advantages are well founded. The grade of matte which can be satisfactorily treated in these converters varies greatly, and at present the Kyshtim Corporation in Russia is converting 25 to 30-per cent. copper matte, the International Nickel Company 25 to 30 per cent. nickel-copper matte, while the Tacoma Smelting Company in Washington and the Steptoe Valley company in Nevada are treating 50-per cent. copper matte. The life of the converter lining is even longer than was first expected and a record of three converters shows that each produced over 3000 tons of copper before being shut down for relining. The runs were 3170 tons, 3276 tons and 4031 tons. A converter will produce, on an average, 2000 tons of copper before the lining requires repairing and this is very remarkable when we consider the former life of a converter lining. Another record shows that for nearly 60,000 tons of copper produced the loss of magnesite material per ton was a fraction over 10 lb. While claims are made for a lower consumption of air and a better efficiency, practice seems to indicate that the consumption is about the same as for acid-lined converters, namely, about 150,000 cu. ft. of air per ton of copper produced from straight copper matte, and about 100,000 cu. ft. of air per ton of copper produced from leady matte. On account of the large charges sometimes 25 per cent. of the weight of the charge can be made up of cold material such as ore, cleanings, etc.

At the U. S. Metals Refining Co. at Chrome, N. J. and the Anaconda company's plan, at Anaconda, Mont. the regular type of horizontal or barrel converters is still used, being lined with magnesite brick, and it is claimed at the latter plant that by this means the lining costs have been reduced to less than 30c. per ton of copper, and that one of these converters, 12½x8ft., has produced over 2000 tons of copper with one lining from a 40-per cent. matte. At Anaconda the magnesite lining is laid with an improved mortar consisting of a mixture of five parts of sodium silicate to 100 parts of magnesite dust, which mixture is said to be superior to the linseed oil-magnesite mixture usually employed. The tuyeres have been increased in size from 1-in. to 1¼-in. diameter, and the latest reports indicate, that one lining has been used for 130 days in one converter, during which period 10,000 tons of matte were treated. It is estimated that this lining is good for 15,000 tons. Comparing the operation of these remodeled basic-lined converters with that while they were acid lined, it is found that the temperature of the charge is much lower and does not average over 1150 deg. C.

At Cananea[4] the practice of blowing fine slimes into the converter through the tuyeres was experimented with, using the Day process, and several thousand tons of rich fine concentrates were treated, blowing them through a single tuyere at each converter stand. Blowing the concentrates into the converter in this manner increased the dust losses in the gases, but by means of a comparatively inexpensive dust chamber the metals were recovered and the practice is now considered satisfactory. The rich concentrates treated are very fine, 50 per cent. being under 200-mesh in size.

---

[3] Eng. and Min. Journ., Apr. 8, 1911, and May 13, 1911

[4] Eng. and Min. Journ., Oct. 7, 1911.

Smeltery Smoke

Comparatively little agitation occurred during 1911 to damage by smeltery smoke, and with one exception, conditions were apparently quite satisfactory.

At the Tennessee Copper Co.'s plant at Copperhill, Tenn., the sulphuric acid department was increased to a capacity of about 200,000 tons of 60-deg. Baumé acid per year. and in producing this large amount of acid so much sulphur is extracted from the gases that the resulting smoke has not been complained of.

The primary object in the installation of this acid plant was to consume fumes that damaged timber and agricultural products in the vicinity, and in order to demonstrate the success of the operation the Tennessee Copper Co. itself has instituted farming operations on some of its adjoining lands to prove that the gases now produced are not harmful. From a financial standpoint, the acid plant has also been a great success, since, on account of its geographical situation, a ready market is found for the acid, especially in connection with the manufacture of fertilizers.

In Salt Lake City no objection has been raised to the continued operations of the lead smelteries in the valley and the smoke from the copper smelting plants at Garfield and Tooele has not as yet been the cause of complaint. At Anaconda but little trouble was experienced on account of smeltery gases, the efforts made by the company to show that its fumes were not harmful evidently having been convincing.

In Shasta county, Calif., the smoke question is still being agitated; and while the United States company's smeltery at Mammoth is still in operation, all the gases must be specially treated by neutralizing the sulphur trioxide with zinc oxide, which is formed by the oxidation of zinc in the ore itself, and then passing the gases through a baghouse. The capacity of the plant is limited on account of the size of the latter, and only two furnaces out of the five were in operation. The baghouse contains 3000 bags and filters 250,000 cu. ft. of gas per minute[1].

At the Balakalala smeltery at Coram, Calif., the Cottrell system was installed on a large scale, and at a cost of something over $110,000[2]. At this plant, by the use of the Cottrell system, it was the intention to deposit from the gas all of the solids and all of the sulphuric acid by means of powerful electric discharges between electrodes placed in the flue. At the start the discovery was made that while particles of solid matter can be precipitated by alternating-current discharges when the gas is at rest, in swiftly moving gasess direct-currents are required, and therefore intermittant direct-current discharges of 20,000 to 30,000 volts were used. By these discharges from electrodes suitably arranged, 72.8 per cent. of the total solids, including the dust, sulphuric acid and sulphur trioxide, was deposited, but of course the sulphur dioxide was unaffected and passed out with the gases. As a result the smeltery is now closed until it can conform to the original decree of the United States Circuit Court, which was that all solids must be removed, that there must never be over 0.75 per cent. of sulphur dioxide in the exhaust gas, and the gases must do no damage. The third condition would seem to cover everything. It is rumored that an attempt to comply with these conditions will be made by the erection of a baghouse. Inasmuch as at both the plants above mentioned the solid matter and sulphuric acid were eliminated from the fumes, the problem remaining is to remove sulphur dioxide so that the discharged gases will not contain more than the limit mentioned by the court.

The Thiogen Process

For this problem the thiogen process for eliminating sulphur dioxide from fumes is proposed by Stewart W. Young, of Stanford University, California. In substance this process recovers free sulphur from sulphur dioxide in the gas. When vaporized fuel oil is heated with sulphur dioxide at high temperatures a more or less perfect reduction of the sulphur dioxide and oxidation of the oil occurs, but the reaction is incomplete and it is found necessary to use some reagent as an intermediary. Calcium sulphide is such a reagent and when treated with sulphur dioxide at a temperature of 100° C. reacts to form calcium sulphite and sulphur. In fact, the sulphide of any sufficiently basic metal would act equally as well from a chemical point of view, but for physical reasons calcium sulphide offers distinct advantages. In carrying out this idea it has been found that if a mixture of gas containing sulphur dioxide and hydrocarbon vapor, which react imperfectly, is passed over a mixture of calcium sulphite and sulphide, the reaction is rapid and complete. The sulphite is attacked by hydrocarbons and is reduced to sulphide which in turn is attacked by sulphur dioxide and reconverted into sulphite, sulphur being produced at the same time, and so on. The application of this principle involves some unique and interesting problems, but it is claimed that the process has been worked out so successfully in the laboratory it could undoubtedly be applied to smelter gases in actual practice. The advantage of course is that sulphur produced from smelter gases could be made a source of profit at many plants where sulphuric acid would not only be worthless, but difficult to dispose of in any way.

The Use of Oil in Smelting

The practice of using oil in metallurgical operation in lieu of coal, is becoming more and more evident all the time, especiallly in reverberatory-furnace smelting. In this class of work it is frequently used even where oil costs more than coal per unit of heating value on account of its greater flexibility, the possibility of obtaining almost any heat desired and the ability to regulate the temperature to a nicety. At present reverberatory furnaces are fired with oil wherever it is possible to obtain it at a reasonable price; as for example, at the plants of the Nevada Consolidated Copper Co., the Copper Queen, at Douglas, the Cananea smeltery, at Cananea, the Garfield Smeltery, at Garfield, Utah. Oil has not as yet been used successfully for blast-furnace smelting, but E. H. Hamilton[3] used oil in his blast furnace operation in Arizona and obtained satisfactory results for several days, replacing some of the coke with oil injected at the tuyeres with a hot blast. The amount of saving is not stated, but the only difficulty experienced was slagging of the furnace tuyere. Possibly in some cases oil could be used in blast furnace operations to replace a certain amount of the coke but no satisfactory experiments have as yet been made to show to what extent, and the question of manipulation appears to be a most important one.

Flux Used in Iron Furnaces

So much has been said about the depreciation of the grade of iron ores that a large increase in the production of cinder made per ton of ore might be expected, as well as an increase in the use of flux; especially the latter, as the increase in lime in the slag may be made to pay for itself by the use of the cinder for cement manufacture. However, the limestone used per ton of iron made has changed but little in 10 years, being at present about 1200 lb. per ton.

---

[1] Eng. and Min. Journ., March 25, 1911.

[2] Eng. and Min. Journ., Oct. 14, 1911.

[3] Eng. and Min. Journ. Jan. 28, 1911.

Metallurgy of Iron and Steel

By Bradley Stoughton *

Iron-ore discoveries were made in the Lake Superior ranges and elsewhere in America and two new sintering processes were tried. The Gayley blast-drying process was developed to cheapen the cost of installation and new uses discovered for blast-furnace gas. There are important improvements emanating from Germany in the design of openhearth furnaces; electric ore-smelting and steel refining processes were developed, while the production of high-grade alloy steels increased materially, as did also the American exports of iron and steel.

SINTERING OF FINE ORE

The special continuous process of "blast roasting" of non-ferrous ores invented by Arthur S. Dwight is quite adaptable to the sintering of iron ores, as suggested by H. O. Hofman a year ago. With the coöperation of James Gayley, whose name is well known for his important services in the manufacture of pig iron, and especially in recent years for his invention of the dry-blast process, this sintering process was tested on iron-bearing materials, and the results communicated to the American Institute of Mining Engineers. The sintering process has for its prime object the agglomeration of fine particles into lumps, and the advantage of the Dwight-Lloyd method is that the lumps have a cellular structure which gives them a large area of contact with furnace gases and other substances, thus increasing the chemical activity, as well as decreasing the resistance offered to the upward current of blast furnace gases. Efficiency of blast-furnace operation is promoted by a pretty uniform size of particles charged.

It is therefore now customary in America to crush lumps of unusually large size with advantageous results, but the cheapness and abundance of the fine Mesabi ores has led on the other hand to the use of as much as 50 or even 80 per cent. of fine material. This practice brings an additional burden on the furnace, and also results in the formation of large amounts of flue dust. Some managers wet this flue dust and recharge it to the furnace, while others consider it almost a waste product. It may, however, be readily sintered into cellular lumps without the addition of any fuel to provide the necessary heat, because it already contains sufficient coke dust for the purpose. This sintering is accomplished by the Gayley-Dwight-Lloyd process with satisfactory results.

It is even suggested that economy would be promoted by sintering the fine ores themselves. Such practice would not only remove the disadvantages of using the fine Mesabi ores, but would also render available many other ores which are too impure to be treated economically and cannot be concentrated mechanically without very fine crushing. An enormous amount of ore of this character is available in North America alone. Tests made with the sintering process on these ores, after mixing with them about 7 per cent. of coal to give the necessary heat, produced a material that was well suited to smelting. Finally, the treatment renders available some ores too high in sulphur to yield a good grade of iron, by reducing the amount of this element in them. Patents for ore agglomerating processes which have also aroused interest were those of David Baker, whose improvements in blast furnace practice, and especially in charging apparatus are well known, and those of a German inventor named Weiss.

DEVELOPMENT OF BLAST DRYING APPARATUS

The undoubted advantages of dessicated blast in blast-furnace practice has been handicapped always by the heavy cost for installation of the necessary drying apparatus. This has been reduced at a Welsh blast furnace by dispensing with the use of brine, and refrigerating with liquid ammonia direct. The ammonia is used over and over again by evaporating the strong liquor from the condensation apparatus with the latent heat in the waste steam. At a Luxemburg blast furnace, refrigeration is dispensed with altogether, and the air is dried by dessication with calcium chloride, which is said to reduce the cost of installation 70 per cent. After about 6 to 8 hours, the calcium chloride is charged with moisture; it is then regenerated by heating with the flue gases from the boilers and hot-blast stoves. A triplicate installation of calcium-chloride apparatus always affords one unit for drying purposes.

TURBINE BLOWING ENGINES

J. E. Johnson suggested the use of turbine blowers, employing waste steam from the steam blowing engines of blast furnaces, and supplying the steam engines with air at low pressure, which is by them raised to high pressure necessary for blowing, thus bettering the conditions of operation of both types of apparatus, increasing their efficiency and reducing their cost. Although this combination was not tried at a furnace, the turbine was introduced in simple form at at least three American blast furnaces, with the result of more uniform blowing conditions and decreased cost of blowing. This innovation is doubtless of far-reaching importance in mechanical equipment of blast-furnace plants, although the significance of it seems to be slow in obtaining recognition.

NEW USES FOR BLAST FURNACE GAS

Probably there is no sub-department of iron and steel manufacture in which improvements effecting economies in operation have been more notable and far reaching than in the better use of blast-furnace gas. Several of these improvements have originated as an indirect result of better cleaning of the gas for its use in gas engines, which has also facilitated and improved the care and operation of the hot-blast stoves, conducting pipes, etc. Where byproduct coke ovens are operated in conjunction with a blast-furnace plant, the blast-furnace gas may be used for burning in the coke-oven flues, thus making available a larger proportion of the richer coke-oven gas for more valuable purposes. For heating openhearth furnaces, blast-furnace gas has not sufficient, calorific power when used alone; we may estimate it at about 85 to 95 B.t.u. per cu.ft., as compared with 130 to 145 B.t.u. for good coke-oven gas, and 970 to 1010 B.t.u. for natural gas. Another deficiency of blast-furnace gas for radiation heating (openhearth, annealing, reverberatory, and similar furnaces) is its lack in luminosity. But by mixing some coke-oven gas with blast-furnace gas, it may be brought to the desired degree of calorific power and luminosity, and thus employed economically. It is stated by Dr. Rudolph Buck, who cites many experiments made in Germany in this connection, that a mixture having 170 to 213 B.t.u. per cu.ft. gives satisfactory results.

BRIQUETTING IRON BORINGS

A byproduct of almost every machine shop consists of borings, turnings and drillings of cast iron, wrought iron and steel—in short, metallic chips which are melted only with excessive waste of metal due either to much oxidation on ac-

---

*Consulting mining engineer, 165 Broadway, New York.

count of the proportionately large surface exposed, or to being blown out of the furnace, if a cupola is used. A new method of treating these in the cupola or openhearth furnace is to briquet them into solid masses which do not disintegrate during their passage through the furnace. By means of the Ronay process, of which there are now several installations, the chips are agglomerated by means of pressure alone, but allowing a few moments for the force to exert its full influence. The pressure employed is 35,000 lb. per sq.in., and the cost of the process is said to be about 50c. per ton. As metallic chips can be bought for $6 or so per ton, and the briquets are nearly equal to pig iron or heavy steel scrap costing $10 to $14 per ton, the process seems to have a bright future before it under the proper conditions.

CHANGEABLE OPENHEARTH FURNACE PORTS

The ports of the openhearth furnaces must be maintained fairly constant in size and form in order that they may direct the gas and air efficiently and uniformly throughout the operation. The brick work at these points, however, suffers more damage from heat than almost any other part of the furnace, and is consequently comparatively short lived, because of the intense temperature to which it is subjected by the outgoing gases. Water cooling and other devices have been installed in order to increase the endurance of this part of the furnace with noteworthy success. A recent German innovation, in manner somewhat similar to Alexander L. Holley's improvement of the Bessemer converter, by supplying interchangeable bottoms, consists of a construction that permits of the removal and replacement of the ports of the furnace without closing down for more than five hours, which can easily be accomplished during the customary week-end shutdown. This makes the life of the openhearth furnace practically independent of the life of the ports. In this way basic openhearth furnaces whose life might normally be 350 to 500 heats, have been made to last for 1000 heats with three changes of ports.

ELECTRIC SMELTING OF IRON ORE

The success of electric smelting of iron ore under special conditions of high-priced coke and cheap power were further confirmed, not only at the two previous furnaces—at Domnarfvet, Sweden, and Heroult, California,—but by the establishment of the new furnace and new plant of the Swedish Association of Iron Masters at Trolhattan. In the ENGINEERING AND MINING JOURNAL of Sept. 30, 1911, and in *Metallurgical and Chemical Engineering* of October, 1911, are given complete descriptions of this plant and practice. An important innovation is the use of screw joints on the carbon electrodes, thus avoiding the waste due to having to throw away the butts of old electrodes. This improvement has reduced the consumption of electrodes from 10.28 kg. per ton of pig iron produced to 5.5 kg. The consumption of electricity is said to be 1736 kilowatt-hours per ton of iron, or 5.05 tons of pig iron produced per kilowatt-year. The results of this furnace operation has led to the contemplated early installation of three additional furnaces in Sweden and one in Norway. The Trolhattan furnace has been in continuous operation since Aug. 4, 1911, having been first started in November, 1910. This furnace is substantially the same general type as the Domnarvfet furnace, with certain changes suggested by experience at the latter plant. One of these changes is an increase in the pressure of the tunnel-head gases, which, it will be remembered, are taken off from near the top of the furnace and blown against the vault of the smelting crucible to cool it; another is charging the ore nearer the middle of the shaft. By these means, the efficiency of carbon reduction is increased, and the carbon dioxide in the escaping gases is brought to over 30 per cent.

COMBINATION ELECTRO-OPENHEARTH AND ELECTRO-BESSEMER FURNACES

The chief function of electric refining processes from the industrial standpoint is doubtless the super-refining of steel which has already been purified as far as is commercially practical in furnaces using cheaper sources of heat, —namely, openhearth or bessemer furnaces, and perhaps even puddling and Bell-Krupp furnaces, as the electric processes develop. Substantially all of the 50,000 tons of electric steel produced in America in 1910 was made by purification in bessemer or openhearth furnaces, followed by further refining in electric furnaces, this super-refining consisting virtually in the removal of the last traces of phosphorus, and of sulphur, gases and entangled solid particles of oxidized metals. Realizing this, the Homestead steel works has been operating for some time an openhearth furnace to which have been added two graphite electrodes, which can be brought into play for heating purposes in a manner similar to the action of the ordinary Heroult steel furnace, after the customary openhearth process of purification is completed, thus avoiding the transfer of metal from one furnace to another. An unconfirmed consular report from England states also that a firm in Sheffield is installing a double-ended bessemer converter, in one part of which the metal can be purified by the ordinary bessemer process, and then transferred to the opposite end by merely tilting the converter. In this further end, are situated electrodes by means of which electric current is brought to heat the charge by arc and resistance, thus maintaining the metal at the desired temperature while the super-refining is carried on. The general report for the year 1911 is that electric refining in the three chief siderurgical countries,—America, Germany and England—is progressing at a rate as rapid as could be reasonably expected in view of the large cost for installation and operation, and the financial conditions in the industry at present. One German plant has even gone so far as to produce regularly ingots by purification complete from pig iron to finished steel in the electric furnace.

THE ELECTRIC FURNACE FOR HEATING, ROLLING AND FORGING

One of the great factors contributing to the advantage of using an electric furnace is its ability to heat in a non-oxidizing atmosphere. Further advantage has now been taken of this characteristic by an American forging plant which has installed an electrically heated furnace for heating previous to forging. Since the loss of metal by oxidation in this operation is often as great as 5 per cent. of the weight of the piece, and greater than that when the pieces are small and have to be heated many times, so that occasionally so much metal may be lost that the piece will not fill the die where drop forgings are being made, the advantage of reducing oxidation to a minimum can be readily appreciated. The accompanying advantage of such a furnace is that it may be occasionally used for annealing, in which its unexcelled control of the temperature would tend to improve the quality of the product.

SOLUBILITY OF CARBON IN IRON

Ruff and Goecke publish in *Metallurgie* for July 22, 1911, an account of some discoveries they have made in the solubility of carbon in iron. They heated carbon in contact with iron in an electric furnace, to temperatures ranging from 1100 to 2500 deg. C. (2012 to 4532 deg. F.) and determined the amount of carbon absorbed. On plotting their results in graphic form, there is seen to be a rise in solubility with increase in temperature up to 6.7 per cent. of carbon, which corresponds to the chemical compound Fe_3C, and which was obtained at 1837 deg. C. After this point there is a temporary decrease in the rate of absorption with increasing temperature, but carbon continues to be dissolved until, at 2220 deg.

C., there is 9.7 per cent. absorbed, corresponding to the formula Fe_3C. This is the maximum amount dissolved; with further increase in temperature less carbon was absorbed.

G. K. Hooper patented and installed in at least one malleable iron foundry in America, a form of spout which permits the continuous pouring of metal from air furnaces and openhearth furnaces, by means of which the metal may be distributed to as many different ladles as desired without closing the tap-hole, thus saving time, heat, oxidation of metal, drip of metal and use of large ladles.

The manufacture of cement from iron blast-furnace slag has grown from 32,000 bbl. in the year 1900, to over 7,000,000 bbl.—equivalent to over 1,000,000 gross tons in 1910. Thus a waste product now supplies 10% of the production of an important industry.

The following statistics of the production of alloy steel ingots and castings, presented by the American Iron & Steel Association, show not only great improvements of this high-grade industry at the present time, but also the large increase during 1910, which bids fair to be again exceeded when the 1911 figures are published.

PRODUCTION OF ALLOY STEELS

Alloy	Tons	Per cent.
Titanium	326,316	57.5
Nickel	106,707	18.8
Nickel-chrome	52,021	9.1
Chrome	23,550	4.2
Manganese	19,360	3.4
Vanadium	9,049	1.6
Chrome-vanadium	6,903	1.2
Nickel-chrome-vanadium	8,760	1.5
Miscellaneous	15,153	2.7
Total	567,819	100.0

Included in miscellaneous are 3163 tons of tungsten steel. Of the total reported, 296,298 tons were made by the bessemer process; 296,135 were basic openhearth; 44,394 tons acid openhearth; 20,392 tons crucible, electric, etc. The total includes 29,357 tons of direct castings, chiefly of manganese nickel and chrome alloys. As compared with 1909 there was an increase of 385,839 tons, chiefly in titanium steel.

It is doubtful whether the term "alloy steels" is really applicable to the steels which have been subjected to a super-refining by vanadium or titanium. Nevertheless the vanadium and titanium steels are included in these special classes for convenience. In this connection it it worthy of note that nearly 196,000 tons of rails, out of a total production of 6,334,000 were treated with titanium in the United States, and the indications are that double this amount will be so treated during 1911. An illuminating discussion was carried forward in *Iron Age* as to the advantages of using titanium for super-refining with or without aluminum.

Stamp Milling in 1911

By Louis D. Huntoon*

In 1911 extensive experiments were carried on in South Africa to increase the crushing capacity of stamp mills and to determine whether some other machine or combination of machines cannot be substituted to advantage for the stamp mill. Amalgamating plates were also investigated, resulting in decreased area of plate per ton of ore treated and in segregating the plates into one building. In the United States the weight of the stamps was not increased, but the introduction of chilean mills preceding the tube mills greatly increased the milling capacity and was most satisfactory. At one plant in Colorado rolls were substituted for stamps. In Mexico the weight of the stamp was increased following the practice in South Africa. In Ontario the practice follows that in use in the United States.

On the Rand, preliminary hand dressing is still practiced to a large extent. The new mill of the City Deep, designed for a capacity of 65,000 tons per month, installed four separate sorting belts, showing the importance which is placed upon this method of disposing of waste rock or rock low in value. Considerable discussion took place this last year regarding the percentage of waste which can profitably be discarded. E. C. Hutton stated, "The smaller the percentage of sorting, the lower the value of the waste rock." With the consolidations which are in progress, resulting in the larger mills being erected, together with more economical treatment of ores, the cost of milling per ton will be reduced materially and a smaller percentage of waste rock discarded. The amount discarded resolves itself into a commercial proposition in which the cost per ton of waste discarded, added to the extraction which might be obtained from such waste, is equivalent to the cost of milling.

In the United States hand sorting is gradually being looked upon more favorably. The new plant of the Tonopah-Belmont installed ore-sorting belts from which 15 to 20 per cent. of waste is discarded at a cost of 68c. per ton of waste. At the Tonopah Mining Co. 11 per cent. of waste is discarded at a cost of 80c. per ton of waste. Hand sorting is also practiced to a large extent in Cripple Creek, Colo., and the Cœur d'Alene district of Idaho. At the North Star mine specimen ore is collected after blasting in the mines and is amalgamated in one battery at clean-up time or in Berdan pan.

Stamp Weight and Capacity

The increase in weight of stamps up to 2000 lb. apparently reached the limit in South Africa. The advantages claimed for the heavy stamps are a reduction in the initial capital expenditure in erecting a lesser number of stamps for the same capacity, a smaller building to contain them, less shafting, belts and other moving parts to maintain, and less labor for operating. It is estimated that the capital charge of a modern reduction plant per ton milled is but one-third of what it was 15 years ago. The Rand Central mill, which is the largest on the Rand, was designed for 1000 stamps weighing 1650 lb., 300 of which were started in March. The framework is of timber, whereas the framework at the City Deep has been made of reëinforced concrete, due to the high price of timber. The new mill of the City Deep contains 200 stamps weighing 2000 lb. This mill was designed to treat 20 tons per stamp, crushing through ⅜ in., but it is expected that a capacity of 24 tons will be obtained. To obtain this capacity by-pass screens preceding the stamps were installed. The undersize from these screens will go direct to the tube mills. The new Brakpan mill contains 160 stamps weighing 2004 pounds.

Some interesting experimenting[1] was done on the Rand at the City Deep mine, where four Nissen single stamps, weighing about 2000 lb., were operated side by side with two City Deep five-stamp batteries, each stamp of which weighed about 1800 lb., and indicated a saving of 2.6c. per ton for the Nissen stamps.

In the United States we have a few small mills operating stamps weighing 1400 lb. and over, but no large mills operating heavy stamps have been built. In Mexico the tendency is to adopt Rand practice, and the stamp weights are gradually increasing. At the Santa Gertrudis 1500-lb., and at the Providencia 1600-lb. stamps are used. At the Rosario mine in Honduras 20 stamps have been installed, weighing 1800 lb. In the Porcupine district of Ontario, the Dome Mining Co. is installing 1250-lb. stamps, and two mills of the Cobalt district, Ontario, are reported to contain 1500-lb. stamps.

---

*Consulting mining engineer, 42 Broadway, New York.

[1] Eng. and Min. Journ., Dec. 23, 1911.

Bypassing of Undersize

To increase further the capacity of stamps, screens are being introduced preceding the stamp mill, and the undersize from the screen is bypassed directly to the tube mill. On the East Rand, E. H. Johnston proved recently that 10 stamps weighing 1634 lb., together with one tube mill, will crush 26.1 tons per stamp in 24 hours by the introduction of a bypass for the fines, whereas 80 stamps weighing 1680 lb., together with 8 tube mills and no bypass, crushed only 20 tons per stamp. The introduction of the bypass was tried in 1905, but never carried into practice on a large scale.

Other Pulverizers and Combinations

The Giesecke mill, which is a combination of a ball mill and a tube mill revolving on the same trunnion, is being tested on the Rand by the Geldenhuis Estate. It resembles an ordinary tube mill with the exception of having two different-sized divisions. The first section, or ball mill, is 7 ft. 6 in. in diameter by 6 ft. long, and the second section, or tube mill, is 6 ft. in diameter and 18 ft. long. The feed to the mill comes directly from the crushers and should be about 1½ to 2 in., although it is built to receive a feed of 7-in. material. It is claimed by the manufacturers that one mill, in one operation, will do the work of 50 stamps and 2 tube mills. The tests have not been carried far enough to offer any positive opinion, but the final results from these tests will be looked forward to with much interest. If the results are favorable and the mill is introduced, it will eliminate amalgamation plates for ores containing no coarse gold. In Kalgoorlie ball mills are in use and have been most successful for crushing gold ores, and it is claimed by the operators that they show a much greater efficiency than stamps.

At Victor, Colo., the Ajax mill was designed along the lines advocated by Philip Argall, of Denver. The mill has a capacity of 200 tons and can be enlarged to 460 tons. The ore is broken to 1¼ in. and further reduced by rolls to ¼ in., thereby eliminating the stamps. The product from the rolls is fed to classifiers, from which the coarse is fed to tube mills and the overflow, together with the product from the tube mills, is then cyanided.

Chilean Mills Following Stamps

Chilean mills between the stamp and tube mills were introduced in the Goldfield Consolidated mill, Goldfield, Nev., and in a 10-stamp mill at Wonder, Nev. The results obtained by the Goldfield Consolidated mill have been published and can be summarized as follows: It was decided in 1909 to increase the capacity of the mill from 600 to 850 tons per day. Two schemes were considered. The first required the installation of 40 stamps, 3 tube mills and 25 concentrators, together with the enlargement of the building for increased floor space, and the building of heavy foundations. The time required for this installation would have been six months and the cost would have amounted to $175,000. The alternate scheme, which was adopted, consisted of the installation of six 6-ft. chilean mills between the stamps and tube mills, together with the necessary tables. The time required for this installation was three months and the cost amounted to $75,000. In the present flow sheet the discharge from the 4-mesh battery screen is conveyed to classifiers from which the coarse product is fed to chilean mills having a discharge screen of 16 mesh. The sands from this crushing are fed into the tube mills. Not only has the installation cost $100,000 less, but the cost of pulverizing is also slightly reduced, as will be seen from the following figures, when the stamps are crushing 8.5 tons per day through four mesh.

CRUSHING COSTS AT GOLDFIELD CONSOLIDATED

	Two-stage Reduction Cents	Three-stage Reduction Cents
Stamping	13.4	13.4
Chilean milling .. .	...	10.3
Tube milling	30.0	16.6
Total	43.4	40.3

The crushing installation of the Nevada Wonder mill consists of 10 stamps weighing 1400 lb. each and crushing through four mesh. The product from the stamps is fed to a spitzkasten from which the coarse is fed to one 6-ft. chilean mill crushing through 30 mesh. The products from the spitzkasten and chilean mill are fed to a Dorr classifier, from which the coarse is fed to one tube mill.

Amalgamation

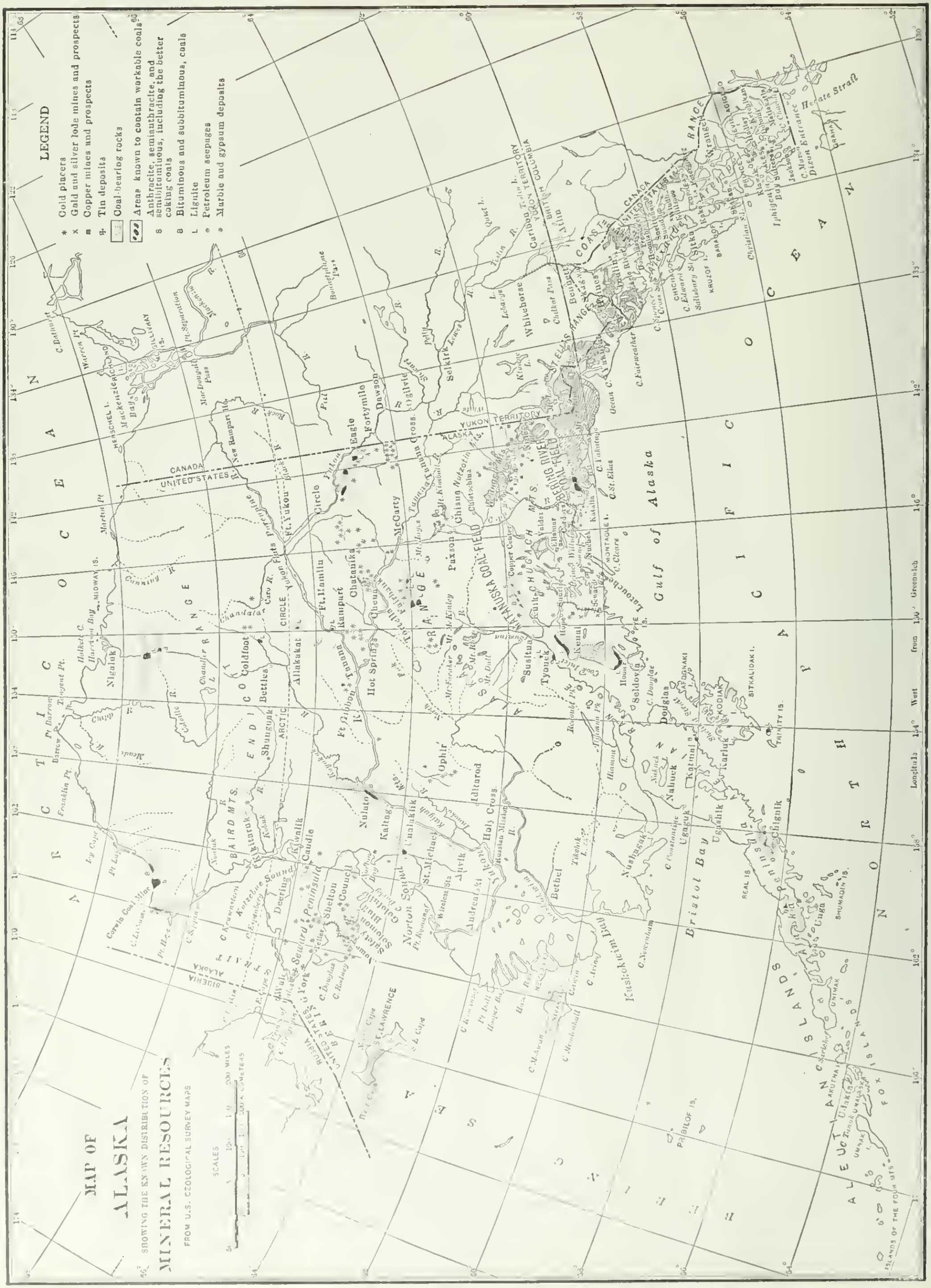
The suggestion was made to do away with amalgamation plates entirely in South Africa, pulverize the ore and cyanide direct. The objection to such a method would be the loss of coarse gold. There is a tendency to do away entirely with the apron plates, decrease the plate area and assemble the plates in a separate building together with the precipitating boxes for cyanide solutions. This building is known as the reduction house. The advantages of having the plates in a separate building are that there is freedom from grease and oil, that stamps do not have to be hung up while plates are being cleaned, and that there is less likelihood of amalgam being stolen. At the new mill of the City Deep, containing 200 stamps weighing 2000 lb., the ore, after preliminary sorting, breaking and stamping through 10 mesh, is pulverized in tube mills. The product from the tube mills is conducted to amalgamating tables in the gold recovery house. In this house are also placed the precipitating boxes for cyanide solutions.

At the Simmer Deep-Jupiter the opening in the battery screen was enlarged, the apron plates abandoned extra tube mills installed and the shaking plates replaced by stationary plates. The total plate area was decreased from 5276 sq. ft. to 1700 sq.ft.; the gold saved by amalgamation was 56.8% with the old arrangement and is 55.52% with the new arrangement The total extraction by the old arrangement was 93.38%, and with the new arrangement the recovery has increased to 94.23%. At the Robinson Deep 74% of the amalgamable gold is saved on plates following the stamps and 26% on plates following the tube mill. Of the total gold recovered 56% is saved on the apron plates, 19.5% on the tube-mill plates and 24.5% by cyaniding of the tailings.

At the Goldfield Consolidated mill of Nevada, apron plates were used for the ores obtained from near the surface, but as depth was obtained the character of the ore changed and apron plates were abandoned. The practice at the present time consists of concentrating the slimes from the tube mills and amalgamating the concentrates. The concentrates contain 72% of the gold contained in the ore, from which 20% can be recovered by amalgamation. The concentrates, after being passed over amalgamating plates, are given a special treatment. In Ontario the only large mill nearing completion is situated at the Dome mines in the Porcupine district. The specifications call for apron plates and plates following the tube mill.

Summary

Preliminary hand sorting is still being extensively practiced on the Rand and is becoming more in favor in the United States. The weight of stamps in South Africa was not increased but we find an increase in weight in Mexico. Experiments are being conducted on the Rand. to increase the crushing capacity per square foot of mill area. The Giesecke combined ball-and-tube mill and the advisability of screening the fines from the stamp-mill feed are being tested. In the United States chilean mills were introduced between the stamps and tube mills, thereby increasing the capacity and reducing the cost. In amalgamation, apron plates are being discarded and the coarse gold extracted on amalgamating plates following the tube mills.



MAP OF ALASKA

SHOWING THE KNOWN DISTRIBUTION OF MINERAL RESOURCES

FROM U.S. GEOLOGICAL SURVEY MAPS

Mining in Alaska in 1911

By Alfred H. Brooks[*]

The value of the total mineral output of Alaska in 1911 is estimated at $20,370,000, compared with $16,883,678 in 1910. The gold output in 1911 is estimated to be worth $17,150,000; that of 1910 was $16,126,749. It is estimated that the Alaska mines produced 22,900,000 lb. of copper in 1911, valued at about $2,830,000; in 1910 their output was 4,241,689 lb., valued at $538,695. The silver production in 1911 is estimated to have a value of $220,000, compared with $85,236 for 1910. The value of all other mineral products in 1911, including tin, marble, gypsum and coal, was about $170,000, an increase over that of 1910.

By using the above estimates for the output of 1911, the total value of Alaska's mineral production since 1880, when mining first began, is found to be, approximately, $206,600,000, of which $195,950,000 are represented by the value of the gold output. The total production of copper in Alaska since 1901, when systematic mining of this metal began, is about 56,700,000 lb., valued at about $8,170,000.

General Conditions Favorable

The favorable showing made by the Alaska mining industry during the year is due, first, to the large output of copper and, second, to the greater production, compared with 1910, of the gold placer mines in the Innoko-Iditarod region. Aside from the increased production, the most important event of the year was the opening of the Copper River region by the completion of the railway into it. The industries already stimulated by this line strikingly illustrate the importance of railway communication to Alaska. As no progress was made in the opening of the coal fields, the needs for cheap fuel in Alaska are being met by the substitution of oil-burning for coal-burning engines. The importation of California crude oil is rapidly increasing, with a corresponding decrease in the use of coal. Some new drilling was carried on in the Katalla oil field during 1911, one or two old wells being reopened and a small production made. The oil was refined and the gasoline sold in the local market.

Although most of the gold still comes from the placers, much progress was made during 1911 in paving the way for an increased output from auriferous lodes. This work was carried on in most of the gold-bearing areas of Alaska, but the most notable advances were in the Juneau, Valdez, Kenai Peninsula, Willow Creek and Fairbanks districts. Aside from the increase in copper mining, the advances made in developing lode gold mines are the most encouraging feature of the year's operations. Dredge mining also made great progress, notably in the Nome region. It is estimated that, in the entire territory, 22 dredges were operated for the whole or a part of the open season of 1911. In addition to those operated, at least six were in process of construction.

Transportation Facilities Increased

As improvement in transportation is the most important element in the advancement of the mining industry, the progress of the year in this respect will be briefly summarized. The Copper River & Northwestern Ry. was completed to Kennicott in April, 1911. There was no other railway construction in Alaska during the year, though some railway surveys were made. At the close of 1911 there were 465 miles of railway in the territory, compared with 371 miles in 1910. This mileage is distributed among nine different railways, from 5 to 196 miles in length. The existing lines emphasize the need of additional transportation facilities. The most urgent need is for a railway to connect an open port on the Pacific with the Yukon basin. Until such a line is built only the richest placers of the interior and only the most favorably situated lodes can be profitably operated.

Important New Trails

The Alaska Road Commission continued its important work of making mining districts accessible by the building of wagon roads and trails. Probably the most important undertaking of this kind was the completion of the winter trail from Seward, on the Pacific seaboard, to the Iditarod placer district. This not only serves several placer camps, but also shortens the winter route to Nome by about 300 miles. Work was also continued on the Valdez-Fairbanks trail, which can now be used both as a winter route and as a wagon road in summer. A cutoff was built which connects the wagon road with Chitina, on the railway.

Larger Production From Gold Lodes

It is estimated that there were 15 mines in Alaska which produced in 1911. Custom mills at Valdez, Chena, Fairbanks, Nome and Skagway were operated and milled ore from many prospects which can not yet be classed as productive mines. Some development work was done during 1911 on several hundred prospects widely distributed over the territory. The output from auriferous lodes in 1911 is believed to have been somewhat larger than that of 1910, which was valued at $4,105,459.

Auriferous lode mining was first attempted in the Ketchikan district about 12 years ago. Several conspicuous failures made at that time so discouraged operators that relatively little attention has since been paid to gold mining in this district. However, some development work has been continued, and in 1911 work was pushed on several properties near Dolomi and on Georges Inlet. The advances made in the Portland Canal region of British Columbia stimulated prospecting on the Alaska side of the boundary and within the Ketchikan district. Some encouraging results were reported in this field.

Juneau Center of Lode Mining

In point of production the Juneau district continues to be the center of the gold lode mining industry of the territory. In 1911 the Alaska-Juneau Co. began driving a 6000-ft. tunnel from lower Gold Creek, which by the use of a tram from the entrance of the tunnel will form an outlet for the mine to tidewater and permit operations throughout the year. The Treadwell group of mines and the Perseverance mine continued their normal activity. Work was continued at the Eagle River mine, and much systematic prospecting was accomplished in the region lying between the Juneau and Berners Bay districts. In the Berners Bay district work was done which will soon put both the Kensington and Jualin mines again on a productive basis.

The Chichagof and Golden Gate mines, in the Sitka district, each supplied ore to 10-stamp mills. The success of these two properties has stimulated the development of a number of prospects in the adjacent portions of Chichagof Island.

---

[*] Geologist in charge of Alaskan division, U. S. Geological Survey.

Note—Abstract of preliminary report to the director of U S Geological Survey.

PRINCE WILLIAM SOUND REGION

Gold lode prospecting and developing were active in the Prince William Sound region during 1911. Interest centered in the Port Valdez district, though much was accomplished in the McKinley Lake region near Cordova, and some promising prospects are said to have been found near Port Wells and Gravina Bay.

The gold-bearing region of Port Valdez, as defined by the prospecting already accomplished, stretches from Columbia Glacier on the west to the east side of the Valdez Glacier on the east, a distance of about 20 miles. It can be roughly blocked out on the north by a line paralleling the axis of the inlet and three to five miles from tidewater and on the south by a similar line from one to two miles from tidewater. Some gold-bearing veins have, however, also been found to the east of the above-described boundary, in the vicinity of the Valdez-Fairbanks trail, and the Port Wells prospects lie in what may be a western extension of the same belt. Most of the important development work in the region has been confined to the vicinity adjacent to Shoup Bay, to Mineral Creek, and to the west side of Valdez Glacier.

The bedrock consists of closely folded and faulted slates and graywackes, with some quartzites, cut by a few porphyry dikes. Well-defined fissures are not uncommon in the district, and some of them carry the metalliferous quartz veins which furnish the orebodies now being prospected. Fissuring seems to be especially marked in the Shoup Bay region, where two systems were noted. Besides the fissure veins there is a larger number of stringers, some of which carry high gold content. The vein filling consists chiefly of quartz. The most abundant metallic minerals are pyrite, galena and free gold. In most places there is marked surface enrichment in gold content, but this does not usually extend to a depth of more than a few feet. It seems improbable that the grade of ore found below this superficial zone will continue in depth.

The Cliff is the only productive mine yet developed in the district, but a score or more of other properties have produced some ore that has been milled at Valdez. A depth of 100 ft. below tidewater has been reached in the Cliff mine, with, as reported, no marked changes in grade.

DEVELOPMENTS IN KENAI PENINSULA

The year 1911 witnessed much activity in the prospecting and developing of gold lodes in Kenai Peninsula. The bedrock of this field is similar to that of the Port Valdez district, being composed of closely folded and faulted slates and graywackes cut by porphyry dikes. As much of the bedrock is mantled by vegetation or alluvial deposits, less information regarding the fissuring is available than in the Port Valdez district, but some well-defined fissure veins have been uncovered. Quartz, with some calcite, forms the chief vein filling, and the dominating metallic minerals are pyrite, arsenopyrite and free gold. Another form of deposit is found in the mineralized porphyry dikes. These are fractured and permeated by quartz and calcite veins, and the dike rock itself is in places heavily charged with pyrite. In 1911 a 5-stamp mill was installed on the property of the Kenai Alaska Gold Co. and a 3-stamp mill on the property of the California Alaska Mining Co. The smaller mill appears to have been utilized only in prospecting, but the larger one was operated for a part of the summer. Considerable development work was also accomplished on a number of other properties, notably on some near Seward, at the head of Kenai Lake, and on Crow Creek.

In the Willow Creek district of the Susitna Valley there were two productive lode gold properties, the Gold Bullion and the Alaska Gold Quartz. Development work was done on three other properties. The claims of three companies, the Gold Bullion Co., the Alaska Gold Quartz Mining Co. and the Brooklyn Development Co., were surveyed for patent, aand preliminary surveys were made on other properties. Considerable prospecting was also done on other claims. An average of about 50 men was employed in the district during the summer. Five 1000-lb. stamps were added to the 2-stamp mill in use at the Gold Bullion mine in 1910. A 3-stamp mill with 500-lb. stamps, driven by a Pelton waterwheel, was erected on the property of the Alaska Gold Quartz Mining Co. Aerial tramways were installed on both these properties

Lode gold mining advanced but little in southwestern Alaska during 1911. The Apollo mine, on Unga Island, was operated during the summer and some developments were made on other properties in the vicinity. Some veins were also prospected on Afognak Island, near Malina Bay.

THE FAIRBANKS DISTRICT

Much work was done during the year on lode gold properties in the Fairbanks district. Many of these shipped ore from development to the custom mills at Chena and Fairbanks, and it is estimated that over $50,000 worth of gold was recovered from this source. Late in the summer small stamp mills were installed on the Free Gold and Tolovana properties, in the upper Cleary Creek basin, and on the Newsboy, which is situated near the divide between Eldorado and Cleary Creeks. Although claims were staked and more or less prospecting was done during the year in much of the Fairbanks district, the most important developments were confined to certain areas. These will be mentioned in geographic order from east to west.

A more or less ill-defined belt parallels Fairbanks Creek. In this belt the most easterly prospect reported is on Coffee Dome, where a vein is reported to be 18 in. wide. A 50-ft. shaft, showing 3 ft. of ore is said to have been sunk on the Eureka claim, and work was continued on the McCarty Creek vein. Both these properties produced some ore, which was milled at Chena. A 30-ft. shaft, in which a vein 1 ft. wide is reported to have been exposed, was sunk on the Governor claim, situated in the upper Fairbanks Creek basin.

To the west the Fairbanks Creek belt merges with a second center of mineralization, which lies on the divide between Fairbanks and Cleary Creeks. An adit tunnel was driven on the Russian Kid claim, at the head of Wolf Creek, for about 300 ft. to intersect a vein which outcrops higher on the hill. Though at last reports the adit had not reached the main vein, a rich stringer was crosscut. On the adjacent Rexall claim a vein was crosscut at a distance of 127 ft., then followed for about 52 ft. This vein is said to be from 8 in. to 2 ft. 10 in. wide, and the ore recovered was shipped to the Chena mill. A new vein about 18 in. wide is said to have been found not far from this region.

CLEARY CREEK REGION

A third zone of mineralization is that defined by numerous properties situated in the headwater region of Cleary Creek. Among the important developments were those at the Gold Bullion mine, which was operated for most of the year. Here a 5-stamp mill was installed in September, before which the ore had been treated at the custom mill. The Tanana Quartz Hydraulic Co. is opening what is said to be an extension of the same vein. Here a 100-ft. shaft was sunk and the ore followed by a 20-ft. drift. The vein is said to range from 10 in. to 7 ft. in width. A 4-ft. vein is also reported to have been stripped on this property. This work, as well as that done on the Free Gold, shows that faulting is not uncommon. A small mill was installed at the Tolovana property, which lies in the same belt. An adit tunnel was also driven on a claim near the junction of Rex and Chatham Creeks, and a 4-ft. vein is said to have been exposed. Skoogy Gulch, on the Pedro Creek side of the divide, has been the scene of considerable development work. The reports indicate that the most important advances in this field were those on the Rainbow claim. A 45-ft. shaft was sunk on a vein said to be 2½ ft. wide. Considerable ore was shipped to the Chena mill from this property.

In 1911 some discoveries of gold-bearing quartz were made in the divide between Cleary and Eldorado Creeks. Here the Newsboy property was developed by a shaft 112 ft. deep and the vein was followed by drifts on two levels. An air compressor and a 5-stamp mill were installed on this property in the late summer, before which considerable ore had been shipped to Chena. Some work was also done on claims situated near the divide between Dome and Cleary Creeks. A 78-ft. shaft was sunk on the Friederichs property. A 370-ft. tunnel and 100-ft. shaft were put down by the Reliance Mining Co., and are reported to have opened a 7-ft. vein. The Ryan vein, situated near the divide between St. Patrick and Eva Creeks in the western part of the Fairbanks district, marks a new center of lode-mining development. This vein has been opened by a 45-ft. shaft, said to have revealed a thickness of 3 ft. of vein matter.

COPPER MINING INCREASES

Copper mining in Alaska received an enormous impetus in 1911, due chiefly to the activity in the Prince William Sound region and the Kotsina-Chitina belt. The production was more than five times that of 1910. In the Ketchikan district productive mining was continued in the Mount Andrew, It, Rush & Brown and Jumbo mines during 1911. The Red Wing mine was equipped with a compressor and drills and preparations were made to begin shipping ore. Considerable development work was done on the Victory property, near Seal Bay.

Of the Prince William Sound properties the Beatson-Bonanza and Ellamar were operated on a productive basis throughout the year. Some shipments were also made from the Threeman property, on Landlocked Bay. This mine has been systematically developed on three levels, and the completion of a new wharf in 1911 places it in a position to become a regular producer. The Fidalgo Bay Copper Mining Co. has also arrived at the stage of shipment, an aerial tram having been completed from mine to wharf in 1911. The Seattle-Alaska Copper Co. installed a concentrating plant at its mine on Latouche Island, which has been developed by an adit said to crosscut the orebody 400 ft. below the outcrop. Some developments were also made on the Barrack Girdwood claims on Latouche Island. The Knight Island Copper Co., at its property near Drye Bay, installed an air compressor and drove two tunnels in which an orebody said to be 12 ft. wide is exposed at a depth of 85 ft. below the outcrop.

IMPROVED TRANSPORTATION

The improved transportation facilities furnished by the Copper River Ry. led to more development work on copper properties in the Kotsina-Chitina region than in any previous year, but details in regard to this work are lacking at present. The shipping of ore from the Bonanza mine began in April and continued throughout the rest of the year. A plant was installed at the end of the railway for concentrating the lower-grade ores of the talus slope at the Bonanza mine. Much development work was done on the Mother Lode property, which is on the McCarty Creek side of the Bonanza divide, and a large body of high-grade ore is said to have been blocked out. Systematic development work was also undertaken at the Nikolai property, also in the McCarty Creek basin. At Copper Mountain, near the western end of the belt, the orebody was crosscut at a depth of 1000 ft. below the outcrop. It appears that developments in this vicinity have been sufficient to block out a large amount of ore, and the depth to which the lode has been traced is an encouraging feature, indicative of the permanency of at least some of the ores in this part of Alaska.

TIN RECOVERED BY DREDGING

There was much mining activity in the York tin-bearing district of Seward Peninsula during 1911. The tin placers of Buck Creek have been worked in a small way for nearly 10 years. In 1911 these operations gave way to dredging. A dredge with 2½-ft. buckets was installed about the middle of September and operated until the close of the season. According to current reports, between 80 and 100 tons of concentrates were recovered in this way. It is reported that new drifting on the Lost River and Cape Mountain cassiterite-bearing lodes met with encouraging results.

PLACER YIELDS NEARLY $13,000,000

The value of the output of the gold placers of Alaska in 1911 is estimated at about $12,700,000; the corresponding value in 1910 was $11,985,000. This increase in 1911 is to be credited to the Iditarod-Innoko region, for the output from both the Fairbanks and Seward Peninsula districts was less than in 1910. Placer mining is a relatively unimportant industry in the Pacific coast region of Alaska. In 1911 one placer mine was operated on Gold Creek, near Juneau, and several in the Porcupine district, north of Lynn Canal. Beach mining occupies the time of from 25 to 50 men during part of each summer at Yakataga, east of Controller Bay, and at several places in southwestern Alaska. Some new beach diggings are reported to have been discovered near Uyak, on Kodiak Island, during the year. Two hydraulic plants and several smaller outfits were employed in placer mining in the Nizina district. About 20 claims were worked in the Chisna district. A hydraulic plant was installed on Chisna River and considerable drilling was done to test placer ground in other parts of this field.

No noteworthy advances were made in the mining of Kenai Peninsula placers. The discovery in 1910 of gold-bearing gravels near the head of Kenai River was followed by the staking of practically the entire length of the river as possible dredging ground. In 1911 a small dredge was installed below Copper Creek, but it appears to have given unsatisfactory results. The installation of a large dredge, started during the summer, was not completed at the end of the season. Hydraulic plants were in operation on Crow, Resurrection, Canyon, Gulch, Quartz, Cooper, Mills and Sixmile Creeks. On Cooper Creek a Ruble elevator was in use.

PROSPEROUS SEASON IN SUSITNA BASIN

The Yentna district of the Susitna Basin, where about 100 men were employed, had a more prosperous season than usual, although the shortage of water during the latter half of the summer somewhat cut down the production. Most of the gold output came from Cache and Peters Creeks and their tributaries. The largest production in 1911, as in 1910, was from Nugget and Willow Creeks, although the discovery of an old channel in the bench of Dollar Creek placed that stream among the important producers of the district and gives promise of a still larger output for 1912. Mining operations were continued in the basins of Twin and Mill Creeks. Some excitement was caused late in the summer by the discovery of coarse gold on Lewis Creek, a tributary of Theodore River, on the west side of the Susitna Mountain. The creek was visited by a number of men, and most of it was staked, but the lateness of the season prevented a thorough prospecting of this valley.

Placer mining continued in a small way on Valdez Creek during 1911. The most important event of the year was the consolidation of a group of claims, with a purpose of their development as a single unit. Preliminary steps were taken looking to the installation of a large hydraulic plant.

Fairbanks Leads in Placer Mining

Fairbanks continues to lead all the other Yukon camps in placer gold mining, though the output of 1911 was considerably less than that of the previous year. The most important advancement of the year was the installation of a dredge on upper Fairbanks Creek, the first dredge in this district, though plans have been made for others. Mining operations were somewhat hampered in June and July by the lack of men, due to the stampede to Ruby Creek. The water supply was, as usual, inadequate, and this condition was probably of more serious consequence than in the previous year. Goldstream, Engineer, lower Cleary, and Fairbanks Creeks were the principal producers. It is estimated that about 75 claims were worked in the winter and about 124 claims in the summer of 1911, and that from 900 to 1200 men were employed.

Circle District Second

Of the Yukon camps Circle was second in importance as a gold producer. Three hydraulic plants, all on Mastodon Creek, were installed in this district during the summer of 1911. All these suffered for lack of water and operated only a part of the season. In addition to this, the two existing hydraulic plants on Eagle and Mammoth Creeks were operated so far as water permitted. The principal producing creeks were Mastodon, Deadwood, Mammoth, Eagle, Independence and Switch. It is estimated that in the Circle district 29 claims were worked during the winter and 37 claims during the summer of 1911. In the Beaver Creek region no important advances were made. The best prospects in this basin are said to be those on Ophir Creek.

Smaller Yukon Districts

The Hot Spring district had a successful season. The mines in the Sullivan Creek region had the largest production. Some new placer ground was discovered on American Creek, 15 miles west of Sullivan. Mining continued to yield about a normal production in the Koyukuk, Rampart, Salchaket and Bonnifield districts.

Two dredges were successfully operated in the Fortymile region. One on Walkers Fork worked the entire open season; the other, situated on the South Fork, 3 miles below Franklin, began operations about July 1. The latter had been moved from Walkers Fork to its present site during the winter. The smaller operators were hampered during the summer by lack of water, and the Ruby Creek excitement carried many men away from the district. A large ditch was under construction at Dome Creek. It is estimated that in the Fortymile district proper about 115 men were working on 35 claims during the winter and 90 men, including those engaged in dead work, on 15 or 20 claims in the summer.

Mining was continued in a small way in the region tributary to Eagle, which includes the American, Mission and Seventymile basins. It is estimated that winter work was done on 20 claims by the same number of men, and summer mining on 19 claims by 30 men.

New Placer Districts

In the summer of 1911 some placer gold was found near Red Mountain, on the headwaters of Indian River, which is in the Koyukuk River drainage basin. There are said to be about 50 men prospecting in this region, and a little placer gold was mined. The auriferous gravels of the Nowitna River region also excited some interest in 1911, though no important discoveries were reported.

The Ruby Creek region of the Yukon attracted renewed interest in 1911. Ruby Creek is a small stream flowing into the Yukon from the south opposite the mouth of Melozitna River, about 200 miles below the Tanana. Gold was found in the Ruby Creek gravels in 1907, and since then there has been a little productive mining each year. Considerable excitement was caused among the Yukon miners by the reported discoveries during the summer of 1911 of rich placers in some creeks situated in this general region and from 20 to 30 miles from the Yukon. As a consequence, there was a general movement toward the new find from the Yukon camps. These discoveries of placer gold were made in the headwater regions of Solatna River, which heads on the south side of the Ruby Creek divide and flows northeastward to join the Nowitna, a southerly tributary of the Yukon. The creeks reported to carry gold are Glenn and Birch, both tributary to Flint Creek, and Long Creek.

It is known that there is a considerable area lying south of the Yukon, in which the bedrock is the schist and intrusive granite typical of most of the Yukon placer districts, and that alluvial gold has been found at a number of places within this area. This region is one, therefore, worthy of careful attention on the part of the prospector.

Iditarod-Innoko Yield

Little detailed information is available regarding the season's operations in the Iditarod-Innoko region. It is reported that the total gold production for 1911 is worth $3,500,000, compared with $800,000 for the previous year. It appears that much of the gold produced was from the Flat, Otter, Willow, Happy and Chicken Creek basins, in the region tributary to the town of Iditarod, and that in this field some work was also done on Black, Little and other creeks.

On the Kuskokwim side of the divide, including the Georgetown and Tokatna regions, Julien and Moore creeks were reported to be the scenes of the most important mining and it is said that gold placers have also been found on Doulin, Crooked, Beaver, Marietta and Michigan creeks. In the Innoko region Ganes and Little creeks are said to have been the chief producers. There was much prospecting during 1911 in the lower Kuskokwim region. Mining continued in a small way on Tuluksuk Creek, and it is reported that some promising finds of gold placers had been made near Goodnews Bay.

Dredging in Seward Peninsula

The gold production of Seward Peninsula for 1911 is estimated to be worth $3,100,000; that of 1910 had a value of $3,500,000. In view of the fact that the winter operations of 1910 produced almost $1,000,000 worth of gold, while those of 1911 probably had a value of less than $200,000, the output of the summer was far greater than in the preceding year. It seems probable, therefore, that the peninsula may have reached its minimum gold production for some time to come.

As in 1910, the important feature of the mining industry was the building and operating of dredges. Nineteen dredges were operated for a part or the whole of the season, of which five were built during the summer of 1911. Of these, seven were in the Nome region, seven in the Solomon River basin and five in the Council district. In addition to these, five more dredges were in process of construction, of which three are in the Nome region and one each in the Council and Kougarok districts. While dredging was the most important industry, other phases of mining were not neglected. A number of hydraulic plants were operated in the Kougarok, Nome and Fairhaven precincts, and there were in the aggregate many small plants in operation. An important feature of the year's mining was the fact that a large number of the dredges continued operations until the first week in November.

Interest in the Kobuk region appears to have subsided somewhat. A number of claims were worked in the Squirrel River region, but, so far as known, no new discoveries of importance were made. There was a little mining in the Shungnak region of the upper Kobuk and a $600 nugget was found on Dahl Creek.

Metal Mining in Colorado in 1911

By George E. Collins*

The history of mining in 1911 throughout the State of Colorado was comparatively uneventful. No bonanza discovery was recorded, and the most important new developments were the continued opening up of bodies of zinc-carbonate ore at Leadville, and the completion of the Roosevelt drainage tunnel, which is bound in time to exert a great effect in the Cripple Creek district.

GOLD AND SILVER

Cripple Creek retains its position of undisputed primacy in the production of gold, and is likely to do so for many years to come. The greatest mines are those which have held the lead for several years past; namely, the Golden Cycle, Portland, Vindicator, Elkton and El Paso. The Golden Cycle has displaced the Portland as the premier producer, and it is generally understood that it has by far the largest ore reserves. A special dividend of a million and a half dollars was recently declared, but this may have some relation to the announcement that a suit has been brought against the Golden Cycle by the Christmas Mining Co., the control of which is held by the Vindicator. It is claimed that the Christmas contains the apex of one of the most extensive orebodies now being worked in the Golden Cycle. There is no change in the milling situation at Cripple Creek, excepting that the cyanide process has virtually displaced the chlorination method, both for the treatment of high-grade and low-grade ores.

Reports are current that the plant of United States Reduction & Refining Co. will be acquired by the Golden Cycle company. Meantime, the mill has been closed, the reason given being the difficulty of obtaining a sufficient ore supply in competition with the Golden Cycle and Portland mills. For the handling of material from the dumps, raw cyaniding, preceded by concentration, is a proved success at the Stratton's Independence and Portland mills. At the Ajax a new mill, employing the Clancy method, is being completed, and its results will be looked forward to with deep interest.

SMUGGLER-UNION WILL WORK ZINC ORES

In the San Juan district, San Miguel County continues active. The Liberty Bell, Smuggler-Union and Tomboy each maintains a large production. The Smuggler-Union has, however, seen its best days, and will in the future have to depend for its output largely on dumps and old stope-fillings. The vein contains considerable zinc, especially in the lower levels, and the Smuggler mill is in process of being remodeled, with a view to saving this. The life of the Tomboy will probably be greatly extended by the recent purchase from the Revenue company of the Montana group of claims, which will be worked through the Ophir tunnel, and the ore trammed direct to the Tomboy mill. At Ouray the large production during recent years has been furnished almost entirely by the Camp Bird, which is now practically exhausted. The outlook for this district is, therefore, somewhat unpromising. It is indeed probable that many other bonanza mines will be developed, but they have yet to be found.

In the Silverton district the Sunnyside is now the only large producer of gold. The Gold King and Iowa are being operated only in a small way by leasing companies. The continuation of the large orebodies formerly worked in the Gold King, which were cut off by faulting, has not been found. In the southeastern part of San Juan County, and in the Bear Creek district, a number of veins have been opened up carrying gold and silver in the form of tellurides. Experiments indicate that these can best be treated by modifications of the cyanide process, preceded in most cases by wet concentration. The main drawback is that the orebodies at present exposed are relatively small, but the grade is often high, and but for the difficulties in transport, due to severe winter climate and rugged topography, it is probable that cyanide custom mills would have been built before now.

Several promising discoveries of high-grade ore are reported from the La Plata district, but its output has been restricted by the inactivity of the Idaho and May Day, which are still engaged in litigation. The Neglected mine is practically idle, awaiting some comprehensive plan of reorganization.

The Creede and Aspen districts continue to make a large production of silver. In the latter the consolidated Smuggler and A. J. properties have been unwatered through the Free Silver shaft, and the management has been transferred to W. W. Davis and John Campion, well known in connection with the Yak tunnel, at Leadville.

NEWHOUSE TUNNEL DRAINS LARGE AREA

In Gilpin County the expected revival has been delayed, owing largely to the exhaustion of the resources of the local mining men, in consequence of the long period of stagnation and the difficulty of raising capital outside under present conditions. Work on the Gregory-Bobtail group is entirely suspended, and this great property is advertised for sale in the United States bankruptcy court. Meantime, the water has not risen as high as was feared, and it seems evident that it is carried off to some extent, at least, through the Newhouse tunnel. The latter has drained the Gunnell, and partially all the other mines north of Nevada Gulch, while its influence has been felt for a great distance along an east-west line in the direction of Black Hawk. The Quartz Hill mines are, however, practically unaffected, and will doubtless continue so until some lateral is made from the tunnel toward the west, so as to cut the California watercourse. The largest producer has been the Frontenac, the new concentrating plant of this company having commenced operations early in the year, while good ore is said to have been opened up in the Topeka.

In Clear Creek County the bulk of the production has been made by lessees. The largest producers were the Gem and Bellman, worked through the Argo (Newhouse) and Central tunnels, respectively, and situated on the same fissure. The continuation of the same line of fissure has just been intersected in the Lucania tunnel, where it is understood that extensive bodies of mineral were found. At Georgetown tributers have been busy in the Capital property on the Aetna vein. As a whole, however, the industry is distinctly depressed in this district.

PROFITABLE DREDGING OPERATIONS NEAR BRECKENRIDGE

At Breckenridge the Revett and Reiling dredges, on French Gulch, were actively and profitably operated, and the large dredge on the Swan, operated by the Colorado Gold Dredging Co., was also kept at work. A steam-shovel plant was installed to operate the Buffalo placers in this district, with what commercial result is not known. The Twin Lakes placer, near Granite, has been idle, and its future operation is likely to be hampered by opposition of those owning water rights on the Arkansas River. The other placers in Colorado have been unproductive; but plans have been made for reworking on a large scale some of the alluvial ground near Fairplay. The discovery of placer gold in commercial quantity is reported at Newlin's Gulch, near Denver.

---

*Consulting mining engineer, Boston Block, Denver, Colo.

Lead and Zinc

It is believed that the lead production of the state continued to decrease, and it is hardly probable that any great development of lead ore can be looked for at present. The production of zinc has, however, increased, owing to the important discoveries of zinc carbonate at Leadville, previously referred to. These discoveries were made during the preceding year but have only now begun fully to show their effect on the production. No great extension has yet been added to the productive area, which still centers in the Wolf Tone, Maid of Erin, Morning Star and Evening Star. So far, there is only a market for such ores when they contain over 30% of zinc. It is, however, certain that Leadville has great resources in zinc-carbonate ores of much lower grade, running from 15 to 30%, which at present are awaiting some method of utilization.

The largest aggregate production of lead is made in the San Juan, particularly at Silverton. Here the chief individual producing mines are the Iowa, previously referred to, and the Silver Lake, which is now being operated again on a small scale by the owners. Considerable bodies of mixed lead-zinc ore have been opened up in the Silver Ledge. At Telluride the Alta is a large producer of lead ore.

Aspen continues to produce a large tonnage of low-grade silver-bearing lead ore. The same may be said of Creede, where the various claims along the Amethyst vein are actively producing lead-zinc concentrating ores, and where a project is under way to sink below the tunnel level. The principal lead resources of the state are intimately associated with zinc, and usually also with pyrite. Such mixed-sulphide ores are capable of making a great aggregate production, the chief difficulty being that most of the individual mines are small, and therefore do not warrant the provision of the elaborate separating plant necessary to produce marketable products. Large orebodies of this character exist in the Iron Mask and other mines at Red Cliff; and the Wellington mine at Breckenridge may also be cited as a case where complex lead-zinc ores are being treated successfully. Other important deposits occur at Rico, at the Mary Murphy, in Chaffee County, and many other localities scattered throughout the state. At Bonanza a deep tunnel is being driven to unwater and develop in depth the Rawley mine, which promises to become a considerable factor in the lead output.

Copper

There has been no change in the output of copper, the production of which continues to be incidental to the mining of other metals, and particularly of gold and silver. A number of small producers of purely copper ores may, however, be noted in the San Juan. The principal of these, the Frank Hough, has been idle throughout the year on account of the destruction by fire of its surface equipment. It is probable that this mine will be reopened by tunneling through Engineer Mountain during the coming year. The greatest production, however, is at Leadville, where copper occurs intermixed with the well known complex sulphides of that district.

Rare Metals

The falling off of the demand for tungsten concentrate, due to the depression in the steel market, occasioned a sharp fall in the prices paid, which was followed by a great diminution in the activity of mining for this metal in Boulder County. No production of tungsten was made in the San Juan, or in the other known localities throughout the state, the occurrence in every case outside of Boulder County being pockety and uncertain. A little uranium ore (pitchblende) has been mined in Gilpin County, where occasional lenses of this mineral are found, associated with gold ore, in a belt of country on either side of the western part of Quartz Hill. In San Miguel County the mill at Newmire, now owned by the Primos Chemical Co., kept steadily at work treating the vanadiferous sandstone of that district, while an active market has existed for the uranium- and vanadium-bearing sandstone, impregnated with carnotite, from the neighborhood of Paradox Valley. Several teams were kept continuously busy hauling ore from the latter district to the railroad, and many claims are reported recently to have changed hands. There is, however, little accurate information available with reference to these deposits, or the market for the ore.

General Conditions

The labor situation remains unchanged. There is, if anything, a gradual increase in efficiency, as the supply of miners overtakes the demand, and especially because the Western Federation of Miners is less active. It will, however, take many years before mining labor generally will be as efficient as it was previous to 1900. The older districts, such as Gilpin and Clear Creek Counties, where no important improvements in mining methods or ore treatment have yet been evolved to counter-balance the higher underground costs, have been the greatest sufferers in this respect.

In October a great blow was struck at the prosperity of the San Juan region, and particularly the Silverton and Rico districts, by a destructive flood, which destroyed many miles of the Denver & Rio Grande and Rio Grande Southern railroad tracks. Railroad communication with Durango and Silverton is now restored; but the road between Durango and Rico is still blocked. The railway blockade necessitated the temporary closing of the Durango smeltery, and of such of the mines as are dependent on coal for power. The experience of the last few years has shown conclusively that the economic bearing of such recurring disasters has hitherto been under-estimated.

Apart from Leadville, the only district in which increased activity may be looked for in the near future in Cripple Creek. The Roosevelt drainage tunnel has not relieved the deep mines of their water quite so rapidly as was hoped by the more sanguine operators; and it appears that the volcanic plug is less permeable in depth, the water discharge being more confined to definite channels. The total quantity of water, on the other hand, as estimated from the amount discharged in proportion to the rate of recession of the water-level in the mines, is less than was estimated. The lowest levels of the El Paso, Elkton, Portland and other mines are becoming accessible for the first time since 1907. Even if it proves correct, that the orebodies at great depth are on the whole fewer than at surface, it is probable that the production from those already proved, together with the encouragement to prospecting which will follow the liberation of large sums of money in dividends, will together suffice to maintain the production of the district at or above the present level for several years.

The greatest need of Colorado is vigorous prospecting; and a praiseworthy attempt was made, by a committee appointed by the Denver Chamber of Commerce, to stimulate this. A fund was raised to grubstake prospectors, who were outfitted and sent into the hills. As a result, a large number of claims have been located, from several of which encouraging assays are reported. One-half interest in the claims was reserved by the Chamber, and a development company is now being organized under its auspices to develop them. It need hardly be pointed out that the expenditure of a few thousand dollars to grubstake prospectors is a mere drop in the bucket, and nobody realizes this better than some of the gentlemen who gave their gratuitous services to organize the work. The greatest value of the undertaking will doubtless be in the direction of legitimate advertising; and it is very probable that the Chamber's venture may be the indirect means of stimulating a really noteworthy increase of interest in prospecting. The great difficulty—that of finding competent prospectors—still remains. Prospecting is a rough life at the best, fuller of hardships than rewards; and it is probable that the prospector, like the pioneer, belongs to a vanishing race.

New Mexico in 1911

Special Correspondence

The chief interest in mining in New Mexico in 1911 centered in the developments at the mine and mill of the Chino Copper Co. On Oct. 21, the first section of the mill at Hurley, about 10 miles from the mine at Santa Rita, was placed in commission, after several years of continuous and well directed mine development and mill construction. The mine is by no means a new one, having been worked in former years under the name of the Santa Rita. While the ore is a "porphyry ore," it differs in some respects from that found in the other "porphyry" properties. The successful development of the mine has been largely due to John M. Sully, now manager of the company, who made a minute study of the peculiarities of the deposits, over a period of about seven years. Up to October there had been developed approximately 50,000,000 tons of 2.3% copper ore, of which a large percentage is capable of removal by steam shovels. In October, also, there were five large shovels at work preparing the property to supply the mill.

During the first four weeks that the mill was in operation it was reported that the average extraction amounted to 66% on oxidized surface ores running between 2.5 and 3% copper. One unit of 750 tons per day capacity was used. The original plans for the mill called for three sections, of 1000 tons daily capacity each. Two additional sections are contemplated but have not been started. It is expected that transportation to the mill will amount to 10c. per ton and that copper can be produced for 8c. per lb. The orebody is well adapted to steam shoveling, there is ample dumping ground available near the mine and there is a good labor supply at moderate wages. In consideration of these factors and the results of the Nevada Consolidated company, it is not unlikely that the prediction as to ultimate costs will be realized.

Mogollon District

Development and mining in the Mogollons continued and new installations were made at some of the properties. At the Ernestine, some new stamps were added; and at the Socorro and several other plants De La Vergne oil engines were placed in use, owing to the high cost of power from wood fuel, which is becoming scarcer each year. No unusual discoveries of new orebodies were recorded, but development continued to open about the average grade of ore in most of the mines.

The Deadwood mill handled a quantity of custom ores in addition to its own product. During the year an option was given on the Ernestine property to A. Chester Beatty, of New York, and other Eastern men. This expired in December and it is stated that nothing resulted from the negotiations.

The Republic or Union iron mines of the Colorado Fuel & Iron Co., about halfway between Hanover and Fierro, in Grant County, continued to produce steadily throughout 1911. The iron ore outcrops as magnetite mixed with a little limonite and it has been worked in previous years mostly in opencuts by quarrying. Some underground stoping has also been done in the past.

Mining in California in 1911

By Lewis H. Eddy*

The value of gold produced in California in 1911 is conservatively estimated at $20,800,000; an increase over 1910 of more than $1,000,000, of which approximately 75% was due to the increased output of the gold dredges, the balance chiefly to advancement in quartz mining. That the quartz mines did not show a larger increase is due to the fact that the greater effort was directed to the development of new orebodies in established mines and the exploiting of prospective mines. Large amounts of money were expended in this class of development and in the installation of modern machinery. The reopening of old mines in most instances proved the wisdom of the undertaking. These features of advancement in quartz mining were particularly notable in Nevada and Sierra Counties and in several counties of the Mother Lode district. In Nevada County the North Star Mines Co. took over the old Champion group, and under the management of A. D. Foote exploited new ground, repaired and enlarged the Champion shaft to be employed as the central working and pumping shaft, installed an electric pump that will handle all the water from five separate shafts; new roads were built, old ones repaired, and other improvements made. The mine will be thoroughly developed before the milling capacity is increased. The working force was increased to 175 men. It is reported that the North Star will exceed $1,000,000 output for the year; the company devoted some attention to other districts, including Nevada City and Alleghany. The Empire mine installed a modern 100-ton cyanide plant, took over on lease the Pennsylvania and W. Y. O. D. mines, and began the work of extensive development and installation of machinery. Other active advancement in 1911 includes the Sultana, Cassidy, Cedar Hill, Mountaineer, Coan, and numerous small mines. The Alleghany district in Sierra County near the Nevada County line came into particular prominence through the taking over of the Tightner and Red Star by J. M. O'Brien of San Francisco. These properties have been developed under the management of C. Derby and Lawrence Y. Wagner, consulting engineer. A new electric plant, and compressor and 10-stamp mill were installed. In the course of development the property produced about $100,000, and employed 35 men. The Plumbago, one of the oldest producers, increased its production and started a new shaft. A mill and machinery were installed at the Independence. The Caeser began operation in November and prepared for installation of a new compressor.

Use of Electric Power

The dividend-paying mines on the Mother Lode continued to pay during 1911 besides making extensive and costly improvements, and directing the main effort to the opening of new orebodies and proving others. The attractive feature in this district was the completion of the installation of electric power, new hoists, and added milling capacity. The Bunker Hill, South

---

*2218 Peralta St., Oakland, Calif.

Eureka, Central Eureka and Argonaut completed electrical installations, while the Kennedy and the Zeila hoisted with steam, though the Zeila mill ran by electric power. In all the important installations during 1911 in this district, electricity was employed, and some of the smaller mines also discarded steam or water power. Reopening of old producing mines in all instances proved well, and resulted in taking over old properties with the evident purpose of practical and extensive development. Notable among these were the Plymouth Consolidated in Amador County where preparations were made in December for the installation of modern machinery by Bewick, Moreing & Co., the Georgia Slide in Eldorado County, by Sacramento men who installed machinery and did extensive development work; the Lightner in Calaveras County which did extensive development, made improvements, and paid a large amount of the purchase price. The Lincoln and the Lucky Baldwin are among the prominent old mines that were reopened. These mines mentioned are typical of the district and briefly illustrate the activity in that branch of development. The demand for electric power induced the construction of a new power line by the Pacific Gas & Electric Co. extending from Electra to Sutter Creek, which will supplement the old line.

The activity in development was not confined to the Nevada-Sierra region and the Mother Lode, but extended to nearly all the gold-producing counties of the state. Plumas drew capital along the line of the Western Pacific; Butte and Yuba had new prospects that promise well; Mariposa attracted attention by improvements made on the old Fremont grant, and the opening of several small mines; Inyo, San Bernardino, and Kern had a prosperous year.

In Trinity County the extensive development, production, and the installation of stamp mills and cyanide plants formed the attractive feature of the year. In the last half of the year the bonding of a number of old mines in the Weaverville basin gave new interest to that section, and promised renewed development and operation. In Humboldt, an adjoining county, the development of copper claims on Horse Mountain gave an impetus to exploitation. A plant for reduction of copper ores was being installed at the close of the year.

IRON, TUNGSTEN AND ANTIMONY

The mining of iron ore in California was in 1911, as in 1910, confined chiefly to the requirements of the Noble Electric Steel Co. at Heroult, Shasta County, where experiments in electric smelting were in progress. One thousand or more tons of ore was mined. While the experimental work and furnace construction were not fully completed, it was demonstrated that the pig iron produced contained a high percentage of pure iron and can be produced at probably 25% less than in the eastern iron districts. There is an abundance of iron ore of high grade.

The output of tungsten in California in 1911 was less than in 1910, owing to a decline in price and a falling off of the demand. The principal production came from the Atolia Mining Co. in the Randsburg district in San Bernardino County. The plant was not operated full time during the year, but the company had a good supply of ore on hand, so the suspension of operations gave opportunity to make some needed repairs and improvements. The usual run of about 40 tons per month of 65 to 67% concentrates was made while in operation. Other tungsten ores were mined in the district during the year and some development made in prospects. Tungsten was discovered in the Forbestown district in Butte and Nevada Counties, associated with the gold in the sulphide ores; but it was not determined of commercial value, owing to the presence of sulphur and pyrite. No antimony ores were smelted in 1911 owing to the low price of the metal.

Mining in Oregon in 1911

By Frederick W. Scofield

The depression resulting from the general uncertainty of business did much to retard the active development of Oregon mining properties in 1911, and at the close of the year the full measure of activity had not been realized which the beginning of the year promised. Many companies and individuals, with properties of conceded merit on which extensive development work was planned, were obliged, through inability to raise money, to hold their plans in abeyance or curtail them in a marked degree.

The mining industry in Oregon still has to contend with the unenviable reputation it acquired during its boom period, and while this reputation is probably deserved insofar as stock operations are concerned, it is not altogether so when the value of its mining properties is given just consideration. During the time that the smeltery at Sumpter was in active operation, covering a period of three years ended Nov. 15, 1907, there were smelted 19,068 dry tons of ore, both crude and concentrates, showing an average assay of 2.75 oz. gold; 9.9 oz. silver and 2.8% copper. At present prices of metals this represents a gross value of $1,282,514 or an average of $67.26 per ton which compares not unfavorably with more active mining districts.

MINES BUREAU ESTABLISHED

Mining in Oregon in the past received little aid from the state, but there was passed at the last session of the legislature a bill establishing a State Bureau of Mines and making an annual appropriation for its maintenance. The work of the Bureau is being carried on by the Department of Mines of the State Agricultural College, thus bringing at once to its aid a complete organization. The first work of the Bureau will be devoted to compiling statistics of Oregon's mineral production, which figures have heretofore been sadly lacking.

In the Snake River district the Iron Dike Mine remained idle on account of lack of available funds. There was some work of a desultory nature carried on at other properties in the district, but little was accomplished in the way of substantial progress. In the Mormon Basin district, the United States Smelting, Refining & Mining Co. completed its purchase of the Rainbow mine, early in the year, since which active development work was carried on and it is reported that the results achieved both as to extent and grade of ore verified the estimated value of the mine.

Development work was carried on uninterruptedly at the Ibex, Ben Harrison and Dixie Meadows mines and the results obtained are, in each case, reported as entirely satisfactory to the owners and the management. The successful devel-

---

*Consulting mining engineer, P. O. Box 78, Sumpter, Oregon.

opment of these properties, which should become early shippers of a regular tonnage, demonstrates what may be done with many properties, now idle, when provided with a sufficient fund to prosecute development work, and arrangement made for its disbursement under competent and intelligent management.

One of the notable transactions of the year was the sale of the North Pole mine. This property, recently taken over by its purchasers, has produced more than $2,500,000 in gold, but has been closed for about five years, and reported to be worked out. The new owners began extensive development work and in a short time opened up an orebody which it is reported promises to make the mine a greater producer than it was in the past.

The Keystone Dredging Co., which purchased extensive placer areas in the Powder River Valley, began the work of installing one dredge, but owing to the lateness of the season, together with delay in shipment of machinery, work was suspended until the spring of 1912, when two or possibly three dredges will be installed. The Northwest Smelting & Refining Co. did not blow in its smeltery at Sumpter due to lack of ore tonnage sufficient to keep it in operation, but the plant is being maintained in condition to begin the handling of ores as soon as produced. In Josephine, Jackson and Lane Counties, constituting the southwestern mining district of the state, a number of smaller properties and prospects were purchased and development work inaugurated on them, and many older properties completed plans for resuming operations and installing new equipment.

Another company was organized in 1911, for operations in Lincoln County in treating beach sands, said to contain gold and platinum, but the experience of others in this direction creates some doubt to its success. Although 1911 was somewhat disappointing in the extent to which operations were resumed, conditions showed a substantial improvement over 1910, and with a readjustment of general business conditions the immediate success of Oregon's mining industry seems assured.

Montana in 1911

By F. L. Fisher*

The absorption of the various operating companies, formerly constituting the property of the Amalgamated Copper Co. in Butte, by the Anaconda Copper Mining Co. was completed in 1911, making the Anaconda company the foremost producer of copper in the Butte district, the only other companies being the Tuolumne, East Butte, Davis-Daly, North Butte, Butte & Ballaklava and Alex Scott. The reduction of the output of the mines to from two-thirds to three-quarters of their normal capacity, which was instituted in 1910, was continued through 1911 on account of the low price of copper. Probably the most important change made by the Anaconda company was the substitution of compressed air for steam as the power used for the hoisting engines, as it was demonstrated that a great saving in fuel expense was made by the change. The first mine in the camp to make the change was the Mountain View, and after one or two false starts it was found to be as efficient as steam.

Anaconda Operated 23 Mines

The mines operated during 1911 by the Anaconda company were the Anaconda, Never Sweat, St. Lawrence, Mountain Con., Bell, Diamond, High Ore, J. I. C., Original, Moonlight, Tramway, Stewart, Gagnon, East Gray Rock, West Gray Rock, Silver Bow, Berkeley, Mountain View, Pennsylvania, Leonard, East Colusa, West Colusa and Badger State. At the Pennsylvania mine the airshaft was continued to the 1600-ft. level by upraising from that level to the 1400-ft. level. A crosscut 1200 ft. long was driven between the West Colusa and Pennsylvania mines for a new route to carry the mine water from the latter mine to the Leonard mine pumps. A large amount of development work was done on the 600-, 1300-, 1400-, 1500-, 1600- and 1800-ft. levels and electric motors, as ore carriers, were installed on the 1600-ft. level, and an air fan was installed in the tunnel level for the purpose of ventilating the upper workings of the mine. The airshaft of the Mountain View mine was continued to the 1800-ft. level and a station was cut on the 1600-ft. level, after which the level was developed by crosscutting, and drifting on several veins which were cut. The mine was closed down about two months in the middle of the year for changes in the engine, for the use of compressed air; after resuming operations the daily output was kept at about 1500 tons of ore. Electric motors were installed on the 800-ft. and 1100-ft. levels, and new ore bins were completed. The Leonard hoists over 1200 tons of ore daily from the 1200-, 1300-, 1400-, 1600- and 1800-ft. levels. The No. 1 shaft of the Leonard mine was extended from the 1600-ft. to the 1800-ft. level by raising from the 1800-ft. level; also the East Colusa airshaft was extended to the 1400-ft. level from the Leonard workings by raising from the 1200-ft. to the 400-ft. level, from the 1300-ft. to the 1200-ft. level, and from Hthe 1400-ft. to the 1300-ft. level, and an exhaust fan, having a capacity of 100,000 cu.ft. of air per min., has been placed at the collar.

At the West Colusa mine a winze was sunk from the 1800-ft. to the 1900-ft. level, from the bottom of which crosscutting was done to the extent of 40 ft. both north and south. About 800 tons of ore are hoisted daily from this mine. An air fan was installed at the collar of the East Colusa airshaft for exhausting the bad air from both the East Colusa and Leonard mines. Considerable development work was done at the Badger State mine on the 1300-, 1600- and 1800-ft. levels, and several large bodies of ore encountered and drifted on; about 200 men were employed there and in the vicinity of 500 tons of ore were hoisted daily. The Tramway, Rarus and Minnie Healy mines were all operated through the Tramway shaft; the Rarus shaft was used only for lowering supplies, and the Minnie Healy shaft was allowed to cave. A single-deck cage was also installed in the Rarus airshaft to facilitate keeping the shaft in repair.

Fire in the High Ore Mine

At the High Ore mine what promised at first to become a difficult fire to subdue, was discovered in the stopes in January, but it was put out after a month's siege. The mine was closed down for a month or more to allow of remodeling the hoist for compressed air. At the West Gray Rock mine a new hoist operated by air was installed, and the East Gray Rock was also operated through this shaft. The shaft was extended from the 1100-ft. level to the 1300-ft. level by raising. At the Silver Bow and Berkeley mines, work was confined mostly to stoping and little development was done. A raise was driven from the Silver Bow 1000-ft. level to connect with the Berkeley shaft on the 800-ft. level, and the Silver Bow No. 1 shaft was sunk 15 ft. to allow for a sump. The two mines hoisted together about 15,-

---

*Mining engineer, 513 Henessy Building, Butte, Mont.

000 tons of ore monthly. The shaft of the Speculator mine of the North Butte company was extended approximately 100 ft. to the 2800-ft. level and much development work was done on the lower levels with the result that richer and more extensive orebodies were discovered under the somewhat barren zone between the 2000- and 2300-ft. levels. The shaft of the Granite Mountain mine was enlarged to three compartments from the 1800-ft. level to the surface. Production was maintained at the rate of about 2,000,000 lb. of copper monthly. Skip pockets were cut on the 2600- and 2800-ft. levels and a pump station was cut near the bottom of the shaft.

BUTTE & BALLAKLAVA STILL IN LITIGATION

The shaft of the Butte & Ballaklava mine was repaired between the 1200- and 1400-ft. levels, where it was damaged by water during the High Ore fire, and shaft sinking was continued near the end of the year; development work was done on those veins where no injunction in the suit of the Anaconda company prevented the work from being carried on, also considerable legal representation work was done in the interest of the suit with the Anaconda company. The Ballaklava company brought a counterclaim against that company attacking its title to the Right Bower claim, alleging that the certificate of location as recorded in the county clerk's office was void, in that it was not verified as required by law.

Production at the East Butte company's property was held at about 1,000,000 lb. of copper monthly. Extensive improvements were made upon the smeltery at the mine; work was begun on a new dust chamber and a slime pond was constructed for working over the old tailings dump. Extensive development work was done on the 1000- and 1200-ft. levels. At the property of the Tuolumne Copper Co. many improvements were made during the year and considerable ore developed and blocked out. A complete new hoisting apparatus was installed consisting of a Nordberg engine with capacity for hoisting from the 3500-ft. level and provided with automatically dumping skips; a new steel gallows frame and steel engine house were constructed, and new ore bins, having a capacity of 1000 tons, were built; a railroad spur was laid from the bins to the main track, a quarter of a mile, effecting a saving of 60c. per ton in haulage rates. About 100 tons of ore, mined on the 1200-, 1400- and 1600-ft. levels, were shipped daily to the Washoe smeltery at Anaconda.

At the Colorado mine of the Davis-Daly company development work was done on the 1400- and 1700-ft. levels and ore shipped at intervals. Walter H. Wiley, of Los Angeles, who examined the property, recommended extensive development work, and that the company mine only its high-grade ore until an advance in the price of copper should make it more profitable to work the low-grade. Development work was done at the Alex Scott company's mine, principally on the 1500-, 1600- and 1800-ft. levels, and an average of 1.5 cars of ore was shipped daily to the East Butte smeltery. The company also operated the Little Annie mine, a silver property near Walkerville. At the Ophir mine of the Butte Central Copper Co. the shaft was sunk to the 1000-ft. level and a pump station cut there. Mining was confined chiefly to the silver ore on the 100- and 300-ft. levels from which several shipments were made. Plans were perfected for the building of a concentrator at the mine. The Washoe sampling works, which was destroyed by fire early in 1910, was replaced by a new all-steel and concrete plant, modern in every particular and equipped with the Brunton automatic sampling system. Operations were begun with the new plant about the middle of the year.

CORBIN-WICKES DISTRICT

In the Corbin-Wickes district the Corbin Copper Co. operated its property to some extent, the ore being mined from the tunnel level and conveyed to the concentrator near the mouth of the tunnel. The concentrator was started again in November after a shutdown of some months. Operations at the Boston & Corbin mine were confined principally to development work and blocking out of ore in readiness for the proposed concentrator. Sinking the shaft from a point a short distance above the 1300-ft. level to the 1500-ft. level was begun. At the property of the Wickes-Corbin Copper Co. 4 ft. of ore were cut in Tulare Tunnel No. 2, and in the Bunker Hill No. 4 tunnel six veins of various width were passed through.

GOLD AND SILVER

Mining activity was renewed in a number of gold and silver districts, which have been practically deserted since the slump in silver about 18 years ago. In the Georgetown district in Deer Lodge County a number of old properties were rejuvenated and work started on several new ones. The Hidden Lake group of mines was worked until Oct. 1 by Harry Bacorn, who gave up his lease at that time, however, and since then the owners have operated there. The George Hill Mining Co. was incorporated by Anaconda men, and some work was done on the George Hill claim owned by them, adjoining the George mine. The Silver Lake Mining Co. operated the George mine and made several shipments of ore to the Washoe smeltery. Other properties where mining was conducted in this district were the Venezuela, Old Bonanza, Roundup, Oro Fino, Holdfast, Montana, Twilight and the Cochrane.

The Radersburg district in Broadwater County was also the scene of considerable activity. The Keating Gold Mining Co. operated steadily and made regular shipments of ore. At the Black Friday mine development work was done on the 600- and 700-ft. levels. The Calumet & Corbin company sank a shaft and developed its property to some extent. The Black Diamond group of claims was operated by a company of that name composed of Butte men. The Ohio Keating company also operated and shipped ore to some extent. The Combination Keating company installed an electric hoist on its property and developed some ore. The De Lome Gold Mines Co. was incorporated and operated the De Lome and Sunlight claims after installing an electric hoist for sinking purposes.

In the Marysville district in Lewis and Clark County, mining was done at a number of properties. The St. Louis Mining Co. resumed operations after winning its suit over disputed ground against the Montana Mining Co., and treated its ore in the 60-stamp mill of the latter company. The Bald Mountain and Belmont claims were operated by Col. Cruse, of Helena, and considerable rich ore opened. Riley Hendricks kept his 5-stamp mill in operation most of the time with ore mined from his claims, and a 5-stamp mill was erected by the Boyer brothers at their property. Others who worked claims in the district were James Schaffer, Albert Price, Barney Moran and Thomas O'Connell.

GOLD DREDGING PROFITABLE

Madison County easily took the lead in the production of gold, due principally to the working of the four gold dredges of the Conrey Placer Co., at Ruby, which produced steadily from the first of the season. A mill was erected at the Gold Coin mine in the Rochester district, Madison County; the shaft was continued to near the 400-ft. level, and considerable mining was done. The Easton mine employed a force of 60 men, and mined about 25 to 30 tons of ore daily, which was treated at the mill at the property. The Alder Gulch Consolidated Mining Co. operated its placer ground near Virginia City from the middle of April.

A gasoline hoist was installed at the St. Lawrence mine near Virginia City, the shaft was retimbered to a depth of 170 ft. and a level driven at 150 ft. At the Highland Chief mine a vertical shaft was sunk to replace the old inclined shaft on the vein, and a vein 6 ft. wide and running about $15 to the ton in gold and silver was developed. In Jefferson County the Comet mine in High Ore Gulch was mined in the upper levels by leasers, who shipped ore occasionally, and a vein of zinc ore was cut on the 100-ft. level. The Ruby mine and mill in the Lowland district were operated the latter part of the year, employing three shifts. The Norma Mining Co. was incorporated by Butte people to operate the Norma mine, one mile from Clancy.

The Elkhorn silver mine at Elkhorn was worked steadily during the year, a large force being employed and regular shipments made. In Lincoln County several companies operated placer mines on Libby Creek, near Libby. At the Libby Placer Mining Co.'s property work was begun early in the season after a shutdown of seven years; a new hydraulic plant was constructed, and after its completion in October the output was greatly increased. The Comet Placer Mining Co. operated its property until forced to suspend operations in October, owing to lack of water. The Snowshoe mine, in Lincoln County, was purchased by E. H. Wilson, of San Francisco, and three additional claims were acquired by the firm for which he bought it. The mine was operated from early spring, and the ore run through the concentrator on the ground. Shipments of the concentrates were begun late in the fall.

In Gallatin County placer gold in paying quantities was discovered in the West Gallatin Basin near Bozeman; most of the river-bed was staked and a number of companies formed for operation there. The property of the Bi-Metallic company in Granite County was worked in a small way by leasers, who made regular shipments. The Snow Creek Mining & Milling Co. operated the Snow Creek mine in Cascade County, the ore being treated in a cyanide mill erected there over a year ago. The Johannesburg mine was considered worked out and closed down in March. A gold dredge was constructed by the Kennedy Creek Gold Mining Co., owning 400 acres of placer ground in the Nine-Mile district near Missoula, and operations started late in the year.

Mining in South Dakota in 1911

Special Correspondence

The mines of the Black Hills have been prosperous in 1911 and the value of the total output will exceed $7,500,000, and equal that of 1908. The mills were able to operate throughout the year, notwithstanding the prolonged drought which caused great distress in the surrounding agricultural country, but which was terminated by early and heavy falls of snow.

In spite of the strike nominally existing there is no labor trouble. All the mines which resumed work on a nonunion basis have had an ample supply of men, and the only visible reminder of the threats of two years ago is the nightly operation of the seachlight from the Ellison hoist at Lead. During the 12 months ended June 30, 1911, the Western Federation of Miners' reports having paid out nearly $230,000 for strike benefits in the Black Hills, out of a total of $365,000 collected, which includes $60,000 obtained from the State of Colorado. The monthly sums appropriated ranged from $25,000 to $12,000, and it is understood that at present $10,000 is being expended per month at Lead. One of the men charged with firing the Homestake cyanide plant at Blacktail, in 1910, was tried last year and found guilty, and the other, a Western Federation of Miners organizer pleaded guilty to arson.

Prospecting to be Encouraged

Prof. C. H. Fulton resigned the presidency of the State School of Mines at Rapid City, to take charge of the mining and metallurgical department of the Case School of Applied Science, at Cleveland, Ohio; his successor is Prof. C. C. O'Harra. Following the example of Denver, the Deadwood Business Men's Club took up during the summer the question of encouraging prospecting, and perfected an arrangement with some of the mining companies for making free assays for prospectors.

The Homestake company nearly completed its Spearfish hydro-electric system, which, together with the present plant, will deliver current to a substation at Lead for distribution to the mills and other works. All its underground shops for drill sharpening and car repair were removed to a single large shop at the surface, near the Golden Star shaft, and the change is said to be decidedly advantageous. The Mogul company operated its mines and mills without intermission. The position of general manager of this company, vacant by the death of W. L. McLaughlin, was filled by the appointment of J. V. N. Dorr, who designed the present mill.

DATA OF SOUTH DAKOTA GOLD MINES

Company	Men employed	Tonnage	Production	Yield per Ton
Homestake	2,700	1,510,300	$5,875,000	$3.89
Mogul	210	135,000	481,700	3.57
Golden Reward	134	66,900	392,700	5.87
Wasp No. 2	75	148,700	295,900	1.99
Lundberg, Dorr & Wilson	22	21,000	75,700	3.61
New Reliance	40	8,300	31,500	2.80
Individuals and small companies	793	55,100	380,000	6.90
Total	3,974	1,945,300	$7,532,500	$3.88
Placer mines about			$83,000	
Total including Placers			$7,615,000	

The Golden Reward further developed its new sulphide orebody, and prepared to erect a Wedge furnace at the Astoria shaft, near Terry, for roasting this ore before shipping to its cyanide plant at Deadwood. The Wasp No. 2, on Yellow Creek, completed its new mill early in the year, and has been milling ore with a recovery of about $2 per ton at a cost of about $1. A steam shovel will shortly be in operation for stripping the overburden, and another will be put in this year for handling ore. The Bismark Consolidated, on adjoining ground, is enlarging its mill to 250 tons capacity, and expects to have it in operation shortly. The Reliance company, on Annie Creek, replaced its Huntington mills by 20 stamps, which have been running for six months. The Trojan, including the Portland and adjacent mines, shipped smelting ore and is now operating its mill, formerly the American Eagle. The Lundberg, Dorr & Wilson Co. continued to operate its cyanide plant near Terry, partly on custom ore and partly on the product of its own mines. A number of small mines in the Southern Hills made shipments or mill runs of rich ore, notably the Golden Slipper near Hill City, and the Columbia near Keystone.

New Smeltery

In the Garden City district the Maitland, or North Homestake, and the Minnesota companies actively developed their properties, but have not milled any ore; and the Echo company prospected its ground. In the Carbonate district the Black Hills Development Corporation has reopened some of the old workings of the Iron Hill and Seabury & Calkins mines, formerly large producers of silver, and shipped several cars of ore. Near Galena a smeltery has been under construction for the Black Hills Smelting Co. under the direction of Paul Danckwardt and H. C. Osterman of Chicago. A contract calls for its completion by Feb. 1, 1912. It is announced that pyritic ore from the Gilt-Edge Maid will be treated, together with silicious gold ores. Part of the equipment was obtained from the old Deadwood & Dakota or Golden Reward smeltery near Deadwood. A diamond drill-hole was sunk on the ground of the Pluma Mining Co., near Lead.

The Castle Creek dredge, near Mystic, south of Lead and west of Rapid City, worked the greater part of the year, and the results appear to be satisfactory although no details have been made public. It is operated by electricity generated at a power station on the bank. Another dredge is likely to be erected by the St. Louis Placer Mining Co. on Box Elder Creek, and a third on the Sherman Bros. ground on Rapid Creek, near Pactola.

Some work was done in the Tinton tin mines, and on the Custer Peak copper properties, and attempts are being made to work some complex ores by the Deadwood Lead & Zinc Co. Amblygonite and spodumene continue to be shipped from the Southern Hills, but none of the other rare minerals are now worked. The Westinghouse mica mines, near Custer, are reported to have shipped about the same amount as the preceding year, nearly 1000 tons.

The accompanying table of statistics of gold production for the year ended Nov. 1, 1911 are taken from the report of Robert L. Dougherty, who succeeded Nicholas Treweek as State Inspector of Mines.

Arizona in 1911

By C. F. Tolman, Jr.*

The bettering of transportation facilities now in progress, and the increase in population, are directing attention to the nonmetallic products of the state, and the production of fuels, building material and the rarer metals should assume more importance in the near future. Following is a brief summary of some of the more important mining developments during 1911, with some suggestions as to the possibilities that may be realized in the future.

Gold and Silver

The gold production of Arizona is obtained from two sources; as a byproduct in the production of the base metals, and from mines where gold is the most important content in the vein being worked, with silver of secondary importance. The production of gold from these two sources is about equal. The group of older gold-bearing veins is found in or near granites or allied rocks. The most valuable of these deposits are characteristically grouped together in certain regions, the same class of veins in less favored regions developing too great irregularities in grade, size and shape to permit successful exploration. Yavapai County contains the majority of important deposits of this kind, and while at present mining is at a standstill in this region, when the revival comes, real mining should become profitable in many cases.

Examples of the second group are distributed over the southwestern United States and Mexico, such as Goldfield, Nev., Cripple Creek, Colo., etc. These are younger veins in effusive rocks, "porphyries" of the miners, and the three most famous producing gold mines of Arizona belong here, viz., the Gold Roads and Tom Reed, in Mojave County, and the Golden Star (North Star), in Yuma County. The first mentioned mine was purchased during the year by the United States Refining, Mining & Smelting Co. The famous Commonwealth mine, Cochise County, was bonded to the Montana-Tonopah company, and the Commonwealth Extension was reported to have opened important new orebodies. The silver content exceeds the gold in these mines. The Mammoth mine, Pinal County, noted for its former production and the beautiful cabinet specimens of the rare minerals, wulfenite, vanadinite, descloizite, etc., was reported to have consolidated with the surrounding properties, and to have been taken under option by Colorado mining men. New mines of this type are most likely to be found in Mojave and Yuma Counties and less often in Pinal, Pima and Cochise Counties.

Silver, Lead and Zinc

Silver mining, long on the decline in Arizona, received a severe setback by the failure at Tombstone. The cost of pumping 7,000,000 gal. of water, with a 1000-ft. lift, proved too great a task for the old mine. Curiously enough, Tombstone history was repeated on a smaller scale at the Jack Rabbit mine, near Casa Grande, Ariz. A superficial deposit of rich silver ore was mined in early days, and an attempt was made to pump down the water level in a limestone basin, fed by the underground drainage of the Santa Rosa Valley. The attempt, well planned and thoroughly carried out, to reopen the Vekol silver mine, Pinal County, was finally abandoned in 1911, and resulted only in demonstrating that the extensive orebodies are superficial.

Arizona lead mining offers a little more promise than the silver mining, and a moderate increase can be expected on its revival. The Golconda mine, Mojave County, is the only zinc property that has made a record during the last few years. Improvement in financial conditions and better railroad facilities, may result in other producers.

Vanadium and molybdenum were found in several regions, but the small demand for these has not as yet justified extensive development of the deposits. The mercury deposits, Yuma County, were not successful in the attempts to produce continuously. Cobalt was reported from the Saddle Back district, and nickel in a superficial deposit of silver ore in schists, near the Southern Pacific R.R., in Yuma County.

Oil

The following is a partial list of the drilling operation for oil, conducted during the year: Two drills working near Bowie, Ariz.; two drills east from Tucson, Ariz.; one rig at Mammoth, 60 miles north of Tucson. Drilling was also done at Agua Caliente, Yuma County, and was reported in a region two miles north of Phœnix. Two companies are also prospecting for oil in the Verde Valley.

If oil is found in Arizona, it will probably not be in the mountain ranges, composed either of lavas or of quartzite, limestones and schists broken into by intrusions, but in the desert valleys, where the softer and more recent shales are often protected under thick deposits of desert gravels. These later strata of the valleys have as yet received almost no study, but some information along these lines will be contained in the report on the Tucson quadrangle, to be published by the U. S. Geological Survey. Lack of information regarding the possible oil-bearing strata, however, does not excuse boring for oil in formations that have suffered sufficient heat and pressure to turn the carbonaceous matter into graphite, or in broken formations turned up on end, without structures capable of holding oil, and least of all in granite gneisses.

Structure Materials

Marbles of excellent quality were opened in the quarries of the Huachuca Marble Co., Cochise County, and the Santa Rita Marble Co. found an unusual variety of marbles and granites in its properties, 30 miles east of Tucson. Slate of good quality exists south of Phœnix, and cement materials are distributed throughout the territory. An interesting development was the manufacture of ornamental pressed bricks, at Tucson, from shales which contain a large proportion of fusible volcanic ash.

---

*State geologist, Tucson, Ariz.

Mining in Nevada in 1911

Special Correspondence

Broadly considered, the mining industry prospered in Nevada in 1911. In a few cases developments did not confirm the earlier predictions, but it is safe to say that in general, mining is on a sounder basis in this state now than at any previous time. There were no unsavory fiascos, such as marked the mining history of Nevada in previous years; the nearest approach to such that could be cited is the case of the Nevada-Utah Mines & Smelters Corporation, and apparently this company has fallen into more responsible hands; it is believed that the change presages more prosperous times for the Pioche camp. As an instance of unfulfilled hopes may be mentioned the Montgomery Shoshone Co., which found that it was operating at a loss.

Two important tendencies were noted in mining developments: (1) concentration; (2) deep prospecting. There was a tendency throughout the year for larger companies to absorb smaller ones, or to take over properties strategically situated. This was evident in Pioche and Tonopah. The tendency towards deep prospecting was made plain at Goldfield in the formation of the Goldfield Deep Mines Co. This attempt to test the ore bodies at depth is commendable and fills a long-felt want, frequently commented on by mining men. In the outlying camps noteworthy progress was made at the Nevada Wonder, Nevada Hills and Mason Valley properties. Jarbidge and several other districts received attention from prospectors and investors, but no important developments took place. With a few exceptions, work was confined to sound, legitimate development of the older properties.

THE ELY DISTRICT

In 1911 as in 1910, the only producing property in the Ely district was the Nevada Consolidated. Stripping operations were continued throughout the year at the Liberty pit; the intention being to continue this until 2000 tons of ore per day can be mined, when necessary to supplement the Eureka pit output. Improvements were made at the reduction plant and the reverberatory furnaces were altered to operate with oil instead of coal. The results have fully justified the installation of oil as fuel. In addition, one basic converter was installed and work on a second one was started. In the concentrator experiments were conducted with slime tables with a view to the installation of such a plant; other experiments were also made to effect a greater saving of metal contents. During the quarter ended Sept. 30, 1911, the ore treated averaged 1.7% copper. Near the end of the year, production was started from the Veteran mine, which had been idle for several years because of labor troubles.

Giroux has yet to become a regular producer. During the year exploratory work was continued and the tenth level on the Alpha orebody was connected with the large 5-compartment shaft. More pumping equipment was installed and the Giroux shaft sunk to the 1400 ft. point. The permanent hoist was also placed in commission at this shaft. Work since August was retarded somewhat by a fire which occurred in the Giroux shaft. The shaft was sealed and permitted to flood, since when much time was consumed in dewatering operations.

After a visit to the property in October, T. F. Cole, president, announced that plans for development included a concentrator of 1000 tons capacity, the building of a railroad from the Bunker Hill shaft to connect with the mill, the equipment of that shaft and the stripping of the sulphide zone where it outcrops near the surface; and that actual construction would start soon.

Prospecting and development work was carried on less actively in 1911 than formerly at the smaller properties, and operations at the Ely Consolidated, Ely Central and Boston-Ely were practically at a standstill.

GOLDFIELD

In the Goldfield district, the two large producers in 1911 were the Goldfield Consolidated and the Florence-Goldfield; of these the former maintains its position as the largest gold producer in the world. The gross value of the production from the Consolidated mines in 1911 was about $10,540,000. With the estimated December production, the average for the year amounted to approximately 28,300 tons of ore per month, which yielded an average of $31.02 per ton gross and net $22.11. The company purchased the Bulldog Fraction claim from the Red Top Extension Co. While development work has continued to disclose rich orebodies from time to time throughout the properties of the company, it is quite evident from the comparison of the monthly reports that the net profits per ton have decreased somewhat with the depth thus far attained. The indications are stated to be that the Jumbo mine will produce a large tonnage of $15 ore. Additional equipment including roasting furnaces and tanks were added to the mill to treat the residue from the present concentrating process. During the year a one-half interest was purchased in the Vinegerone claim from the Jumbo Extension Co., for $195,000. During November the production was 28,628 tons, which yielded $766,351 gross and net $510,596. This was secured with an extraction of 94.45% and the average net profit was $17.83 per ton.

At the Florence-Goldfield production continued at the rate of from 100 to 170 tons per day, a satisfactory recovery being maintained from low-grade ore. The low tonnage was reached in October when a shortage of ore necessitated a reduction of working force and mill operations. New mill equipment was added during the year, including Akins classifiers and Dorr thickeners, which resulted in a reduction of costs and an increase in capacity. In December a fire occurred which destroyed the mill and its machinery, entailing a loss estimated at about $400,000. Slight damage was done to the shaft collar. The company has not yet announced its plans in connection with the rebuilding of the plant.

Leasing operations were continued at the Goldfield-Belmont, but during the year it was reported that no more leasing would be done; that a deep shaft was contemplated, to open the property at depth and that exploration would be carried on from this shaft. A change of control occurred in the affairs of the Silver Pick Mining & Milling Co., and it was announced that a deep shaft would be started in January, 1912.

GOLDFIELD DEEP MINES COMPANY

An event of interest was the formation of the Goldfield Deep Mines Co., about the middle of the year. The company was formed to operate at depth in the Goldfield district and Sen. William A. Clark was reported to be interested. The company controls the Goldfield Merger Mines Co. In October an announcement was made that operations would start soon on the property of the latter company, and that a 4-compartment shaft, from 1500 to 2000 ft. deep was planned. The St. Ives was one of the properties included in the merger.

TONOPAH

In the Tonopah district the Tonopah Mining Co., during the year easily maintained its position as the first producer of the camp. During November, 14,799 tons of ore were milled with an extraction of 91.81%. The ore averaged gross

$20.75 per ton and net profits for the month were $172,316. The Tonopah-Belmont company did much development work and started the construction of a new mill. This plant was originally planned to include 60 stamps, eight tube mills, concentrators and a complete cyanide plant; the whole was designed to treat 500 tons of ore per day. The company maintained a good production throughout the year and in November sent 7807 tons of ore to the mill and 2730 tons to the smeltery. Net profits for that month were $156,459. Retimbering of the main working shaft is expected to start soon, because of which the output may be curtailed temporarily. In February a fire in the East Belmont shaft did considerable damage and caused the death of 17 men. Operations were hindered by this for a short time.

Mining and development were conducted at the Tonopah Extension and in December it was announced that the company had paid the final installment of its bonded indebtedness and had a surplus. The output for November was 4362 tons of ore, which yielded net $25,000. In December a friendly settlement was concluded between the Tonopah company and the Jim Butler company over the question of apex right on the Fraction claim.

In April the MacNamara company announced its intention of building a mill of 2000 tons monthly capacity, the equipment to include stamps, tube mills and cyanidation. Mining was discontinued following this announcement and pending the completion of the plant.

On November 14 the Montana-Tonopah company made the first payment on the Commonwealth mine at Pearce, Cochise County, Ariz., which it purchased on a working option. Development work was started at that property. The West End company purchased the Midway mill at Tonopah, with the intention of reconstructing it, its original capacity being 120 tons per day.

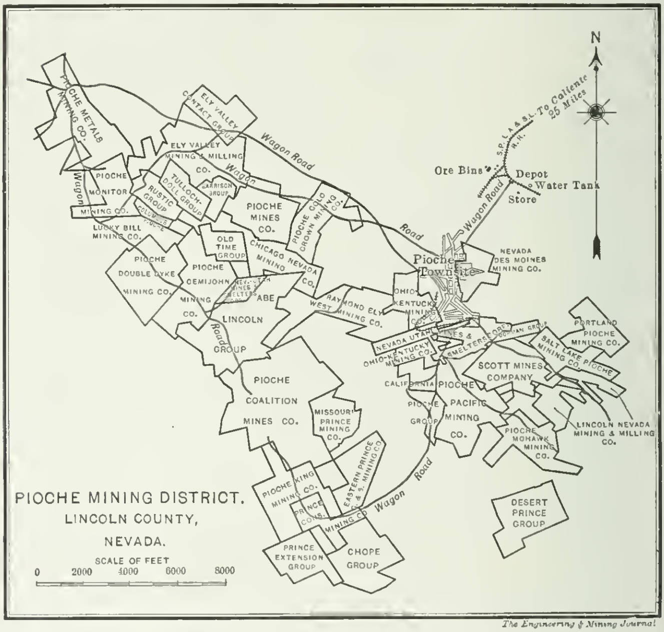
The Comstock

The revival of operations at the Comstock mines continued unabated throughout the year and while assessments were still the rule, dividends were paid by the Mexican, Ophir and Comstock-Phoenix companies. Underground developments were generally satisfactory, new orebodies being opened in several of the properties. Pumping facilities were increased, the Ward shaft continued sinking and the old workings were reopened in several places. The Mexican company continued the construction of its new mill and the Butters plant conducted tests on the ore.

The following mines were producing during the latter part of the year: Ophir, Mexican, Union Consolidated, Crown Point, Yellow Jacket, Chollar, Potosi, Gould & Curry, Justice and Comstock-Phoenix. Of these the Ophir, Mexican and Comstock-Phoenix produced high-grade ore. Ventilation and pumping continued to be the most serious obstacles to successful operation. The latter was apparently solved by electrically driven pumps; an entirely satisfactory solution of the former remains to to be found. The opening and satisfactory development of orebodies in the Mexican mine furnished a stimulus which was badly needed and were responsible for the renewed activity and interest which followed.

Other Districts

The Nevada Hills company at Fairview continued the construction of its 20-stamp mill and finished it during the latter part of the year, when it was placed in commission. There still seems to be some uncertainty as to the continuance of the vein beyond the large fault. The company secured control of the Fairview-Eagle company, during the year. In August, the mill of the Nevada Wonder company at Wonder, was started, thus marking the culmination of several years of development and experimenting.



The Engineering & Mining Journal

During the year 1911 the Mason Valley company continued development work underground and the construction of the smeltery and electric power line, the latter being 69 miles long. The smeltery is expected to go into commission at any time.

Mining in the Eureka camp was retarded by lack of adequate transportation facilities. Reconstruction of the 10 miles of line washed out in 1910, was started. The mine is in readiness for production as soon as the railroad can take consignments. Activity continued in the Jarbidge and Manhattan camps, chief interest in the former having been aroused through an option secured by George Wingfield on the Bluster group.

Pioche District

By A. L. Scott—On Dec. 15, 1911, the Prince Consolidated made its first shipment of four cars of tailings from the old dump at Bullionville, over the new spur just completed by the Salt Lake Route. On the same day T. J. Bivens, who was in charge of the construction of the Bingham & Garfield R.R., arrived in Pioche with a force of engineers and commenced a survey for the construction of about nine miles of standard-gage track to connect the Prince mine with the present terminus of the Caliente branch at Pioche. Also on the same day letters were received from Robert G. Mead, recently elected president of the Nevada-Utah Mining & Smelters Corporation that "plans have been completed for a readjustment of the affairs" of said corporation, which plans "call for the organization of a new company," "that a syndicate is being formed by Theodore Gross, New York, manager of the Hirsch Syndicate, Ltd., of London, for underwriting a substantial amount of bonds"; that "Willard V. King, president of the Columbia Trust Co., William J. Palmer of Trippe & Co., and L. Vogelstein of L. Vogelstein & Co., all of New York, have consented to act as a nominating committee to select the personnel of the new company and its first board of directors"; and that Allen H. Rogers of New York would probably "take full charge of the development work on the properties." In consequence, the above date will undoubedly mark the birth of a new Pioche, to be raised on strictly business principles.

The tailings at Bullionville, near Panaca and about 14 miles from Pioche, are from an old pan-amalgam process mill which handled the ores from the Raymand & Ely in the early days of the camp. The first dump to be shipped, at the rate of 200 tons per day, contains about 15,000 tons which is expected to net about $5 per ton. It is being shipped to the new International smeltery at Tooele. The extension of the railroad to the Prince mine has been under consideration for several years and has finally materialized through the action of the Prince Consolidated in advancing $100,000 to defray the cost of construction, to be remitted to the mining company by the railroad in freight charges. Contracts for the work will specify that the work shall be completed by May 1, 1912. The length of the road will be between nine and 10 miles. The average grade from the depot up to the western end of the Ely Range, known as the Point, and thence down to the Prince mine will be about 2½%. Few, if any difficulties should be encountered in the construction work.

At the Prince mine about 5000 tons of ore, already extracted, are awaiting the completion of the road, and blocked out in the mine are about 1,000,000 tons of manganese ore occasionally carrying high lead and silver contents. With the present incline shaft, possibly 100 tons per day could be handled from the mine, but when the road is in operation the company may sink a new vertical shaft to increase the output to 500 tons per day. If the Prince were the only mine benefitted by the extension, it would mean much for Pioche. The road, however, will pass in the immediate vicinity of the Pioche mines, Ely Valley, Pioche Metals, Pioche Demijohn, Abe Lincoln, Pioche Coalition and the Pioche King, all of which will then have payable ore; the mines in the Highland district, such as the Mendha and the Highland Mary, will be able to save $1.25 per ton on shipments by cutting out what has always been the worst part of the wagon haul, between the Point and the present depot.

Referring to the action of the Nevada-Utah, the reorganization of the company by the parties mentioned above means early shipments from the famous black vein on the hill just back of Pioche town, and the financing of the Day-Bristol tunnel in the Jack Rabbit and Bristol districts about 15 miles from town. The Nevada-Utah had just tapped the black vein at a depth of 1200 ft., when the recent entanglement of its affairs, caused a cessation of work. The Day-Bristol tunnel would have the same effect on the Bristol properties as the railroad extension has on the Prince Consolidated, that is, it would cut out about 10 miles of expensive wagon haul. The reduction in transcontinental freight rates which became effective on Nov. 15 and the fact that at least two companies are now in the field to exploit agricultural possibilities in the vicinity of Pioche, will be potent factors in the development of the district.

Mining in Idaho in 1911

By Robert N. Bell*

The mining industry of Idaho during 1911 was dull except in a few districts. This state, however, enjoyed a record year in metal production, with a total output of lead approximating 275,000,000 lb. and 8,750,000 oz. of silver. This splendid result is accounted for by the remarkable vitality of the main Coeur d'Alene producers and the new sources of rich lead and silver ore that were developed and put on a producing basis during the last two years, especially in the Wardner end of the district.

Gilmore District Revived

The production of lead-silver ore was greatly stimulated in Idaho in 1911 by the mining revival in the Gilmore district in the central part of eastern Idaho, made possible by the completion of the Gilmore & Pittsburgh Ry., which gives an easy transportation outlet to the Salt Lake Valley smelteries for these desirable smelting ores. This district is rapidly assuming considerable importance in shipping lead-silver ore.

The Gilmore district is situated at the head of the Lemhi river in Lemhi County, Idaho, near the Montana line and about 140 miles south of Butte, Mont. It presents a more extensive connected field of lead, silver, copper and gold mineralization that does the Coeur d'Alene district at the north end of the state.

Its principal producers, the Pittsburgh-Idaho and the Latest Out mines, with a mere prospecting equipment, are already shipping and are making a profit equal to some of the steady dividend payers of the Coeur d'Alene. They are showing such strength and ore resources in the deepest workings as to indicate permanency and the probable birth of a lead-silver district of exceptional merit and lasting production.

Geology Resembles That of Park City

The geology of the district is entirely different from the Coeur d'Alene and more resembles that of Park City, Utah. In fact, one or two members of the Park City series of formations are recognized here. The Pittsburgh-Idaho mine is situated near the foot of a bold mountain uplift which parallels the main range of the Rocky mountains about 20 miles to the west. This range is made up of a broad core of Silurian quartzite with overlying limestone formation in conformable layers, which are believed to include the Devonian and lower Carboniferous series. The elevation at the Pittsburgh-Idaho mine is 7500 ft. Two miles farther west at the crest of the range the elevation is 11,000 feet.

The Pittsburgh-Idaho deposits are contained in a series of nearly vertical parallel fissures, with a connecting ore course at an angle of 50°, with two series of intrusive dikes resembling diorite porphyry. One of these dike series is found associated with the ore and the other, of later date, cuts the ore course at a slight angle.

The orebodies have been developed through a vertical shaft and winze to a depth of 500 ft. and have shown steady improvement in quantity with every succeeding level. The formation is dry and the ore so far encountered consists entirely of hard and sand carbonate of lead, with brown iron-oxide. The main ore courses in this mine have been developed for a total length of 600 ft. The mine produced 19,000 tons of crude shipping ore during 1911, containing an average of about 35% lead and a half ounce of silver to each unit of lead, together with 50c. gold per ton. This splendid output was made without any mill equipment or second-class ore dump, only a mine equipment of a 15-hp. gasoline hoist.

On the Latest Out mine, adjoining the Pittsburgh-Idaho 1000 feet farther west, with a 12 hp. gasoline hoist, an output of ore amounting to 9000 tons was made during the year, containing about the same metal contents with probably a little more silver.

---

*State inspector of mines, Boise, Ida.

New Mines in Blaine and Bonner Counties

On the opposite side of this high range of mountains and 40 miles farther southeast, the Wilbert mine developed a measurable reserve of rich concentrating ore estimated at 20,000 tons with an average content of 22% lead. This deposit occurs in the Silurian quartzite in a nearly vertical zone of fissuring several hundred feet wide. It is being equipped at the present time with a concentrating mill of 150 tons daily capacity, that will afford another interesting source of rich lead concentrates during the coming year. This mine is in Blaine County and it will be necessary to haul the products by wagon 40 miles over a level desert road to Arco, a station on the Salmon River branch of the Oregon Short Line R.R.

Another important producer of lead-silver ore that is likely to add materially to Idaho's production is being developed in Bonner County within three miles of the Canadian line, where the Idaho Continental mine shows a reserve of practically measurable ore amounting to 175,000 tons, which by extensive and careful sampling is shown to contain an average of 14% lead with 5¾ oz. silver per ton, and probable ore that may quite safely be anticipated with additional adits amounting to 145,000 tons. This is one of the strongest and most persistent manifestations of lead-silver ore at the surface that has been found in Idaho and occurs in a close succession of definite shoots for nearly 3000 ft. on the strike of the vein which is a nearly vertical and intensely sheared fissure in quartzite and shows every evidence of persistency to great depth. The ore is a fairly coarse galena free from zinc and maintains its sulphide condition almost to the grass roots. The mine has a shipping record of 1200 tons of hand-sorted ore that averaged 45% lead and 18.5 oz. silver per ton. The property is situated 25 miles from the nearest shipping point at Port Hill, a station on the Great Northern Ry., from which point a wagon road is now being constructed with a maximum grade of 4%, which will probably be transformed into a light railway in the near future. The company is planning a large mill to be erected next season, when it is likely to become one of the producers of high-grade lead-silver concentrates and crude ore before the close of another year.

Gold Production Increased

The gold production of Idaho in 1911 showed a marked improvement over the previous year amounting to fully 26%, which is accounted for by the successful operation of two new dredging enterprises. One of these dredges is at Idaho City, 40 miles north of Boisé, and was put into commission in June by the Boston-Idaho Gold Dredging Co. It was built by the Yuba Construction Co. of Marysville, Cal., and has a capacity of 8000 to 10,000 cu.yd. per day, with 13¾ cu.ft. buckets, close connected. It is operated by hydro-electric plant owned by the company, and uses 500 hp. It is working on ground that runs from 10 to 20c. per cu.yd., and has been in steady operation since June and expects to be able to continue throughout the winter.

Another dredge built by the same company, with 9 cu.ft. buckets was put in operation on the Kirtley Creek placers near Salmon, Idaho, in September on ground of similar value. These two large plants have extensive resources of gravel and should continue to make a rich and profitable yield for years.

Some new gold-ore discoveries and developments were made in central Idaho during the last summer that promise good results in vein-gold production when more fully developed and equipped. These discoveries were made near the head waters of Big creek, a tributary of the middle fork of Salmon River and are in Idaho county, 100 miles by wagon road east of Meadows, the nearest railroad shipping point. This is one of the best watered and timbered parts of the state which may prove an offset for the present isolation. Here an immense zone of gold-bearing mineral strikes north and south across the high mountain spurs which are drained by a series of large tributary streams running to the middle and south forks of Salmon River. The elevations range from 6000 to 8000 ft. above sea level. The lode can be traced along its strike for 10 miles.

A Wide Ore Zone Opened

At the Moore property, its most interesting development so-far occurs. The total width of the zone is 250 ft. and 1500 tons of ore were mined and milled in a crude old-fashioned stamp mill, with a 4-mesh screen, that yielded $5 per ton to plate amalgamation. A sample of clean concentrates from the sulphide ore below the tunnel level gave an assay of $32 per ton in gold and silver, of which $6 was silver, and showed 94% extraction by fine grinding and agitation in a cyanide test.

At intervals of about two miles to the north from this property three other properties are showing similar great ore-shoots. On the Laufer & Davis property, which is a new discovery, the surface croppings indicate a shoot of ore over 100 ft. in width that shows more free gold upon panning than does the Moore property, but its development so far consist only of discovery cuts. Following north on the strike, there is another shoot of ore or the Golden King group of claims possibly over 100 ft. wide and 300 or 400 ft. long, on which rich ore has been found by panning.

At Smith Creek, two miles farther north, the Independence mine has a crosscut showing a body of white quartz heavily impregnated with bright, yellow, iron sulphide 200 ft. thick, that is conservatively estimated to assay $4 to $5 per ton in gold and silver, of which two-thirds is gold and one-third silver.

Phosphate Deposits Extensive

One of the most interesting new mineral developments in Idaho is that of phosphate rock, which were made in four of the southeastern counties of the state, where the government has withdrawn 1,100,000 acres of rock-phosphate land for classification. Of this great withdrawal, the government's geologists examined and reported on only nine townships, which are estimated[1] to contain within a reasonable minable depth 1,425,000,000 tons of phosphate rock of the finest quality.

This mineral occurs in pitching beds in the middle Carboniferous series known as the Park City formation. The principal bed is from five to six feet thick and is uniform in quality and texture. It is black in color, rather soft, and mined in the same manner as pitching coal veins with the same kind of tools, and at about the same cost per ton. The rock contains on an average 70% calcium phosphate, with less than 1% of iron and alumina for all the samples of the region tested.

The northern border of this extensive withdrawal, 100 miles north of these recent investigations, is known to be fully as rich as the area already examined, and the resources of this mineral in this state are practically exhaustless. It is conveniently situated in relation to transportation lines, and with the utilization of the waste sulphur fumes in the copper smelteries of Montana and Utah, presents the basis of an extensive mining and fertilizer manufacturing industry.

So far, the only shipping phosphate mine in the state is that of the San Francisco Chemical Co. at Montpelier, Idaho, which is opened on a five-foot bed at a depth of 500 ft., with a crosscut, from which an entry 1000 feet long has been driven on the course of the seam. This mine is shipping at the rate of about 5000 tons per year to the company's works near San Francisco, where it is reduced to superphosphate.

In addition to the great lead and silver output of Idaho, the state produced during 1911, 65,000 oz. gold, 3,377,000 lb. of copper, and ore containing 10,087,000 lb. of zinc.

---

[1] Bull. 470, U. S. Geol. Surv.

Mining in Utah in 1911

By Edward R. Zalinski*

The year 1911 in Utah was one of steady production. It is not yet possible to obtain the output of the various metals accurately, but from the tonnages available from Park City and Tintic, also from the known greater lead output of Bingham it is safe to say that the production of lead and silver increased largely over that of 1910. The gold production will probably show an increase, on account of the greater tonnage of low-grade copper ores and silver-lead ores mined. More gold and silver bullion was received by the U. S. Assay Office than during 1910, though part of this came from other states. The gold production from silicious ores decreased, as few gold properties, with the exception of the Consolidated Mercur, operated steadily. The production of zinc was about the same or greater on account of the greater tonnage mined at Park City, from which it is obtained as a byproduct. There was an increase in copper, due to the larger output of the porphyry mines at Bingham, whose tonnage increased from the beginning to the close of 1911.

Ore and Bullion Production

The ore tonnages from Park City and up to November 30, shown in the accompanying table, were obtained through the courtesy of the railroad. The month of December is estimated for the Park City shipments, while for Tintic the month of November also is estimated in part. The Park City shipments, include crude ore and concentrates. Deducting for moisture 6%, the average in Park City ores, there would be 103,139 dry tons as compared to approximately 83,474 dry tons in 1910, an increase of over 23%. The Tintic shipments include iron ores from the Dragon Iron, now part of the Dragon Consolidated. These amounted to 28,623 tons during seven months when this class of ore was shipped. There were also small shipments from the Iron King. Deducting the iron ore, and allowing for 4% moisture, the average in Tintic ores, there would be 322,001 dry tons of copper, lead, and silicious ore as compared to approximately 250,541 dry tons in 1910. This is an increase of 28.5%. The large increase in shipments is partially due to the marketing of some of the lower- and middle-grade ores, while shipments of high-grade ores also increased. The copper ores are roughly 46% and the lead ore about 50% of the total.

The bullion handled by the U. S. Assay Office at Salt Lake City in standard ounces of gold and standard ounces of silver in 1911, amounted to about 70,500 oz. gold and 37,343 oz. silver having an approximate total value of $1,330,000. The bullion came from Utah, Nevada, Idaho, Montana, Wyoming, Arizona, and from some points in Colorado and California. There was considerable variation in the monthly receipts caused by the closing down of milling plants undergoing alterations or repairs. The Salt Lake Office was established in February, 1909, and during the first 11 months received bullion valued at $1,056,945.56. During 1910, $926,306.73 worth of bullion was received.

During the first quarter of 1911 the output of Bingham was about the same or slightly less than the average production for 1910. It increased steadily each succeeding quarter. As nearly as can be learned, the average daily output was in the neighborhood of 18,000 tons. This is an estimate based on the production of the Utah Copper, Highland Boy, Bingham-New Haven, Yampa, United States properties, Ohio Copper, Bingham Mines, and Utah Apex. It includes ore produced by the Ohio Copper, Utah Apex, and Bingham-New Haven, which was milled in the camp; also shipments by the New England, Last Chance, and by leasers. Taking 18,000 tons per day the production was 6,570,000 for 1911 as compared to 5,840,000 tons estimated for 1910. The production of Bingham is equal or in excess of the total production of the state in 1910, averaging over a half million tons per month.

PARK CITY AND TINTIC ORE SHIPMENTS IN 1911.

	Park City Tons	Tintic Tons
Jan.	5,963	26,517
Feb.	6.981	27,863
Mar.	8.421	34,487
Apr.	6,584	31.173
May	9,423	27,057
June	8,958	32,958
July	9,140	28,610
Aug.	12,171	31,542
Sept.	12,104	26,255
Oct.	11,333	30,805
Nov.	9,484	33,524 (*b*)
Dec.	9,160 (*a*)	33,249 (*a*)
Total	109,722	364,040

(*a*) December estimated. (*b*) Partly estimated.

The tonnage mined in Tooele (including Mercur), Beaver (including ore milled by the South Utah), Box Elder, Iron, Piute, and Sevier Counties aggregated approximately 415,000 tons, judging from past production and the data available on this year's output. In round numbers the total estimated production of the state was in the neighborhood of 7,458,000 tons.

The production of ore of all kinds was stimulated by the wider market offered, as is shown by the total tonnages for 1911 which are considerably in excess of the ore mined in 1910. The production in the first quarter from Tintic, Park City, Bingham, and other camps amounted to about 1,331,000 tons, which was less than the average for the last three quarters.

The Utah Ore Sampling Co., the only independent sampler in the Valley, operated plants at Murray and Sullivan City, and sampled custom ores from Utah, Idaho, Montana, Oregon, and Nevada. More ore was sampled than in 1910.

Smelting Operations

The smelting plants at Midvale, Garfield, and Tooele employ an average of 2470 men, who are paid $2,178,000 in wages annually The present investment in plants, power houses, and machinery aggregates $12,250,000, exclusive of land and mining ground. The four plants have a combined capacity of 11,700 tons of ore daily, and in the first half of 1911 handled 1,078,820 tons. In 1910, the value of the ore smelted was placed at $27,825,176.

Railroad Facilities Increased

The Western Pacific, crossing a relatively undeveloped mineral section of the state, operated regular freight and passenger service. Two roads were projected for eastern and southern Utah. The Bingham & Garfield R. R. was completed and put in operation. All of the grading on this line was finished about the middle of the year, and work on the steel bridges, trestles, etc. was completed a little later. The first cars were sent over the line Sept. 6, and passenger and freight service started Sept. 15. Ore shipments are reported as high as 14,500 tons in one day. The Denver & Rio Grande handled 7500 tons, as compared to 6000 tons, the maximum contracted for last year. This made a total available railroad capacity of 22,000 tons.

The B. & G. R.R. is reported to have cost $3,000,000 being one of the most expensive for its length in the country. Bingham now has railroad facilities ample to handle the present tonnage, and to accomodate probable future developments.

---

*Mining engineer, 607 Newhouse Building, Salt Lake City, Utah.

Utah Copper Development

In 1911, the Utah Copper produced steadily, remodeled its Arthur mill in part, and completed the Bingham & Garfield R. R. New steam shovels were added, bringing the number at work up to 21, the greater part of which was used in stripping operations. Additional shovels were put on overburden on the Boston Consolidated side in June bringing the number of shovels worked on overburden to 19, while an average of two shovels were worked on ore. Steam shovel operations now extend vertically 1500 ft. Underground mining was done on the Boston Consolidated, but in order to discontinue this as soon as possible stripping operations were pushed, and 3,947,748 cu. yd. of capping, were removed from the Utah and Boston groups in the first three quarters. Additional territory was acquired, including the Payroll group of eight claims (175 acres) covering ground between the original holdings and the Boston Consolidated. Ten acres of ground in McGuire's Gulch were purchased for dumping purposes from the Bingham Amalgamated.

Arthur Mill Remodeled

Five or six sections of the Arthur mill were remodeled, and chilean mills substituted for the Nissen stamps. Garfield roughing tables and Janney classifiers were added. The plant was not operated at full capacity, but only to such an extent as to take care of the excess of ore produced above the capacity of the Magna plant. The operation of four of the remodeled sections was about equal in capacity to that of the 13 original sections. The remaining stamp mill sections were permanently closed down, and will be gradually remodeled to keep pace with ore production. An extraction of up to 72 % on ore running 1.46% copper was reported. When the Arthur plant is completely remodeled it will have a capacity of about 8000 tons, which with the 12,000 or more tons treated by the Magna will bring the capacity up to 20,000 tons. The Magna and Arthur mills employ 1460 men.

The Magna plant was operated steadily, but not crowded. A few minor changes were made, including the installation of larger motors, etc. The Copperton plant was dismantled, and the buildings torn down.

The total amount of ore treated in the first quarter, as given in the reports was 981,104 tons of an average grade of 1.55% copper; for the second quarter, 1,060,414, of an average assay value of 1.63%; for the third quarter 1,273,373 tons averaging 1.48%. This makes a total of 3,314,891 tons of ore milled in this time. In the third quarter about 24% of the ore came from underground mining, and 76% from steam shovels. The Magna plant in the last quarter handled about 83% of the ore, and the Arthur plant about 17 per cent. In December 18,000 tons per day are reported to have been milled, the Magna treating 12,000 and the Arthur 6000 tons.

The production was 21,296,709 lb. for the first quarter; for the second, 24,469,812 lb.; for the third, 25,851,456. pounds. This makes a total of 71,617,977 lb. for the first three quarters. The average monthly production for this time was 7,957,553 lb. as compared to 7,834,188 lb. for the last three quarters of 1910. The average cost per pound was 8.43 for the first quarter, 8.02 for the second, and 7.56 for the third, the latter being the lowest in the history of the company.

Quarterly dividends of 75c. on 1,504,100 shares amounting to $1,128,075 per quarter were paid, bringing the total for the year to $4,512,300. There was also a net surplus. The Boston Consolidated sulphide mine was not operated on company account, but leasers at this property shipped one car of lead-copper ore daily.

Silver and Lead Producers

The greater part of the silver produced came from the Tintic district in Juab and Utah Counties, and from Park City in Summit and Wasatch Counties. The silver in the copper and lead ores from Salt Lake County also added appreciably to the output. Bingham produced an increased tonnage of lead ore from the Utah Apex, Highland Boy, Yampa, and other properties.

The Utah Apex developed important bedded deposits of silver-lead ore, which were opened in December, 1910. The Parvenu tunnel orebody was followed 400 ft. on the strike, 100 to 150 ft. in width, with a known thickness of 90 ft. at one point and an average thickness where opened of 60 ft. The real extent of this orebody has not yet been determined. Up to September, 28,000 tons of first-class ore from this deposit were shipped and for the balance of the year 200 tons per day were mined, or a total of 24,000 tons. During this period 115 tons of ore and concentrates daily were shipped. At the beginning of September the ore reserves were 143,000 tons, of which ore developed amounted to 83,000 tons and partially developed to 60,000 tons. Mining was discontinued November, 1910 and resumed April, 1911, during which time work was devoted to development. A mining profit of $121,299 was made for the six months.

Gold Production

The Consolidated Mercur was the chief producer of gold from silicious ores. This company treated from 600 to 700 tons of ore daily. The February cleanup brought $45,000. The annual report for the year ended June 30 shows that 239,190 tons were treated; the heads averaged $3.21 and the tailings 88c. This is lower than in former years because the tonnage included 12 per cent. of the old tailings retreated with the ore. Mining costs were $1.29; milling, $1.04; total, $2.33 per ton.

The gold produced for the year was 26,675 oz., which cost $20.92 per oz. to produce, making a loss of 25c. per oz. There was a small gain for the year from receipts from other sources.

Sources of Zinc

The zinc output for 1911 did not vary much from that of 1910, but will probably show an increase, due to the increase in the production of Park City lead-silver ores from which zinc is obtained as a byproduct. The production from the remainder of the state remained practically unchanged. Bingham produced a limited tonnage, and Beaver County added to the output. Zinc ores proper were mined by the Scranton in north Tintic. This property produced from 700 to 900 tons of zinc and lead ores monthly, the zinc ore coming from high-grade lenses of zincite. The output was shipped to Oklahoma, Kansas, Wisconsin, and other points in the East.

Zinc concentrates were produced by the Daly West and Daly-Judge, while the Grasselli company's mill at Park City treated zinc middlings, and shipped concentrates to its works in Cleveland. Some repairs and changes in the machinery were made. An auxiliary plant built to treat tailings along Poison Creek was tried out, but was not operated continuously. The main Grasselli plant shut down in September, after working the 30,000 tons of accumulated zinc middlings. Numerous small tailing plants treating from the Daly West, Daly-Judge, etc., operated at Park City, and made occasional shipments of zinc concentrates to the East.

A mill is being built below Park City for re-treating tailings for zinc and lead. Wilfley tables and the Macquisten flotation process will be used. The capacity will be about 40 tons daily.

The Huff electrostatic zinc plant at the Midvale smeltery of the United States company handled zinc middlings produced by the company's wet mill. This mill was operated three shifts, and treated over 300 tons of ore per day, producing about 50 tons of zinc middlings, treated in the Huff electrostatic plant.

Ontario Mineral Output in 1911

By Thomas W. Gibson *

The production of silver in 1911 reached the highest point in the history of Ontario, say 31,500,000 fine oz., an increase over 1910 of about 1,000,000 oz. The entire output came from the mines of Cobalt, which from their opening in 1904 down to the end of 1911 have yielded 125,500,000 fine oz. of silver, worth say $64,000,000, each year showing an increase over the one previous.

How long will Cobalt maintain the pace? While it is quite possible that the climax of production may prove to have been reached in 1911, the indications are that for many years to come the Cobalt mines will be yielding silver, and in considerable quantities. Naturally the phenomenally rich ore at first obtained is now less in evidence, although by no means worked out, and more and more dependence is being placed on the low-grade concentrating material. This is shown by the fact that while the aggregate tonnage of shipments from the camp was less than in 1910, the shipments of concentrates increased from 6874 tons to over 9000 tons. Some of the high-grade ores are also now being refined on the spot.

Tendency is to Reduce Ores at Cobalt

The Nipissing company introduced a novel and ingenious amalgamation method for recovering the silver from their rich ores. Silver bullion was first produced in the camp in 1910 when 980,633 oz. were turned out. The bullion output for 1911 will be much greater. This tendency towards final treatment in the camp, or at any rate within the province, was a strongly marked feature of the operations of 1911. There are now 13 concentration plants in operation, and two more—at the Beaver and Cobalt Lake properties—are under construction, with a total capacity of about 1350 stamps.

The producing mines remain much as before, the most important being Nipissing, La Rose, Crown Reserve, Coniagas, Kerr Lake, McKinley-Darragh-Savage, O'Brien, Buffalo, Beaver, Temiskaming, Trethewey, Townsite, Hudson Bay, Nova Scotia (Peterson Lake), Cobalt Lake; Wettlaufer in South Lorrain, and Millerett and Miller Lake-O'Brien in Gowganda. A fault has been found in the La Rose property which increases the depth of the conglomerate formation and opens up fresh possibilities for that mine. Like conditions exist on the Cobalt Lake. The Temiskaming mine had good ore at 575 ft. Its vein is wholly in the Keewatin.

The power conditions were unsatisfactory during the early part of 1911 when the continued severe frost checked the run-off into the Montreal and Matabitchouan Rivers, the falls on which supply the camp with electric power, and also to some extent with compressed air. Hydraulic operations are being projected by the Nipissing for removal of the drift on their property, thus facilitating the discovery of veins.

Mercury has been recognized in small proportions in some of the Cobalt ores. As byproducts of silver, white arsenic and cobalt and nickel oxides are being largely produced by the Canadian refineries, which now treat most of the high-grade ore and concentrates from Cobalt, and the output of these substances for 1911 was much in excess of any previous year. Cobalt oxide as such, and also mixed with nickel oxide, is exported to the European market.

Porcupine not yet Producing

The actual output of gold for the year was small, perhaps not exceeding 3400 oz., but much is being hoped for from Porcupine. Production from this field would doubtless have been begun ere this, had it not been for the disastrous fires of last summer which destroyed the mills at the Hollinger and Dome, and greatly retarded development. These mills are being rebuilt and will probably be in operation before spring. The owners are satisfied that there is plenty of ore of milling grade, some of it rich. Numerous other properties are being developed. The Vipond mill is far advanced, and the McIntyre and several other mines are also proposing to put in stamps. Fresh discoveries of spectacular free-gold showings have been made since the fires, particularly at the Dome, where a new lead containing much valuable gold has been christened "the golden sidewalk." The fire-swept towns of Golden City and South Porcupine have been rebuilt. The construction of the Temiskaming & Northern Ontario railway spur into the camp has given much needed facilities for transportation.

Electric power from Sandy Falls is already on the ground, and another large installation is going in at Wawaitin, both on the Mattagami River. At Swastika, Munro and Larder Lake camps there are stamp mills and considerable activity. The St. Anthony mine at Sturgeon Lake, northwestern Ontario, has been taken over by Messrs. Glendenning, Mackie & Kennedy, who have overhauled the mill and resumed production of bullion. At West Shining Tree Lake, gold was found in quartz veins, and one of the largest and most promising claims, known as the Gosselin, Messrs. Mackenzie & Mann are preparing to test by means of a diamond drill. In some of the finds free gold is abundant.

Only Two Nickel Producers

The output of nickel was about 3,000 tons, or say 1000 tons less than in 1910. The mines of Sudbury remain the sole source of production. The operating companies were the Canadian Copper Co., and the Mond Nickel Co. The works of the former are at Copper Cliff, to which place the ore is brought from the Creighton and Crean Hill mines, whence the bulk of the production has come for the last few years. The Mond company is rapidly getting its new smelting grounds into shape near Rumford, and when ready will remove its smelting plant from Victoria Mines thither. Both companies roast the ore, smelt it in blast furnaces and then convert it into bessemer matte, containing say 45% nickel and 35% copper. The Northern nickel range has not yet begun to produce ore, but drilling is going on at Blue Lake. It is proposed to raise a quantity of ore from a location in Dundonald township, where nickel is found in pyrrhotite similar to that of the Sudbury mines.

About the same quantity of iron ore, say 230,000 tons, was raised and shipped in 1911 as in 1910. It is mainly hematite from the Helen mine, Michipicoten, owned by the Lake Superior Corporation, the output of which goes to the company's furnaces at Sault Ste. Marie. Other producing mines were Atikokan, west of Port Arthur, and Moose Mountain, northwest of Sudbury, both of which are of magnetite. At the last mentioned mine a Gröndal concentrator is being erected with a capacity of 375 tons of finished material per day. The iron mines of eastern Ontario shipped nothing during the year, but a concentrating plant is talked of for Trenton on Lake Ontario, to treat ore from deposits on the Central Ontario railway. The production of pig iron for the nine months ended Sept. 30, 1911, was 22,842 tons less than in the corresponding period of

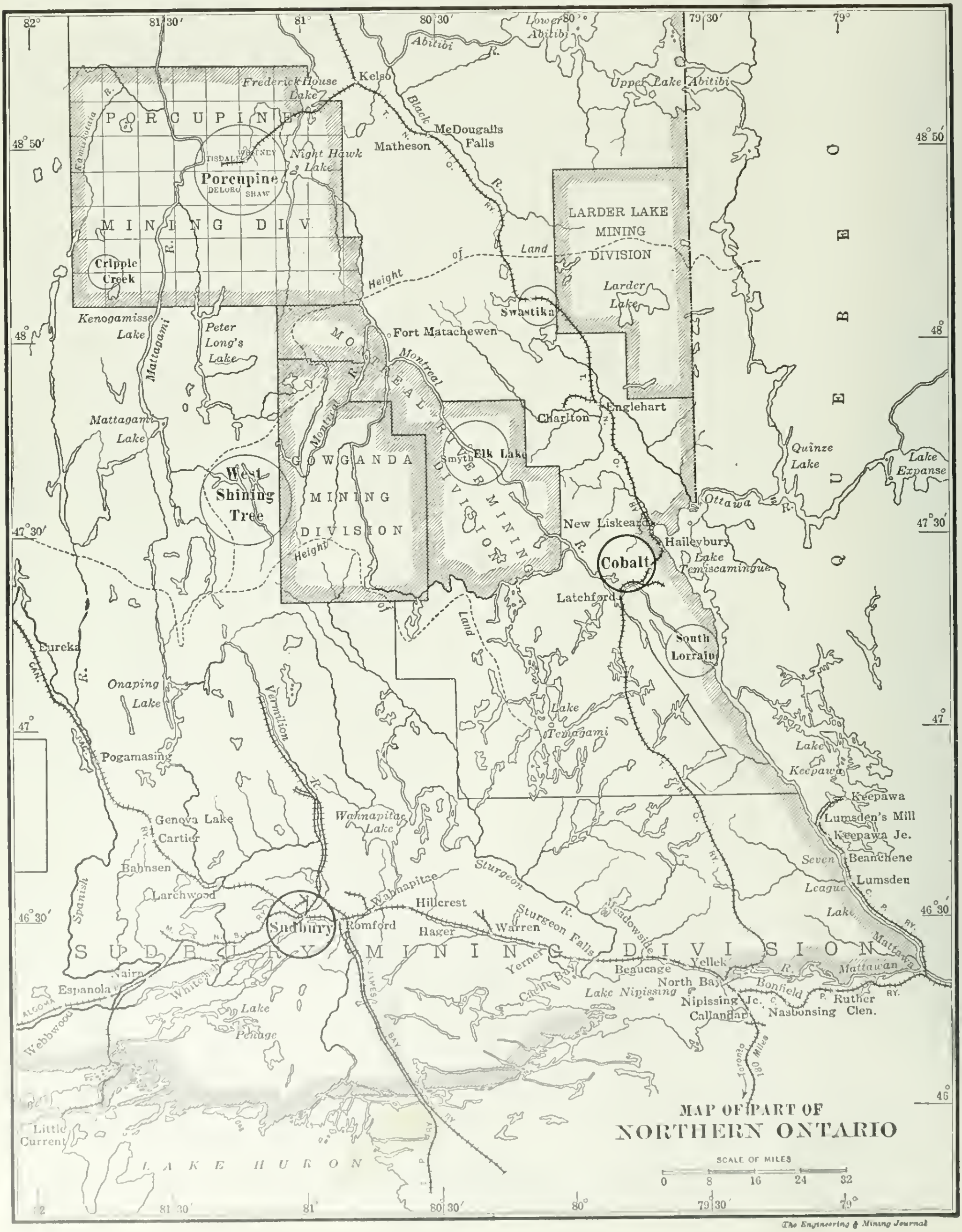
---

*Deputy Minster of Mines, Toronto, Canada.

1910. The total for the year will be about 400,000 tons.

Practically all of the copper raised in Ontario comes from the nickel mines of Sudbury, where the pyrrhotite is mixed with chalcopyrite. The output in 1911 was in the neighborhood of 9000 tons, or slightly less than in 1910. There are many other deposits of copper ore, mainly sulphide, on the north shore of Lake Huron, west of Lake Superior, and elsewhere, but for the present they are nonproductive.

The decline in the production of the petroleum wells of Ontario, which are



The Engineering & Mining Journal

situated in the Southwestern peninsula, continued during the year, and it is probable that the yield was not more than 10,000,000 gal. as against 11,000,000 gal. in 1910. Twenty years ago the output was 35,000,000 gal. The great bulk of the crude product of Ontario has come from the Petrolia, Oil Springs and Bothwell fields, which have been yielding oil for over 40 years. Here the oil-bearing rocks belong to the Corniferous formation (Onandaga limestone), and the wells are not of great depth, say 400 or 425 ft. In the newer field of Tilbury and Romney the oil is more deeply seated, being found mainly in the Guelph formation. This field is showing a much more rapid falling off than the older ones. The latest pool, in the township of Onondaga, has not so far made a large production. The oil here is found in the White Medina, a still earlier formation. There is a little flurry at Delaware, where shows are obtained from the Corniferous. The thickness of the oil-bearing rocks from the Trenton up to the Corniferous is great, as is also their superficial extent, and these conditions provide a fair chance of striking new oil fields. So far all the Ontario oils have been of the paraffin-base variety.

The natural-gas area of Ontario is steadily spreading, and now covers a large part of the northern shore of Lake Erie. There are two fairly distinct fields—one in the counties of Welland, Haldimand and Norfolk, and the other in the counties of Kent and Essex. There were in 1910, 828 producing wells in all, of which 781 were in the former and 47 in the latter field. A population of about 250,000 in southwestern Ontario enjoys the advantages of natural gas both for fuel and lighting purposes, the gas being piped to the cities, towns and villages for some considerable distance outside of the gas fields. It is also used to some extent in manufacturing industries. The production in 1910 was valued at $1,491,239 at an average of 20.5c. per 1000 cu.ft. and the output for 1911, owing to the extension in the use of the gas which has been going on, will probably amount to $2,000,000.

Pyrites and Other Minerals

There are numerous deposits of iron pyrites in Ontario. In 1910, 33,812 tons were raised and shipped, part of the product being used in the manufacture of sulphuric acid in Ontario, and part exported for similar purposes to the United States. The Vermilion mine on the Grand Trunk Pacific is now in shape for large shipments, and a good deal of pyritic sand is extracted from the workings of the Helen iron mine. The production for 1911 will show an increase over that for 1910.

Talc of good quality is mined near Madoc and ground at that place into several grades of product used in the manufacture of cosmetics, paper, soap, etc. In 1910 the output was 5824 tons, worth $46,592, and this will no doubt be exceeded by the production in 1911.

Construction materials are abundant in Ontario, including clay, stone, limestone and sand. As a consequence the towns and cities of the Province are largely built of brick and stone, and there is annually a large output of drain tile, sewer pipe and similar products. Marl for portland cement is being displaced by solid limestone, of which there are deposits of suitable quality. The cement industry is rapidly expanding. In 1910, 2,471,837 barrels were made, and no doubt the statistics for 1911 will show an increase. Fine variagated marbles in striking and harmonious colors are being taken from newly opened beds near Bancroft.

Corundum in Renfrew and Hastings Counties, feldspar along the Kingston & Pembroke Railway, gypsum in the valley of the Grand River, mica in Lanark and Frontenac Counties, salt on the east shore of Lakes Huron and St. Clair, graphite in Lanard and Renfrew, and quartz in several parts of northern Ontario, all form the bases of important local industries. The output of the mineral industry of Ontario for 1911 had a value of about $40,000,000 based on the selling price at the mines or works.

Mining in British Columbia in 1911

By E. Jacobs*

When the British Columbia Bureau of Mines issues its official annual report, next summer, it will be found that there were in 1911 decreases in the quantities of all metals produced, and in coal and coke, and these to such an extent as may make the recorded value of the year's mineral production the lowest of any since 1904. The chief reason for this was the strike of the men employed in the coal mines and at the coke ovens in Crow's Nest Pass district, southeast Kootenay. Besides largely reducing the output of coal and coke, smelting operations were interfered with, so that the Granby Company's reduction works were non-productive nearly half the year and the output of metals from other smelteries also lessened, though in smaller degree. Other unfavorable conditions are mentioned below. The general shortage in production does not, however, truly represent the actual condition of the mining industry of the province, for notwithstanding this, satisfactory progress was made in various directions. Reviewing the several minerals separately, the following comments are submitted.

The Precious Metals

The production of placer gold is believed to have been less than in 1910. Atlin creeks yielded less, by about $50,000. There will probably be a smaller production from Cariboo division of the Cariboo district, but this is in part compensated for by an increase in Quesnel division. The 1911 total production in all districts is not expected to reach $500,000 in value. The output of lode gold, too, may be expected to be less than in 1910. The largest decrease was in the gold from Granby ores, of which only about half the usual yearly tonnage was smelted. Nelson mining division will probably also show a decrease. A gain of about 6000 oz. is expected from the Hedley Gold Mining Co.'s Nickel Plate group, Similkameen, while Rossland's total should be about 5000 oz. larger and the British Columbia Copper Co.'s output approximately 3000 oz. more than that of 1910. A preliminary estimate of the 1911 Hedley production is 57,000 tons of ore averaging $12.10 per ton. Dividends from this mine in 1911 totalled $300,000, or 25% of its capitalization. In the absence of details of production of numerous smaller mines, a close estimate is not practicable; roughly, the 1911 total production may be placed at 250,000 to 255,000 oz.

An output of 2,000,000 oz. of silver, as compared with 2,450,000 oz. in 1910, seems likely, judging by the returns available. Preliminary figures indicate decreased production at 10 or a dozen of the larger silver-producing mines. Generally the loss in output is temporary, attributable to causes already, or shortly to be, removed. In one case, however—that of the St. Eugene East Kootenay—

---

*P. O. Box 645, Victoria, B. C.

the decrease is a result of gradual exhaustion of known ore deposits. On the other hand, the Rambler-Cariboo, Slocan, made an increase larger than any single decrease, and it may reasonably be expected to do even better in 1912, for it has comparatively large reserves of ore the stoping of which will shortly be commenced, following completion of a concentration mill and railway transportation facilities.

Although conditions unfavorable to the production of silver-lead ore were experienced in several parts of both East and West Kootenay, much development work was done in these districts in preparation for an enlarged output in the future. Deep development in several Slocan mines proved the occurrence at considerable depth of ore of good grade and in quantity, consequently the outlook for enlarged production is better now than for years past.

Lead

A combination of adverse conditions appears to have caused the total production of lead in 1911 to be smaller than in any other year since 1903. The largest individual decrease was that of the St. Eugene, which in 1910 produced nearly 15,800,000 lb. out of a total for the whole province of 34,652,000 lb.; its output for 1911 was from approximately 35,000 tons of ore from which 5300 tons of concentrate were produced, containing 5,882,000 lb. lead and 136,000 oz. of silver. Other decreases were those of the Blue Bell, in Ainsworth division, from which no production was made; the Whitewater group, also in Ainsworth division, which in the summer of 1910 was deprived by forest fires of both concentrating mill and railway transportation; and the Standard, Slocan Lake district, at which production was suspended during the greater part of the year, while power, concentration and transportation facilities were being provided, all of which became available late in the year.

Several Slocan mines increased their respective outputs, and in less degree two in Nelson division also produced more lead. On the whole, though, the known supply of lead ore has during recent years gradually become smaller. Developments in Slocan mines promise a change for the better, and there is, as well, hope of considerable improvement near Salmo, Nelson division.

Copper

Notwithstanding that during about half of 1911 production was suspended at the Granby company's mines, the net decrease in total production of copper was less than had been feared. Preliminary figures show that the British Columbia Copper Co., as compared with its 1910 output, made a gain of between 2,000,000 and 3,000,000 lb., and it is reported the Britannia mine produced 7,000,000 lb. more than in 1910. The marked improvement at the Britannia is noteworthy. Robert H. Leach, before ill-health necessitated his relinquishing its management, had during the last two years effected an entire transformation in its capacity to produce ore of profit-yielding grade. Allowing for a decrease of 2,000,000 lb. from the Snowshoe (Boundary) and say 9,000,000 lb. from Granby, and placing against these an estimated gain by other mines of not less than 9,000,000 lb., the year's aggregate production should be within 2,000,000 to 3,000,000 lb. of that of 1910. A prominent feature of the year was the development by the Granby company at its Hidden Creek mine of a large tonnage of ore—variously calculated by different engineers at 6,000,000 to 12,000,000 tons—estimated to contain a minimum of 2% of copper for the smaller tonnage and 1.65% for the greater. Some large shoots in this mass of ore give an average assay return of 5% of copper.

Metallurgical Notes

At the Consolidated Mining & Smelting Co.'s works, at Trail, West Kootenay, a Dwight-Lloyd sintering plant was put in. This was found to give most satisfactory results when roasting gold-copper concentrate from the Le Roi No. 2 Co.'s Josie mine, Rossland. It has not been so successful, however, with lead-zinc ores and concentrates, with which a second roasting was found necessary. Some changes in the arrangement of the Huntington-Heberlein roasters and converter pots are being made at Trail. The operation of the electrolytic lead refinery there was continued with excellent results. At Grand Forks, Boundary district, the Granby company constructed flumes, bins and an incline trestle (with conveying belts) up to a height of 100 ft., for disposal of granulated slag, thereby making the old dump again available for use for this purpose.

Approximate figures indicate that in 1911 the total value of metal products at the Consolidated smeltery was $4,750,000, in the following proportions: Gold, $2,745,000; silver, $715,000; lead, $770,000; copper, $520,000.

The Consolidated Company's Mines

The Snowshoe is a low-grade copper property, situated in close proximity to the Granby company's mines in Phoenix camp, Boundary district. While the tonnage received during the year from the company's lead mines was also less, owing to the practical exhaustion of the St. Eugene mine, development work in progress at the Sullivan, Molly Gibson, and on some claims near Salmo, Nelson mining division, on which there is a large surface showing of lead carbonate ore, together with the opening of large shoots of silver-lead ore in Slocan mines, warrants the expectation that more lead ore will be received in 1912 and that the quantities of silver and lead recovered in that year will be proportionately larger. Further, not only has there been developed, during recent months, below the 12th level of the company's War Eagle mine, Rossland, a larger tonnage of ore and of higher gold value than was expected, but a considerable quantity of ore is being obtained from the Le Roi mine, now owned by this company, which will add substantially to the 1912 ore receipts at the smeltery. The Center Star group at Rossland, owned by the Consolidated Mining & Smelting Co., in 1911 shipped about 195,000 tons of ore containing, approximately, 86,512 oz. gold, 57,670 oz. silver, and 2,183,000 lb. copper. Nearly 12,000 lineal ft. of development work was done and about 20,000 ft. of diamond-drilling.

Milling Operations

At the Hedley Gold Mining Co.'s 40-stamp mill, Similkameen, where no gold is saved on amalgamating plates, but is chiefly recovered in a concentrate which is smelted, the gold-carrying cyanide solution passes to Merrill presses and the slimes to Oliver filter presses, the final result being an average total extraction of 92% of the gold contained in the ore fed to the stamps. At Sheep Creek, Nelson mining division, the Motherlode Sheep Creek Mining Co. has erected and equipped a 10-stamp gold mill and cyanide plant. Near Silverton, Slocan Lake, the Van-Roi Mining Co.'s concentrator was completed last spring and has since treated about 30,000 tons of silver-lead-zinc ore, making silver-lead and silver-zinc concentrates; the Silverton Mines, Ltd., put in one unit of the Elmore Vacuum Process plant at its Wakefield mill, to treat zinc middlings from the jigs; and the Standard Silver-Lead Mining Co. built a 100-ton concentrating mill, also near Silverton, and commenced operations with it in November. In the coast district, satisfactory results were achieved at the Britannia mill in concentrating ore containing chalcopyrite, and the unit of the Elmore Vacuum plant put in here proved well adapted for saving the mineral from fines and slimes. These combined processes promise to give a high total extraction and a nearly neutral product for smelting. The Portland Canal Mining Co. increased the capacity of its concentrating mill to 75 tons per day, and made a good average saving in two classes of concentrate—iron with gold, and lead with both silver and gold.

Mining in Mexico in 1911

By Kirby Thomas*

During 1911 the condition and progress of the mining industry of Mexico was directly related to and concerned with the outcome of the political revolution which began in November, 1910 and terminated sensationally in April, 1911. The revolution as far as directed and controlled by Francisco I. Madero and his associates was directly aimed at reforming and changing domestic political conditions, and fortunately was absolutely free from any prejudice or antagonism toward the foreign interests, which in the mining industry are so preponderant.

Following a carefully considered and well promulgated policy, the revolutionists, particularly in the northern part of the republic, gave full and complete protection to foreign property interests and to foreigners. This situation was reciprocated generally by the American and English operators in Mexico by a policy of absolute neutrality, although there was undoubtedly a large element of sympathy and approval for the Madero movement among the foreigners, particularly among Americans. During the war, however, the foreign mining operators in Mexico conducted themselves with noteworthy calmness and judgment, with the result of creating the basis for a good relation between the foreigners and the new government.

Interruptions Caused by the Revolution

During the revolution the operating mines were seriously hampered by the interruption of the usual means of transportation, and particularly by the restrictions placed, as a war measure, upon the distribution of dynamite. However, most of the large operating companies continued active, and all of them were in position to resume activities at the close of the war. The revolution had the effect of discontinuing a great many development and exploratory operations, partly by reason of the special caution of foreign investors and partly because of the difficulties and disadvantages of trying to operate with the disturbed economic and social conditions in the country. It is undoubtedly true that many of the top-heavy and inflated Mexican mining enterprises found the war a convenient excuse to enable them to haul in sail.

Until recently American investors have been somewhat timid about reëntering the field, particularly in the way of new enterprises, but it is to be noted that even during the time of the disturbances certain English investors became more active and took advantage of the naturally advantageous terms and prices offered.

Resumption of Mining

Following the sudden termination of the war and the inauguration of a provisional government representing the successful revolutionists, the mining industry of the republic began rapidly to resume a normal condition. The transportation systems were quickly restored to normality, and the scarcity of labor which was a factor in some districts was relieved by the availability of the ex-soldiers of both sides. The policy of the new government, as expressed in interviews and official messages, indicated a distinct fairness toward foreigners engaged in the mining industry. In one respect some alarm was felt; that was with regard to the announcement of restrictions as to the granting of concessions and monopolies. While this policy, partly inaugurated under President Diaz, was one which would in ways interfere with some of the special privileges granted to foreign companies, yet, on the whole, it is just and wise, and is generally considered by the individual foreign investors not participating in these favorable concessions, as beneficial. One of the issues of the revolution was the discontinuance of the policy of granting these special concessions, and the confirmation and continuation of the policy of an open field will be for the best interests of the industry and the individual.

The vast Madero family estate is largely interested in mining and is closely identified with the industry in a number of ways. This fact alone had a favorable tendency in forming public opinion locally and abroad and in creating confidence in the outcome of the new government as regards the mining industry of the country.

Wages May Rise

Owing to the prevalence of extremely liberal ideas among the people resulting from the political changes and to the natural social disorganization following the transformation of the government, more or less local labor and class disturbances arose throughout the republic, but these were mainly local, and were on the whole easily handled by the granting of moderate concessions on the part of employers. In one or two instances these strikes, so-called, took the form of riots and necessitated the calling out of the local soldiery. On the whole, the labor situation in Mexico, while uneasy and disturbed, is not serious. The tendency to rising wages is, of course, to be recognized, and in some cases the demands are large. The adjustment of the labor question is one of the problems which the mining industry will have to meet and gradually work out.

Railroad Extensions

Little advance in railroad extension in Mexico was made in 1911. The Southern Pacific late in the year resumed construction on its Pacific Coast line in Tepic and it is expected that trains will be running to the city of Tepic in January, 1912. No work was done on the westward extension of the line from Magdalena in Jalisco nor is there any prospect of early work being done. Work on the Yaqui River extensions was suspended all the year. It is now announced that the southward extension from Nacozari will be begun soon and that the line as planned may be changed to go by the Cieneguita district. The Mexico Northwestern road completed its connection between the line from El Paso and the line from Chihuahua via Madera. Nothing is in sight as to the proposed extensions of this system to the Pacific. The National Railways of Mexico is building a line westward from Guttierez, north of the city of Zacatecas, to Durango tapping the important camps of western Zacatecas. There is a revival of the project for a line along the Pacific coast northwestward from Acapulco, concession for which was granted to Americans in 1910. A branch was built into the Cusihuiriachic district in central Chihuahua. In many parts of Mexico the extensions of the railroads to adjacent mining districts is a long delayed need and it is hoped that the new administration will be able to direct the policy of the National Railways and to encourage private enterprise so that this situation can be relieved soon. No work was done on the Orient road in Mexico during 1911, but operations were concentrated on the trunk line in the United States. It is announced that this work will be resumed at once on the gap in the line to connect the westward extension from Chihuahua with the line now built from Topolobampo.

---

*Mining engineer, 20 Broad Street. New York.

Extension of Power Projects

During 1911 a number of mining companies, particularly in the mountain regions where transportation conditions are unfavorable, found it necessary to utilize the available hydro-electric power. In the western Sierra Madre the Sierra Consolidated and Cocheño companies built power plants. The Dolores mine is also using hydro-electric power. The Guadalajara power plant in Jalisco was partly completed during the year, but in the main its relations with the mining companies were more or less unsatisfactory owing to certain inflexible conditions imposed by the company which is controlled by Mexicans. The Guanajuato plant increased its power capacity and extended its lines to San Luis Potosi and Aguascalientes.

The use of gasoline or oil engines for exploration, and particularly for hoisting purposes, is becoming more frequent in the Mexican field. Particularly the multiple-cylinder, automobile type is found advantageous in connection with hoisting operations, inasmuch as intermittent operation is permitted. The use of the gas engine in the republic is increasing, and advantage is taken of the wider range of fuel available for the modern types of gas-producer plants.

The Conchos River project is underway and promises within a year to supply power to a number of important Chihuahua camps. This project is financed by English capital, represented by Lord Cowdray. The project to develop the power on the Balsas River has been in abeyance for some time, and at present no movement is being made to realize it.

Zinc Shipments Resumed

In the latter part of 1911 there was a resumption of the shipment of zinc ore from northern Mexico. Most of the shipments going to Europe, but some ore came into the United States, paying the new duty. However, the zinc industry is still seriously hampered in Mexico. A notable feature in connection with the possibilities of the zinc industry is a contract made by the San Francisco del Oro company with certain Europeans, under which it is profitable to ship roasted concentrates containing 10% zinc and 30% lead, or the reverse percentages. This special contract has attracted considerable attention because of the possibilities it holds out with regard to other properties.

The Coal and Oil Industry

The coal production during the year was reduced greatly. However, work in exploration and development was underway, and a new district was developed northeast of the present coal area near the Rio Grande River.

The oil industry, particularly at Tampico, was prosperous in 1911. The production increased greatly and a number of new wells were brought in, greatly extending the oil areas and also indicating large possibilities for the field. A number of independent American companies became engaged in the exploitation of oil in the Gulf region.

Mining in Sonora

In Sonora the Greene-Cananea, Moctezuma, Creston-Colorada, Chispas and several other large mines maintained practically continuous operation during 1911. Little new work was undertaken and many pending negotations were suspended or entirely broken off. The Greene-Cananea continued to introduce economies in operations and the present earnings hold out hopes for an early dividend. In November, Phelps, Dodge & Co. acquired the Promentorio copper mine near Nacozari, under mortgage greatly extending the company's large copper properties in northwest Sonora. The Mina Mexico in the Yaqui River district started operation late in the summer of the new furnace installed at the mine. The Pacific Mining & Smelting Co. completed arrangements for a supply of sulphide ore and will operate the smeltery at Fundicion soon. The Chispas mine recently suspended work owing to differences over water rights and labor disputes. But little progress was made in the Altar district or in any of the West Coast properties. The Sahuaripa district was practically idle most of the year. Development operations were continued at the San Antonio in the Yaqui River district. Investigations of the coal area in central Sonora have been underway with reported good results. No results from the desultory attempts at oil discovery in northern Sonora are reported. In the Alamos and Rio Mayo districts a new property, the Muchacho Grande was extensively developed and some work was done at Minas Nuevas near Alamos, and also in the nearby new gold district of Sobia. Resumption of work in the northwestern part of the state was begun and the activity promises to be great for 1912, especially if the proposed extension of the railroad is assured. Arrangements for the operation of the smeltery at Toledo in the Yaqui River district are being made.

Conditions in Chihuahua

The mines maintained production very well for 1911 under the conditions of interrupted traffic. The Batopilas, Palmarejo, Dolores, Sierra Consolidated, Cocheño, Yoquivo and others in the western Sierra Madre were in practically continuous operation. With the operation of the railroad to Cusihuiriachic much work was done in that old camp. Santa Eulalia continued to show remarkable richness in new and deep development. The copper smelting project at Terrazas was resumed late in the year. Much of the mining in northern and eastern Chihuahua was suspended throughout the year. Recently some interesting rich gold discoveries were made at San Sostones, about 60 miles east of the city of Chihuahua.

The Parral camp made much progress during 1911 and promises greater production than ever before. The Palmilla, Sierra Plata and Veta Colorada mills were put in commission and several new smaller mills were planned. Recently men allied with the Conchas power project acquired wholesale options in the camp presumably with the intention of providing an outlet for an expected power surplus. The electric power should be in the camp within a year and several companies are anticipating it. The Esmeralda disclosed rich ore at depth and the Europa opened an extension on the El Tajo vein. The famous Palmilla mine is still idle, the mill finding its ore supply from the dumps and from other properties owned by the company on the Veta Colorada. The Naica mines produced less ore and several operations in the camp were discontinued. At Almoloya operations continued. The Francisco del Oro mine, near Parral, made changes in its mill plans and expects to ship soon. At Santa Barbara operations continued during 1911. El Rayo made important new discoveries and increased its output and ore revenue.

The mining situation in Sinaloa was quiet in 1911 and operations still await the full restoration of political stability.

Mining in Northeastern States

In the northeastern states of Mexico, Nuevo Leon and Coahulia, there was but little change in mining during 1911. The coal mines after some interruptions, resumed usual activity. A new coal area near Ciudad Porfirio Diaz was developed in 1911. The principal output of the metal mines of these states continued to be lead, silver and zinc. The zinc-lead operations in Tamaulipas were resumed in the latter part of the year. The smelteries at Monterey and Torreon continued operating during most of the year except for a short interval at the Torreon plant during an acute labor strike. The zinc output of these estates continued small and is much less than two years ago before the United States tariff was revised.

In Durango there was a practical suspension of all mining except at the larger camps as Velardeña and Mapimi during much of 1911. The Indé district showed few changes and little progress. The Lustre district was revived by the reorganization of the Magistral company and the project for a railroad. Guanacevi operated on a reduced scale during the year. The Mexico Consolidated passed through a period of reorganization, the end of which is not yet in sight and only operated on a small scale. In the remoter Sierra Madre camps political conditions were unsettled up to the end of the year. Some new discoveries were reported near San Dimas on the western boundary. The operations at Mapimi during the year were successful as to output and ore development. The Peñoles company is now operating also the San Juan. The Velardeña smeltery was interrupted during the war but is now in full operation.

In the Central States

In the central states there was but little change during the year. At Zacatecas the Goerz company of London is continuing development on the Rio Tinto. The Magistral smeltery is successfully operating. New negotiations are underway for the San Roberto. The camps in southern Zacatecas have remained unchanged and quiet. In the northwestern part of the state the Mazapil company continued large operations at Mazapil and Concepcion del Oro. The camps in the western part of the state are being revived preparatory to the new conditions which will result from the railroad projection into that section.

The operations at the Aguascalientes mines were interrupted during the first part of the year and again recently by labor troubles. The smelting plant at Aguascalientes continued in operation throughout 1911. The mining conditions in San Luis Potosi were resuming normality toward the close of 1911. The smelteries at Matehula and San Louis Potosi are in full operation again. The Tiro General mine at Charcas was acquired by the American Smelting & Refining Co.

In Hidalgo operations were largely suspended for most of the year except in the important Pachuca camp. The Cortez company of Boston continued extensive developments in the northern districts. At Pachuca the new activities were largely represented by the work on the Santa Gertrudis mill which has a daily capacity of 600 tons. A new plant to treat the tailings on the Pachuca River was installed. The Real del Monte y Pachuca company continued satisfactory earnings as did the San Rafael, La Blanca and several other of the old mines. The Blaisdell treatment plant for tailings made a good showing. Improvements in transportation between the mines and the mills were begun.

The Tezuitlan smeltery in Puebla resumed after some technical adjustments and is now operating. In Guerrero work was and still is hampered by political conditions. At Taxco work on a railroad is being done and some new investments have been made in the camp. The situation in Oaxaca has been generally unsatisfactory owing to the political disturbance and only in recent days have the prospects seemed better. The extensive operations of the Oaxaca Iron and Coal Co. near Nochtitlan were suspended late in 1910 and have not yet been resumed. The Taviche camp continues to yield rich shipping ore but milling is limited.

In Jalisco activities continued during 1911 in the Hostotipaquillo district and several new enterprises were undertaken. The district is still awaiting satisfactory power and the extension of the Southern Pacific railroad from Magdalena. The Amparo mine at Etzatlan yielded good returns and extensive development was carried on at the Magistral copper mine near Ameca. Some work is being done in the Bolaños district north of Guadalajara. The operations in Jalisco are more fully described and a resumè of mining in Guanajuato for 1911 given in other articles in this issue.

Mining in Oaxaca in 1911

Special Correspondence

In general there was a considerable falling off in the production from mines in the state of Oaxaca during 1911. While there were no serious disturbances in the mining districts during or after the revolution, most of the small properties, the production from which did not pay running expenses, suspended operations, and others reduced expenses to a minimum. Practically all non-producing prospects suspended. At the same time the two chief producers of the state, the Natividad and San Juan mines, increased their production considerably over that of 1910. Data are not available at this time as to the exact production of the various mines, but it is probable that the total gross production of the state for 1911 was in the neighborhood of 1,200,000 pesos, of which about 1,000,000 pesos were produced by the Natividad and San Juan mines.

The San Juan mine worked steadily, producing about 400 tons of shipping ore monthly. All ore extracted from the mine was sorted, the sorted product shipped to Aguascalientes, and the poorer ore stored for future treatment. It is planned to erect a 10-stamp cyanide mill at this mine. The shaft was sunk to a depth of 500 ft., and a 200 h.p. first-motion steam hoist was installed. The Escuadra and Zapote mines produced more or less regularly, and some production was made from the San Francisco mine, though it is now idle.

The ores of the Taviche district are silicious silver ores, largely in the form of sulph-antimonides of silver, with little pyrite or base metals other than antimony, and, as shipped, seldom contain more than five kilograms of silver per metric ton, with a proportion of 5 to 15 grams of gold per kilogram of silver, so that a considerable percentage of the gross value is paid for the high shipping and treatment costs. Several mills have been put up in the district, but have all failed to make a success of the treatment of the ores.

Ocotlan, Ejutla and Totolopam

The 10-stamp amalgamation and concentration mill belonging to the Mimiaga family ran about a quarter of the year on low-grade ore from the old opencuts of the Natividad del Valle mine at San José. The San Martin mine between Ocotlan and Ejutla continued development and made small shipments.

The Ocotes mine, the property of the Tezuitlan Copper Co., continued development work, and it is understood that the already large reserves of silicious copper ore were considerably augmented. It seems probable that this mine in the Ejutla district will not be placed on a productive basis until a concentrating mill is erected that will economically bring the concentrate to a grade that will readily stand the expense of shipment to the company's smeltery at Tezuitlan. No other work of importance has been done in this district.

Two new cyanide mills were completed in 1911 in the Totolopam district. Of these the Victoria y Tapada mill ran intermittently, and operations were suspended towards the end of the year. The Soledad mill was also shut down having run but a short time. The ores are chlorides and bromides near the surface; sulphides in depth.

Sierra Juarez District

The 30-stamp cyanide mill of the Natividad company ran at two-thirds capacity all the year, owing to lack of sufficient motive power in the present 300 h.p. hydro-electric plant. Ground was broken in March for the construction of a new 1000 h.p. hydro-electric plant for this company, which is now nearly completed and is expected to be in operation in January, 1912. Power will be generated by two 500 h.p. Pelton wheels under a 566 ft. head, each directly connected to a 375-k.v.a. generator. The ore of the Natividad mine contains pyrite, galena and blende, with a gold and silver content in the proportion of 80% of the value in gold and 20% in silver. The ore is crushed in cyanide solution, completely slimed in the tube mills and afterwards concentrated on vanners and the concentrate returned to the tube mills for regrinding. The whole pulp passing from the vanners is agitated and filtered in a slime filter plant. An extraction of about 85% of the gold and 50% of the silver is secured. From 10 to 15 tons of high-grade ore were shipped monthly, of an average gross value of 1500 pesos per ton. A foundry, new machine shops and several buildings were added to the equipment during the year.

No other mining operations of importance were undertaken in this district during 1911, though the San José de Gracia mill of five stamps was operated for a short period.

Villa Alta and Peras Districts

Development work was carried on at Santa Gertrudis in the Villa Alta district by British investors.

The mines of Wenceslaus Garcia in the Peras district of Oaxaca were worked successfully during 1911, and the ore was milled at the 20-stamp mill of the Los Reyes company, which was rented. A production of something over 5000 pesos per month of small gold bars was also made by the *buscones* who worked the oxidized surface ores and treated them in arrastres turned by waterwheels. The ores of this district are free-milling gold ores in the oxidized zone.

Mining at Guanajuato in 1911

By Austin C. Brady*

The political upheaval in Mexico affected Guanajuato only to the extent of keeping out capital that otherwise might have been invested for the furtherance of plans of established companies, or for new enterprises. The operations of the principal producing companies continued through the year with but few interruptions. The production of the Guanajuato district in 1910 was placed at 14,000,000 pesos, and it is estimated that the 1911 production will at least equal that of the previous year.

The Peregrina Mining & Milling Co. has had a successful year. In addition to treating about 7000 tons monthly from its own properties, it has been milling 6000 tons per month from the Villapando mine, of the Cubo Mining & Milling Co. The Villapando ore is the product of new development, and the Cubo company has been making a good profit on the deliveries made to the Peregrina mill. During the year the Peregrina has continued payments on its preferred stock.

Work Resumed on Nueva Luz

Early in the year the Providencia Mining & Milling Co. placed in commission its 200-ton cyaniding plant, and good results are being obtained in the all-slime treatment of the Tajo de Dolores ores.

Of late the company has been handling about 200 tons daily, and has been operating at a good profit. The Providencia has been financed by the Proprietary Mines Company of America, and in order to concentrate attention on that enterprise until such time as it should reach a profitable basis, the Proprietary Mines, also controlling the Mineral Development Co., early in the year suspended work on the latter's Nueva Luz project. Recently this work has been resumed, the mechanical plant has been overhauled, shaft improvements have been made, and crosscutting for the mother lode of the Guanajuato district now is in progress. If the work continues without interruptions, it is believed the *veta madre* will be cut in February or March.

During 1911 the Guanajuato Reduction & Mines Co. treated approximately 20,000 tons monthly. About one-third of the ore treated has been taken from new workings in the old Rayas and Tepeyac mines, the remainder has been from dumps and fills. The company plans to push steadily new development, and the percentage of ore from new workings probably will be considerably increased in 1912. The earnings of the company have been more than sufficient to keep up interest payments on its $3,000,000 bond issue.

The Guanajuato Consolidated Mining & Milling Co. has been operating only 40 of its 80 stamps during the greater part of the year, but higher-grade ore has been treated, and the showing for 1911 is expected to be as good, if not better than that for 1910, when 80 stamps were dropping. The Carmen-Guanajuato Gold Mining Co., which is controlled by the Guanajuato Consolidated, has been milling at a satisfactory profit.

The mill of the Pinguico Mines Co. has been treating from 5000 to 7000 tons of ore per month. Less high-grade ore has been shipped than in 1910. The Humboldt-Guanajuato Co., owning properties adjoining the Pinguico, has continued development.

El Monte Vein a Rich Producer

The year's production of the rich El Monte de San Nicolas mine was over 1,000,000 pesos. Shipments have been made regularly, and lower-grade ore has been treated in arrastres. In the adjoining Pasadena property, of which E. A. Montgomery, of Los Angeles, Calif., is the principal owner, a parallel vein has been cut and some rich ore has been taken out. Sinking for the El Monte vein has been continued.

The San Cayetano Mines Co., controlled by the Lewisohns, of New York, and of which much was expected, abandoned operations some time ago. The company was organized to work the old San Cayetano properties, and in 1910 took over several adjoining mines. It is reported that the results of the extensive development accomplished were not up to expectations.

The Oro Grande Co., organized to operate the famous old mines of La Luz, has not met the success that was hoped for. The old Bolañitos mine was unwatered, but so far new development has not opened extensive orebodies. The deal made last year with the Guanajuato Amalgamated Mining & Milling Co. for its Jesus Maria mines and mill may not be consummated. At present only 50 of the 100 stamps of the Amalgamated mill are in operation.

The 10-stamp concentrating and cyaniding plant of the Tula Mining Co., placed in commission early in the year, has been shut down, pending the development of reserves of higher-grade ore. The capacity of the plant is not sufficient for profitable operation on the grade of ore that can be supplied.

---

*Guadalajara, Jal., Mex.

Milling Ore from the Sirena Dumps

The San Matias mill, of the Mexican Milling & Transportation Co., has been making a good profit monthly operating as a custom plant. Much ore from the Sirena dumps and croppings, connected with the San Matias by aërial tramway, has been milled. The Santa Natalia mill of Cooper Shapley, leased to the French interests that last year took over the Santo Niño and other properties, has been shut down. The French interests are carrying on development. The Nayal mine, leased by the Dwight Furness Co. to Martin Hines, has been returning profits of 500 pesos weekly on ore sent to the Nayal mill. Important deals on the Dolores, San Gregorio and other properties in which the Dwight Furness Co. is heavily interested, are pending.

The Guanajuato Power & Electric Co. has had a successful year. Its third power plant on the Angulo River, in the state of Michoacan, was completed and the power capacity was doubled thereby. A branch from the transmission line, extending to San Luis Potosi, is supplying the Providencia San Juan de la Luz properties, at San Felipe. Arrangements were completed for the building of a 50-mile transmission line from Guanajuato to supply the mines of the important Angustias Mining Co., at Pozos.

El Oro District in 1911

By Frederick MacCoy*

The end of 1911 found the camp of El Oro producing about the same amount of gold and silver as in 1910. The mines from which come practically all of the production are those of the Dos Estrellas Mining Co., Mexico Mines of El Oro, Ltd., El Oro Mining & Railway Co., and the Esperanza Mining Co. Other mines in the district which produced during 1911, but not sufficiently to be self supporting, were Oro Nolan, and the Victoria; while still in state of being prospects, may be mentioned the Descubridora, Reforma, Carmen, Buen Despacho, Planeta, La Lucha and San José.

About the only effect that the recent revolution in Mexico had on the camp was to slightly lower the value of the shares on the stock market. During 1911 the control of Mexico Mines of El Oro, Ltd., passed from the London-Mexico Exploration Co. to French owners, representing practically the same interests as those in the Dos Estrellas company. The only new company of any size to enter the field in 1911 was the Compañia Minera San Vidal y Anexas, which has organized with a capitalization of 600,000 pesos to undertake the exploration of the northwestern extension of the El Oro-Tlalpujahua mineral zone. This company has now been financed, and will start work on the above mentioned San José claim, acquired by the company within the year.

Little change is to be noted in milling practice during 1911; the Mexico Mines of El Oro and Esperanza increased their tankage room, the Mexico Mines by the addition of mechanically agitated tanks, and Esperanza by the addition of six more Pachuca tanks.

The El Oro Mining & Railway Co. is installing additional Burt revolving filters and there were installed in the various plants several Esperanza-Federal drag classifiers.

Nicaragua in 1911

By T. Lane Carter*

Mining in Nicaragua in 1911 did not make the progress that was indicated at the beginning of the year. The greatest disappointment was the collapse of negotiations regarding the Bonanza gold mine, the most promising property in the Pis Pis district. At one time it looked as if the sale of this property to some influential Western capitalists for the sum of about a million and one-half dollars, would go through, but unfortunately after six months' work the deal was declared off. The failure of this sale was a distinct setback for mining in Nicaragua. Had it gone through, other large capitalists would have undoubtedly gone into the country.

The La Luz y Los Angeles made an excellent showing in 1911. This property is about 35 miles south of the Pis Pis district The minority interest of 18½% was bought during the year by the majority interests in Pittsburg, for $185,000, thus putting a valuation of $1,000,000 on this property.

Defect in Mining Law

A serious defect in the mining law of Nicaragua was discovered in 1911, while negotiations were going on for the purchase of the Bonanza property. This is in relation to the status of deep-level claims. Now that the fault has been pointed out, it is probable that this law will be changed.

[According to the law, which does not recognize extralateral rights, the owner of a property could not denounce new claims adjoining and paralleling his own, nor could the land be denounced by others without actual discovery of ore on the land.—Editor.]

Most attention has been given to the Pis Pis district, but the year closed with rather discouraging conditions in this part of the country. The Bonanza mine is doing well. Its neighbor, the Lone Star, is still running, but it is to be hoped that this property can soon be put in other hands. At present a deal is under consideration by Eastern men. An attempt in 1911 to sell the Lone Star to some London capitalists proved unsuccessful. As yet Nicaragua does not appeal to them.

The Siempre Viva mine recently closed down. It is said that the oxidized ore is nearly exhausted and that the plant is not suitable for the treatment of sulphide ores. It will be necessary to put in a regrinding plant and other machinery in order to treat this ore successfully. Whether the Siempre Viva people can finance this deal remains to be seen.

The Concordia mine, on which several rich strikes have been made in the past, continues in successful operation. In 1911 one or two fairly promising prospects were opened up in the Pis Pis district.

So far there has been no answer to the important question as to what will happen in depth on the veins in the Pis Pis district. At present there is not a really large company in this section of Nicaragua. What is most needed there is sufficient capital to carry out the work of exploitation. It is now fully realized that Nicaragua mines, being comparatively low grade, require plenty of capital.

In 1911 little was done in Nicaragua mining save in gold. The country has considerable promise in other metals, but present conditions are such that they cannot be worked. The all-important question of transportation was much discussed during the year, and it is now fairly assured that a railroad will be built from Bluefields to connect with Managua. It is to be hoped that one can be built from the coast into the Pis Pis district. Negotiations are now pending with American bankers to supply Nicaragua with sufficient money to construct railroads and help the development of the country. This will mean a great deal, not only for the agricultural interests, but mining as well.

Political interests in Nicaragua, which have such a vital bearing on mining, have been comparatively satisfactory. There were one of two "flare-ups," but this is to be expected in that country. President Estrada was succeeded by Adolpho Diaz, a man who is well acquainted with the needs of Nicaragua. It is to be hoped that in 1912 the country will make distinct advances under his administration. The total output of gold in 1911 was about $1,000,000. The outlook for 1912 is not overbright.

More than a third of the new gold now produced by the United States goes into the arts and manufactures. Ten years ago the proportion put to this use was only about one-fifth of the total production, or $18,000,000. About $35,000,000 is now annually used in the arts.

---

*Esperanza Mining Co., El Oro, Mexico.

*Mining engineer, Osgood, Carter & Co., First National Bank Building, Chicago, Ill.

Central American Operations

Special Correspondence

The year 1911 was one of steady progress and development throughout Central America. The most interesting work was done and is still going on in Guatemala. A company known as the Guatemala Mining & Development Co., in which A. E. Spriggs, formerly of Montana, and William Sulzer, of New York, are interested, obtained an important concession covering all the mineral deposits of the country. A corps of engineers was, and still is in the field. The entire country was blocked out in squares, each division was placed under the supervision of a superintendent and thoroughly explored. No development work was done nor was the task of prospecting the country anything like completed. The only producing property was that at Quebradas de Oro, near Morales, on the Guatemala railroad. This is a hydraulic mine, owned and operated by John Knight. The production is not made public, but has been variously estimated from $10,000 to $30,000 per year.

Salvador

The principal mines of Salvador are the Butter's Salvador in Santa Rosa and the Divisidero mine, in La Union. The Salvador property produced about $60,000 per month in gold during 1911. The treatment included roasting, but toward the end of the year changes were made in the treatment process without interfering with regular production, so that when completed roasting will not be necessary. The ore will be crushed in rolls and cyanided. At the Divisidero mine the production was $40,000 per month in gold and silver bullion. This property is equipped with a 20-stamp mill and cyanide plant.

Honduras

The New York & Honduras Rosario Mining Co., operating mines at San Juancito, north of Tegucigalpa, continued to be the principal producer in Honduras. The new mill, to be equipped with twenty 1800-lb. stamps, was not completed. Development work was continued, the results of which are to be published in a report within a few weeks. American engineers examined the iron mountain at Agalteca, near Tegucigalpa. Various small mines were in operation in the department of Choluteca, on the Pacific Coast. In the department of Olancho, some gold prospects were examined, and several placer deposits in other parts of Honduras were tested, but no results were made known up to the end of the year.

Costa Rica

The Abangarez mine, in the province of Guanacaste, operated throughout the year and was the principal producer of the country. There were two mills in operation, with a total of 60 stamps dropping. At the Montezuma mines, in the provice of Puntarenas, the mill was operated only in wet season, when there was sufficient water power. The production was about $70,000. At the Aguacate mine, a 10-stamp mill was operated toward the end of 1911. The first shipment of bullion was received in New York in December. A small cyanide plant was being planned at the close of the year. The mine is developed to the 500-ft. level, and a tunnel was being driven toward the vein, with the expectation of cutting it at the 750-ft. level.

Panama

It was confidently expected that the acquisition of the Canal Zone by the United States would stimulate interest in prospecting the mineral resources of Panama. Such has, however, not been the case. Some prospecting was done and some old mines and newly discovered prospects were examined, but in the year 1911 no important discoveries or beginnings of operations were made. It was reported that the United Fruit Co. interests had mining engineers in the field in the eastern part of the country, near Bocas del Toro, but this report has not been confirmed. The heavy rains of the wet season, dense vegetation and prevalence of malaria were serious obstacles to prospecting.

South America in 1911

Special Correspondence

In general the mining industry of South America was characterized by slow, steady progress in 1911, as in preceding years. The figures of production are always difficult to obtain, for although all the governments maintain records of production, statistics are tardily published, if at all. The quantities of metals produced by the large English and American companies are usually obtainable, but such is not the case with the native-operated mines and they contribute a large proportion of the total output. Estimates have therefore largely to be based on the imports into other countries.

Gold

The total production of gold was probably $13,000,000. The principal sources were the placer deposits of the eastern countries. In 1910 the leading producer was Colombia with $3,370,000 with French Guiana a close second with a production of $3,100,000. The English syndicate that operates dredges at Oroville, Calif., owns a large area of placer ground on the Niche River near Zaragoza in Colombia. It was the intention of this company to dismantle some of the smaller Oroville dredges and use them in Colombia, but this plan was not carried into effect. The bulk of the production came from a number of small operations, mostly placer mines although a few lode mines were worked.

Some small progress was made in dredging on the Elysee placers in French Guiana. The principal producer was the Syndicat Mana. The gravels are richer than those of Colombia, but hostile climatic conditions and transportation difficulties hindered progress even to a greater degree than in Colombia.

The principal producers of Brazil were the Minas Geraes mines which contributed most of the $2,000,000 produced in Brazil in 1910. The ore reserves now exceed a million tons. In Argentina gold was produced in the provinces of San

Juan and Rioja. The 1910 production of $165,000 will be exceeded in 1911, especially by the increase caused by the operations of the Famatina Development Corporation, Ltd., in Rioja province. In 1912 the new mill and cyanide plant of the Argentine & General Exploration Co., Ltd., in San Juan province will be in operation.

A company was formed late in 1910 to operate placer ground in the province of Esmeraldas, Ecuador and in 1911 a dredge was ordered. The principal producer of Ecuador was the lode mine operated by the South American Development Co. north of Guayaquil. In Peru considerable development work was done on the placer deposits in the southern part of the country. The principal company engaged was the Inambari Gold Dredging Concessions, Ltd., that took over the placer property of the Inca Gold Development Co. in the Carabaya and Sandia districts. Another company that operated in the latter district is the Aporoma Goldfields, Ltd. of London, which owns placers near the Hauri Hauri River. Hydraulic machinery was installed. In the same vicinity, an Argentine company operated the Poto deposits with 15 monitors.

The most notable discovery of new gold fields was that made at Putú, Chile, in September. Little work was done in the new field before the close of 1911, except by the discoverer who, under the Chilean laws, had a long period of time in which to measure his claims before any others could be registered.

SILVER

While Bolivia was the largest producer of silver in 1910, contributing 7,000,000 out of a total South American production of 16,500,000 oz., Peru was a close second with 6,500,000 oz. As most of the Peruvian silver was produced from copper ores from the Cerro de Pasco, Yauli, Morococha and Casapalca mines and as there was much greater activity during 1911 at these mines than at those of Bolivia, and production fell off in the latter country, Peru ranked as the leading producer and the South American output probably exceeded 18,000,000 oz. While Chile produces more copper than Peru, the ores usually contain far less silver so that a production of 1,500,000 oz. is a fair estimate for that country.

COPPER

The copper production of South America is constantly increasing. During 1911 the Braden Copper Co. entered the list of Chilean shippers, but the effect upon the production will not be fully felt until 1912. The company is nearly ready to operate its mills to full capacity to treat 3000 tons of ore per day. The Cerro de Pasco Mining Co. was by far the largest producer of Peru and shipped more copper than in 1911.

The Famatina Development Corporation, Ltd., an English company, owning 700 acres of mining land in the Mejicana district in the province of Rioja operated a 100-ton smeltery equipped with converters and produced about 400 tons of copper, 75,000 oz. of silver and 4000 oz. of gold. An aerial tramway 21½ miles long was built by the Argentine government from Chilecito at the foot of the Andes to the district. Railroads connect Chilecito with Buenos Aires, La Plata and Rosario. This is but one example of the government's projects to aid in the development of the mineral resources of the country.

OTHER MINERALS

During the first half of 1911 the Chilean nitrate production was 1,232,492 metric tons, an increase of 33,091 tons over the corresponding period of the previous year. The demand from Germany fell off considerably owing to the increase in use of ammonium-sulphate fertilizers in that country. Improved processes made it possible to treat caliche that was formerly unprofitable.

The oil wells of northern Peru continued producing throughout the year; no falling off in production was reported. The oil produced was of unusually high grade, and considerable quantities were shipped to California for refining, while California oil was sent to Peru for fuel purposes. The Titicaca Oil Co. is drilling in the southern portion of the country in the province of Huancane. The government of Argentina appropriated $850,000 for the exploitation of petroleum at Comodoro Rivadavia. The German Transmarine Electricity Co., contracted to take the total production. Three test wells yielded not less than 10 tons daily. The locomotives of the railroad to Lake Buenos Aires were supplied with 2000 tons of petroleum through the Ministry of Agriculture. Late in the year some oil fields were examined in Venezuela by American engineers, but none of the facts have been made known.

Bolivia produced about 25,000 metric tons of tin. There was only normal activity in the tin fields. One property in La Rioja province operated with 75 men and had 2000 tons of ore ready to supply a mill, but the lack of transportation facilities hindered and will continue to hinder development until railroads are built.

At Minasragra, near Cerro de Pasco, Peru, vanadium ore was produced by the American Vanadium Co. and shipped to the United States. Tungsten ores in the province of Caluyo, department of La Paz, Bolivia containing 56% tungstic acid were not shipped on account of the fall in the price of the metal. Most of the mines were closed. In northern Peru, in the department of Piura the Sociedad Azufrera de Sechura produced 150 tons of sulphur daily. English engineers investigated some iron-ore deposits in Chile. It was reported that the average analysis showed 68% iron, 0.03% phosphorous, and little sulphur. The Sociedad de Altos Hornos del Central developed iron deposits at Topo near Totoraillo. The production of platinum in Colombia continued to be irregular. The estimated value of the output in 1910 was $260,000, but it is impossible to determine even approximate statistics of the production for 1911.

Arsenic in 1911

The general arsenic-products situation has not materially changed in 1911. One large factory for the manufacture of paris green has been erected at Grand Rapids, Mich., and by some the announced reduction in the price of paris green is attributed to this competition.

There is a constant increase in the amount of insecticides used, as reflected in the increased production in the United States and Canada, due to the vigorous spraying propaganda of the various agricultural bureaus and colleges. The Grasselli Chemical Co. is understood to be the largest arsenate of lead producer in the United States, with the Merrimac Chemical Co. second.

The year opened with white arsenic at 2¼c. per lb., which was followed by a gradual decline until about July 1, when arsenic could be bought for 1⅝c. The market then suddenly stiffened, due to stoppage of supplies from the Compañia Minera de Peñoles, in Mexico, and the restriction in production of two American producers, and prices rose until they now stand at 2⅜@2½c. per lb. A small amount of English white arsenic was sold during a great scarcity of spot goods. About 125 tons per annum of red arsenic, and 50 of metallic arsenic were also imported. Ordinarily no European white arsenic is sold in the United States except some poor-quality Belgian.

The Canadian producers are the same as in 1910, the Deloro Mining & Reduction Co., Deloro, Ont.; the Canadian Copper Co., Copper Cliff, Ont.; and the Coniagas Reduction Co at St. Catherines, Ont. In the United States two plants of the American Smelting & Refining Co., the Washoe smeltery at Anaconda, Mont., and the United States Smelting Co.'s plant at Midvale, Utah, are the largest producers, but there is a small amount of arsenic recovered by the manufacturers of sulphuric acid.

According to information furnished by the producers, the total United States production of white arsenic in 1911 was 3081 tons, against 1326 tons in 1910, and 1008 tons in 1909.

Mining in the Transvaal in 1911

By Hugh F. Marriott*

The production of gold from the mines of the Witwatersrand in 1911 showed the remarkable increase of approximately £3,000,000, with a total production for the year of £33,680,000, obtained from roughly 24,000,000 tons crushed, an increase of 2,500,000 tons on 1910. A total of 10,500 stamps were at work at the end of the 1911 and 245 tube mills, as compared with the maximum totals of 9756 and 190, respectively, in 1910; and the stamp duty was increased from 7.19 tons per stamp per day to 7.82 tons. Individual rates of duty per stamp were 14 tons per day at the Bantjes, 14.6 at the Brakpan, 13.73 on the City Deep; 17.26 at the Jupiter, 20.6 at the Roodepoort United, and 17.5 at the Simmer Deep. These figures show the tendency to increase the duty of stamp mills.

TABLE I. TRANSVAAL GOLD PRODUCTION.

Year	Witwatersrand District.			Outside Mines.	
	Tons Milled.	Value.	Value per Ton Milled. Shillings.	Value.	Total Value for Transvaal.
1884-89	1,000,000	£2,440,000	48.83	£238,231	£2,678,231
1890	730,000	1,735,491	47.4	134,154	1,869,645
1891	1,154,144	2,556,328	44.2	367,977	2,924,305
1892	1,979,354	4,297,610	43.4	243,461	4,541,071
1893	2,203,704	5,187,206	47.0	293,292	5,480,498
1894	2,830,885	6,963,100	49.2	704,052	7,667,152
1895	3,456,575	7,840,770	45.2	728,776	8,569,555
1896	4,011,697	7,864,341	39.2	739,480	8,603,821
1897	5,325,355	10,583,616	39.74	1,070,109	11,653,725
1898	7,331,446	15,141,376	41.3	1,099,254	16,240,630
1899	6,872,750	15,067,473	48.84	661,220	15,728,693
1900	459,018	1,510,131	65.82	....	1,510,131
1901	412,006	1,014,687	49.25	81,364	1,096,151
1902	3,416,813	7,179,074	42.00	74,591	7,253,665
1903	6,105,016	12,146,307	39.79	442,941	12,589,248
1904	8,058,295	15,539,219	38.46	515,590	16,054,809
1905	11,160,422	19,991,658	35.82	810,416	20,802,074
1906	13,571,554	23,615,400	34.8	964,587	24,579,987
1907	15,523,229	26,421,837	34.04	981,901	27,403,738
1908	18,196,589	28,810,393	31.6	1,147,217	29,957,610
1909	20,543,759	29,900,359	29.1	1,025,429	30,925,788
1910	21,432,541	30,703,912	28.5	1,297,823	32,001,735
1911*	23,950,000	33,680,000	28.0	1,466,000	35,146,000

The principal additions to the list of gold producers were the Brakpan, City Deep, and Modderfontein B, which are together crushing about 130,000 tons a month for a yield of roughly £200,000. Besides these the Benoni made a beginning, but at present no returns are available. The new mills of the Randfontein Central and the Crown Mines also swelled the total.

During 1911 the amalgamation took place of the Randfontein Central and the Randfontein South, two important groups of mines under the Robinson control. The amalgamated company—the name of which is the Randfontein Central—has an issued capital of £4,000,000, and a crushing capacity of 3,100,000 tons per annum or 258,000 tons per month; at present, the crushing is about 200,000 tons per month. The crushing plant of this huge concern consists of 1000 stamps (of which 600 are in the new Central mill), besides which 23 tube mills are in commission.

Another amalgamation was that by which the Princess Estate absorbed the West Roodepoort Deep and the Roodepoort Central Deep.

The yield per ton milled was again reduced slightly, the average for the year being 28s. as against 28s. 6d. during 1910 and 29s. 1d. in 1909. The average working costs for the whole of the Witwatersrand showed an increase of 5d. per ton, due, chiefly to the higher cost of native labor.

The total yield of the districts outside the Witwatersrand again showed a gratifying increase, the figures constituting a record.

METALLURGICAL PRACTICE

During 1911 metallurgists on the Rand were constantly endeavoring to improve methods and results in their department, and they may fairly claim to have made considerable progress in these respects.

An extended trial was made with the Giesecke ball mill on the Geldenhuis Deep mine under the auspices of the Mines Trials Committee. So far, the trial has not led to the installation of a plant on any mine, but further tests may be made.

Experiments with the Nissen gravity stamp mill were made at the City Deep, and satisfactory results were obtained. A feature of this mill is its great simplicity. With the gradual increase in the weight of stamps up to the present high limit of 2000 lb. and over, it began to be believed in some quarters that battery-construction in groups of five stamps was not entirely satisfactory. The Nissen stamp is the result of an endeavor to obtain the greatest crushing capacity possible with very heavy stamps, and to combine this with sound mechanical construction. Each stamp has its separate mortar, and the inventor claims that in large installations it has been found possible to obtain an actual operation of over 95 per cent. of the total possible running time. The tests at the City Deep were carried out with four Nissen stamps, with running weights varying from 1920 to 2240 lb., and the duty per stamp per day with a 9-mesh screen varied from 24.47 to 30.8 tons; with a $\frac{3}{8}$-in. screen the average duty per stamp per day was about 37 tons. Power consumption per ton of ore crushed varied from 2.7 to 4 hp.-hours as compared with 4.45 to 5.5 hp.-hours with the City Deep ordinary stamps of weight averaging about 1800 lb. A comparative table—presented by Mr. Nissen in a paper read before the Chemical, Metallurgical, & Mining Society in Johannesburg—between 4 Nissen stamps of 2000 lb. each and 10 ordinary stamps of 1800 lb. each showed an estimated total saving in favor of the Nissen stamps in cost of power, interest on capital, and maintenance costs of 1.3d. per ton milled.

The recently completed Benoni plant contains several metallurgical innovations. The battery consists of 55 stamps of 2000-lb. weight, supplemented by four tube mills, coarse screens being used. Stadler classifiers are used throughout the plant. The cyanide plant includes 32 Way-Arbuckle treatment agitators, the pulp passing from agitator to agitator. The whole process is practically continuous; sands and slimes are treated together. Experiments carried out with large quantities of ore showed a high extraction after four or five hours' treatment. The consumption of cyanide is also reduced to a minimum. It is claimed that the capital cost of the plant on the basis of tonnage treated works out to approximately only one-half of the cost of the most uptodate plants running.

---

*Mining engineer, 1 London Wall Bldgs., London, E. C., Eng.

TABLE II. STAMP DUTY IN TONS PER DAY AT RAND MINES.

1902	4.85	1907	5.60
1903	4.91	1908	6.27
1904	4.90	1909	6.79
1905	5.05	1910	7.19
1906	5.34	1911	7.82

One of the most interesting developments was the increased use of the Butters filter, which is now installed at a number of important mines. Statistics show that where the filter is in use large reductions in final residue values have been obtained. The average value of slimes residue on several mines where Butters filter plants are installed has been reduced to 0.1 dwt. Altogether nine such plants are now in operation in the Transvaal with a combined capacity of 6000 tons of slime per day.

The trials given to the Merrill zinc dust process were so successful that plants are being installed on several mines.

A new type of agitation, so far as the Rand is concerned, is to be introduced in the Trent agitator, of which good accounts come from America.

DUST ALLEVIATION

Yet another method was devised for solving the dust problem in rock-drilling operations. In this case the improvement was due to a miner in the Nourse mines. His principle is to "kill the dust at the point of creation," and, in effect, it is to pass, at the very moment of drilling, a jet of water on to the face by means of a piece of rubber hose inserted in the hole alongside the drill. It is hoped that great benefit will result from the use of this idea, which has already been adopted largely.

The greatest difficulty the mine managers have to contend with in their efforts to reduce the dust trouble is the apathy of the miners and native laborers themselves; and although the contrivance mentioned above has already done something to alleviate the trouble, it cannot cure the evil entirely. Dust is created in various other ways than by drilling; for instance, in such operations as blasting, shovelling and transport. Probably the worst that has to be contended with is the fine dust made after blasting. The mine authorities have tackled this dust question in no half-hearted way, and much has been done by installing mechanical ventilators to improve the mine air.

An interesting occurrence was the commencement of the sinking through water-bearing strata at the Western Rand Estates of a circular shaft lined throughout with lead-jointed cast-iron tubing The whole shaft is designed to be completely watertight, the lining being strengthened by concrete filling behind. A novel baling skip was used in connection with the sinking shaft, consisting of a tubular contrivance with a capacity of 600 gal., the interior of which is fitted with a piston capable of being operated by the wire.

At the New Modderfontein mine a new departure was inaugurated towards the end of 1910, when a circular shaft was commenced. This shaft, which is to be brick-lined throughout, is now down about 950 ft. The cost of sinking compares favorably with the cost of rectangular shafts sunk on the Rand, and it is anticipated that the cost of maintenance will also be considerably lower. Further, it is expected that rapid hauling and ventilation will be much facilitated.

TABLE V. MORTALITY AT MINES.
RECORDS FOR YEARS 1902 TO 1911 INCLUSIVE.

	Average No. Natives Employed	Accident.		Disease.		Total.	
		No. of Deaths	Death Rate Per 1,000	No. of Deaths	Death Rate Per 1000	No. of Deaths	Death Rate Per 1000
1902 (11 mos.)	 38,320	—	——No	Records	——	1,698	48.34
1903	 62,056	200	3.22	4,822	77.71	5,022	80.93
1904	 69,831	296	4.24	3,076	44.05	3,372	48.29
1905	 88,617	371	4.19	4,158	46.92	4,529	57.11
1906	 78,260	425	5.43	2,591	33.11	3,016	38.54
1907	 92,421	466	5.04	2,931	31.71	3,397	36.75
1908	131,194	602	4.59	4,096	31.22	4,698	35.81
1909	154,908	858	5.54	4,985	32.18	5,843	37.72
1910	177,795	867	4.87	5,485	30.85	6,352	35.72
1911	184,620	882	4.78	5,602	30.34	6,484	35.12

TABLE VI. PREMIER (TRANSVAAL) DIAMOND MINING CO., LTD.

Year Ending Oct. 31	No. of Loads Washed	No. of Carats Found	Value of Diamonds	Yield Per Load	Value Per Carat	Value Per Load	Cost of Product'n Per Load
			£		£ s. d.	s. d.	s. d.
1903	76,931	99,208	137,435	1.29	178.5	1156.7	47.2
1904	939,265	749,654	866,030	0.798	131.2	0185.3	27.62
1905	1,388,071	845,652	†994,687	0.609	136.29	0143.98	33.44
1906	2,988,471	899,746	‡1,277,739	0.301	184.82	086.61	35.71
1907	6,538,669	1,889,987	§1,702,630	0.290	0180.20	052.49	24.14
1908	8,058,844	2,078,825	1,536,719	0.258	0149.40	039.75	110.24
1909	7,517,793	1,872,137	1,172,378	0.249	0126.29	031.43	111.42
1910	9,331,882	2,145,833	1,496,641	0.230	01311.39	032.49	20.56
1911*	....	1,771,000	1,324,550	.....	0150.	....	......

* Estimated. † Proceeds of Cullinan Diamond not included. ‡ Includes Cullinan Diamond at nominal valuation. § Subject to the loss on contract with Diamond Syndicate.

MINE LABOR

A glance at Table IV will show that there was an increase in the total number of negro employees, although that increase was not commensurate with increased requirements. Unfortunately, competition amongst the various controlling groups for the acquisition of recruits to the native force resulted in an increased average cost for this class of labor. It is hoped that some way will be found to reduce the ill effects of this competition.

Another question which occupied the attention of the heads of the gold mining industry was that of mortality amongst the natives, particularly amongst those from the more tropical districts of the recruiting area. Table V shows the death rate from accident and disease amongst the natives employed by members of the Witwatersrand Native Labor Association from 1902 to 1911, inclusive. It will be seen from this table that a considerable and fairly regular reduction in mortality rates has been obtained, but it is thought there should be a possibility of effecting still greater reductions in the death rate from disease.

With the object of combating sickness the Chamber of Mines set aside a large sum for the establishment of a laboratory for the study of mine employees' diseases, and the annual upkeep of this will also be the care of the Chamber. In addition, the eminent bacteriologist and pathologist, Sir Almroth Wright, is conducting, with a staff of London experts, an investigation into the mortality amongst mine natives, particularly in regard to pneumonia amongst those from British and Portuguese territories north of the 22d parallel.

POWER TRANSMISSION

The year 1911 saw a great development in the use of electric power on the Witwatersrand by the coming into operation of the central power stations of the Rand Mines Power Supply Co. The present electric installation of the company consists of one station of five turbine sets, each of which is designed to generate 11,000 k.w. In addition, the company installed four 3000-k.w. steam compressors for the manufacture of compressed air and six electrically-driven compressors of 3000 k.w. each. A further station is about to be erected.

The Victoria Falls Power Supply Co., to which the Rand Mines Power Supply Co. is allied, has also two large power stations, and it is stated that, when all the stations of both companies are working to their full capacity, 128,000 k.w. will be generated.

An important piece of legislation from the point of view of the mining industry was passed during 1911; namely the Mines and Works Act, 1911, which came into operation on Oct. 1. This act deals with the control and supervision of mining operations, and, among other things, restricts work on Sundays. Underground work on Sundays is confined to such operations as pumping, ventilation, and repairs, and, on the surface, to such as are in their nature continuous. As regards milling, the ban on Sunday work refers only to such mills as may be erected after the date when the act came into force. The hours of occupation underground are also limited by the act to eight per day, excluding the time occupied in going to or from the working place.

TABLE IV. LABOR EMPLOYED IN TRANSVAAL GOLD MINES.
(MINES DEPARTMENT STATISTICS.)

		White.	Colored.	Chinese.	Total Colored and Chinese.
1902	July	8,162	32,616	....	32,616
	Dec.	10,292	45,698	....	45,698
1903	June	11,825	66,221	....	66,221
	Dec.	12,695	73,558	....	73,558
1904	June	13,413	74,632	1,004	75,636
	Dec.	15,023	83,639	20,885	104,524
1905	June	16,939	104,902	41,340	146,242
	Dec.	18,159	93,831	47,267	141,098
1906	June	17,959	90,882	52,352	143,234
	Dec.	17,495	98,156	52,917	151,073
1907	June	17,166	111,862	51,517	163,379
	Dec.	17,697	129,618	37,118	166,736
1908	June	18,181	147,557	21,460	169,017
	Dec.	19,605	164,826	12,275	177,101
1909	June	21,620	175,895	7,317	183,212
	Dec.	23,077	168,665	2,038	170,703
1910	June	24,794	201,770	......	201,770
	Dec.	25,376	191,784	......	191,784
1911	June	25,960	206,197	....	206,197
	Sept.	25,431	196,421	....	196,421

Diamond Mining

The principal producer of diamonds is the Premier mine. There was a small number of other producers, but the total output from them was so small as to be practically negligible. Table VI gives the production of Premier Mine from the inception of the company to date:

The total yield in carats for 1911 decreased by approximately 370,000c. or 17 per cent. when compared with the yield for 1910, but in compensation the value per carat steadily increased the average for 1911 being 15s. as against 13s. 11d. for the previous financial year. Notwithstanding the increase in value per carat, the total value of the output decreased by approximately £175,000. Figures of the number of loads washed, and of costs, have not yet been published. The increase in the valuation of the diamonds is in all probability due more to the increased demand for diamonds generally, and the class of diamonds produced by the Premier Co. in particular, than to any improvement in the actual quality of the goods.

Tin and Other Metals

Tin production was of record dimensions during 1911 the total value being estimated at £410,000. Previous production has been by fiscal years ending June 30, 1906-7, £27,180; 1907-8, £81,700; 1908-9, £148,340; 1909-10, £303,210. For the half year to Dec. 31, 1910, the value was £147,530. The high price of tin naturally gave a great stimulus to its production.

The recent advance in the market price of zinc served to direct attention to the ore to be found in the Transvaal, and, although the production is at present very small, it is anticipated that the output will be increased to some extent in the near future.

Silver is produced in the Transvaal only so far as it is obtained in the gold ores. It amounted in 1911 to 892,000 oz., the highest previous amount for any year having been the 830,000 oz. in 1910.

The quantity of copper produced in the Transvaal is small, the total value of the production for the year 1911 being estimated at about £61,000 as against £71,914 for the previous fiscal year.

Coal Mining

Twenty-nine collieries were producers in 1911, and roughly 5,550,000 tons were mined from the Transvaal coal mines during the year. From this quantity an average of 20 per cent. was sorted, and approximately 4,440,000 tons of coal were sold, at an average price at pit's mouth of 4s. 9d. per ton. The total sales of coal in previous years have been for the fiscal years ending with June: 2,912,000 tons in 1906-7; 2,892,000 in 1907-8; 3,312,000 in 1908-9; 3,876,000 in 1909-10. For the half-year from July 1 to Dec. 31, 1910, the total was 1,984,000 tons, indicating an output of nearly 4,000,000 tons for the full year.

Mining in Rhodesia in 1911

By H. F. Marriott*

Gold mining is, in Rhodesia as in the Transvaal, by far the most important of the mining activities of the country. The number of gold producers increased from 145 in 1910 to 163 in 1911. As in previous years, a large proportion of these were very small units working with 5 stamps and under. There were in fact only five concerns which crush regularly 5000 tons a month or more.

The total tonnage crushed during the year, as will be seen from Table 1, was slightly less than 1910, which in turn showed a decrease on the two previous years. Notwithstanding this, however, the total yield was estimated to be more than £200,000 in excess of the 1910 figures, and the yield per ton has increased from 30.84s. to 35.66s. per ton. This is a most satisfactory feature, as this figure is higher than any that has been attained since 1903.

Table II shows the tonnage crushed and yield for the quarter ended Sept 30, 1911 of the mines which are crushing over 5000 tons a month, with one other (The Lonely) which produces over £10,000 in gold monthly

The total ore crushed by all producers during those three months was 120,795 tons, and the total yield £707,006. The six companies whose results are tabulated above were therefore responsible for 37¼ per cent. of the total tonnage milled and for no less than 43 per cent. of the combined yield.

New Mines

Considerable activity in prospecting operations was observable during the last year, many of the leading Transvaal mining houses having emissaries in the field.

Early in the year the Consolidated Gold Fields of South Africa, Ltd., floated a company with a capital of £2,000,000 to take over its assets and interests in Rhodesia. The working capital provided was £500,000. Negotiations were on foot in December last to consolidate this company's interests with those of another Rhodesian company, the Rhodesian Exploration & Development Co., Ltd. Details of this proposition have not yet been published, but should the fusion be carried out the amalgamated concern will be an extremely strong one with great resources in mining interests, land, and cash.

---

*Mining engineer, 1 London Wall Bldg., London, E. C., Eng.

The Shamva Mines, Ltd., a low-grade operation of great width, from which great things were prophesied on its formation in 1910, had developed by the end of September, 1911 over $1,500,000 tons of ore of an average value of 20.27s. This valuation was made after reducing abnormally high assays. It was officially stated that the cost of developing this tonnage has averaged just over 6d. per ton. Plans for the erection of a mill are being discussed, and it is believed that, owing to the width of the orebody, working costs will be well below 10s. per ton.

TABLE I. GOLD PRODUCTION OF RHODESIA.

	Tons Milled.	Value of Gold Won. £	Value per Ton. s.
Prior to Sept. 1, 1898...	*	23 456	.....
Sept. 1, 1898 to June 30, 1899	81,841	177,072	43.26
July 1, 1899 to June 30, 1900	104.746	208,877	39 88
July 1, 1900 to March 31, 1901	140,716	320,457	45.54
Year ended Mar. 31, 1902	249.667	640,661	51.32
Year ended Mar. 31, 1903	338,156	709,461	41.96
Year ended Mar. 31, 1904	516,747	845,359	32.71
Year ended Mar. 31, 1905	787,936	1,113,068	28.25
Year ended Mar. 31, 1906	1,100.609	1,556,741	28.28
April 1, 1906 to Dec. 31, 1906	1,051,908	1,531,481	29.10
Year 1907	1,610,875	2,178,886	27.05
Year 1908	1,819,230	2,526,006	27.77
Year 1909	1,807,771	2,623,785	29.00
Year 1910	1,666,223	2,569,201	30.84
Year 1911 (Estimate) ..	1,620,000	2,880,000	35.66

*No details available.

Copper and Other Metals

The Tanganyika Concessionns, Ltd., the major portion of whose interests are in the Congo, has also a large copper deposit at Kansanshi in Rhodesia, near the Congo border, where it has a smelting plant. It is understood that it is at present smelting ore from the Star of Congo mine, which is, as its name implies, situated in the Congo State.

The output of silver fell from 217,000 oz. in 1910 to 188,000 oz. in 1911. About 650 tons of lead were produced, compared with 750 in 1910. The output of chrome ore was estimated roughly at 50,000 tons as against 44,000 tons in the preceding year.

The output of coal increased from 180-000 tons in 1910 to approximately 210,-000 tons in 1911, all from the Wankie district.

Although so far there have been no diamond discoveries of any importance in Rhodesia, considerable interest attaches to the final result of the litigation which has long been proceeding between the De Beers Consolidated Mines, Ltd., and the British South Africa Co. The latter, under charter, has vested in it the right to all minerals in the country, and, in 1892, it entered into a contract with De Beers whereby it agreed, in consideration of a loan, to grant that company an exclusive license to work all diamondiferous ground in its territory. The British South Africa Co. claimed that, the loan having been paid off, the clause giving the monoply ceased to be effective, and that in any case, it was incapable of enforcement in law as creating a clog in the equity of redemption. This contention was upheld by the Chancery Court and confirmed by the Court of Appeal. The case has, however, finally been won by the De Beers company on appeal to the House of Lords.

TABLE II. STATISTICS OF SIX IMPORTANT MINES, QUARTER ENDED SEPT. 30, 1911.

Name of Company.	Reduction Plant.	Tons Crushed	Yield	Yield per ton.
Globe & Phoenix	40 Stamps 10 Pans.	18,761	£117,041	124s. 9d.
Wanderer	4 Gates Rolls	54,600	24,471	9
Giant Mines	30 Stamps 2 Tubes.	35,536	59,611	33 7
Eldorado	20 Stamps 2 Chileans	22,188	53,916	48 7
Penhalonga	....	17,400	13,984	16 1
Lonely	15 Stamps 2 Tubes.	9,862	39,874	80 10
Total		158,347	£308,864	39s. —

Mining in Australasia

By F. S. Mance*

The mineral production of Australasia in the year 1910 was valued at £27,525,000, and it is expected that, when the final returns for 1911 come to hand, this total will again be closely approached. It is true that the gold yield of all the states exhibits a falling off, but against this both New South Wales and Queensland show compensating advances in the value of the production of the industrial metals. The year was not devoid of labor troubles, and operations were checked for a time at many centers, but, taken generally, work proceeded on steady and systematic lines. The same degree of attention was certainly not given to the mineral industry as in previous years, due, no doubt, to the series of favorable seasons causing a diversion of energies into other channels. There was a noticeable scarcity of labor followed as a consequence with a good advance in wages. It demanded the effecting of all the improvements and economies practicable to enable these higher wages to be met without increasing working costs above profitable limits. The conditions, therefore, had been against the carrying out of prospecting operations, but with such evidence existing of the capability of the industry at least to maintain the present rate of production, there was scarcely occasion for any anxiety on this score.

Gold

The accompanying table is a comparative statement of the gold yield of Australasia for the years 1910 and 1911; the figures for 1911 were estimated from the production for the first ten months of that year; the figures are in fine ounces. The estimated decrease for the year 1911 was thus 220,703 oz., fine.

It will be seen that Western Australia continues to furnish the largest proportion of the gold, but in comparison with that of nine years ago, there was a drop of over £2,750,000 in value. The mines which gave such good yields from the upper levels have failed to maintain their grade with increasing depth. Thus the value of the ore mined in this state in 1903 was 77s. per ton, and in 1910 it had fallen to 42s. a ton, while a still lower figure will be recorded for the year under review. There have been some recent develpomnts of promise, but not of such extent as to warrant the opinion that the supplies of ore which will be forthcoming are likely to be sufficient to arrest the downward tendency of the yield.

---

*Department of Mines, New South Wales.

Victoria ranks next in importance for its gold production, but in this state, also, developments at the deeper levels have shown declining grade, and the yields from the old established fields, such as Bendigo and Ballarat, fall far short of the average for the past six years.

In the state of Queensland the decrease is likewise noticeable, but fortunately the deficiency was more than made up by the increased production of the industrial metals. The diminishing yields from fields such as Charters Towers and Gympie have had a depressing effect on prospecting, attention being given to the search for other minerals, and any immediate improvement in the gold yield cannot be hoped for under existing conditions.

The yield from New South Wales is not of large dimensions, and, as in Queensland, the mining for silver, copper and tin commands most attention. The Cobar district is the chief center of gold-mining operations, and now that the Great Cobar, Ltd., has acquired the Cobar gold mines, a good increase has to be looked for from the treatment of the auriferous-copper ores. The yields from the other fields and from the dredges were disappointing.

GOLD PRODUCTION OF AUSTRALASIA

State	1910	1911	Changes
Western Australia	1,470,632	1,398,500	D. 72,132
New South Wales	188,857	181,150	D. 7,707
Victoria.....	570,383	511,600	D. 58,783
Queensland..	441,400	383,900	D. 57,500
South Australia and Northern Territory	6,600	5,500	D. 1,100
Tasmania.....	37,048	30,500	D. 6,548
Papua.....	13,990	13,990	....
Total Commonwealth	2,728,910	2,525,140	D. 203,770
New Zealand	446,433	429,500	D. 16,933
Total Australasia	3,175,343	2,954,640	D. 220,703
Value.. ...	£13,653,975	£12,704,952	D. £949,023

From the other states of Tasmania and South Australia, as also from the Northern Territory and Papua, the total output contrasts unfavorably with that of previous years.

The Dominion of New Zealand also added to the depressing record. The decrease was mainly due to the restriction of the output from the Waihi mine. Recent developments in the lower levels of this mine have gone to confirm the previous evidence of decreasing assays as depth is attained. This mine has now produced gold to the value of about £10,000,000, and returned £4,300,000 to shareholders. Other important contributors are the Talisman and Waihi Grand Junction mines, while there were over 100 dredging plants which supplied a good quota of the production.

Silver and Lead

The preliminary returns indicate that the value of the output from the silver-lead mines of New South Wales for the year 1911 is likely to constitute a record. The chief contribution is supplied by the mines at Broken Hill, and operations on that field have been attended with most gratifying results.

The accompanying statement shows the output of silver and lead from the mines of New South Wales during the three years 1908-1910:

SILVER-LEAD PRODUCTION OF NEW SOUTH WALES

Year	In Bullion		In Concentrates Exported	
	Silver	Lead	Silver	Lead
	Oz.	Tons	Oz.	Tons
1908 ...	6,484,288	103,371	5,499,381	69,501
1909 ...	3,717,016	64,821	6,867,775	90,307
1910 ...	5,196,323	94,818	7,608,336	85,035

The value of the output for the first nine months of 1911 exhibited an increase of £561,872, compared with the same period in 1910, and this gives some indication of the headway which had been made. Each year witnesses the attainment of greater excellence in milling practice, with a corresponding improvement in recoveries, and a reduction in working costs, and this despite the fact that the ore is being mined from deeper levels, and is of poorer grade, while wages have been materially increased. The output would have been still greater if more skilled labor could have been obtained.

Touching upon developments underground, the lode in the bottom levels of the South mine is maintaining its great size, although at the 1070-ft. level the work so far done showed that the orebody is more irregular than at the 970-ft. level. In the North mine a fine body of ore is being followed at the 1100-ft. level. Owing to the relocation of the lode which was previously missed, the British mine has been given a new lease of life. In the parent mine, the Proprietary, there were no new developments in the lower levels; the old fire area in blocks 13 and 12 is being attacked at the 300- to 500-ft. levels. The Central mine (Sulphide Corporation) possesses good ore reserves, and has furnished a splendid output. The large low-grade lode which is being opened up by the South Extended Co. gives promise of a successful future for the mine. It is estimated that the ore reserves at Broken Hill in sight at present are sufficient for nine years, and the indications are thus in favor of a continued period of activity. From the Yerranderie field, N.S.W., high-grade silver-lead ore had been supplied in considerable quantity.

In Tasmania the cessation of smelting operations by the Tasmanian Smelting Co. affected the output from the mines at Zeehan during the first half of the year, but owing to the timely intervention of the government, the smelteries were again put into commission, and during the second half of the year operations proceeded with marked energy. The success of the exploratory work carried on at the North Mount Farrell mine at depth has given a fillip to mining at this center.

In Queensland the Mungana mines were still the chief producers of silver-lead ore, the bulk of the output being drawn from the Girofla mine. Operations at the Lady Jane mine have been considerably retarded by the condition of the workings which were affected by the creep and the fire.

Zinc

The spelter plant of the Proprietary company, at the Port Pirie works, was completed at considerable cost during the year, and put into commission, but in the absence of the company's report at date, it cannot be stated whether the project has so far proved a commercial success. This plant is only of sufficient capacity to deal with a portion of the tailing produced by the Proprietary company, so that the quantity of zinc concentrates exported is not likely to be greatly affected.

The accompanying statement shows the quantity and value of the zinc concentrates exported during the three years 1908-1910, the figures being in tons.

EXPORTS OF ZINC CONCENTRATES

Year	Concentrates, Tons	Zinc Contents, Tons (By Assay)	Value of Concentrates
1908	258,898	113,853	£926,610
1909	321,173	144,018	1,530,128
1910	403,220	184,897	1,801,143

The production for 1911 has been on an increased scale, and the figures when available should show a good advance over those for 1910.

As regards the several processes in use, the Zinc Corporation has installed a Minerals Separation plant in lieu of the Elmore. It would seem that, judged by actual results, the Mineral Separation plant is capable of dealing satisfactorily with tailings of variable grade, such as the Corporation has to handle, while the Elmore process is more adapted for tailings of uniform grade. The British company has an Elmore plant in operation, and it is doing good work. The De Bavay plant is also giving gratifying results. The tendency all round is to simplify the zinc processes. Little oil (some eucalyptus) is now used, and the plant is of the simplest kind. An interesting experiment is being made by the Junction North Co., and a new plant is being installed by which it is proposed to eliminate the ordinary lead concentration mill, as after a preliminary extraction of from 12 to 15 per cent. lead by jigs, the crude ore is to be submitted direct to the flotation—a lead concentrate and a zinc concentrate resulting.

Copper

It was estimated that for the year 1911 the mines in Australasia produced 42,000 long tons of copper, of which about 16,000 tons were shipped as refined copper; the balance was made up of blister, matte and high-grade ore. The copper-mining industry made no great strides, and the position remains much the same as in the preceding years, while, looking ahead, it cannot be said there is any probability of a material increase in 1912. However, it must not be thought that Australia is failing to open up new supplies of ore, for in point of fact the number of producing mines has been materially added to, but these new mines were merely compensating for the shortage created by the decreased production from some of the older ones, and for the interruption of operations at the established mines by labor troubles, etc.

Of the total output the mines in the state of Queensland supplied probably 50 per cent. The principal centers were Mount Morgan and the Cloncurry fields.

The production from the Mount Morgan mine during the last three financial years is given in the accompanying table.

MOUNT MORGAN PRODUCTION

Year Ending May	Gold, Oz.	Copper, Tons
1909	138,341	5,799
1910	178,867	7,062
1911	142,449	6,973

The decreased output in 1911 was occasioned by unavoidable delays in effecting the necessary additions to the copper reduction works rendered necessary by the substitution of the basic ore from the Many Peaks mine for the barren ironstone formerly used. With the new plant in full operation the lost ground will soon be made up. The reserves of auriferous copper ore in this mine have been revalued, and, after allowing for the year's depletion, a slight increase in the former estimate is disclosed. The reserves are estimated as in the table herewith.

The extension of the railway to the Cloncurry field has been responsible for a large increase in the copper production of Queensland. This field is remarkable for the extent of its oxidized deposits, an area of 250 by 80 miles being studded with holes from which the working miner has removed parcels of ores; but, as yet, only in a few instances have sulphide bodies of any extent been found. Consequently it has yet to be demonstrated that the life of the field is likely to extend for any lengthy term. The two largest mines in this field are the Mount Elliott and the Hampden Cloncurry, and during the latter part of the year they contributed between them a monthly output of about 1200 tons of blister copper.

ORE RESERVES, MOUNT MORGAN

Quantity of Ore, Tons	Copper, Per Cent.	Gold per Ton, Dwt.
1,543,000	3.5	8.0
2,070,500	3.0	2.5

Copper in New South Wales

In New South Wales the bulk of the copper produced was obtained from the Great Cobar, Ltd., the Kyloe, and the Grafton copper mines. There were few fresh developments to record, and the rate of production during 1910—8900 tons—was just about maintained. There are numerous deposits of copper ore in this state, but their exploitation and development are hampered owing to the failure of the legislature to sanction the necessary lines of railway communication. The Great Cobar, Ltd., has purchased the Cobar gold mines, and with the large quantity of auriferous copper ore now available, a steady increase in the output should result. The output by this company for the year was about 7000 tons of copper.

In Tasmania the Mount Lyell Co. was practically the only producer, and the output of the company was adversely affected by labor troubles, the smelteries being idle for about seven weeks. During the financial year ending September the company produced 7411 tons of blister copper. The exploratory work undertaken during the year has resulted in substantial additions to the ore reserves; the lode opened up at the 1100-ft. level of the North Lyell was of good dimensions, and showed a higher percentage of copper.

In South Australia operations proceeded at the Wallaroo & Moonta mines at the same steady pace as in former years. Little work was done at the outside mines, so that practically no custom ores were available for purchase. The yield from all sources was estimated at 5900 tons, the quantity of material treated being 158,000 tons.

In Western Australia small supplies of ore continued to be drawn from the Phillips River, and from the Whim Well mine.

Tin

A review of the tin mining industry disclosed the fact that while the aggregate value of the yield was well ahead of that of 1910, as a result of the higher prices ruling, little, if any, improvement was shown in the quantity won.

In Queensland the production for the first nine months of the year was 2306 tons of tin oxide valued at £229,914, which is 142 tons and £57,456 in value in excess of the corresponding months of 1910. In the Herberton district the exploitation of the various deposits has resulted in good additions to the supplies of ores, and a corresponding stimulus to operations. Regarding the established mines the most important developments had occurred at the Vulcan mine at Irvinebank and from the 600 ft. and lower levels good quantities of high-grade ore were won. The group of mines at Koorboora contributed an output of importance, while lode-tin in quantity was also obtained from Herberton and Watsonville. The yield of aluvial tin was won principally from the Herberton, Cooktown and Stanthorpe districts.

In New South Wales the output has apparently fallen below that of the previous year, although there is an increase in the value. As in the preceding year, the dredges furnished the bulk of the yield, and are the mainstay of the industry. In the Tingha district the dredges are rapidly working out the available deposits, and the returns from this center were on a decreased scale, but on the other hand, the plants in the Emmaville division have furnished an output well in advance of that of the preceding year. Little attention has been given to lode mining, and with the rapid exhaustion of the alluvial deposits the outlook of the industry in this state is anything but promising.

In Tasmania the Mount Bischoff mine is still pursuing its profitable career, and up to the end of September this company had paid £2,271,000 in dividends. The various faces are showing well, but each year's work brings home the fact that the problem of the treatment of the low-grade sulphides has yet to be solved. Other important contributors were the Pioneer and Briseis mines.

In Western Australia the Greenbushes and Pilbarra fields were estimated to have supplied about 420 tons of tin ore.

Coal

The output of coal from New South Wales was estimated at 8,250,000 tons. In Queensland the coal-mining industry was showing a steady advance concurrent with the growth of industrial enterprises, and some of the seams opened up were of exceptional size. In Victoria the output from the State coal mine was being well maintained, and amounts to about 300,000 tons per annum.

The Russian Empire in 1911

By John Power Hutchins*

The year 1911 was one of general progress in precious-metals mining in the Russian Empire, particularly was the mining of platinum stimulated and aided by the high price which averaged about twice as much as for gold.

Copper mining, protected as it is against foreign competition by a duty of about 7c. per lb., had a good year; copper sold for about 17c. per lb. during 1911.

Although the harvests of several years, except that of 1911, have been good, the iron and coal industries have not prospered for several years, as is usually the case in times of good harvest.

Total Gold Production Exceeds That of South Africa

The gold production of Russia and Siberia for 1911 was about $40,600,000. Of the total gold production in the empire since the beginning of the XIX. century, Russia produced about 25 and Siberia about 75%. In total gold production, Russia and Siberia rank third, being surpassed by the United States and Australasia, but still remaining ahead of South Africa. This may surprise many, but, when one pauses to remember the huge size of Russia and Siberia, and to note the wide distribution of gold, one may well be surprised, not that they have produced so much, but rather, that they have produced so little.

The gold producing region in the Urals is farthest west; thence, easterly across Siberia, are scattered gold deposits to the east coast, about 4000 miles, while a journey from the south Urals, through the Altai Mountains, and southern Siberia, thence to the upper Amur, down the Amur, thence overland to Anadir, opposite Nome, all of which would be in gold-producing regions, would be about 6000 miles long. This is the greatest length of auriferous series in an east and west direction in the world, and is only exceeded by the length of the north and south deposits of the Cordillera, continuing as they do from Tierra del Fuego, the southernmost part of South America, to the Arctic Ocean.

Gold Exploited in the Last Century

The question naturally arises as to the reason of the small production with such a wide distribution. It would at first seem that the poorness of the deposits must be the cause, but this is not the reason. The gold deposits of Russia have been worked only about 100 years and the richest deposits, which occur in the inaccessible regions of Siberia, have been exploited only during the last 50 years.

In agriculture, with a fertile soil extending from the Baltic Sea, practically without interruption, to Vladivostok, about 6000 miles away, there is an inconsiderable amount of agricultural products as compared to smaller regions elsewhere. So with gold there is a small output that seems capable of large expansion, as the present producing regions are more thoroughly exploited by improved methods and intensive working, helped by the extension of transportation systems. New auriferous districts will be discovered and worked and a slow but steady expansion will occur. As in other industries, gold mining is largely handicapped by a lack of capital and the most successful mining companies are those which have had the help of foreign capital to develop, equip, and operate them. This is not only true of gold, but of copper, iron, platinum and zinc mines as well.

Foreign Capital Invested in Mining

There is an increasing interest in Russian and Siberian enterprises, largely due to the success of English, German and French capital in gold, copper, zinc and platinum mining. While London is at present manifesting a considerable interest in Russia and Siberia, it is probable, that, as the Alaskan placers near Nome shall become exhausted, those of East Siberia may be exploited by Americans. Unfortunately, some of the Russian regulations not only do not encourage the ingress of American or other foreign miners into East Siberia, but discourage this with restrictions preventing mining within 66 miles of the coast by foreigners without permission, which is difficult to obtain. Then, too, there are the difficulties of transportation, a language hard to learn and a rigorous climate. It is thought that there will be a change of policy that will open East Siberia, which would probably attract experienced miners from the Klondike and Alaska and result in a more intensive exploration and exploitation, particularly of the more accessible coastal regions. Russia and Siberia, with their large distribution of gold, and other metals, have large possibilities that it will take years even to investigate.

More gold is produced by drift mining than by either dredging or opencutting; quartz mining is, as yet, insignificant.

Method of Opening Drift Mines

As an operation typical of the present state of mining technique in Russia and Siberia, the following description of a drift-mining operation is given. Shafts, 14x14 ft. are sunk 100 to 150 ft. to bedrock, about the middle of the gravel channel, and 300 to 500 ft. apart. Two corridors, one a drift and the other a crosscut, are run at right angles to each other, the drifts, to the distance of 150 to 250 ft. from the shaft, and the crosscuts to the limit of the pay gravel on the sides of the channel. These corridors are 14 ft. wide and 7 to 14 ft. high, depending upon the depth of the pay gravel.

As soon as these corridors have been started and extended 14 ft. from the shaft, drifts or crosscuts 14 ft. wide are started from these four points in opposite directions and at right angles to the corridors. When these drifts and crosscuts have been advanced 14 ft., other drifts and crosscuts are started, as above described, and this is continued until the limits are reached, at which time, the ground tributary to the shaft is one-half worked out. The mine plans, with the worked parts blacked, look like a chess-board.

Then the unworked ground is mined by beginning at the corners most distant from the shaft and robbing the 14-ft. pillars. Close timbering is used, even in frozen ground, in all corridors, crosscuts and drifts with poles four to six inches thick and 7 to 14 ft. long. As a drift is advanced 14 ft., heavy timbers, 14 ft. long, are inserted inside the caps and at right angles to them, with heavy posts at the ends, sometimes with a third post in the middle.

Ground is thawed by wood or charcoal fires. The latter are preferred in some places as they make less smoke, the great danger of carbonic acid gas being overlooked. Gravel is shoveled into poor, home-made wheelbarrows and wheeled to the shaft, frequently over rough boards, and dumped direct into the skip, there being no pockets or loading chutes. Much time is lost while loading the skip.

The skip is hoisted to the surface, 100 to 150 ft., by two or four horses, and the bottom of the skip, which is hinged into two doors, is knocked loose, by driving out two wedges, and the gravel falls on to an inclined door on the top of the shaft, sliding down a chute into a horse cart or, often, on the ground, as there is no bin. Later it is shoveled into a cart for transport to the washing plant, if in summer, or to the pay dump, if in winter.

---

*Mining engineer, 20 Galernia, Saint Petersburg, Russia.

The capacity of the horse hoist governs the rate of mining through each shaft and so, to mine an extensive area rapidly, many shafts are needed. As only about 25 men are needed to break and tram all the ground a horse whim can hoist, and these men do not work fast, it takes several years to mine the ground tapped by one shaft, and all the ground must be kept open until robbing the 14-ft. pillars is commenced. Thus, timbers must often be renewed before such time, and pillars are robbed so slowly that they must be timbered while being robbed. Thus timbering is expensive, as little or none is pulled and the cost for timbering alone is 30 to 40c. per cu.yd. even when timber is plentiful.

Operations in Opencut Mines

It can be readily understood that such mining as described above must be costly; this operation with labor at 50c. per 12-hr. shift, and wood and timber at the rate of $2.25 per cord, cost about $2.50 per cu.yd. of which 44% was working cost, and 56% administration cost. So where ground is even as much as 30 to 50 or more feet deep, it is considered cheaper to work by opencutting, even where the pay gravel comprises only about one-tenth or less of the total gravel section or about two to five feet. Opencutting can be done by contract for 6 to 10c. per cu.yd. with hand shoveling into horse carts. These figures will seem low to many, but they are not unusual. As a matter of fact in one operation I observed, overburden was stripped by hand shoveling into horse sleighs in winter with minimum temperatures of —40° F., cheaper than the gravel underneath was dredged in summer; the respective costs being 6 and 9c. per cu.yd.

The same transporting of ore underground in wheelbarrows and hoisting by horses, is seen in many vein mines. Close timbering is also used, even where there is no heavy ground.

Excessive Timbering a Result of Laws

One who has seen large untimbered workings in other countries and, particularly, those in the frozen gravel of Alaska and Klondike, wonders at such timbering especially in frozen gravel, until he ascertains that it is largely due to the mining regulations. In the paternal efforts to protect the workmen, there is a system of inspection of mining works by mining engineers in the government service. In case of accident to a miner, the responsibility must be fastened upon someone and, in case of fatal accident, even though the miner may have been himself to blame, someone else may be made responsible and punished, even to the extent of imprisonment. Thus the mine foreman, or the mine superintendent, or the government inspector may be judged responsible for the accident by the judge before whom the matter is adjudicated, who must thus decide technical mining questions. This leads to great caution and the use of an excessive and unnecessary amount of timbering.

There is only an inconsiderable amount of gold vein-mining in Russia and Siberia. The chilean mill is generally used, being preferred because of its supposed simpler construction requirements and cheaper operation on the generally soft oxidized ores now being worked. Quartz mining is as yet comparatively shallow. The metallurgical difficulties encountered when sulphide zones are reached have caused the cessation of mining in numerous instances. Most of the quartz mining has been done in the Urals where geological conditions are in many respects like those of the Appalachian Mountains and the outlook for quartz mining is thought to be rather unfavorable. Much of Siberia, except the Altai region and that in the mountains paralleling the east coast of Siberia from Vladivostok to and beyond the Kamchatka Peninsula, is like the Urals, where the mountains are of considerable age, geologically speaking. The railroad crosses the continental divide at an altitude of only about 1000 ft. The Altai in South Siberia and the mountains in East Siberia are seemingly recent and there is present volcanism near Kamchatka. It is thought that more intensive investigation may find quartz veins of value in them, but up to the present there is no quartz mining of importance in either of these regions.

Quartz mining, by foreign companies, has been generally unsuccessful in Russia and Siberia. The only mine of this kind, operated by foreigners east of Lake Baikal has, during 1911, been shut down after a disastrous career of about 10 years. It is noteworthy that in this region that has produced more than $500,000,000 worth of placer gold, there is not one really successful vein mine.

The Possibilities of Copper Production

Copper mining during 1911 continued to demonstrate that there are deposits of this metal that can be worked profitably. The production increased rapidly and it is probable that Russia will soon become an exporter instead of remaining an importer of copper. The increase of production is due to the successful exploitations by English capital of several important and extensive deposits in the Ural and central Siberian regions. Other copper deposits, under control of English capital, are soon to become producers.

The Caucasus region has been investigated for copper, but, as yet, efforts have not been rewarded by commensurate success. Copper mining in the Caucasus has been in difficulties. There seem to be large low-grade pyrite deposits, but metallurgical difficulties, due to the ore being too silicious for smelting, hinder their profitable working. It is thought that these problems can be solved.

East Siberia has no copper mines although copper is known to exist in the region between Vladivostok and Nicolaievsk, at a city at the mouth of the Amur River. This region awaits further investigation to determine whether there are orebodies of economic importance.

At present there is a protective duty on copper of five rubles per pood or about 7c. per lb. It is said that this is likely to be reduced which procedure is being opposed, particularly by Russian producers whose copper, being more expensive than that made by foreigners, would be more seriously affected in case of reduction of the tariff. It is said that without the protective duty to help them nearly all the Russian copper mines cannot produce copper at a profit.

The production of copper for the first seven months of 1911 was about 13,600 long tons and the importation of copper in the same period was about 5400 long tons. It is probable that the production for 1911 will be about 26,000 tons as there was an increased rate of production in the last half of the year.

Ural Iron Business Threatened

The iron works of south Russia have been able to control the iron business because of the accessible supplies of good coking coal. The Ural Iron works have suffered severely from competition of the south Russia works and though making an excellent grade of iron, using charcoal, they have lost ground and the last year has been one of loss for most of the Ural iron producers. The future of the Ural iron business is uncertain.

The iron production for the first six months of 1911 was 1,710,000 long tons, of which south Russia produced about 70%; Ural, 22%; Poland, 8%: Coming as it has after a period of enthusiastic buying of oil businesses in London, the petroleum business of 1911 was not as good as expected. Maikop, which was hoped to be a second Baku, has not as yet fulfilled these hopes, although good results were obtained in some instances. The production for nine months was about 400,000,000 poods.

Production of Platinum

Russia and Siberia are the largest producers of platinum. Most of this metal is found in the Urals, where it is mined by dredging, by opencutting and by drifting. The price of this metal has been very high during 1911 and it has stimulated an active search as well as the working of deposits that were impossible of profitable exploitation before the reign of the present high prices. The reserves of platinum bearing gravel seem to be rather limited and it is not thought that the rate of production can be greatly increased. French capital is largely interested in platinum mining and has achieved success with dredges.

It is worth noting that some of the foreign companies interested in platinum mining in Russia and Siberia are scouring North and South America for deposits of this metal. The estimated production for 1911 is 400,000 ounces.

Dredging is having a varied result. There are 63 dredges in Russia and Siberia, but most of these have not been successes. In many instances dredges have been installed where only failure could result. Bad design and weak construction have contributed to similar results. A general lack of capital for mining enterprises has resulted in installing cheap machinery. The last year witnessed the successful operation of a drag-line excavator in conjunction with a floating washing-plant containing, in addition to the trommel, tables and belt stacker of the California type of dredge, a large disintegrator of the log-washer type, to free the gold from an extremely clayey gravel. A second trommel was used to screen out large stones before the material passed to the disintegrator. This plant worked in material so clayey that it would be considered by most dredge operators to be impossible for dredging and in a climate almost as severe as that of Klondike, but without perennially frozen ground with a working cost, not including administration, of about 17c. per cu.yd.

Dredges Operated in Clayey Ground

There are several floating dredges in the Russian Empire having clay-disintegrating devices for there is a wide distribution of clay. The common form of disintegrator is the *chashka*, which resembles an arrastre, but has a stirring, instead of crushing action. Whether this, or the modified log-washer, is the better machine has not been determined, but it would appear that the application to some clayey areas in America, heretofore considered impossible for dredging, of one or the other of these devices, might permit successful operation of ground now thought impossible for successful exploitation.

The first American-built dredge was installed during the year. This dredge has 8 cu.ft. close-connected buckets, steel hull, and is operated by electricity, generated at a steam-electric plant about 10 miles away. The electric plant was placed on a lake to allow easy wood transport to it from the forests surrounding the lake, and, possibly, to use coal, later, should it prove cheaper, as the lake is navigable and only about 50 miles from where sea-going vessels, drawing 16 ft. of water, can anchor in a river and unload coal on to barges.

Labor Conditions

It is extremely difficult to find good hard-rock miners in Russia or, indeed, to get an adequate force of any kind of miners who constitute a mining population such as is had in American mining regions. In many districts, the men work as miners only when their agricultural pursuits need no attention. Thus, during the harvests, there may be a shortage. While the Russian miner is not paid much, in many instances, only about 30 to 50c. per day, he is not a cheap miner, when the cost per ton of ore is considered. He works well with pick and shovel on the surface, but in rock or underground he lacks skill. Many holidays with much drunkenness interfere.

In eastern Siberia there is considerable difficulty in getting enough laborers. The Russian government discourages the employment of Chinamen and Koreans, some of whom are good miners, and the present policy seems to point to their eventual exclusion. This policy tends to retard production, for there is the need for laborers in east Siberia. Many believe that Chinamen and Koreans are as good or better and cheaper laborers than Russians, they are more sober and law-abiding and have not the numerous holidays that are such a disadvantage. It is interesting to note that in some mining districts, nearly one-half of the year is spent in celebrating holidays, usually accompanied by drunkenness, and many of the days, immediately subsequent to the more important holidays, are devoted to recuperation from alcoholic excess.

Immigration Encouraged

The Russian policy is to encourage immigration to east Siberia, which is only sparsely populated, from the more populous regions of Russia. About $30,000,000 per year is spent for this purpose. The Chinese government has tried to populate the rich Manchurian country with the surplus population of its southern regions. Both these attempts are meeting with difficulties, for both the Russians and Chinamen have not the enterprising and colonizing spirit that shows itself in the present rapid immigration into North and South America. The climate of east Siberia and Manchuria is severe, with long cold winters which tends to discourage the emigrant from warmer climate.

A Famine Imminent

With the largest and probably richest agricultural possibilities in the world, there will be severe famine this winter in the south Ural and about $80,000,000 is thought to be necessary to keep the people alive until the next harvest.

By comparing Siberian and Alaskan mining costs in similar ground with Siberian labor at one-tenth as much per day as that in Klondike, it will be found in many instances that the Alaska labor cost, per cu.yd., is less. This seems paradoxical, but, when one pauses to remember, that close timbering, wood-fire thawing, wheel-barrow-transport underground, and horse hoists are in vogue, it is not difficult to account for the high costs in Siberia, even with cheap labor.

The mining laws of the Russian Empire are rather complex and it is difficult, particularly for the foreigner, whose knowledge of Russian is only acquired after much time and painful effort, to get even a working familiarity with the laws. There is not a universal law for all parts, and troublesome restrictions are encountered in east Siberia and along the coast and southern boundaries. These restrictions are for strategic purposes.

Mining machinery enters Siberia for the region east of Lake Backal duty free. That for western Siberia and Russia must pay a duty, steam engines and pumps about 5c., boilers and structural steel about 3c., electrical machinery about 12c., smelting machinery about 6c. per pound.

The production of coal for seven months in the Don region was as follows:—Soft coal—9,000,000 long tons; anthracite—1,500,000 long tons; coke—1,900,000 long tons, and briquettes—38,000 long tons. In Poland, the production for nine months was 4,000,000 long tons of soft coal.

The Ural region produced 240,000, the Caucasus region 20,000 and the Moscow district 80,000 long tons of coal in the first nine months of the year.

Mining on the Gold Coast

The operations at the mines of the Gold Coast on the west coast of Africa were greatly hampered during 1911 by shortage of unskilled labor. To this were ascribed the comparatively high costs of mining; Abosso $8 and Taquah $11.50, as compared with an average of $4.10 on the Rand. An association was organized to recruit savages from the outlying country, but it was deemed unwise to make any such attempt without government sanction, which was withheld. The production in 1910 was 189,443 oz. of unrefined bullion, it is expected that returns will show that the 1911 yield exceeded 265,000 oz. of crude bullion.

Petroleum in the United States

The accompanying table shows the production of crude petroleum in the United States for the year 1910 and an estimate of the production for 1911. The most significant figures are those for the Mid-continental field which produced four million barrels, or 7½% more than in 1910, and those for Texas with an increase of two million barrels or 25%.

The California figures show an increase in production though not nearly so large as the increase of 1910 over 1909 production. As in the previous year, the production for 1911 will exceed in value the gold production of the state. The demand for oil is expected to gradually increase as the Alaskan demand will be greater and the use of oil for fuel is rapidly extending along the Pacific Coast, but in spite of this increase the production was much greater than the demand. Although there were no gushers like the Lake View producing, the increased number of small wells counter-balanced the effect of the cessation of the Lake View gusher.

The decline in the Illinois field was about equal to the increase in California, while the decline in the Appalachian was nearly equal to the increase in the Mid-continental field. The production from Colorado has shown a steady decline for the last few years. The increase in production of the Gulf fields, notably those of Texas, about balances the decrease in the Lima fields so that the total production of the United States in 1911 about equaled that of the previous year.

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES

(In barrels of 42 gal.)

Field		1910	1911
California		74,327,150	77,224,359
Colorado		239,794	(*a*)200,000
Gulf	Texas	8,181,580	*a*10,000,000
	Louisiana	6,841,395	*a*7,000,000
Illinois		33,143,362	30,000,000
Lima	Indiana	2,159,725	4,656,000
	Ohio	5,094,136	
Mid-continental (*b*)		53,613,030	57,911,525
Kentucky-Tennessee		468,774	(*a*)300,000
Appalachian (*c*)		26,089,900	22,275,000
Wyoming(*d*)		115,430	(*a*)360,000
Others		15,000	(*a*)5,000
Total		210,279,276	209,931,884

(*a*) Estimated. (*b*) Kansas and Oklahoma. (*c*) Pennsylvania, New York, West Virginia and eastern Ohio. (*d*) Includes Utah

Petroleum in California in 1911

By Mark L. Requa*

Conditions in the California oil field in 1911 fulfilled the prognostications made in the autumn of 1910. Production outran consumption and the surplus that began to manifest itself in the summer of 1910 continued more or less unabated throughout the last year.

OVERPRODUCTION DETERRED DRILLING

While it is true that the great Lake View gusher ceased to produce, the bringing in of which created the first signs of over-production, it is also a fact that apparently this decline in output was more than counter-balanced by other wells that were brought in in the Midway district, so that, notwithstanding the entire cessation of the Lake View gusher, California is still confronted with a surplus production.

It is not probable, however, that this condition can continue over any long period for the reason that under existing conditions there is no incentive for the drilling of additional wells and unless additional wells are drilled there must inevitably be a decrease in production and in consequence more nearly a balance between consumption and production.

While conditions remained about stationary in 1911, so far as over-production was concerned, yet indications point toward a hardening of prices in 1912, and it would not be surprising if in the latter part of the year prices advanced sharply with material gains in the early part of 1913. On the whole it is impossible for the producers of oil in California to market their product at the existing price of 30c. for fuel oil and 45c. for refining oil with satisfactory profit. This was brought home in 1911 to many of the producers, and it was not only because of the inability to raise capital that drilling materially declined, but also because operating companies have realized the futility of drilling against a 30-cent price for oil.

CALIFORNIA OIL PRODUCTION, 1911, Less Fuel Used*

District	Bbl.
Midway	20,821,669
Coalinga	17,793,221
Kern River	12,225,273
Santa Maria	6,259,766
Fullerton	5,887,069
McKittrick	5,339,364
Maricopa	4,468,087
Salt Lake	2,815,097
Whittier-Coyote	1,106,966
Ventura	153,764
Los Angeles	436,200
Newhall	139,508
Summerland	64,875
Lost Hills	63,500
	77,874,359
Less loss and overestimates	650,000
Net for year	77,224,359
Shipments, 1911	66,665,000
Surplus	10,559,359

*Fuel used in the fields is estimated at 425,000 bbl. per month

The speculative fever that was so acutely manifest during the summer and autumn of 1910 entirely subsided and there were practically no new flotations in 1911. Capital declined to come forward and purchase stocks under existing conditions, and the state as a whole, and in a lesser degree other Pacific Coast states and the United States, learned a lesson that will not be forgotten during the next year or two.

SURPLUS PRODUCTION, 10,559,000 BBL.

At present there is above ground in storage a total of approximately 39,000,000 bbl. of oil, as compared with 28,000,000 at the end of 1910. The total production for the year approximated 77,224,000, as compared with 77,000,000 in 1910, an insignificant increase. The surplus for 1911 approximated 10,559,000 bbl. Assuming production as above and surplus as 10,559,000, consumption was 66,665,000, a figure probably not far from correct.

The Midway field did not entirely fulfill the hopes of its most ardent supporters, but developed an important and rich field the limits of which are now fairly well outlined; in the other developed fields of the State there were no material changes, and the new fields of Lost Hills and Bell Ridge are yet too young to hazard any estimate of their ultimate capabilities. Both of these fields, however, developed oil at comparatively shallow depths, and there seems to have been a complete upsetting of certain geological prognostications regarding this territory. The developments here indicated interesting possibilities for a large section of country between Coalinga and McKittrick which has not yet been proved or disproved, except in certain isolated areas.

---

*Mining engineer, 1026 Crocker Building, San Francisco, Calif.

The Kettleman Hills more than fulfilled geological prophecy as to the depth at which the oil would be encountered, one well at present being over 4000 ft. in depth without any showing of oil. On the whole, the proved oil area was not increased to any large extent. It is also true that certain areas that were looked upon as extremely promising did not on development prove of value.

Considerable territory in the Santa Maria field is showing a constantly increasing volume of water, and development in areas presumed to be oil-bearing indicated that the oil was at such depth as to be unprofitable at prices now prevailing, or at prices that are likely to prevail for several years to come.

The Kern River field did not materially alter its position. Coalinga continued a reliable and steady producer, and the fields in the southern part of the state, as a whole, more than held their own.

The gas field developed in the Buena Vista Hills gave promise of large production, although there was not any effort made to pipe this gas to other parts of the state. The proposed pipe-line to Los Angeles, which was much discussed, is as yet unconstructed. In fact, save for some construction by the Standard Oil Co., there was no new pipe-line construction in 1911.

Standard Refinery at El Segundo

Invasion of Southern California by the Standard, with a refinery at El Segundo, near Los Angeles, was the most important happening in the refining industry for the year.

Nowhere throughout the state was there any well that in any way approached the Lake View, and all of the drilling done in the vicinity of the Lake View was productive of nothing comparable with this famous gusher.

There were numerous wells in the Midway field coming in with a production of from one to 5000 bbl., but their decline was rapid and a few months apparently served to bring their yield down to at most a few hundred barrels.

The extension of the Coalinga field to the south was not productive of any commercial results. Whatever may be found there was demonstrated as being at great depth and will have no part in unsettling market conditions. To the north of Coalinga there was nothing discovered of commercial importance. Some work was done in the Vallecitos country, north of Coalinga, but so far as is known results to date were negative.

Aside from the Lost Hills and the Bell Ridge areas, there have been no new developments in improved areas, although there are certain places that are believed to offer attractive possibilities and will probably be developed as soon as the price of oil justifies.

Activity of Southern Pacific

As compared with a year ago, there is a marked decrease in the number of strings of tools running, notwithstanding a very large increase in drilling on the part of the Southern Pacific. The activity of the Southern Pacific dates from midsummer, at which time it appeared to have adopted a policy of line drilling against other producing wells, although it is understood that it will not drill lines until work has been started upon adjoining property.

It is unfortunate for the industry as a whole that some equitable arrangement cannot be perfected whereby the Southern Pacific could keep its oil for future requirements. If it continues its campaign with unabated activity, it must, in the near future, have a very large volume of oil with which it will supply its needs and supplant oil now being purchased by it from the producers of the state through the Associated Oil Co. A conservation of its resources would not only give it a supply for future needs, but would give a market for independently produced oil and would create a volume of paying freight and passenger traffic that would materially add to the revenues of the Southern Pacific Co. It can hardly be believed that it would willingly adopt a drilling policy that would so materially affect freight revenue.

On the other hand the draining of oil territory by independent producers unquestionably deprives it of oil beneath its territory. To just what distance a well will drain adjoining territory is an interesting problem which has not been satisfactorily solved and, from data available, unquestionably varies from field to field.

Corporate Affairs

The recent agitation that brought about the dissolution of the Standard Oil Co. effected no change in the dominating position of the Standard in California, and the oil producers of the state are asking themselves what real benefit was derived from this dissolution, and whether it would not have been much better if some form of regulation had been attempted that would have permitted agreements as to production and price. Certainly from a financial standpoint there was nothing gained by independent producers.

The much discussed agreement between the Independents, the Union Oil Co. and the Associated Oil Co., whereby it was hoped that prices would be steadied, was apparently a complete failure. The hoped-for increased consumption which was to have benefited the Union-Independents was not forthcoming; on the contrary, there was a marked tendency to declining consumption during some of the autumn months.

Consumption by the Northern Pacific, Great Northern, and the Canadian Pacific did not materially affect the sales of the Union-Independent Agency, although it is believed that, during 1912, these roads will greatly increase present consumption.

New Consumers of Oil

The most noticeable invasion of new territory in 1911 was at the plant of the Nevada Consolidated Copper Co. at Ely, Nev. This plant had been burning Utah and Wyoming coal, and had been presumed to be within the coal zone.

The extension of the burning of oil on the Southern Pacific from Sparks to Carlin was also accomplished in 1911, and there are rumors of this being pushed still farther to Montello and possibly as far east as Ogden. It is, however, improbable that California oil can maintain a foothold in this field at the price at which producers can profitably afford to sell their production, and rather than further increase in this direction it is probable a decline would take place in the event of oil reaching the price hoped for by producers, that is, a minimum of 50c. at the well, which seems now to be the base price hoped for.

Owing to a rapid increase in production and the unpreparedness of the companies to tank their oil, there was enormous waste during the year. It is entirely out of the question accurately to calculate this loss, although well informed producers agree that 4,000,000 bbl. would be a minimum, and many believe that double this amount was lost.

Possibilities of Domestic Use

The use of California oil as a fuel for domestic purposes is attracting considerable thought and attention at present. While as yet no means has been developed whereby it can be successfully burned for domestic use, it is hoped that some simple device will soon be perfected for this purpose. There is, of course, no difficulty in burning oil for domestic purposes by the installation of an electrically driven pump and blower. The cost of this installation, however, precludes its adoption in any general way, although it is being used in several private houses, being in principle the same system as is being used by hotels, apartment houses and restaurants in the larger cities. The incentive for some such apparatus is great for the reason that coal delivered at private dwellings in San Francisco approximates from $12 to $16 per ton. Should there be devised some cheap means of burning oil for domestic purposes there would be a considerable additional demand and the coal trade of the state would suffer a still further decline.

Oil and Gas in Mid-Continental Field

By Erasmus Haworth*

The production of oil in 1911 by the Mid-Continental field was the greatest since its development began, the total aggregating 57,911,525 bbl., as shown by the accompanying tables. The Prairie Oil & Gas Co. was again the greatest purchaser of oil, its total purchase reaching over 34,500,000 bbl. The Texas Oil Co. and the Gulf Oil & Pipe Line Co. were the next two largest purchasers, the former reaching almost 9,000,000, and the latter more than 8,500,000 bbl. The independent refineries did not consume as much as they did in 1910, their total being about 5,500,000 bbl. Compared with 1910 each of the three large purchasers handled a little more, raising the grand total to a small fraction under 58,000,000 bbl., which is by far the largest ever produced in the Mid-Continental field in one year. The Prairie Oil & Gas Co. increased its storage about 1,250,000 bbl., although during a number of different months it delivered considerably more than it bought.

1911 OIL PRODUCTION, MID-CONTINENTAL FIELD

Company	Bbl.
Prairie Oil & Gas	34,691,298
Texas Oil	8,934,800
Gulf Oil & Pipe Line	8,669,827
Independent refineries	5,365,600
Fuel oil, crude	250,000
Total	57,911,525

New Developments in Texas

No developments of a startling character were made within the limits of the Mid-Continental field proper, but to the southwest just across the line in Texas, about Electra, great interest arose. Drilling was pretty well kept up during the year throughout the entire field. A new pool was discovered north of Cleveland in Oklahoma, commonly known as the West Osage field. Here a number of strong wells were obtained, a few of which rivaled the big wells in the Glenn Pool years ago. At present, however, the field seems to be fairly well circumscribed. Considerable oil was also found about Jenks, near the north end of the Glenn Pool which at the present time is attracting a number of drillers. It seems that the oil will be developed on both sides of the river. Recently, the Prairie Oil & Gas Co. brought in a good well reported at about 600 bbl. natural, situated near the northern edge of its tank farm at Jenks. Beyond these comparatively new pools development has been confined almost entirely to drilling here and there throughout the areas already exploited at the beginning of the year. Every area received considerable attention, with fairly good success, showing that the oil supply is by no means exhausted.

The Electra field is in Wichita County, Tex., just south of the Red River, between the 98th and 99th meridians. A promising oil field has been developed here, and also much gas a little to the east of the oil fields, closer to Henrietta, from which gas already has been piped into Wichita Falls. It seems probable that the productive area will reach north and northeast across the river into Oklahoma. With the development in Oklahoma migrating southward continuously, it is quite possible the Mid-Continental field proper may yet connect with this Texas field.

Almost no developments of pipe lines were made during the year. The National Refining Co. at Coffeyville, offices at Cleveland, Ohio, extended a line into the shallow field from Coffeyville. The term "shallow field" now includes all of the old time shallow field around Alluwe and Coody's Bluff, and also the northeastward extension commonly known as the Delaware field lying principally to the west of Delaware. The Gulf Pipe Line Co. and the Texas Pipe Line Co. extended their lines into this shallow pool area early in the year. Each of the purchasing companies continuously extended its gathering lines, so that oil could be marketed from all the wells throughout the entire year.

Gas Outlook Dismal

No startling developments of gas were made during the year. Drilling was kept up reasonably well both in Kansas and Oklahoma, and many new wells were found, but no distinctly new pools. A number of gas wells were obtained in Oklahoma both north and south of Cleveland, particularly in the neighborhood of the West Osage oil field, already mentioned. Likewise throughout the well known gas territory in the aggregate many new wells were obtained. The gas pressure over the entire area is seriously reduced. The Kansas Natural Gas Co. extended its pipe lines into the Hogshooter gas field early in the winter of 1910 and 1911. During the latter part of the summer months the Kansas Natural Gas Co. applied to Kansas City for the privilege of increasing the retail price of gas from 25c. per 1000 cu. ft. to 35c. No action has been taken upon the subject yet. The Kansas Natural also gave notice of an increase in the price of gas to consumers in a number of towns in Kansas.

Early in September the Public Utilities Commission of Kansas City, Mo., employed me to investigate the gas situation. The conclusions reached were substantially:

(1) That all the companies are now drawing gas from substantially the same areas. These are the Kansas Natural Gas Co.; the Oklahoma City Pipe Line Co.; the Quapaw Pipe Line Co. carrying gas to the Joplin mining district; the Caney River Pipe Line Co., carrying gas to Wagner and Muskogee; and the Wichita Pipe Line Co., carrying gas to Winfield, Wichita, Hutchinson and Newton, Kan., and the Portland Gas Company.

(2) That more than 1,000,000 people are now being supplied for heating, lighting and manufacturing purposes with natural gas from the Mid-Continental field, about 45% of which is used by factories. (3) That at the present rate of consumption, Kansas City need not hope for a supply of gas sufficient to meet its wants longer than two or three more years. (4) It seems probable that towns and villages within the gas fields may reasonably expect to have their supply continued for a decade or more after the big pipe lines practically have gone out of existence.

Some Oklahoma Wells Already Waterlogged

Barring a small supply which may yet be obtained from the Vilas field, and the Independence field, Kansas can no longer supply the pipe lines with any material amount. Across the line in Oklahoma the pressure is low and most of the wells are waterlogged within 10 miles of the Kansas line excepting some new developments in the Osage. The area around the erstwhile famous burning Caney well is substantially exhausted. Southward in some places where the gas sands are irregular many new wells come in about as strong as ever, but throughout the great Hogshooter area, one of the most remarkable gas fields in the country, the pressure is reduced from an average of about 470 lbs. to about 350 lbs., and the volume from an original average of about 15,000,000 cu. ft. per well to 8,500,000 cu. ft. per well. The Hogshooter pool occupies a nicely marked anticlinal area and a number of wells along the limbs of the anticline are already waterlogged, which certainly looks bad for the field.

---

*State geologist, Lawrence, Kan.

Petroleum in Illinois in 1911

By Raymond S. Blatchley*

Illinois suffered a relapse in oil production in 1911. The estimated production for the year is 30,000,000 bbl., as against 33,143,362[1] in 1910. An accompanying table gives the total production of oil in Illinois from 1905 to 1911. The decline in 1911 is the second in the brief history of the oil business in Illinois. The first came in 1909 and was due to disturbed market conditions. Recovery was immediate in 1910 but the imminent decline of the early fields and the lack of new development in later pools in 1911 caused a second reversal. Unless new fields are discovered the decline must continue. The basis of estimating the production, since only 11 months returns are available, is to assume the December runs of the Ohio Oil Co. and the Tidewater Pipe Line Co. equivalent to those of November and the tank-car shipments to be about 3,000,000 bbl. The accompanying table gives the pipe-line runs and the stock by months, according to the *Oil City Derrick*, of the Ohio Oil and the Tidewater Pipe Line Companies.

ILLINOIS OIL PRODUCTION

Year	Bbl.
To 1905	6,576
1905	181,084
1906	4,397,050
1907	24,281,973
1908	33,686,238
1909	30,898,339
1910	33,143,362
1911 (estimated)	30,000,000
Total	156,594,622

The tank-car shipments in the Illinois fields are those of the Sun Oil, Cornplanter Refining and Missouri-Illinois Oil Cos., and railroad shipments from Sandoval and Carlyle, Illinois. Dr. David T. Day gives 3,070,925 bbl. as the tank-car shipments for 1910.

The prices of the two general grades of oil remained steady from the previous year until May 2, 1911. Until this time oil of gravity over 30° Bé., commanded 60c. per bbl., and under 30° Bé., 52c. per bbl. The price increased in May for the two grades to 63 and 55c. per bbl. A second increase for the first grade to 65c. per bbl. took place June 14. A third increase for the first and a second increase for the second grade to 67 and 57c. took place on Sept. 15 and 19 respectively.

SOUTHEASTERN ILLINOIS OIL FIELDS

The combined daily output of the Clark, Cumberland, and Edgar County wells was about 8000 bbl., as against 9000 bbl. in 1910. Crawford County showed the first step of a rapid decline in 1910. The average daily output of the county was about 18,000 bbl., as against 30,000 bbl., in 1910 and 100,000 bbl., in 1907.

Lawrence County is the richest producing area in the state. There are seven sands from 750 to 1900 ft. that yield steadily. In order they are the Bridgeport Nos. 1, 2 and 3 lenses, 750 to 1000 ft.; the Buchanan sand, 1100 to 1400 ft.; the Kirkwood sand, 1350 to 1650 ft.; the Tracey sand, 1550 to 1750 ft.; and the McClosky lime, 1750 to 1900 ft. The Kirkwood and McClosky sands, especially the latter are the richest developed in Illinois. The accumulation of oil and gas in these sands is governed by a long double plunging anticline. Lawrence County maintained her usual production without new additions to the field. The average daily yield of the field was about 42,000 bbl. Both sour and sweet oils were produced, which were handled separately.

ILLINOIS OIL PRODUCTION FOR 1911

Month.	Runs, Bbl.		Stocks, Bbl.	
	Ohio Oil Co.	Tidewater Pipe Line Co.	Ohio Oil Co.	Tidewater Pipe Line Co.
January	2,169,879	124,783	26,243,015	3,860,578
February	1,994,231	113,489	25,635,245	3,998,278
March	2,589,635	124,746	23,997,496	3,941,079
April	2,173,939	117,003	24,005,010	3,141,490
May	2,299,881	139,925	24,129,388	3,193,449
June	2,208,358	132,833	23,195,749	3,744,088
July	2,292,927	131,641	22,714,183	4,076,403
August	2,340,877	126,921	22,265,928	3,986,160
September	2,179,591	114,807	21,904,719	3,558,641
October	2,195,408	114,752	21,359,482	2,444,909
November	1,996,321	109,719	20,211,934	....

The Sandoval field of Marion County was clearly defined in 1911, and was found to be limited to about three-fourths of a square mile. There are about 66 producing wells that have a daily yield of 1800 bbl. The oil comes from the Stein and Benoist sands in the basal portion of the Chester rocks of the Mississippian series of formations and is equivalent to the Kirkwood sand of Lawrence County. The Sandoval field lies along an irregular structural terrace upon the broad and gentle western flank of the Illinois basin. A new field was opened three miles northwest of Carlyle in Clinton County, in April, 1911, which proved to be the best new field for the year east of the Mississippi. The area was described by the State Geological Survey[2] previous to opening the field.

The field is governed by an elongated dome on the western flank of the Illinois basin and has an areal extent of about 1½ square miles. The gravity of the oil is about 35° Bé. There are about 120 producing wells yielding about 4500 bbl. daily. The initial production of the first Carlyle wells was about 200 bbl.

In Macoupin County, two gas wells of about 100,000 cu.ft. daily, and two oil wells of 5-and 10-bbl., daily yield were completed about three miles south of Carlinville. The production comes from the base of the Pottsville rocks immediately overlying the massive St. Louis limestone. The structure, according to F. C. Kay of the Survey, seems to be a small elongated dome. The Midvalley Oil Co. of St. Louis found a showing of oil in its prospect four miles east of Pinckneyville County, late in November. A conspicuous north and south anticline has been pointed out between Duquoin and Pinckneyville by the State Geological Survey, and much drilling is contemplated along this area.

The Carlyle development caused the average initial production to rise in April and July, to the highest point in two years. Of the 1256 wells drilled in 1911, Lawrence and Crawford Counties, with 479 and 449 respectively, headed the list. On Jan. 1, 1911 it was estimated that 18,618 wells had been drilled in Illinois. Of these 2847 or 15.2% were barren. In the first 11 months of 1911, 1256 wells were drilled, with 287 or 22.8% barren. The total up to Dec. 1, 1911 was 19,874 wells drilled with 3134 or 15.7% barren. The greatest number of wells were drilled in 1907, 4988, and in 1911, the smallest number.

---

*Geologist in charge of oil studies, State Geological Survey, Urbana, Ill.

[1] Figures by Dr. David T. Day, U. S. Geological Survey.

[2] Ill. Geol. Surv., Bull. No. 16, pp. 87 and 167.

The Appalachian Oil Fields in 1911

By H. C. George*

The Appalachian oil field, comprising the oil pools of New York, Pennsylvania, Southeast Ohio, West Virginia and Kentucky, produces a high-grade petroleum with a paraffin base, rich in illuminating oil, benzine, and gasoline. In the last five or six years, nearly all of the oil pools in this district have shown a continuous decline in the number of wells drilled and the new production secured, 1911 to a greater extent than any previous year.

PRODUCTION OF WELLS DRILLED IN THE APPALACHIAN OIL FIELD IN 1909, 1910 AND 1911.

	Number of Wells Drilled			Daily Production, Bbl.			Daily Production, Bbl. Per Well Drilled			Per Cent. of Dry Holes		
	1909	1910	1911	1909	1910	1911	1909	1910	1911	1909	1910	1911
Allegheny County, N. Y.	468	303	201	838	446	201	1.8	1.4	1.0	7.6	16.2	33.3
Pennsylvania	3,958	2,056	1,646	10,361	5,936	4,349	2.6	2.8	2.7	15.6	23.7	27.3
West Virginia	1,810	1,735	1,228	35,872	35,347	10,556	19.1	20.4	8.6	36.9	40.6	48.4
Southeast Ohio	2,285	1,682	1,178	25,239	19,321	9,363	11.0	11.5	7.9	36.2	36.6	41.2
Kentucky	179	119	114	2,108	997	1,541	11.7	8.4	13.5	44.7	62.2	32.4
Totals	8,700	5,895	4,167	81,918	62,047	25,810	9.4	10.5	6.2	25.6	32.8	39.2

The total number of wells drilled in all pools of the Appalachian oil field in 1911, was 4167 as compared with 5895 in 1910 and 8700 in 1909. The decline in new production was still more noticeable. The daily production from new wells in 1911 was 23,810 bbl., as compared with 62,047 bbl. in 1910, and 81,918 bbl. in 1909. The number of dry-holes increased from 25.6% in 1909 to 32.8% in 1910 and 39.2% in 1911.

The total production for the Appalachian oil field in 1911 was 22,275,000 bbl., as compared with 26,089,000 bbl. in 1910, and 25,394,000 bbl. in 1909 and 24,240,000 bbl. in 1908. From 1908 to 1910, each year showed an increase in production, but 1911 showed a less total production than any of these years. No change in the price of petroleum of the grade production in this field took place during the year. The price in 1911 was $1.30 per bbl., as compared with $1.33 in 1910, $1.62 in 1909 and $1.78 in 1908.

The only pool in the field that did not show the general decline, was the small one of Kentucky, which had about the same number of wells drilled in 1911 as in 1910, but with a larger new production and a smaller percentage of dry holes. In Pennsylvania, the question of drilling to greater depths in the Bradford pool in the northwest part of the state, and the finding of a few good wells at Canonsburg, Washington County, in the southwest part of the state, are the only new features for 1911.

In West Virginia, there were some good wells found in Wetzel County. There was considerable activity in Roane and Kanawha Counties with prospects of finding a large pool in the latter. But none of the large gushers, such as were secured in 1910, where found during the last year.

In southeast Ohio, as a result of the new operations of 1911, there are prospects of finding an extension to the deep-sand territory, to the south and east of its present limits. There were many failures in the shallow territory. In Harrison County the large gas companies were active in new operations.

In Kentucky and Tennessee there was much land leased, but no increase in the drilling operations. Most of the work done in 1911, was in Wayne County, Ky. Central Ohio, the old Clinton Sand gas district, has shown the most activity during the last year, resulting in the finding of many good wells.

The Lima Oilfield in 1911

By H. C. George

The production of the Lima Oilfield of northwestern Ohio and eastern Indiana shows a continuation of the decline in production which has been noticed since 1907. The total production in 1911 was 4,656,000 bbl., as compared with 5,171,000 bbl. in 1910, 6,192,000 bbl. in 1909 and 7,287,000 bbl. in 1908. The average price paid for North Lima oil in 1911 was 82c. per bbl., as compared with 83c. per bbl. in 1910, 91c. per bbl. in 1909 and $1.03 per bbl in 1908. South Lima oil has constantly brought 5c. per bbl. less.

PRODUCTION OF WELLS DRILLED IN THE LIMA FIELD IN 1909, 1910 and 1911.

	Number of Wells Drilled			Daily Production Bbl.			Daily Prduction, Bbl. per Well Drilled			Per Cent. of Dry Hole		
Year	1909	1910	1911	1909	1910	1911	1909	1910	1911	1909	1910	1911
Northwest Ohio	917	573	561	7,771	6,344	6,471	8.4	11.1	11.3	9.6	13.4	9.0
Northeast Indiana	304	363	151	3,852	8,010	1,528	12.6	22.1	10.1	27.3	19.0	35.8
Total	1221	936	712	11,623	14,354	7,999	9.5	15.3	11.2	14.0	15.7	14.6

Almost the entire decline in the wells drilled and in the new production secured, is from the Indiana part of the field. In the Ohio part, the old gas end of the Finley pool in Hancock County furnished the best producers. Years ago this district was not worked, on account of the large amount of salt water associated with the oil. Years of pumping has reduced this, and has produced conditions which led to the developments of 1911.

There were a number of new wells in Wood County in northwestern Ohio in 1911, but there as in most other parts of the Lima field, most of the wells drilled were on inner locations on old leases, which give a small but sure production.

Petroleum in Texas

By William B. Phillips†

The production of petroleum in Texas during 1911 is estimated as exceeding 10,000,000 bbl., a considerable increase over 1910 and preceding years. Activities in the older and better known fields, such as Spindle Top, Sour Lake, Saratoga, Batson, Humble and Corsicana were continued.

Production from a New Field

The most noteworthy circumstance in connection with the production of petroleum was the opening of the Electra oil field, Wichita County, 140 miles northwest of Fort Worth. At the close of 1911 the production in this new field was close to 10,000 bbl. per day and a pipe-line was being laid to the refineries near Dallas, a distance of 160 miles. Two new oil refineries will be built at Fort Worth. The oil from the Electra field varies in gravity from 38 to 42 B, the general average being close to 41 B. It is, therefore, more like the Corsicana oil than the oils from the Gulf coast. The formations involved appear to be Carboniferous and Permian-Carboniferous. The deepest well in the region is now down 3985 ft., but is not productive. Most of the oil is now coming from a depth of 1000 to 1200 ft. although the deeper sands, 1700 to 1900 ft., are also good producers.

Natural Gas

There was a notable extension of the use of natural gas in the state. By far the greater production came from Clay

---

*Mining engineer, Wisconsin Zinc Co., Platteville, Wis.

†Director, Bureau of Economic Geology and Technology, University of Texas, Austin, Tex.

County, 100 to 120 miles northwest of Fort Worth. Many cities and towns in north Texas are now supplied with this fuel. The price varies according to consumption and may be taken at about 25c. per 1000 cu.ft., on the average. On what appears to be reliable authority it is stated that the town of Wichita Falls, Wichita County, will offer natural gas to industrial establishments at 1½c. per 1000 cu.ft. This gas is also obtained from Clay County, the piping distance being from 15 to 20 miles.

The natural gas fields of Clay County are north of Henrietta and around a little station known as Petrolia. This area also produces oil, but not in such amounts as the Electra field. A considerable amount of natural gas is used in and around Corsicana, but is not piped to any distance. On the Rio Grande the town of Laredo is supplied with natural gas from Webb County. Texarkana and Marshall get their gas from the Caddo field, Louisiana. There is some natural gas used at Pittsburg, Camp County, at Santa Anna, and Trickham, Coleman County, at Moran, Shackelford County, and south of San Antonio, in Bexar and McMullen Counties.

Coal and Coke in 1911

Notwithstanding the general complaints of dull business in many lines, it appears that the total production of coal in 1911 fell below the great output of 1910 by a small quantity only, and that the year will, therefore, be known as one of the best in the history of our coal industry, so far as output is concerned.

Anthracite

The production and consumption of anthracite were alike the largest ever reported. The collieries in the anthracite region worked during the year with remarkable steadiness, and the shipments from the mines showed comparatively little variation from month to month—even less so than usual. Not only was this the case, but the storage yards of the large companies remained almost empty during the year, the shipments being readily taken into consumption.

The total shipments of anthracite from the mines, estimating the latter part of December only, were 69,838,872 long tons. Making the customary allowance for coal used at the mines, this would give a total mined of 77,521,148 long tons—equivalent to 86,823,686 short tons. The increase over the production for 1909 was 4,153,450 short tons.

The well known fact that the miners of the anthracite region have formulated demands for increased wages and other modifications of the agreement under which those mines have worked, practically ever since the settlement of the great strike in 1903, would naturally have led the companies to take some precautions against a stoppage of mining in April next, when the agreement will expire.

The demand for coal, however, was so great throughout the year that there has been little opportunity for preparing for this contingency. Doubtless there will be heavy storage of coal from now on, but up to the close of the year it was not possible.

The anthracite market remained very steady throughout the year. For the prepared or household sizes the schedule prices, as fixed by the large carrying companies, remained unchanged except for the discounts usually made in the summer months. For the small or steam sizes prices were a little uncertain early in the year, but they soon steadied up and remained firm, while toward the close of the year this class of coal sold at tidewater at higher prices than have been known for seven or eight years. The returns to the companies must have been entirely satisfactory, both on account of the large quantity sold and the well maintained prices.

Bituminous Coal

The production of bituminous coal is more difficult to ascertain at an early date than is that of anthracite, which is concentrated in a single district. The advance returns collected by *Coal Age*, however, point to a total output in 1911 of 396,296,823 short tons of bituminous coal, a decrease from 1910 of 14,829,585 tons. This decrease was rather generally distributed over most of the coal-producing states, although West Virginia probably increased its output, but at the expense of Ohio, Indiana and Illinois. In Illinois, which was until recently the second producing state, there was a considerable decrease, owing to the protracted disagreement between the operators and miners, which closed many collieries for several months.

Total Production

Adding the anthracite and the bituminous together, we find that the total production as closely estimated for 1911, was 483,192,888 short tons, that for 1910 having been 493,796,643 tons. There was, therefore, a decrease in 1911 of only 10,603,755 tons, or but little more than 2 per cent. This shows a surprisingly small difference in consumption; practically none at all, as it is the universal testimony that there has seldom been a time when consumers were carrying such small stocks as at the close of 1911. The almost universal practice during the greater part of the year was to buy supplies only as needed.

The Bituminous Market

The bituminous-coal markets generally were not by any means in as good condition as those for anthracite. Even early in the year, when there was much talk of a suspension of mining in the Central West on the expiration of the old contract, prices remained at rather a low point. Later, when difficulties were quickly adjusted in all the states except Illinois, and when West Virginia continued to pour coal into both the seaboard and the western markets, prices became gradually weak. To an unusual degree large consumers failed to make yearly contracts for their supplies, preferring to depend upon the open market with the confidence that they could secure lower prices; and the result generally justified them in this course. For a brief time the stoppage of mining in Illinois raised prices at Chicago and St. Louis, but the shortage was quickly made good from West Virginia, Ohio and Indiana, and prices remained weak and uncertain for the greater part of the year.

Upon the whole, the bituminous markets were not favorable to producers, and the year 1911 will not be remembered by them with any wish to return to its general conditions.

Coke

The production of coke in 1911 is estimated by *Coal Age* at 29,338,214 short tons. This is a decrease of 6,717,845 tons from the output of 1910. The diminution was due chiefly to the comparative dullness in the iron trade and the smaller production of pig iron in the early part of the year; in a small degree also to the fact that there were large stocks of coke on hand unsold at the opening of the year. In the month of December business improved in a remarkable degree, and the year closes with much better prospects for the coming season.

Labor Conditions

Coal-mining labor at the close of the year is in a general state of unrest. In the Central West the miners' union is anxious for a restoration of the old tri-state agreement; the operators of Illinois and Indiana have agreed, but those of Ohio and the Pittsburg district will not consent, preferring to make their own agreements. West Virginia remains outside of all union contracts. The prospect is that the coming spring will see a prolonged struggle, both in the bituminous and the anthracite mines.

The Mining Index

A Classified Bibliography of the Current Literature of Mining and Metallurgy

COAL AND COKE

17,425—ACCIDENT—An Outburst of Coal and Fire-Damp at Valleyfield Colliery, Newmills, Fife. Henry Rowan. (Trans. Min. Inst. of Scotland, Vol. XXXIV, Part I, 1911; 3 pp.)

17,426—BITUMINOUS COAL INDUSTRY, The Condition of the. A. J. Moorshead. (Proc. Am. Min. Congress, Oct. 24-28, 1911; 8 pp.)

17,427—BREAKER — Taylor Breaker near Scranton, Penn. M. A. Walker. (Coal Age, Dec. 23, 1911; 2 pp. illus.) 20c.

17,428—BRIQUETS—Zur Frage der Selbstentzündlichkeit von Braunkohlenbriketts. F. W. Hinrichsen and S. Taczak. (Glückauf, Oct. 21 and 28, 1911; 14 pp.) Concerning self-ignition of lignite briquets. 60c.

17,429—COAL-CUTTING MACHINERY. W. Bolton Shaw. (Iron and Coal Tr. Rev., Dec. 1, 1911; 4 pp., illus.) 40c.

17,430—COAL HANDLING at Power Stations. Charles H. Hughes. (Coal Age, Nov. 18, 1911; 4 pp., illus.) 20c.

17,431—COALDUST — Electricity and Coaldust. W. M. Thornton. (Colliery Guardian, Nov. 24, 1911; 1 p., illus.) 40c.

17,432—COKE—Beiträge zur Chemie des Verkokungsprozessen. Hempel u. Lierg. (Zeit. f. Angew. Chem., Oct. 27, 1911; 1¾ pp.) Contributions to the chemistry of the coking process. 40c.

17,433—COKE-OVEN GASES—Power from Coke Oven Gases. C. A. Tupper. (Coal Age, Nov. 25, 1911; 2 pp., illus.) 20c.

17,434—COKE-OVEN PLANT—A 15,000-hp. Coke-Oven Gas-Engine Plant. C. A. Tupper. (Iron Age, Dec. 21, 1911; 2 pp., illus.) Purification and utilization of gas from by-product coke ovens at Alsdorf, Germany. 20c.

17,435—COKE PLANT—The World's Largest By-Product Coke Plant. (Iron Tr. Rev., Dec. 23, 1911; 4 pp., illus.) A description of electrical equipment of the Kopper's coke-oven installation at Gary, Ind. 20c.

17,436—COKING PLANT at Brancepeth Colliery. (Colliery Guardian, Nov. 24, 1911; 1¾ pp., illus.) 40c.

17,437—COLORADO—The New Proposed Coal Mining Law for Colorado. John B. Ekeley. (Journ. of Eng. Univ. of Colo., No. 7, 1910-1911; 10 pp.)

17,438—ELECTRICITY in the Service of the Brown Coal Industry. Alfred Strauss. (A E G Journ., Oct., 1911; 5¾ pp., illus.)

17,439—EXPLOSION—The Adrian Mine Explosion. Pennsylvania. R. Dawson Hall. (Coal Age, Nov. 18, 1911; 3⅓ pp., illus.) 20c.

17,440—EXPLOSIONS—The Causes and the Prevention of Coal Mine Explosions. Edward K. Judd. (School of Mines Quart., Nov., 1911; 7 pp.) 60c.

17,441—HEATING VALUE—Notes on the Calculation of Heating Value of Coals from Their Analyses. O. L. Kowalke. (Wisconsin Engr., Dec., 1911; 4 pp., illus.) 40c.

17,442—HOISTS—Electric Hoists at Collieries. C. A. Tupper. (Coal Age, Dec. 9, 1911; 5 pp., illus.) 20c.

17,443 — LEGISLATION — Coal Land Legislation for the West. George Otis Smith. (Eng. and Min. Journ., Nov. 25, 1911; 1 p.) Address before the Am. Min. Congress. 20c.

17,444—LIGNITE—A Chemical Study of Lignite. Part II. The Volatile Constituents. G. B. Frankforter and Andrew P. Peterson. (Journ. Am. Chem. Soc., Dec., 1911; 8 pp.) 60c.

17,445—LOW-GRADE FUEL—Ausnutzung minderwertiger Brennstoffe auf Zechen des Oberbergamtsbezirks Dortmund. XII. Bütow und Dobbelstein. (Glückauf, Nov. 11, 1911; 5⅙ pp., illus.) Utilization of low-grade fuel at collieries of Dortmund district. Experiments with gas producers. 40c.

17,446 — MICHIGAN — Coal-Mining Problems in Michigan. R. B. Hosken. (Mine and Quarry, Nov., 1911; 7 pp., illus.) 20c.

17,447—MINE GASES—Composition of Mine Gases. G. A. Burrell. (Coal Age, Dec. 23, 1911; 2½ pp., illus.) Paper before the Coal Min. Inst. of America, Dec. 20, 1911. 20c.

17,448—MINE ROOFS—Method of Supporting Mine Roofs. (Mines and Minerals, Dec., 1911; 1¾ pp., illus.) Describes method covered in U. S. patent No. 1,004, 419, granted to William Griffith. 20c.

17,449—MINING METHOD—The "Mine Run System" of Mining Coal. J. E. Finney. (Proc. Am. Min. Congress, Oct. 24-28, 1911; 8 pp.)

17,450—MINING METHODS—Anthracite and Bituminous Mining. Eli T. Conner. (Coal Age, Dec. 9, 1911; 1¼ pp., illus.) 20c.

17,451—OKLAHOMA—Condition of the Coal Mining Industry of Oklahoma. James Eliot. (Proc., Am. Min. Congress, Oct. 24-28, 1911; 3 pp.)

17,452—PLANT—An Illinois City Coal Mining Plant. E. F. Mullin. (Coal Age, Nov. 25. 1911; 3⅓ pp., illus.) Describes plant of Capital Coal Co., Springfield, Ill. 20c.

17,453—RESCUE WORK—Mine-Rescue Service of the State of Illinois. H. H. Stoek. (Bull. A. I. M. E., Dec., 1911; 9 pp., illus.) 40c.

17,454—TRANSVAAL COALS — The Testing of Transvaal Coals. M. Thornton Murray. (Journ. Chem., Met. and Min. Soc. of South Africa, Oct., 1911; 3½ pp.) Discussion on paper previously indexed. 60c.

17,455—VOLATILE MATTER—The Determination of Volatile Matter in Coal. S. W. Parr. (Journ. Ind. and Eng. Chem., Dec., 1911; 1½ pp.) 80c.

17,456 — WEATHERING OF COAL SEAMS. Tom Coventry. (Mines and Minerals, Dec., 1911; 2¼ pp., illus.) Peculiar geological conditions at mines of Charley Coal Mines Proprietary, Ltd., Queensland. 40c.

17,457—WEST VIRGINIA—The Fairmont, W. Va., Coal Region. R. Dawson Hall. (Coal Age, Nov. 11, 1911; 5 pp., illus.) 20c.

COPPER

17,458—ALLOYS—Deoxidizers for Copper Alloys. C. Vickers. (Foundry, Dec., 1911; 1¾ pp.) 20c.

17,460—AUSTRALIA—The Great Cobar, Limited. Donald Clark. (Aust. Min. Soc. of South Africa, Oct., 1911; 9 pp., illus.) $1.

17,461—AUSTRIA — Der Kupfererzbergbau Seekar in den Radstätter Tauern (Salzburg). Redlich. (Zeit. f. prakt. Geol., Oct., 1911; 5¼ pp., illus.) The copper mines of Seekar in the Radstätter Tauern. 40c.

17,462—CHILE—The Braden Copper Company. Pope Yeatman. (Eng. and Min. Journ., Dec. 9 and 16, 1911; 7 pp., illus.) Abstract of annual report. 20c.

17,463—DETERMINATION OF COPPER—A Modification of the Iodide Method. E. C. Kendall. (Journ. Am. Chem. Soc., Dec., 1911; 6 pp.) 60c.

17,464—LEACHING Applied to Copper Ore. W. L. Austin. (Mines and Methods, Nov., 1911; 3¾ pp., illus.) Twelfth article reviewing results accomplished, with special reference to the treatment of copper silicates. 20c.

17,465—MINING METHODS at Braden Mines, Chile. Frank Langford. (Min. Mag., Nov., 1911, 2¾ pp., illus.) 40c.

17,466—MINE WATER—Precipitation of Copper from Mine Waters. Floyd Bushnell. (Min. and Sci. Press, Nov. 18, 1911; 1½ pp., illus.) 20c.

17,467 — ORE DEPOSITION—Some Modes of Deposition of Copper Ores in Basic Rocks. Waldemar Lindgren. (Econ. Geol., Oct.-Nov., 1911; 14 pp.) 60c.

17,468—ORE RESERVES— The Estimation of Ore Reserves at the Ray Central Mine. F. H. Probert and Roy B. Earling. (Eng. and Min. Journ., Dec. 16, 1911; 1¾ pp., illus.) 20c.

17,469—SAMPLING ERRORS Due to Copper Bar Shapes. Donald M. Liddell. (Eng. and Min. Journ., Dec. 16, 1911; ⅔ p., illus.) 20c.

17,470—SMELTING—Direct Smelting of Argentiferous Copper Ore at Rio Blanco, Chile. Ignacio Diaz Ossa. (Met. and Chem. Eng., Dec., 1911; ½ p.) 40c.

17,471—TEXAS—The Permian Copper Ores in Texas. William B. Phillips. (Eng. and Min. Journ., Dec. 16, 1911; 1⅓ pp.) 20c.

GOLD AND SILVER

17,473—ALASKA—Recent Progress on the Klondyke. F. L. Morris. (Min. Mag., Nov., 1911; 2 pp., illus.) 40c.

17,474—ARIZONA—History and Development of the Gold Road Mine. Chas. A. Dinsmore. (Min. and Eng. Wld., Dec. 23, 1911; 2 pp., illus.) 20c.

17,475—BRITISH COLUMBIA—High-Grade Ore Deposits of the Portland Canal District. (Can. Min. Journ., Nov. 15, 1911; 2 pp., illus.) 20c.

17,476—BRITISH COLUMBIA— The Slocan District of British Columbia. (Can. Min. Journ., Dec. 1, 1911; 3¾ pp.) 20c.

17,477—CALIFORNIA—Possibilities of the Mother Lode in Depth. (Min. and Sci. Press, Nov. 18, 1911; 3 pp., illus.) 20c.

17,478—CHILE—Gold Discovery at Putu, Chile. Mark R. Lamb. (Eng. and Min. Journ., Dec. 2, 1911; 1¼ pp., illus.) 20c.

17,479—COLORADO—Notes on the Liberty Bell Mine. Charles A. Chase. (Bull. A. I. M. E., Dec., 1911; 48 pp., illus.)

17,480—CONCENTRATION at Hudson Bay Mines, Ltd., Cobalt, Ont. H. G. Young. (Can. Min. Journ., Nov. 15, 1911; 1 p., illus.) 20c.

17,481—CYANIDING—Chispas Cyanide Plant, Arizpe, Sonora, Mexico. Edward L. Dufourcq. (School of Mines Quart., Nov., 1911; 18 pp., illus.) 60c.

17,482—CYANIDING—Electrolytic Difficulties in the Clancy Process. Victor Zachert. (Min. and Eng. Wld., Nov. 4, 1911; 1 p.) 20c.

17,483—CYANIDING—Premature Precipitation of Gold in Cyanidation. R. Stuart Browne. (Min. and Eng. Wld., Dec. 2, 1911; 3⅓ pp.) 20c.

17,484—CYANIDING—Rapid Estimation of Available Calcium Oxide in Lime Used in the Cyanide Process. Luther W. Bahney.. (Bull. A. I. M. E., Nov., 1911; 6 pp.) 40c.

17,485—DREDGE—Marysville Dredge No. 4. Robert E. Cranston. (Min. and Sci. Press, Dec. 9, 1911; 2 pp., illus.) 20c.

17,486—DREDGING — A Dry Land Dredging Machine. Lewis H. Eddy. (Eng. and Min. Journ., Dec. 16, 1911; 2 pp., illus.) 20c.

47,487—DREDGING at Ruby, Montana. Floyd Bushnell. (Min. and Sci. Press, Nov. 25, 1911; 2 pp., illus.) 20c.

17,488—DREDGING at Waikaia, New Zealand. A. Gordon MacDonald. (Eng. and Min. Journ., Dec. 9, 1911; ½ p illus.) 20c.

17,489—DREDGING — Gold-Dredging Operations in Breckenridge District. Arthur Lakes, Jr. (Min. and Eng. Wld., Dec. 2, 1911; 5 pp., illus.) 20c.

17,490—DREDGING — Goldgewinnung durch Bagger in Kalifornien. Ettrup u. Homberger. (Zeit. des Vereines Deutscher Ing., Oct. 14, 1911; 5 pp., illus.) Gold extraction by dredging in California.

17,491—DREDGING—Sampling Dredging Ground. Robert F. Lafferty. (Eng. and Min. Journ., Nov. 25, 1911; 1 p.) 20c.

17,492—GOLD PRODUCTION—Die Golderzeugung der Welt im Jahre 1910. Simmersbach. (B. u. H. Rundschau, Nov. 5, 1911; 2¼ pp.) The gold production of the world in 1910.

17,493—INVESTMENTS—Conservation of Investments in Gold Mines. Morton Webber. (Min. and Sci. Press, Dec. 9, 1911; 1¾ pp.) 20c.

17,494—MALM PROCESS—Importance of the Malm Process in the Metallurgy of Complex Ores. A. G. Brownlee. (Proc. Am. Min. Congress, Oct. 24-28, 1911; 12 pp.)

17,495—MILL—Concrete Work at New Belmont Mill. C. B. Clyne. (Eng. and Min. Journ., Nov. 25, 1911; ⅔ p., illus.) 20c.

17,496—MILL—The Ajax Mill, Victor, Colorado. (Eng. and Min. Journ., Dec. 2, 1911; 1 p.) 20c.

17,497—MILL—The Tonopah Extension Mill. Claude T. Rice. (Eng. and Min. Journ., Dec. 2, 1911; 3 pp., illus.) 20c.

17,498—MILL AND CYANIDE PLANT RECORDS. A. W. Allen. (Min. and Sci. Press, Dec. 2, 1911; 2 pp.) 20c.

17,499—MILLING at Stratton's Independence. Philip H. Argall. (Mines and Minerals, Dec., 1911; 1¾ pp., illus.) Recent history of the mine, geology of its ore deposits and milling methods. 40c.

17,500—MILLING METHODS at Stratton's Independence. Philip Argall. (Min. Mag., Nov., 1911; 10 pp., illus.) 60c.

17,501—NEVADA—Notes on Mining at Tonopah. Claude T. Rice. (Eng. and Min. Journ., Dec. 16, 1911; 1¾ pp.) 20c.

17,502—NEVADA—Notes on National Mining District of Nevada. P. R. Whytock. (Min. and Eng. Wld., Dec. 2, 1911; ¾ p., illus.) 20c.

17,503—NEW ZEALAND—Mining and Ore-Treatment at the Talisman Mine, Karangahake, N. Z. Arthur Jarman. (Proc. Aust. Inst. of Min. Engrs., Sept. 30, 1911; 51 pp., illus.)

17,504—NICARAGUA—Treatment of Nicaraguan Gold Ores. Henry B. Kaeding. (Bull. A. I. M. E., Dec., 1911; 5 pp.) 40c.

17,505—ONTARIO—Reisebericht aus den Goldfeldern des nördlichen Ontario. Baelz. (Zeit. f. prakt. Geol., Nov., 1911; 8½ pp., illus.) Traveling notes from the gold fields of northern Ontario. 40c.

17,506—PLACER MINING in Colombia. R. D. O. Johnson. (Eng. and Min. Journ., Dec. 9, 1911; 4⅓ pp., illus.) 20c.

17,507—PORCUPINE—Hollinger Reserve Mines of Porcupine. (Can. Min. Journ., Dec. 15, 1911; 3 pp., illus.) 20c.

17,508—PORCUPINE—Progress at Porcupine. H. H. Johnson. (Min. Mag., Nov., 1911; 3 pp., illus.) 40c.

17,509—PORCUPINE—Some Notes on Porcupine. S. F. Shaw. (Eng. and Min. Journ., Dec. 23, 1911; 3¼ pp., illus.) 20c.

17,510—PRODUCTION of Gold and Silver in 1910. H. D. McCaskey. (Advance Chapter from Mineral Resources of the U. S., 1910; 39 pp.)

17,511—REFINING—Volatilization of Gold and Silver from Their Copper Alloys. Edward F. Kern and Albert A. Helmrod. (School of Mines Quart., Nov., 1911; 31 pp., illus.) 60c.

17,512—QUEBEC—Alluvial Gold Deposits in Quebec. Fritz Cirkel. (Eng. and Min. Journ., Nov. 25, 1911; 3⅔ pp., illus.) 20c.

17,513—SINALOA—Mining at San Jose de Gracia, Sinaloa. G. L. Sheldon. (Min. and Sci. Press, Nov. 18, 1911; 1⅓ pp.) 20c.

17,514—SLIME-FILTRATION. George J. Young. (Bull. A. I. M. E., Nov., 1911; 34 pp., illus.)

17,515—SOUTH AFRICA—Methodes d'Exploitation Intensive employées dans les Champs d'Or et de Diamants Sud-Africains. M. Bertrand. (Rev. Univ. des Mines, May, 1911, pp. 150-203, illus.) Brief description of working methods, with particular attention to systems of accounting, distribution of labor, etc.

17,516—STAMP-BATTERY CAM SHAFTS. Charles T. Hutchinson. (Min. and Sci. Press, Dec. 16, 1911; 2 pp., illus.) 20c.

17,517—STAMP MILLS—Notes on High Duty Gravity Stamp Mills. Peter N. Nissen. (Journ. Chem., Met. and Min. Soc. South Africa, Oct., 1911; 15½ pp., illus.) 60c.

17,518—STRAITS OF MAGELLAN—Mining in the Straits of Magellan. H. W. Edwards. (Eng. and Min. Journ., Dec. 2, 1911; 2⅓ pp., illus.) 20c.

17,519—SULPHIDE-ORE TREATMENT—Tonopah Process of Treatment of Sulphide Ores. W. J. Stoneham. (Min. and Eng. Wld., Nov. 18, 1911; 1 p., illus.) 20c.

17,520—TUBE MILLING—The Economics of Tube-Milling. H. Standish Ball. (Bull. Nos. 86 and 87, I. M. M., 1911; 14½ pp.) Discussion on paper previously indexed.

17,521—TURKEY—History and Geology of Ancient Gold Fields in Turkey. Leon Dominian. (Bull. A. I. M. E., Nov., 1911; 21 pp.)

17,522—WEST AFRICA—The Gold Coast Mines, West Africa. (Austral. Min. and Eng. Rev., Nov. 5, 1911; 3 pp., illus.) 40c.

IRON AND STEEL.

17,523—BLAST FURNACE—Heat Efficiency of the Blast Furnace. By G. Geijer. (Jernkontorets Annaler, Sept., 1911; 20 pp.)

17,524—BLAST-FURNACE GAS—Useful Information Relating to the Utilization of Blast-Furnace Gas. Horace Allen. (Practical Engr., Nov. 24, 1911; 2¼ pp.) 20c.

17,525—BLAST-FURNACE GASES—Entschlammung der Waschwässer von der Hochofengasreinigung. E. Steuer. (Stahl u. Eisen, Oct. 26, 1911; 4½ pp., illus.) Settling the sludge of the wash waters from the scrubbers of blast-furnace gases. 40c.

17,526—BRAZIL—Hematite Ores of Brazil and a Comparison with Hematite Ores of Lake Superior. C. K. Leith and E. C. Harder. (Econ. Geol., Oct.-Nov., 1911; 17 pp.) 60c.

17,527—CAST IRON—Begründung einer neuen Theorie der Gusseisenprüfung. D. A. Messerschmitt. (Stahl u. Eisen, Nov. 2, 1911; 5½ pp., illus.) Discussion of a new theory of testing cast-iron. 40c.

17,528 CAST IRON—Etwas über Spaneisen. H. Adämmer. (Stahl u. Eisen, Nov. 2, 1911; 1 p.) Some remarks on cast iron made directly from chips without previous briquetting. 40c.

17,529—CUBAN IRON ORE DEPOSITS. Dwight E. Woodbridge. (Can. Min. Journ., Nov. 15, 1911; 2¾ pp., illus.) 20c.

17,530 DRY-AIR BLAST—La Déssication du Vent des Hauts Fourneaux a Differdange, Luxembourg. E. Lemaire. (Génie Civil, July 8, 1911; pp. 209-211, illus.) Describes the operation of the Daubine & Roi method of drying air-blast by means of calcium chloride.

17,531—ELECTRIC REDUCTION of Iron Ores. Otto Frick. (Met. and Chem. Eng., Dec., 1911; 6¼ pp.) Special reference is made to results obtained in the electrometals furnace at Trollhättan, Sweden and in the Noble furnace at Heroult, Cal. 40c.

17,532—ELECTRIC SMELTING—Steel Direct from the Ore in the Electric Furnace. (Evans Stansfield Process). A. Stansfield. (Can. Engr., Nov. 16, 1911; 1½ pp., illus.) 20c.

17,533—ELECTROMAGNETIC SEPARATION—Beitrag zur elektromagnetischen Eisenausscheidung. G. Rietkötter. (Stahl u. Eisen, Nov. 2, 1911; 2 pp., illus.) Contribution to the electromagnetic separation of iron. 40c.

17,534—ELECTROSTEEL—Elektrostahl und seine Gewinnung. Rodenhauser. (Zeit. f. Angew. Chem., Dec. 1, 1911; 16½ pp., illus.) Electrosteel and its manufacture.

17,535—ENGLAND—Die Eisenerze Englands. Flegel. (Glückauf, Nov. 18, 1911; 2½ pp.) 40c.

17,536—FERROMANGANESE—Ueber Möller und Gestehungskosten von Ferromangan. Schüphaus. (B. u. H. Rundschau, Nov. 5, 1911; 4 pp.) The computation of charges in making ferromanganese and its cost of production. 40c.

17,537—FOUNDRY PRACTICE—Vergleichende Aufstellung der Ausgaben im Giessereibetrieb. (Stahl u. Eisen, Nov. 2, 1911; 4¼ pp.) Comparative statement of expenses in foundry practice. 40c.

17,538—FRANCE—Les Mines de Fer dans l'Anjou et la Bretagne. S. Brull. (Génie Civil, Sept. 2, 1911; pp. 361-368, illus.) First instalment of a serial article describing the occurrence of the iron ores in the vicinity of Segré, the system of mining and method of treatment.

17,539—HARDENING—Quenching Carbon Steel After Correct Heating for Hardening. Shipley N. Brayshaw. (Eng. Mag., Dec., 1911; 7 pp.) 40c.

17,540—HEAT TREATMENT—A Discussion of the Heat Treatment of Steel. James H. Herron. (Iron Tr. Rev., Nov. 30, 1911; 3⅔ pp.) 20c.

17,541—LORRAINE—Die Verleihung der Eisenerzbergwerke in Lothringen von 1810 bis 1910. Wehmann. (Stahl u. Eisen, Nov. 16, 1911; 6¾ pp.) The concession of iron mines in Lorraine from 1810 to 1910. 40c.

17,542—MANUFACTURE of Iron and Steel. S. M. Rodgers. (Journ., Cleveland Eng. Soc., Sept., 1911; 11 pp., illus.) Brief description of most important processes of making steel and acid bessemer and acid-basic open hearth. 60c.

17,543—MICHIGAN—The Newport Iron Mine, Ironwood, Mich. B. W. Vallat. (Bull. A. I. M. E., Nov., 1911; 19 pp., illus.)

17,544—MINNESOTA—The Biwabik Iron Mine. C. A. Tupper. (Eng. and Min. Journ., Nov. 25. 1911; 2¾ pp., illus.) 20c.

17,545—NICKEL STEEL—Heat Treatment of a Nickel Steel. W. Campbell and H. B. Allen. (School of Mines Quart., Nov., 1911; 12 pp.) 60c.

17,546—OPEN-HEARTH FURNACES—Design of Oil-Fired Open-Hearth-Furnaces. Walter MacGregor. (Iron Tr. Rev., Nov. 16, 1911; 3½ pp., illus.) 20c.

17,548—PHOSPHORUS IN PIG IRON—Ueber die Bestimmung des Phosphors im Roheisen und Güssen ohne Abscheidung des Siliciums. Müller. (Chem.-Ztg., Oct. 28, 1911; 1½ pp., illus.) On the determination of phosphorus in pig iron and castings without separation of silicon. 40c.

17,549—PIG IRON—Peculiar Properties of Pig Iron. John Jeremiah Porter. (Foundry, Dec., 1911; 3⅓ pp.) Paper before Pittsburgh F'dymen's Assn., Nov., 1911. 20c.

17,550—ROLLING-MILL PLANT—Neue amerikanische Walzwerksanlage mit Abdampf-Turbodynamos. Schömburg. (B. u. H. Rundschau, Oct. 20, 1911; ¾ p.) New American Rolling Mill plant with exhaust steam turbo dynamos at Middletown, Ohio.

17,551—ROLLING MILLS—Walzarbeit und Walzdruck. M. Herrmann. (Stahl u. Eisen, Oct. 19, 1911; 5½ pp.) Rolling mill work and roll mill pressure. 40c.

17,552—STEEL WORKS—Western Steel Corporation's Plant at Irondale, Wash. (Iron Tr. Rev., Dec. 7, 1911; 5¼ pp., illus.) 20c.

,17,553—SULPHUR DETERMINATION—Ueber die Schwefelbestimmung im Roheisen und Stahl. H. Kinder. (Stahl u. Eisen, Nov. 9, 1911; 1 p.) On sulphur determination in pig iron and steel. 40c.

17,554—TITANIUM—Zur Frage des Titanzusatzes zu Eisen und Stahl. (Stahl u. Eisen, Nov. 2, 1911; 2 pp.) Concerning the addition of titanium to iron and steel. 40c.

17,555—TRANSPORTATION—Vorschläge zur Verbesserung der Eisen und Schlackenabfuhr in Hochofenwerken. E. Langhenrich. (Stahl u. Eisen, Nov. 16, 1911; 4 pp., illus.) Proposed improvements in removing iron and slag at iron works. 40c.

LEAD, ZINC AND OTHER METALS

17,556—BISMUTH—The "Glen" Bismuth Mines, North Queensland. W. C. Walworth Pearce. (Bull. 87, I. M. M., Dec. 14, 1911; 5 pp. illus.)

17,557—CADMIUM—The Electro-Deposition of Cadmium. Emmanuel Blassett, Jr. (Metal Industry, Dec., 1911; 2 pp., illus.) 20c.

17,558—CERIUM—The Preparation and Properties of Metallic Cerium. Alcan Hirsch. (Journ. Ind. and Eng. Chem., Dec., 1911; 16 pp. illus.) 80c.

17,559—LEAD—A Trip to Przibram, Bohemia. O. H. Hahn. (Eng. and Min. Journ. Nov., 25, 1911; 3⅔ pp., illus.) 20c.

17,560—LEAD—Some New Features in the Electrolytic Determination of Lead. John G. Fairchild. (Journ. Ind. and Eng. Chem., Dec., 1911; ¾ p.) 80c.

17,561—LEAD AND ZINC—Oklahoma Lead and Zinc Field. L. C. Snider. (Eng. and Min. Journ., Dec. 23, 1911; 3 pp., illus.) 20c.

17,562—LEAD-ZINC—Operations at the Wellington Mine, Breckenridge. Arthur Lakes, Sr. (Min. and Eng. Wld., Dec. 23, 1911; 2 pp., illus.) 20c.

17,563—MANGANESE—Die technische Bedeutung des Mangans und seiner Verbindungen. E. Prziwosnik. (Oest. Zeit. f. B. u. H., Oct. 28, 1911; 4¾ pp.) Technical importance of manganese and its compounds. 40c.

17,564—MOLYBDENUM—Report of the Molybdenum Ores of Canada. T. L. Walker. (Canada Dept. of Mines, Mines Branch, 1911; 75 pp., illus.)

17,565—PLATINUM—The Production of Platinum and Allied Metals in 1910. Waldemar Lindgren. (Advance Chapter from Mineral Resources of the U. S., 1910; 10 pp.)

17,566—RADIUM—Modern Uses and Applications of Radium. Hugo Lieber. (Journ. Frank. Inst., Dec., 1911; 12 pp.) 60c.

17,567—TIN—Dredging for Placer Tin in Alaska. Lewis H. Eddy. (Eng. and Min. Journ., Dec. 23, 1911; ¾ p., illus.) 20c.

17,568—TIN in the Karibib District, German South West Africa. (South African Min. Journ., Oct. 21, 1911; 1¼ pp., illus.) 40c.

17,569—TIN—The Tin Fields of South Africa Revisited. (South African Min. Journ., Nov. 11 and 18, 1911; 3 pp., illus.) 60c.

17,570—TUNGSTEN—Die Bestimmung des Wolframs in Wolframit bei Gegenwart von Molybdänglanz. Trautmann. (Zeit. f. Angew. Chem., Nov. 10, 1911; ½ p.) Determination of tungsten in wolframite in the presence of molybdenite. 40c.

17,571—URANIUM—The Occurrence of Uranium (Radio-Active) Ores and other Rare Metals and Minerals in South Australia. Compiled by Lionel C. E. Gee. (R. E. Rogers, Govt. Printer, Adelaide, South Aust., 16 pp., illus.)

17,572—URANIUM AND VANADIUM from Colorado Carnotite. Alb. Benicke. (Min. and Eng. Wld., Nov. 4, 1911; 1 p.) 20c.

17,573—WOLFRAM AND MOLYBDENITE in Queensland. Lionel C. Ball. (Queensland Govt. Min. Journ., Oct. 14, 1911; 4½ pp., illus.) 60c.

17,574—ZINC—Bemerkungen and der Abhandlung des Herrn Dr. E. Schütz über Entwicklung der Zinkblenderöstung. (Metallurgie, Nov. 22, 1911; 1 p.) Comments on the paper of Dr. Schütz on development of zinc blende roasting in "Metallurgie," Oct. 22, 1911. 40c.

15,575—ZINC—Developments in the Yellow Pine District, Nevada. Fred A. Hale, Jr. (Min. and Eng. Wld., Nov. 4, 1911; 1 p., illus.) 20c.

17,576—ZINC—Keeping Mining Costs at Joplin. Otto Ruhl. (Eng. and Min. Journ., Dec. 9, 1911; 3⅔ pp.) 20c.

17,577—ZINC — Schnellmethode für Zinkbestimmung. Voigt. (Zeit. f. Angew. Chem., Nov. 17, 1911; 2½ pp.) A quick method for determining zinc. 40c.

17,578—ZINC—The Hommel Furnace for Volatilizing Zinc. W. Hommel. (Eng. and Min. Journ., Dec. 16, 1911; ¾ p., illus.) 20c.

17,579—ZINC—The Manufacture of Lithopone. (Eng. and Min. Journ., Dec. 16, 1911; 1 p.) 20c.

17,580—ZIRCONIA — Die technische Verwendung der Zirkonerde. Böhm. (Chem.-Ztg., Nov. 14, 1911; 1 p.) Technical use of zirconia. 20c.

NONMETALLIC MINERALS.

17,581—AMBER—Die rechtlichen Verhältnisse des Bernsteinberghaus im Samlande. (B. u. H. Rundschau, Nov. 20, 1911; 5 pp.) The legal aspects of amber mining in East Prussia. 40c.

17,582—BAUXITE MINING in Tennessee. George H. Ashley. (Resources of Tenn., Dec., 1911; 9 pp., illus.)

17,583—BORAX—The Production of Borax in 1910. Charles G. Yale. (Advance Chapter from Mineral Resources of the U. S., 1910; 4 pp.) 20c.

17,584—CLAY—Statistics of the Clay-Working Industries of the United States in 1910. Jefferson Middleton. (Advance Chapter from Mineral Resources of the U. S., 1910; 66 pp.)

17,585—DIAMOND—Speculations Regarding the Genesis of the Diamond. Orville A. Derby. (Journ. Geol., Oct.-Nov., 1911; 5 pp.) 60c.

17,586 — DIAMOND-CUTTING AND POLISHING INDUSTRY. (South African Min. Journ., Nov. 11, 1911; 1¼ pp.) 40c.

17,587 — DIAMONDS — The Bloemhof and Moolfontein Diamond Diggings. Harold S. Harger. (South African Min. Journ., Nov. 18, 1911; 1⅓ pp.) 20c.

17,588—EMERALDS: Their Mode of Occurrence and Methods of Mining and Extraction in Colombia. Charles Olden. (Bull. 87, I. M .M., Dec. 14, 1911; 14 pp., illus.)

17,589—FELDSPAR POTASSIUM. William J. Dwyer. (Am. Fertilizer, Nov. 18, 1911; 1¾ pp.) 20c.

17,590—FLUORSPAR MINING at Rosiclare, Ill. Ernest F. Burchard. (Eng. and Min. Journ., Dec. 2, 1911; 2½ pp., illus.) 20c.

17,591—GYPSUM DEPOSITS of Nova Scotia. W. F. Jennison. (Can. Min. Journ., Dec. 15, 1911; 5¾ pp., illus.) Abstracted from a monograph issued by the Department of Mines of Canada. 20c.

17,592—LIME—The Production of Lime in 1910. Ernest F. Burchard. (Advance Chapter from Mineral Resources of the U. S. 1911; 15 pp.)

17,593—MAGNESITE—The Production of Magnesite in 1910. Charles G. Yale. (Advance Chapter from Mineral Resources of the U. S., 1910; 6 pp.)

17,594—MICA—On the Mica Deposits of Ontario and Quebec. Hugh S. de Schmid. (Can. Min. Journ., Dec. 1, 1911; 2¾ pp.) From Summary Report of Mines Branch, Canadian Dept. of Mines. 20c.

17,595—POTASH—Prospecting for Potash in Sections of Nevada. W. J. Stoneham. (Min. and Eng. Wld., Dec. 2, 1911; 1⅓ pp.) 20c.

17,596—POTASSIUM NITRATE—The Occurrence of Potassium Nitrate in Western America. Robert Stewart. (Journ. Am. Chem. Soc., Dec., 1911; 1 p.) 60c.

17,597—SALT — Die Oesterreichischen Salinen im Jahre 1909. (Oest. Zeit. f. B. u. H., Oct. 21, 1911; 2¾ pp., illus.) Conclusion of article previously indexed. 40c.

17,598—SAND AND GRAVEL—The Production of Glass Sand, Other Sand and Gravel in 1910. Ernest F. Burchard. (Advance Chapter from Mineral Resources of the U. S., 1910; 10 pp.)

17,599 — SLATE — Mining Slate in Maine. H. W. Buker. (Mine and Quarry, Nov., 1911; 6 pp., illus.) 20c.

17,600—STONE INDUSTRY in 1910. Ernest F. Burchard. (Advance Chapter from Mineral Resources of the U. S., 1910; 42 pp.)

17,601—TOURMALINES — Occurrences and Uses of American Tourmalines. Alexander Spotswood. (Min. and Eng. Wld., Dec. 23, 1911; 1⅓ pp.) 20c.

PETROLEUM.

17,602—GEOLOGICAL FACTORS in Oil Production. Dorsey Hager. (Min. and Sci. Press, Dec. 9, 1911; 3½ pp., illus.) 20c.

17,603—OKLAHOMA — Petroleum in Oklahoma. Lucius L. Wittich. (Mines and Minerals, Dec., 1911; 3¼ pp., illus.) Location of the oil district; history; geological conditions; quality and quantity of output. 40c.

17,604—ORIGIN — Fallacies in the Theory of the Organic Origin of Petroleums. Eugene Coste. (I. M. M., Bull. Nos. 86 and 87, 1911; 43 pp.) Discussion on paper previously indexed.

17,605—QUEENSLAND — The Search for Oil at Roma. W. E. Cameron. (Queensland Govt. Min. Journ., Oct. 14, 1911; 3½ pp., illus.) 60c.

17,606—STORAGE—A Concrete Reservoir for Storage of Petroleum. Franklyn W. Oatman. (Min. and Eng. Wld., Nov. 18, 1911; 2⅓ pp., illus.) 20c.

17,607—TRINIDAD—The Oil Fields of Trinidad. (Petrol. Rev., Dec. 3, 1911; (Glückauf, Nov. 18, 1911; 4¼ ppp.) Abstract from the official "Jahrbuch." 40c.

17,608—UTAH—The San Juan Oilfield of Utah. George D. James. (Eng. and Min. Journ., Dec. 2, 1911; 2⅓ pp., illus.). 20c.

ECONOMIC GEOLOGY—GENERAL.

17,609—ANDES—Sur les Filons de la Cordillère sud-americaine. Dr. Steinmann. (Bull. de la Soc. de l'Ind. Min., Sept., 1911; pp. 246-251, illus.) Brief description of the typical occurrence of veins in the mountainous district of South America.

17,610—ARIZONA—Hematite in Veins of Globe District. John Sanders. (Eng. and Min. Journ., Dec. 16, 1911; 1 p., illus.) 20c.

17,611—AUSTRIA—Einige neue Erzaufschlüsse in Tirol. M. Isser. (Oest. Zeit. f. B. u. H., Oct. 21, 1911; 2½ pp.) On some new ore finds in Tyrol. 40c.

17,612—CANADA—Les Industries Minérales du Canada. H. Mortimer-Lamb. (Bull. de la Soc. de l'Ind. Min., Sept., 1911; pp. 297-310.) Reviews the mineral resources of the Dominion, with statistics as to their importance.

17,613—CONTACT DEPOSITS. James F. Kemp. (Min. and Sci. Press, Nov. 25, 1911; 3¼ pp.) 20c.

17,614—METEORITES — Analyses of Stone Meteorites. Oliver C. Farrington. (Field Museum of Natural History, Pub. 151, 1911; 22 pp., and plates.)

17,615—OKLAHOMA—A Report on the Geology and Mineral Resources of the Arbuckle Mountains, Oklahoma. Chester Albert Reeds. (Okla. Geol. Surv., Bull. 3, 1910; 87 pp., illus.)

17,616—ORE DEPOSITS—Problems on the Strike. Josiah Bond. (Eng. and Min. Journ., Nov. 25, 1911; 2⅔ pp., illus.) 20c.

17,617—QUEBEC—Geology of a Portion of Fabre Township, Pontiac county. Robert Harvie. (Dept. of Colonization, Mines, and Fisheries of Quebec, 1911; 32 pp., illus.)

17,618 — ST. ANDREASBERG — Les Filons d'Argent de Saint Andreasberg. Werner. (Bull. de la Soc. de l'Ind. Min., Sept., 1911; pp. 251-262, illus.) Description of the ore occurrence at this historic locality in the Harz mountains.

17,619—UTAH—Some Minerals from Beaver County, Utah. B. S. Butler and W. T. Schaller. (Am. Journ. Sci., Dec., 1911; 7 pp.) 40c.

17,620—WATER—Sources Juvéniles. O. Stutzer. (Bull de la Soc. de l'Ind. Min., Sept., 1911; pp. 285-294.) Discussion of the disputed origin of hot water in volcanic districts. The theory here advanced has elements of novelty.

17,621—WYOMING—Geology and Mineral Resources of a Portion of Fremont County, Wyo. C. E. Jamison, State Geologist, Cheyenne. (90 pp., illus.)

MINING—GENERAL.

17,622—ACCIDENTS—Recording Mine Accidents. Heath Steele. (Eng. and Min. Journ., Dec. 9, 1911; ⅔ p., illus.) 20c.

17,623—ACCOUNTING—Notes on Mine Accounting. T. H. Sheldon. (Eng. and Min. Journ., Dec. 23, 1911; 1⅔ pp.) From a paper before the Cripple Creek District Min. and Met. Soc., November, 1911. 20c.

17,624—ASSESSMENT WORK — The Law of Annual Labor—II. R. S. Morrison. (Min. Sci., Nov., 23, 1911; ¾ p.) 20c.

17,625—AUSTRIA—Die Bergwerksproduktion Oesterreichs im Jahre 1910. (Oest. Zeit. f. B. u. H., Nov. 11, 1911; 6 pp.) Mineral production of Austria in 1910. 40c.

17,626—AUSTRIAN MINERAL INDUSTRY in 1910. (Min. Journ., Nov., 1911; 2 pp.) 40c.

17,627 — BELGIUM — Die belgische Bergwerksindustrie im Jahre 1910. (Glückauf, Nov. 11, 1911; 3 pp.) 40c.

17,628—BOHEMIA—A Trip to Przibram, Bohemia. O. H. Hahn. (Eng. and Min. Journ., Nov. 25, 1911; 3 pp., illus.) 20c.

17,629—COLORADO—Fall River District, Colorado. W. Weston. (Eng. and Min. Journ., Dec. 9, 1911; ½ p.) 20c.

17,630—CONCRETE SHAFT-STRINGERS. A. N. Wold. (Min. and Sci. Press, Dec. 2, 1911; 1½ pp., illus.) 20c.

17,631—COST AND CHECKING SYSTEM for Mine Operations. Edward G. W. Ferguson. (Min. and Eng. Wld., Dec. 9, 1911; 1 p.) 20c.

17,632—COSTS—Keeping Mining Costs at Joplin. Otto Ruhl. (Eng. and Min. Journ., Dec. 9, 1911; 3⅔ pp.) 20c

17.633 — DAM — Building the Gold Mountain Dam. F. A. Post. (Min. and Sci. Press, Dec. 16, 1911; 2½ pp., illus.) 20c.

17,634—DIAMOND DRILLING—Notes on Diamond Drilling in Mexico. (Mine and Quarry, Nov., 1911; 4 pp., illus.) 20c.

17,635—DUST—The Prevention of Dust in the Development Drives of Mines During Drilling Operations. C. J. N. Jourdan. (Journ. South African Inst. Engrs., Nov., 1911; 3 pp., illus.) Discussion on paper previously indexed. 60c.

17,636—EXCAVATION—Cost of Construction on the Panama Canal for the Year Ending June 30, 1911. (Engineering and Contracting, Nov. 22, 1911; 4¾ pp., illus.) 20c.

17,637—FILING NOTES—The Keeping or Filing of Engineering Notes. R. Stuart Browne. (Min. and Eng. Wld., Dec. 9, 1911; 4⅓ pp.) 20c

17,638—FIRE—Der Grubenbrand im Schachtsicherheitspfeiler der Schachtanlage Vondern I/II bei Oberhausen. Hasse. (Glückauf, Nov. 18, 1911; 7¾ pp., illus.) The fire in the safety pillar of shaft Vondern I/II near Oberhausen.

17,639—FRANCE — Die französische Bergwerksindustrie in 1909. (Glückauf, Oct. 21, 1911; 5¼ pp.) The French mining industry in 1909. 40c.

17,640—GAS DETECTOR — Kohlenoxyd-Detektor. R. Nowicki. (Oest. Zeit. f. B. u. H., Oct. 28, 1911; 1 p., illus.) Carbon monoxide detector. 40c.

17,641—EXPLOSIVES — Einiges über brisante Sprengstoffe. Neumann. (Zeit. f. Angew. Chem., Nov. 24, 1911; 7½ pp., illus.) Some remarks on "brisant" (shattering) explosives. 40c.

17,642—HAULAGE—Electric Haulage in Mining Work. James A. Seager. (Mex. Min. Journ., Dec., 1911; 4¾ pp., illus.) 20c.

17,643—HAULAGE SYSTEM at Gray Creek Mine. F. W. Whiteside. (Mines and Minerals, Dec., 1911; 2 pp., illus.) 20c.

17,644—HOISTING—Steam Hoists for Shallow Mines. Sven T. Nelson. (Eng. and Min. Journ., Nov. 25, 1911; 3¼ pp., illus.) 20c.

17,645—JAPAN—The Mining Industry of Japan. Keijero Nishio. (Trans. A. I. M. E., Oct., 1911; 48 pp.)

17,646—LABOR CONDITIONS at Calumet & Hecla. Claude T. Rice. (Eng. and Min. Journ., Dec. 23, 1911; 4 pp., illus.) 20c.

17,647—MAPPING—Topographical and Geological Mapping. A. J. Hoskin. (Mines and Minerals, Dec., 1911; 3 pp., illus.) Methods and instruments employed by the parties making the survey in the field. 20c.

17,648—MINERS—The Michigan Copper-Mine Worker of Today. W. J. Lauck. (Min. and Eng. Wld., Nov. 18, 1911; 1⅓ pp.) 20c.

17,649—MINERS' BATHS and Bath Houses. George Blake Walker. (Eng. Mag., Dec., 1911; 15 pp., illus.) 40c.

17,650—MINERS' HOUSES — Colliery Dwelling Construction. A. T. Shurick. (Coal Age, Nov. 25, 1911; 3¾ pp., illus.) 20c.

17,651—NEW JERSEY—The Mineral Industry of New Jersey for 1910. Henry B. Kümmel and S. Percy Jones. (N. J. Geol. Survey, Bull. 5, 1911; 24 pp.)

17,652—ORE HANDLING at Ray, Arizona. C. L. Edholm. (Eng. and Min. Journ., Dec. 9, 1911; 2½ pp., illus.) 20c.

17,653—ORE RESERVES—The Estimation of Ore Reserves at the Ray Central Mine. Frank H. Probert and Roy B. Earling. (Eng. and Min. Journ., Dec. 16, 1911; 1¾ pp., illus.) 20c.

17,654—ORE TONNAGE—Estimating Ore Tonnage from Drill-Hole Records. Robert E. McConnell. (Min. and Eng. Wld., Dec. 2, 1911; 1⅔ pp., illus.) 20c.

17,655—PIPE LINE—The Repair of a 9500-ft. Leaky Steel Plate Pipe Line at Boulder, Colo., by Oxy-Acetylene Welding. Louis Elliott. (Eng. News, Nov. 16, 1911; 2 pp., illus.) 20c.

17,656 — QUARRYING — "Glory-Hole" Quarrying Process. Paul Van Zandt. (Cement Age, Dec., 1911; 3 pp., illus.) 20c.

17,657—RAIL BONDING in Mines. G. H. Bolus. (Eng. and Min. Journ., Dec. 9, 1911; 1 p., illus.) 20c

17,658—RESCUE APPARATUS — The Use of the Pulmotor in Metal Mining. E. T. Corkill. (Can. Min. Journ., Nov. 1, 1911; 1¼ ppp., illus.) 20c.

17,659—SAXONY—Der Bergbau des Königreichs Sachsen im Jahre 1910. (Glückauf, Nov. 18, 1911; 4¼ pp., illus.) 40c.

17,660—SCIENTIFIC MANAGEMENT—Applied Methods of Scientific Management—VII and VIII. Frederick A. Parkhurst. (Ind. Eng., Nov. and Dec., 1911; 15½ pp.) 60c.

17,661 — SHAFT - SINKING OPERATIONS at the Norma Shaft, Kattowitz, Upper Silesia. B. C. Gullachsen. (Journ. Chem., Met. and Min. Soc. of South Africa, Oct., 1911.; 1½ pp.) Discussion on paper previously indexed. 60c.

17,662—SKIP LOADING—Method of Loading Skips. Guy C. Stoltz. (Eng. and Min. Journ., Dec. 2, 1911; ½ p., illus.) 20c.

17,663—STEAM SHOVELS and Ore Shipping at Bingham, Utah. H. C. Goodrich. (Min. and Eng. Wld., Dec. 2, 1911; 2¾ pp., illus.) 20c.

17, 664—STOPING COSTS—The System of Keeping Stoping Costs at the Goldfield Consolidated Mines. Claude T. Rice. (Eng. and Min. Journ., Nov. 25, 1911; 2½ pp., illus.) 20c.

17,665—SURVEYING—An Approximate Mine Survey without Instruments. J. B. Harper. (Min. Sci., Nov., 23, 1911; 1¾ pp., illus.) 20c.

17,666 — SWELLING GROUND — Methods of Handling Running and Swelling Ground. Harold Lakes. (Min. and Eng. Wld., Dec. 9, 1911; 1¾ pp., illus.) 20c.

17,667 — TRACTION ENGINE — The Steam Tractor Hauling Ore in Washington. Frank C. Perkins. (Min. and Eng. Wld., Nov. 18, 1911; 1½ pp., illus.) 20c.

17,668—VENTILATION—Some Aspects of Mine Ventilation and Temperature on the Witwatersrand. J. Whitehouse and W. L. Wotherspoon. (Journ. Chem., Met. and Min. Soc. of South Africa, Oct., 1911; 3¼ pp.) Discussion on paper previously indexed. 60c.

17,669—WIRE ROPES as Applied to Mining. Dugald Baird. (Trans., Min. Inst. of Scotland, Vol. XXXIV, Part 1, 1911; 13 pp.)

17,670 — WORKMEN'S COMPENSATION. John H. Jones. (Proc. Am. Min. Congress, Oct. 24-28, 1911; 9 pp.)

ORE DRESSING—GENERAL

17,671 — CRUSHING — The Edison Crusher Rolls. W. H. Mason. (Mines and Minerals, Dec., 1911; 1½ pp; illus.) 40c.

17,672—SEPARATION—Huff Electrostatic Plant at Calumet & Sonora Mill in Mexico. (Eng. and Min. Journ., Dec. 2, 1911; 1 p., illus.) 20c.

17,673—SIZING, Diametric and Volumetric, with and without Screens. B. F. Rice. (Met. and Chem. Eng., Dec., 1911; 1½ pp.; Min. Sci., Dec. 7, 1911.) 40c.

METALLURGY—GENERAL

17,674—ALLOYS—Volume Changes in the Alloys of Copper with Tin. J. L. Haughton. (Engineering, Nov. 10, 1911; 1⅓ pp., illus.) Conclusion of article previously indexed. 40c.

17,675 — CHIMNEYS — Steel Stacks. John S. Leese. (Practical Engr., Nov. 10, 1911; 1¾ pp.) 20c.

17,676 — FUEL CONSUMPTION — La Consommation de Combustible dans la Fusion des Minerais de Cuivre et Plomb. G. Ralli. (Rev. Univ. des Mines, Tome XXXIV, No. 3, p. 213, and Tome XXXV, No. 1, pp. 1-104.)

17,677—GAS MEASUREMENT—Messgeräte für Druck und Geschwindigkeit von Gasen und Dämpfen. E. Stach. (Stahl u. Eisen, Oct. 26 and Nov. 16, 1911; 11½ pp., illus.) Instruments for measuring pressure and velocity of gases and vapors. 60c.

17,678—HYGIENE—Die wichtigsten Berufskrankungen der Metallarbeiter. Ascher. (Bergbau, Nov. 2, 1911; 1½ pp.) The most important professional diseases of metal workers. 20c.

17,679—METALLOGRAPHY — Die binären Metallegierungen. K. Bornemann. (Metallurgie, Nov. 8, 1911; 13¾ pp., illus.) The binary metal alloys. Continued from a former article. 40c.

17,680—ORE TREATMENT—The Federal Investigation of Ore-Treatment Problems. W. N. Searcy. (Proc. Am. Min. Congress, Oct. 24-28, 1911; 12 pp.)

17,681—PROGRESS IN 1910—Das Metallhüttenwesen in 1910. B. Neumann. (Glückauf, Oct. 28, Nov. 4 and 11, 1911; 19½ pp.) The metallurgical industry in 1910. Review of improvements and new inventions made during the year. 40c.

17,682—ROASTING—Recent Progress in the Roasting of Sulphides. Leon Guillet. (Chem. Engr., Nov., 1911; 2 pp.) Translated from "Rev. de Metallurgie," Aug., 1911. 40c.

17,683—SMELTER SMOKE—A Brief Review of Flue-Gas Treatment. Editorial. (Eng. and Min. Journ., Dec. 9, 1911; 1 p.) 20c.

17,684—SMOKELESS COMBUSTION of Bituminous Coal in the Pittsburgh District. Miraheau Sims. (Proc. Eng. Soc. W. Penn., Nov., 1911; 51 pp., illus.)

17,685 — WELDING — Elektrisches Schweissen. Löwenherz. (Zeit. d. Vereines Deutscher. Ing., Oct. 7, 1911; 12 pp., illus.) Electric welding. 40c.

MINING AND METALLURGICAL MACHINERY.

17,686—AIR COMPRESSING PLANT—A Large Hydraulic Air Compressing Plant at Cobalt, Ont. (Engineer, Nov. 10, 1911; 2⅓ pp., illus.) 40c.

17,687—AIR COMPRESSOR PLANT—Recent Swedish Air Compressor Plant. A. Hjalmar Eriksson. (Jernkontorets Annaler, Oct., 1911; 15 pp.,) Describes in detail plant at Striberg.

17,688—BELTING—The Use and Care of Belting—II and III. (Ind. Eng., Nov. and Dec., 1911; 9 pp.) 60c.

17,689—BOILER WATER—Verminderung der Kesselsteinbildung durch Zuführung von Kohlensäure zum Speisewasser. Braungard. (Chem. Ztg., Oct. 21, 1911; 1½ pp.) Diminishing the formation of boiler incrustations by passing carbonic acid into the feed-water.

17,690—CONVEYOR SYSTEMS for Handling Coal. Henry J. Edsall. (Elec. Wld., Dec. 2, 1911; 1 p., illus.) 20c.

17,691—CONVEYORS—Conveying and Elevating Machinery, Its Cost and Commercial Value. Reginald Trautschold. (Ind. Eng., Nov., 1911; 5½ pp.) Second and third articles of series dealing with flight (scraper) conveyors and screw conveyors, respectively, their capacities, speeds, costs, etc. 40c.

17,692 — DRILL SHARPENING — A Sharpening Plant for Mine Drills. F. A. Stanley. (Am. Machinist, Nov. 23, 1911; 4¾ pp., illus.) 20c.

17,693—DUMPING SKIP for Winze. K. Baumgarten. (Eng. and Min. Journ., Dec. 16, 1911; ⅔ p., illus.) 20c.

17,694—GAS-ENGINE PLANTS—Some Notes on European Three-Phase Gas-Engine Plants. Warren H. Miller. (Elec. Wld., Dec. 2, 1911; 2 pp., illus.) 20c.

17,695—GAS-ENGINES—Modern Gas-Power Practice. S. E. Fraser. (Proc. Aust. Inst. of Min. Engrs., Sept. 30, 1911; 26 pp., illus.)

17,696—GAS PRODUCER—Der Gaserzeuger System Küppers. Bauriedal. (Chem.-Ztg., Nov. 18. 1911; 2 pp., illus.) The Küppers gas producer. 20c.

17,697 — HOISTING — Untersuchungen an elektrisch und mit Dampf betriebenen Fördermaschinen. (Glückauf, Oct. 21, 28, Nov. 4, 11 and 18, 1911; 44½ pp., illus.)

SAMPLING AND ASSAYING—GENERAL.

17,698—ANALYSIS—Rapid Methods of Technical Analysis. Frank D. Aller. (Colo. School of Mines Mag., Dec., 1911; 2½ pp.)

17,699—MAKESHIFT ASSAYING for Prospectors. Arthur O. Christensen. (Eng. and Min. Journ., Dec. 23. 1911; 2 ppp., illus.) 20c.

17,700—OIL TESTING—A Practical Application of Fluorescence in Testing Oils for Industrial Purposes. Alexander E. Outerbridge, Jr., (Journ. Frank. Inst., Dec., 1911; 9 pp., illus.) 60c.

17,701—SAMPLING—Grab Sampling in Stopes. Claude T. Rice. (Eng. and Min. Journ., Oct. 14. 1911; ½ p.) 20c.

17,702—VALUATION OF ORE—Scheme for Valuing Ore in a Stope. Lee Fraser. (Eng. and Min. Journ., Oct. 21, 1911; 1⅓ pp., illus.) 20c.

The Engineering and Mining Journal

Vol. 93. JANUARY 13, 1912. No. 2.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9300 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE

Editorials:
- Government Aid to Mining........ 103
- Michigan Mine Inspection........ 103
- The Situation in Spelter.......... 104
- Economies in Iron Making........ 104

Metallics—By the Way............. 105
Tightner Mines Co., California..... 106
La Rose and Nipissing............. 106
Racial Distribution in Western Smelteries 106
Correspondence and Discussion:
- A Government Ore Testing Mill ....Steel Arch Supports in Tunnels....Taxation of Mineral Rights in Michigan............. 107

Details of Practical Mining:
- *Guards at Shaft Stations.... Reinforced Concrete in a Tunnel ....*Device for Splitting Pulp Samples....*Calumet & Hecla Ore Cars....*A Temporary Scaffold....Electric Pumping Machinery....*An Automatic Tailing Sampler....Filing Engineering Notes....*Storing Iron and Rails 109

Notes on Pyritic Smelting. George A. Guess 113
International Atomic Weights...... 117
American Chemical Society....... 118
Inspiration Consolidated Copper Co. 118
November Operations at Goldfield Consolidated 118
The Miami District, Arizona. W. R. Ingalls 119
Bat Guano.......................... 122
Zinc Dust in 1911..William J. Dwyer 122
Mining in Great Britain in 1911. Edward Skewes 123
The Mining Industry in Germany. O. H. Hahn 124
Mining in Jalisco in 1911. Austin C. Brady 125
The Cyanide Industry. William J. Dwyer 126
Molybdenum in 1911.............. 126
Igneous Concentration of Zinc Ore. F. L. Clerc 127
Analysis of Commercial Tin...... 131
Data on the World's Principal Mines. S. F. Shaw 132
London Tin Market in 1911......... 135
Personal, Obituary and Societies... 136
Editorial Correspondence.......... 137
Mining News.................... 139
Markets 145

*Illustrated

Government Aid to Mining

A determined effort is being made in certain quarters to induce the Federal Government to mix paternally to a further extent in the mining industry. A mass meeting was recently held in Denver, at which resolutions were adopted, petitioning Congress for an "experiment station . . . . . at which all metalliferous ores may be analyzed and at which all known processes of ore treatment may be applied, and at which new methods and processes may be developed and perfected."

Our friends who promoted this meeting will forgive us, we hope, if we express some amusement over it. The keynote was practicality, and the glorification of the "practical man" was duly sounded. One speaker expressed his approval of the work the scientist is doing, but remarked that the practical miner should be the principal speaker and should be in control of the meeting. A Denver correspondent writes, however, that the time of the meeting was so consumed by the presentation of papers by young men of no particular renown and college professors, that the "practical men" had no chance, which perhaps is merely one more example of the difference between preaching and practicing.

The right or function of the U. S. Bureau of Mines to undertake such an enterprise as that now proposed, is not at present under discussion. Authorization is sought by direct action of Congress; and Congress has the right to appropriate the money of the people in any way it sees fit, providing it be constitutional. The question is merely, therefore, what good would there be in the proposed adventure?

The main idea of the Denver meeting was echoed in the words of a local newspaper reporting it, that "if the government experiments evolve a process for handling ores running below $10 per ton, thousands of mines would be opened in Colorado." We might take exception to the figures, but in substance it is undeniably true, i.e., ability to beneficiate profitably a lower grade of ore would, undoubtedly, promote mining activity.

But what have the despised scientists been doing in all the years? Is it merely a dream that they have developed the cyanide process, the multifold improvements in methods of mechanical concentration, blast-roasting, basic converting, and the whole gamut of advances in the art that have enabled the profitable treatment of gold, copper and lead ores, whereof the total metallic value in the refined state in the market is much less than $10 per ton?

When the Denver meeting said that "In mining as in agriculture, from the very nature of the enterprise, there is and can be but very little coöperation involving the problems of the industry," it made itself ridiculous, not merely by spurning what the engineering profession has done, but also by implying that the Federal Government can improve what private persons ought to do (and, in fact, have done), out of mere self-interest. Does anyone in possession of his senses suppose that our engineers and chemists and our mining and metallurgical corporations, with ample funds and facilities at their disposal, are not going to develop the cheapest possible methods of ore treatment, and does anybody imagine that the government with such talent as it could command with $100,000 working capital could solve problems in which the whole industry has heretofore failed?

Michigan Mine Inspection

Beginning next fall, mine inspectors in Michigan are to be elected by popular vote, a law to that effect having been enacted at the last session of the legislature. This is a step backward. Mine inspectors should be appointed, not elected. This is not merely our opinion. It is that of most mining engineers, operating, inspecting and consulting. The Mining and Metallurgical

Society of America expressed itself that way, with only one dissenting vote, when this question was considered by it last fall. State mine inspectors are by creation and in effect a species of policeman. To elect them is as unwise as it would be to elect municipal policemen.

The Situation in Spelter

The statistics published last week threw much light upon a situation that had previously been obscure, but there still remain some highly puzzling features. Thus, while iron and copper, the metals with which spelter is most closely linked in the arts, showed decreased consumption in 1911, spelter experienced on the face of the statistics a phenomenal increase in delivery, if not in consumption. It is imposible to believe that the quantity of spelter delivered in 1911 was actually consumed. There is no reason to believe that there are any concealed speculative stocks. The inference is, therefore, that consumers overbought during the second half of the year, i.e., accumulated a surplus of stock in their yards against future requirements.

The supply of zinc ore during 1911 was bountiful, wherefore the unusually large margin enjoyed by the smelters. The large production of spelter in 1911 was rendered possible by important additions to smelting capacity. Further large additions are shortly to become available. There being no dearth of ore, the effect of these additions will be inevitably to increase the supply of spelter in 1912, and the outlook is distinctly that this will find a market only at a lower level, although, of course, so long as the European market remains strong the American market cannot fall below its parity and the situation in Europe seems likely to be a firm basis for the market here.

The statistics showed the stock of spelter on Dec. 31 to be unusually low. If the statistics were confined to unsold spelter alone, the quantity available would be practically *nil*, the small quantity reported by the respective smelters being in fact generally sold, but enumerated as stock on hand because the accounting included everything still at the works. With the market thus bare of supplies, and the January output being so nearly sold, belated buyers have again found themselves compelled to pay higher prices. On the other hand, but few consumers seem eager to make contracts for later spelter, evidently considering that when the time comes they will be able to buy it more cheaply. Until the time comes when the smelters have again accumulated a reasonable working stock, the spelter market will be dangerous.

Economies in Iron Making

One of the gains attendant on periods of comparative dullness in the steel trade is that it gives a breathing space in which some attention can be given to improvements in manufacture; further, that it enforces attention to possible economies. It is not meant by this that all improvements were neglected in the construction of the mills at Gary and Allequippa or the other new plants that were the outcome of the boom of 1906-7. Many advances were made, indeed, but the tendency in their design was rather towards intensive production, to increasing the productive power of the working unit, than to securing what may have appeared minor economies. We are ahead of our German and British competitors in the rate of production; but we are behind them, especially the Germans, in economy of working, the saving of byproducts and the devising of possible uses for waste material.

The last year or two has seen some advances made in this direction, among the more notable being the extensive use of blast-furnace slags in the making of cement. A great increase in this use of slag has been made, notably in the works of the Steel Corporation. There are large quantities of slag made, however, which are not suitable for cement; and we have done little in the way of making the slag bricks which are so largely used abroad, or in applying slag in the making of the good roads which are so much needed in this country. There are other uses to which this waste product may be applied which are hardly touched as yet. The use of basic slag in the making of fertilizers, where its phosphoric-acid contents are of value, is hardly known here, though it is common in Germany.

The use of the waste gases of blast furnaces in producing power has made considerable progress in this country. Its extensive application is one of the features of the Gary plant. The use of the byproduct oven in making coke for iron production makes slow progress, however, even allowing for the large plant now being erected at Bethlehem. By far the larger part of our coke is still made in the old beehive oven, without an effort to save or use the gases, to say nothing of the other byproducts. Dr. Douglas referred years ago to the enormous waste of gas in the Connellsville region, for instance; but it still goes on with very little diminution.

The demonstrated economies of the Gayley process of drying blast have not secured its introduction as widely as might be expected. Only a few installations are as yet reported in use. The success of those now operating has not sufficed to bring about the building of others, and there is still plenty of room in this direction for securing economies in production.

Other lines might be mentioned in which there is much room for improvement. The comparative lull in the iron trade and the lower range of prices to which we seem to have settled down may give time and inducement to work out improvements and economies; and in some degree these conditions may be in the end a benefit to the industry.

Discussion of the prices of Lake iron ores for the coming season has hardly yet begun, so that the furnaces which have to buy their ore are yet in the dark as to the effect that the reduction of rates on the Minnesota roads will have. Sellers are holding back, and the season prices will probably depend a good deal on the developments in the iron trade for the next two months. Iron-ore prices are not nearly as important as they used to be, since they affect less than a quarter of the Lake ore shipped; but they mean a good deal to the still important class of merchant furnaces west of the Alleghenies.

The existence of large stocks of silver in Bombay and Shanghai at the close of the year does not seem to disturb the Indian-Chinese syndicate, which has had so much influence in the market for two years past. Notwithstanding many London predictions, the syndicate has seemed —and still seems—able to carry the load. The recent speculative squeeze in London has passed over, spot and future prices resuming nearly their normal relation. The price of the metal is still maintained, however, at nearly the high point which it reached in November and December; and no immediate change seems probable.

Metallics

At the amygdaloid mills of the Quincy Mining Co., in the Lake Superior copper district, the water consumption is in the ratio of 24 tons of water to one of rock. The average copper content of the finished "mineral" is about 70 per cent.

The Coslettizing process for producing a rust-proof finish on iron consists in boiling the article in a solution of 1 oz. of iron filings and 4 oz. of phosphoric acid in 1 gal. of water. The coating produced is black and if the work be carefully done no undissolved iron filings will appear on the finished surface.

At the Talisman mine, Karangahake, N. Z., a water jet is used during drilling. The supply is taken from the main pump column and the pressure varies up to 140 lb. per sq.in. At blasting time a $\frac{3}{16}$-in. nozzle is screwed to the end of the compressed-air pipe and air is allowed to blow through as soon as the fuses are lighted. This air rapidly dissipates the powder fumes.

In sintering experiments with iron-ore fines in a straight-line Dwight & Lloyd machine, it was found that the cohesiveness of the product varied inversely with the amount of the internal shrinkage of the mass. In sintering Cuban (Mayari) ore with fuel, no advantage was found in using over 7.5% coal or coke, nor were the results from coke any better than from coal.

The yield of salt from the evaporating ponds using water from the Great Salt Lake in Utah is usually from 250 to 300 tons per acre; from the French Atlantic fields the yield from sea water is from 0.6 to 11.1 tons per acre; in the French Mediterranean fields, 12.1 to 23.7 tons; and from the Corsican fields about 68 tons per acre. The water of Great Salt Lake is about five times as salty as that of the Atlantic Ocean, having a specific gravity varying between 1.11 and 1.17 and containing from 15 to 22% of solids; at a specific gravity of 1.15 it contains about 238 grams of solids per liter.

A spad or spud is a sharp-pointed, flattened piece of metal, with a small hole through the broad end; it is used in underground surveying and is placed in a wooden plug, the latter being first driven into a shallow drill hole. In placing the spad in the plug, care should be taken to have the broad side at right angles to the line of sight; in other words, the line of sight should look through the hole. By so doing, the chance for error due to moving of the spad by accident is minimized, as the plumb line hanging from the hole is subject to less lateral deviation from the true line than if the spad were placed so that the line of sight is directed toward the thin edge of the spad.

By the Way

It is pointed out in Ishpeming, Mich., that the Oliver Iron Mining Co.'s tax of $100,995 on mines in that city, amounts to 40c. per ton on the ore shipped last season; the Cleveland-Cliffs Iron Co.'s tax of $125,540 amounts to 26c. per ton; the Jones & Laughlin Co.'s tax of $11,604, 5c. per ton.

Albert Freeman, Julian Hawthorne, Josiah Quincy and others were taken before Judge Hough for pleading on Jan. 5 under an indictment for fraudulent use of the mails found by the Federal Grand Jury on Dec. 28, 1911. Freeman was held under $25,000 bail, and the others under $10,000 each. The indictments were found in connection with the selling of stock in the Temagami-Cobalt, Montreal-James, Hawthorne Silver & Iron Mines, and other operations. The JOURNAL has in the past made adverse remarks about the Temagami-Cobalt and Hawthorne promotions upon several occasions. Freeman has been in the background in these recent operations; before them he was engaged in the King Solomon Gold Mining Co. and the United Mining Company.

An official circular announces that the beautiful new resource map of Utah, prepared by the State Conservation Commission, is now ready for distribution. This is by far the most complete and elaborate map of the state that has ever been prepared. It has been drawn to a large scale—a sixth of an inch to the mile—and is 54x78 in. in size; mounted on cloth with rollers top and bottom, ready to hang. It shows the U. S. survey lines, including "off sets," the correct location of the cities, towns, county-boundary lines, railroads, principal and secondary wagon roads, canals, reservoirs, lakes, streams, land boundary districts, experiment stations, coal beds, outcrops, iron-ore deposits, hydrocarbon veins, forest reserves, mining districts, mountains and peaks, valleys, electric-power plants, etc. . . It will be a necessity for the homeseeker, the surveyor and the person who wants accurate, trustworthy information about the geography and natural resources of the state. . . In order to help defray the expenses incurred in the preparation of the map, the commission has found it necessary to make a charge of $5 per copy—a price that is said to be considerably less than cost. The circular further announces that the requests for the map now on file at the office of the commission, 214 Felt Building, Salt Lake City, indicate that the map will have a ready sale and that the supply will not last long. Utah homeseekers and surveyors must be "in bonanza" to be thus tumbling over themselves to hand out $5 gold pieces, when all the rest of the world and his wife are endeavoring to recover from the financial shock of Christmas shopping and other end-of-the-year expenses. We have the word of a local humorist that a large number of people at this time are busily engaged in trying to make up the difference between the deficit and the liabilities. Those who are in a financial subway will have to forego the pleasure of this valuable map and continue to patronize the more modest but excellent maps of the U. S. Geological Survey.

The Lake copper country is already feeling the effect of 14c. copper. According to a local gazette, a pioneer in the jewelry business in the copper country stated, on Dec. 24, that he was having the best business he ever had at that season of the year. The cumulative effect of an impending rise in copper has also been manifest, for the local scribe continues: "Whether it is due to the rise of copper is impossible to say, but the marriage rate has increased wonderfully during the month of December. There have already been a dozen or more weddings of Calumet people this month and a good half dozen are scheduled for the coming week, while there will be a few more right after the first of the year. It is rather odd to note, too, that the stork has been increasing the number of his visits to Calumet homes the last week or so, and Township Clerk George Martin said yesterday that he looks for a 'pretty good month' in birth registrations in December." And copper may go to 15c. Dealers in teething rings would better place additional orders at once.

Berton Braley contributed the following "pome" to the New York *Times*. If you have never worked underground, or if "po'tree" does not appeal to you, don't read it.

BILL AND THE SUPE

Now listen to me, while I tells to you.
The tale of the Supe an' Bill McGrue.
Bill he was takin' a little mope
After drillin' his holes in the stuffy stope.

An' settin' down on a timber car
He lights a match to a bum cigar.
He scurcely more than gits a light
When a guy in overalls heaves in sight.
"Takin' a rest?" says he to Bill.
"You bet," says William, an' sets right still.

"Ain't you got nothin' at all to do?"
"I have," says Bill, "when I'm ready to."
"What would you do," says the stranger guy,
"If the shift boss happened to wander by?"

"I'd set," says Bill, "like a tired bloke,
An' take my time fer my rest an' smoke."
"Do you know," says the stranger, "who I am?"
"I don't," says William, "nor care a damn!"

"Well, I am the Superintendent here!"
Bill's grin extended from ear to ear.
"The Supe," he says, "of the hull big mine?
That's bully," he says, "that's grand, that's fine;

A mighty good job fer a man to git.
If I was you I would tend to it!"
Then Bill leans back on the empty car
An' goes on smokin' his bum cigar.

* * * *

Tightner Mines Company, California

San Francisco Correspondence

The organization of the Tightner Mines Co. to develop the Tightner and Red Star mines in Sierra County, Calif., will have a direct and positive effect on the development of the entire Alleghany district. The prospecting of these properties by J. M. O'Brien, of San Francisco, under an option of purchase, disclosed sufficient orebodies to induce the installation of a 10-stamp mill to continue the exploration. The mill had been in operation only long enough to make test runs which were apparently satisfactory and prompted the company organization and incorporation. A feature of the undertaking, indicating the strong belief that the Tightner and Red Star will develop into a large producer, is that the capital stock is placed at the low sum of $100,000, divided into only 100 shares, none of which will be put on the market, and a considerable proportion of which has been subscribed for by men connected with the North Star mines and other prominent properties in Nevada County.

The Tightner has for some time been known as a specimen mine, rich in free gold-bearing quartz, some of which was so rich that continuity of the ore even of ordinary grade was doubted. H. L. Johnson, the owner, did not mine the claim; he merely took out the rich deposits wherever found and seemed satisfied with the returns which made a competence. In other words, the owner gouged his own mine; and did it in an unminerlike manner, regardless of economic and practical development. The recent explorations have gone beyond the rich deposits and to the exploring of the vein in search for a continuous orebody; this policy will, of course, be pursued in future development by the present company, to which the purchase bond has been assigned. The Alleghany district has for many years been worked chiefly by men and companies unable or unwilling to invest the necessary means for thorough exploration, except in the case of the Plumbago, which has been operated for years by practical men. Many of the owners of claims are men of small means or dependent on the output of their properties for subsistence, and have been greatly handicapped by the long winter seasons necessitating the laying in of six months' supplies, which must be wagon-hauled from Nevada City, a distance of 30 miles over a heavy grade. Besides this, freight for Nevada and Sierra Counties must be transferred from the standard-gage road of the Southern Pacific at Colfax, to the narrow-gage road to Nevada City and Grass Valley, the terminal points. So mining in the Alleghany and other districts of Sierra and northern Nevada Counties is an expensive undertaking, and not inviting to investors, notwithstanding the generally high grade and large deposits of the ores.

The successful development and operation of the Tightner mines may not induce railroad construction but it should attract the investment of capital sufficient to put Sierra County on the map as a present-day producer, as it was in the early days of hydraulic and drift mining and the still earlier days of the pan and rocker. In the last 15 years there has been a larger investment of faith than money in the Alleghany and some other districts of Sierra County.

Abraham Hall, of Grass Valley, is manager of the Tightner Mines Co., and Lawrence Wagner is assistant manager and acting superintendent at the mines. Charles C. Derby, of Nevada City, is consulting engineer. Mr. Derby, as engineer in charge, and Lawrence Wagner, as consulting engineer, made the examination and conducted the preliminary exploration of the Tightner and Red Star and advised the purchase of the property. The following are shareholders in the company: A. D. Foote, manager, and A. B. Foote, assistant manager of the North Star at Grass Valley; C. E. Clinch, Abraham Hall, Robert Bedford, Carl P. Jones, of Grass Valley; Edward Uren, George Scarfe, John Rector, Charles C. Derby, W. H. Martin, of Nevada City; J. M. O'Brien, of San Francisco.

La Rose and Nipissing

Cobalt Correspondence

The two large Cobalt properties, Nipissing and La Rose, have been coming in for a good deal of attention lately, the shareholders of La Rose particularly being greatly stirred up about the plans for the distribution of the cash surplus. This surplus has been steadily piling up, ever since Mr. McGibbon took charge of the affairs of the company, when he cut the dividend rate, until now the cash on hand amounts to approximately $1,500,000. Various suggestions for its distribution have been made, and it is stated that the directors are considering the investment of a part of this fund, in promising properties in other districts. This would appear to be a sensible course of procedure, but some of the shareholders, particularly those who bought in at the high prices, are greatly exercised over the matter, and demand that the surplus be divided among the stockholders in the form of a cash bonus. The property is in excellent physical condition, and the earnings are sufficient to justify an increase in the dividend rate, which will probably be made before long. Several of the directors have for some time been in favor of the increase, but they were held back by Mr. McGibbon who desired to have the company on an assured basis.

While the talk in connection with La Rose has been of an increased dividend rate, Nipissing seems to be scheduled for a cut, and it would seem as if this were probably due within the next six months. This move would not be taken, as is generally supposed, in order to provide funds for the purchase of other properties, but because the physical condition of the property is not such as would permit of the payment of the present rate for a much longer period, without a serious depletion of the ore reserves. The company now has under consideration and under way, new construction and development, that will call for an expenditure of about $400,000 and this cannot be carried on without drawing on the cash reserve, which the directors wish to keep at about $1,000,000. Nipissing has a large acreage, but that does not imply that it will all be as rich as that part which is at present being developed and, in fact, although the property has not been by any means thoroughly prospected, the limits of the mineralized areas have been more or less well defined. The company has large reserves, part of which it does not contemplate drawing on for some years to come, but recent underground developments in certain portions of the property have been disappointing. When the new mill is completed, it should earn at the rate of about $3000 per day gross, and the revenue from this will have to take the place of that lost by the falling off of the high-grade ore.

Racial Distribution in Western Smelteries

Washington Correspondence

The U. S. Immigration Commission has prepared a review of the smelting and refining industry on the Pacific Coast and in the Rocky Mountain states which is shortly to be published. The report shows that about seven-tenths of the employees in Colorado, Montana, Utah and Arizona are of foreign birth. The foreigners include 41 distinct races but the Americans were distributed about equally throughout all the states, Utah, however, having more Americans than the other states. Mexicans are chiefly found in Arizona and Greeks in Utah. The only Japanese employees are in Utah. Southern and eastern Europeans are more generally employed in smelting establishments in Colorado and Montana than they are in the mines of those states. Americans, English or Germans hold practically all the positions as foreman and the like. The scale of wages of smeltery employees is highest in Montana and lowest in Colorado.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

A Government Ore Testing Mill

The meeting held at the statehouse in Denver, Dec. 28, 1911, had a specific object in view, *viz.* to discuss the question of asking the government to establish an experimental ore testing station in the state, and to furnish an adequate appropriation for that purpose.

Instead of adhering to this purpose, the time of the attending representative mining men, most of them of from 20 to 30 years' experience, was taken up in listening to the reading of papers by young men of no particular renown as metallurgists or mining engineers; several of the older mining men who had come there prepared for a *pro* and *con* discussion, left before the meeting was half over.

The best brains and deepest thinkers in the metallurgical fraternity, not alone in this state but in the world, are and have been for years steadily at work on the solution of the low-grade ore treatment problem, and their processes and successes have been described in all the leading technical journals. What they have done is therefore well known to the mining world, and is demonstrated by such prominent examples as Strattons' Independence of Cripple Creek, the Homestake in the Black Hills, Alaska-Treadwell at Douglas Island and the porphyry coppers in Utah, etc. When ores can be treated at a cost of about 75 to 80c. per ton, it would not appear probable that the government or its employees could make any improvement, nor would it seem that there was any excuse for calling on the government to step in with $100,000 and take business away from those firms and individual engineers who make the metallurgy of low-grade ores their life work and their living.

Even if $100,000 were so provided, this sum would be but a drop in the bucket, and if established at Silverton as seemed to be the sense of the meeting, it would be of no use to the miner and prospector about 300 miles distant in the northern part of the state.

This question also arises: If an experimental plant were installed, whom would the government place in charge? If Colorado were allowed to make the selection, five men could be named whose life experience and successes with Colorado ores have eminently fitted them for the work. Not one of these would probably accept the position for less than $20,000 per year and are therefore out of the question with only $100,000 available working capital. Young men just from college would be of no use whatever.

A second meeting is to be held and it is hoped that an open discussion will be in order and the reading of papers omitted. MINE MANAGER.

Denver, Colo., Jan. 4, 1912.

Steel Arch Supports in Tunnels

Some of the arguments that have been advanced by the advocates of circular shafts appealed to me as being equally pertinent to drifts and tunnels in soft ground.

Timber is the material used to support soft ground. The three-piece tunnel sets are cut with the legs or posts inclined inward at the top, to obtain some of the effect of an arched support. When weight comes upon the cap of such a set the tendency is to split the legs, drive them up into the cap itself and bend the cap at the center. Weight coming on the legs tends to bend them inward and to draw them away from the cap so that the cap settles or comes nearer the floor. There is nothing to resist the pressure but the transverse strength of the timber.

The transverse strength of timber is not great compared to some other materials, and in recent years several attempts have been made to use concrete or steel instead of timber. Concrete, even though reinforced, has not proved to be satisfactory.

Steel sets are now satisfactorily employed in coal-mine entries, but in the one metal mine in which they were tried, of which I am acquainted with the results, it developed that the steel caps and legs of the straight three-piece drift set buckled under normal pressures, and the steel became so distorted as to make replacement by the old timber sets necessary.

USE OF ARCHED SUPPORTS SUGGESTED

It is not strange that straight-piece sets should become deformed, and the fact that they do suggests that a different shape of set should be used. It is my purpose to suggest a shape of steel drift support that would stand normal drift pressures without deformation; it is to use arched caps where the pressure is from the roof or closed oval shapes where the pressure comes from the sides, bottom or from all directions.

We have a good precedent for the use of arched caps in the timber segmental arches used in large railroad tunnel work and in the use of curved or circular shapes in the cast-iron segmental lining of the tunnels under the North and East Rivers, in New York.

In the case of an arched cap or stull the pressure would not only be resisted by the transverse strength of the section, but, as deformation must be accompanied by movement, the cap would have to become straight before it could sag at the center. To become straight, the pressure at the ends would become so great as to force the ends into the sides of the drift. In short, the pressure from the roof would tend to elongate the cap, or increase the distance between its ends instead of shorten them, as would be the tendency in a straight, flat cap. The pressure would be resolved into a side thrust that would be resisted by the compressive strength of the material. The pressure would be exerted upon the walls and could be distributed over a large area by using cast-iron plates for the ends of the I- or H-sections of the steel cap to butt against, wooden blocks and wedges being used between these cast-iron plates and the rock walls.

DEFORMED CAPS COULD BE RESHAPED

The wooden blocks would become crushed before the cap would be seriously deformed, and in case of deformation it would neither be a difficult nor expensive task to take down the cap and reshape it.

For side pressures the use of oval rings of I- or H-sections could be used. The drift would have to be cut a little larger and to more or less oval shape, but such increased work would not seem too great an obstacle to the use of structural-steel rings instead of three- or four-piece timber sets. Cast-iron segments as a continuous lining might also be used, but would probably be more expensive than steel oval supports for wood or rail lagging.

The question of lagging is largely one of expense. Old mine rails may be used, but for ordinary timbered drifts small timber of poor-quality wood might be utilized over steel caps or oval ring supports. It is often the case in drift timbering that poor lagging can be used with entire satisfaction if the supports are strong, which would be the case with steel. Concrete panels have been used in coal mines to take the place of lagging, but in most places would be more expensive than timber.

A further advantage of steel supports in drifts lies in the possibility of their removal and use in another part of the mine when it is no longer necessary to keep a drift open.

Clarence C. Semple.

New York, Jan. 8, 1912.

Taxation of Mineral Rights in Michigan

The legislature of Michigan has passed a law to tax mineral rights. The radical enforcement of this law may be a matter of considerable moment to holding companies in the upper peninsula, and the measure was fought by the various interests who retain the mineral rights on vast unexplored tracts of land on which the surface and timber may have been sold. To what extent the taxation of mineral rights of unknown value will tend, is not yet known, and it may be several years before the difficult problem of their proper valuation is solved. However, the new law becomes operative this year, and next spring the assizing officers are expected to put mineral rights on their lists in the same manner as they would real estate. The owner is required to make a sworn statement of the value, but the owner's figures do not necessarily govern the assizing officer.

Reservation of Mineral Rights

Land in Michigan was formerly transferred with no mention of mineral rights as it was taken for granted that these went with the surface. However, as the value of the iron and copper ores grew more apparent, it became the custom to reserve the mineral rights when selling the surface to a farmer or settler. Hundreds of thousands of acres are held in this manner; on much of the land there is no chance of any valuable mineral being found, but the mineral right is retained because such is the custom and because thousand-to-one chances have been known to occur in the mining business. Other property on which the mineral right is held, is known to contain iron formation and would be extremely desirable land to explore.

There has been some sentiment toward forcing the owners of mineral rights to explore their holdings or to sell at a reasonable price to someone who will. The so called "curse of the mining business" relates to the long continued holding of mineral lands and the consequent tying up of the industry by remote owners who have no intention of developing their properties, and who hold out for unreasonable prices. On the other hand, several of the larger companies, such as the United States Steel Corporation and the Cleveland-Cliffs Iron Co., which have looked into the future, have secured large holdings for ore reserves which they cannot develop at the present time because their operating mines are more than furnishing sufficient ore. Such companies are usually doing all that could be expected toward development of their holdings.

Land Divisible into Three Classes

There would then in general be three different kinds of mineral rights to consider. One tract might lie entirely on Archean granite several miles from iron formation, and would, of course, be of practically no value. A second tract might contain iron formation or stand a good chance of so doing under a thick overburden; the owner, we will say, is the Cleveland-Cliffs Iron Co., which is holding the property until the need for ore warrants spending money to explore by diamond drill; the Cleveland-Cliffs Iron Co. is operating mines on the Marquette range and is stocking large amounts of ore that it does not need for a long time, merely to keep its organization up and to give employment to hundreds of employees. A third tract might be held by people living thousands of miles away who never saw the property, but obtained it cheaply in some transaction with a man who needed money at the time; perhaps there is a fair chance of finding ore on the property and it offers an opportunity to men in the district if moderate terms can be agreed upon with the owners. But such owners too often demand a large cash price paid down and will permit of no exploration agreement that can be touched by men of moderate means. It is to reach such owners as fall in the third class that the bill has been passed for the taxation of mineral rights.

Difficulty of Valuing Undeveloped Land

The valuation of unexplored mineral rights is a difficult problem. J. R. Finlay in his work for the Michigan Tax Commission did not attempt the problem, and has been criticized for this policy. His opinions on the valuation of undeveloped iron lands is as follows: "It was hoped, up to the completion of our investigation, that some means would be found of placing a value on unexplored iron-ore formation. The final result, however, is a disappointment. Such lands are undoubtedly valuable, but we have not succeeded in finding any logical measure of their value. If we could compare an area of fresh iron lands with another area that had been explored and had been proved to contain a certain tonnage of iron ore, we might then rationally assume that the undeveloped land would produce somewhat in the same proportion, but it has been impossible to make any such comparison. It must be borne in mind that the iron mines, as well as the copper mines, would lose value every year unless new ore is found to take the place of what is removed. It seems to me that it is a logical position to take in regard to undeveloped mineral lands, that whatever values they may be proved to contain will be appraised as soon as a mine is developed; in other words, the state loses nothing in the long run by not taxing such lands."

In the Journal of Oct. 28, 1911, Edmund B. Kirby disagrees with Mr. Finlay. He says: "Value is desire expressed in cash, and whether the thing is desired for the purpose of eating it, or deriving revenue from it, or of looking at it, or gambling or swindling with it does not affect the reality of its value." This is meant to show that undeveloped mineral lands may have a high value, although bringing in no dividends or profits. He continues: "There is nothing mysterious about mining property which affects the determination of its true cash value. Many other kinds of real estate also have uncertainties as to their possible earnings and productive life. The same principles of valuation apply to mines as in the case of city lots, sawmills or quarries. A private individual has no trouble in ascertaining exactly what he will have to pay for mineral land in a given locality or on a certain formation, and why should the state have any?"

In answer to this, Heath Steele, in the Journal of Nov. 11, 1911, confirms Mr. Finlay's opinion that "the true cash value of a mine is the present worth of its annual dividends (calculated as the present worth of an annuity for the estimated number of years the mine can maintain its dividend) and if the dividend period is a number of years ahead, this present value of the dividends must be deferred a like number of years." Applied to unknown mineral rights the problem becomes, "what is the present value of an X annual dividend for Y years deferred Z years? The last factor may be one or 100 years, depending upon some interested party having faith enough to undertake the development, which may never occur, and in the event development was started the first two factors are still to be determined only by experience, with a percentage in favor of proving conclusively that it has no value as a mine. The mere fact that a certain price is asked for a tract of land does not establish its true cash value; neither does an occasional sale at high prices demonstrate that the land is actually worth the money paid for it. If we were to use this rule, we would be compelled to establish the value of a mine by the prevailing stock quotations, to the absurdity of which any engineer will testify."

P. B. McDonald.

Negaunee, Mich., Jan. 4, 1912.

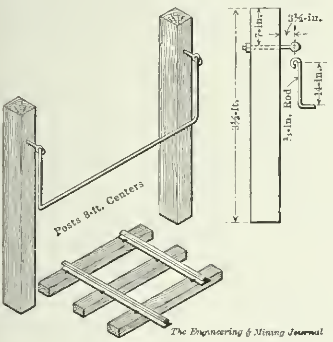
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Guards at Shaft Stations

At the stations of the inclined shafts in the Michigan copper district many different kinds of guards have been tried. At some shafts a wire rope or a light chain is used having a hook at its end that fastens to a ring carried by a post at the hanging-wall side of the shaft. It is an unhandy device as the men have to go clear over to the foot wall, stoop down and pick up the chain each time to put it across the shaft opening. At other inclines the shaft bar that is in common use at vertical shafts has been copied. Owing to the length that this guard arm must have at the inclines, and its weight, a counterweight is sometimes arranged to make the lifting of the arm easier. A nail driven into the post that carries the stop on which the guard arm rests holds the arm out of the way, when it is raised and a car is being dumped.



A Simple Iron Shaft Guard

A guard arm is handier than a chain, but the best form of bar for the inclined shaft stations consists of a ¾-in. iron rod that is bent at each end so as to have arms 14 in. long with eyes in them that hook into an eye-bolt that is fastened into the two posts of the fence that is built around the shaft at the station. These posts are about 3½ ft. high and the eyebolts are placed about 7 in. from the top, and extend out from the posts about 3½ in. Therefore when the guard is turned up so that a car can be dumped into the skip it rests against the top of the posts and will not jar down easily. As soon as the car is dumped the bar is given a push so that it swings down to prevent any car from being pushed into the shaft.

Reinforced Concrete in a Tunnel

The Snake Creek drainage and working tunnel at Park City, which is being driven from Snake Creek to secure deeper drainage for the mines of the district than is at present available, and to open the Bonanza Flat section in the southern part of the camp, is now in over 4000 ft. About halfway in, some extremely bad ground was encountered, which could not be held with ordinary timbering. A system of reinforced concrete has been evolved which will be used for about 300 feet.

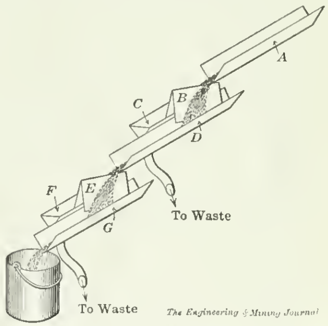
The section is egg shape with the small end down. The reinforcement consists of 50-lb. rails bent hot, in two pieces, these being set at four-foot intervals. At the top of the tunnel arch and above the rails is another rail, the whole being covered with triangular mesh screen weighing 109 lb. per hundred square feet. A shell of from 12 to 15 in. of concrete is put on the outside of the screen, and the space between the concrete and the roof filled with green quaking asp, to take up the first shock of settling ground. The tunnel has room for two tracks. It is 7 ft. high from the tracks to the center of the arch, and 9 ft. across, with a 4½x9-ft. waterway under the track; 8x8 ties are placed at four-foot intervals. About 100 ft. of reinforced concrete has been completed, and this method of holding the ground promises to be successful. Where ordinary timber was used in certain places in the tunnel it was squeezed up to a four-foot opening, so that special measures were necessary. The part completed is holding well. The work is being financed by Daly-Judge and Knight interests. The tunnel is crosscutting the formation, and is expected to reach mineral-bearing ground soon. When completed, it will be between 14,000 and 15,000 ft. long.

Device for Splitting Pulp Samples

By Frederick H. Hazard*

It has been my experience in cutting down wet samples of fine ore, such as material from dumps, tailings, sands and concentrates, to laboratory size, that the limit of accuracy was reached when the sample approached a weight of from 150 to 200 lb. Drying samples of this size for splitting is a slow and vexatious process even if facilities for so doing are at hand.

On one occasion I was called upon to sample the concentrates from a large number of cocoa-matting tables to determine the grade of tables and thickness of pulp necessary for best extraction and the time of operation, after cleaning, during which the matting was effective as a gold catcher. Though there was a small drier in constant operation I soon found the samples were accumulating and it was found necessary to postpone sampling frequently to prepare the samples already taken for the laboratory.



Troughs for Splitting Samples of Wet Pulp

The accompanying sketch illustrates a device that eventually was resorted to for splitting these samples without first drying. When the material for splitting was screened to pass a 10-mesh sieve the apparatus was found to give accurate samples if properly adjusted.

---

*Mining engineer, 1314 Park road, Washington, D. C.

A piece of sheet iron, ⅛ in. thick, about 10 inches wide by 36 in. long, was bent into the shape of a V-trough *A*, the angle of the V being about 60 deg. Care was taken that there was a sharp angle at the bend and that there were no crooks or rough places along its length. This sheet-iron trough was placed on a slope of about 35 deg. and secured by framework.

A hopper for holding the sample to be split was placed above the upper end. The lower end of trough *A* rested, as shown, upon an inverted sheet-iron V-trough *B* which was about 14 in. long and each side 7 in. wide. The angle between the sides was about 20 deg. This trough *B* was placed on an angle of only a few degrees from the horizontal and its apex was filed to a knife edge. In securing trough *B* to the framework sufficient play was allowed in order that its position could be shifted to adjust the knife edge to the flow from trough above.

The material from the hopper was washed into trough *A* by flushing it from underneath with a small stream of water from a ¼-in. hose. When the sample mixed with a large proportion of water reached the knife edge of trough *B* it was split and if the knife edge was placed midway underneath the stream flowing from trough *A* and the flow of water and sand was more or less even the two portions were found to be almost equal both in weight and gold content.

A sheet-iron V-trough *D* similar to the one leading from the hopper was placed under one of the sides of the inverted trough *B* and received one of the split portions. Trough *D* led the split material to the inverted trough *E* (similar to *B* and similarly placed), where it was again split.

One of the split portions from *E* passed to trough *G* and was carried to sample bucket. The sample thus taken represented a fourth of the original. Short troughs placed underneath the opposite sides of troughs *B* and *E* led the discarded portions of the material to the waste sump.

Increasing the length of the troughs leading the material to the splitting troughs beyond three feet is an advantage as it gives the flow of water carrying the material to be split a better chance of straightening itself out before striking the knife edge and more representative samples are the result. For fairly accurate results, however, they should not be less than three feet.

The process of splitting can be carried on indefinitely if sufficient elevation is allowed at the starting point. For a permanent wet sampler the device may be greatly improved but as here shown can be, as it was in this case, knocked together in any out-of-the-way place where material and facilities for doing nice work are not at hand.

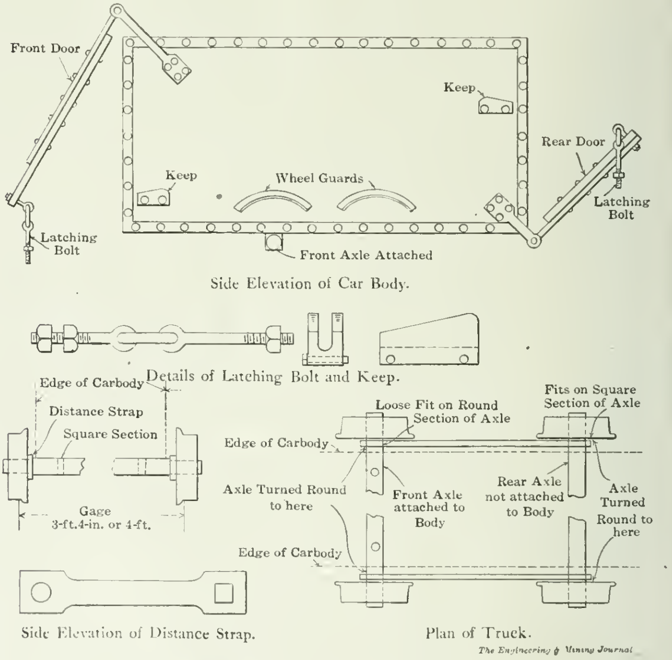
Calumet & Hecla Ore Cars

The Calumet & Hecla is one of the few companies in the Lake Superior copper district, operating mines where the ore is shoveled into the cars or loaded into them by hand from a sollar on the floor of the level, that uses ore cars having doors. At the other mines the cars are open at the front end and closed at the back. The men pile boulders at the front to hold in the finer dirt. This takes time, and time is wasted by the men loading the cars by building the wall more slanting than necessary, or by starting it a little back from the end. The only gain is that no door has to be opened when the car is dumped. But, as the loading of the skip is not planned for speed at these mines where the skips are loaded by dumping the cars directly into them, the few seconds required to open the front door is negligible.

All the Lake Superior cars are built with the body resting directly on the axles so as to allow them to be made with the sides as near the ground as possible. All are built to hold approximately 2½ tons and necessarily are made long, especially where the tracks have a gage of only 3 ft. 4 in., as at most of the mines, although a 4-ft. gage is used at the Calumet & Hecla mines. Owing to the wide gage the cars have to have a short wheel-base compared to their length so as to allow them to make the turns without cramping. The front axle is bolted directly to the body of the car while the rear axle is attached to the forward axle by two distance straps that slip loosely over the axles. The front hole in the strap is made circular to allow the axle to turn in it when the body of the car is being raised to dump, while the back hole is made square to go over the square part of the back axle. In the center of the back axle there is a lug that fits into a hole in the bottom of the body so as to prevent side swing while the car is being pushed along the track.

The front door of the car is made to swing up and is carried from a cross rod in the ends of two horns that extend above the car so as to afford plenty of space for rolling in boulders, while the door at the other end of the car is made to drop down so as to allow perfect freedom in handling the boulders. This door only comes two-thirds the way to the top, so as to allow the ore to be loaded without having to be thrown as high as the sides. As the rear door is sometimes used as an apron to aid in loading boulders, it is secured to the car by four straps instead of three, as in the case of the front door.

These doors are locked by a rather ingenious device. To the doors are fastened two bolts with nuts on them, a link intervening so as to give flexibility, as shown in the accompanying sketch.



Side Elevation of Car Body.

Details of Latching Bolt and Keep.

Side Elevation of Distance Strap.

Plan of Truck.

The Engineering & Mining Journal

Two-door Car for Tramming Boulders

By means of the nut, which is a tight fit on the locking rods, the length of the locking pin is adjusted so as to give the proper amount of tightness when the bolt is down in the keeps. The keeps into which the locking bolts drop are made of cast iron and are bolted to the sides of the car. The back end of these keeps is slightly rounded so that the bolt is tightened as it is shoved down in them, while the bottom part is straight and designed to be perpendicular to the locking bolt when it is down in the keeps. A slight knock on the end of the locking bolt loosens it so as to open the gate, but the bind against the keep is sufficient so that no jar can loosen the door while the car is being trammed. The accompanying sketch shows the keep in detail. To keep fine rock from dropping on to the axles, wheel guards made of 2-in. angle iron are bolted to the side of the cars. The wheels, as on practically all the Lake Superior cars, are loose on the axles and are held on by keys.

A Temporary Scaffold

By A. Livingstone Oke*

The accompanying illustration, Fig. 1, shows a scaffold used in the Latin-American countries by masons when building high walls. Two frames are made from suitable boards, in the form of a right angle, and another length is nailed on the side to stiffen the brackets which are placed against the wall at the desired height for the platform on which the men will work and a pole of suitable length is jammed underneath, the foot being sunk in a pit or otherwise prevented from slipping outward.

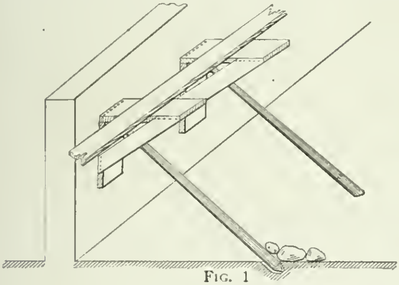


Fig. 1

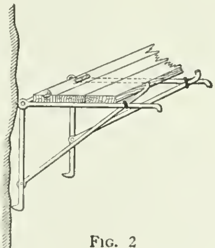


Fig. 2

The Engineering & Mining Journal

Scaffold for Masons or Miners

The brackets may be quickly adjusted to any desired height, by using longer or shorter poles, and planks are laid loosely on top to form the platform. On a perpendicular wall with a smooth face the whole arrangement is remarkably steady.

An adaptation of this scaffold for use in stopes and elsewhere underground is shown in Fig. 2 and consists in making the brackets of iron bars arranged as shown. This is a handy way of getting at high backs or drilling in places where ladders or scaffolding are necessary. The angle of the bracket is made adjustable to suit that of the face against which it rests, and the lower feet are made as wide as possible to prevent rocking, in case only a single bracket is employed.

In Fig. 2 is shown a bracket in which two of the bars of each triangle are passed through an iron ring, around which a piece of rope has to be tied when adjusting the bracket at the face. If desired a set of holes can be drilled in each and a pin used, but in the rough usage of a mine these become lost, bent or broken, and the form shown is to be preferred.

On the bracket, the board at the back has to be strongly bolted on, as this takes all the upward thrust of the pole or ladder underneath. If a bracket of this kind be used in conjunction with two poles or a ladder, only one bracket is needed for the use of one man. Such scaffolds are handier than a ladder when sampling is to be done in a high drift.

---

*Resident manager, San Juan Mines, Ltd., Rodeo, San Juan, Argentina.

Electric Pumping Machinery

By D. B. Rushmore*

A large number of mines are, due to the absence of natural drainage facilities, absolutely dependent on a pumping equipment for their continuous operation, and the importance of installing the most efficient system is at once appreciated when the enormous quantities of water, that in certain instances must be removed, is considered.

Electric Pumps Highly Efficient

The most important advantage of the electrically driven pump is its high efficiency[1], this in certain cases being as high as 70 to 75 per cent. or from 25 to 40 per cent. greater than for steam- or air-driven pumps. In the matter of flexibility, the merits of the electric mine pumps are, the ease with which they can be moved from point to point in the mine, and the economy of space, which should receive careful consideration in cases where the mine conditions demand that pumps be placed in the smallest possible room.

The pumps that are generally used for mining operation can be divided into three classes: the sinking pumps, used for development work or for emptying flooded mines; the main pumps, which are permanently installed in the mines; and finally the auxiliary pumps, used for pumping water into a central sump from various depressions in the mine which cannot be naturally drained.

The sinking pump is generally designed for being lowered in a vertical shaft and is either mounted on a float or suspended from the hoisting cable, so as to always operate at the surface of the water. The motors for operating these pumps can be either of the direct- or alternating-current type, but as they are often liable to be entirely submerged, the inclosed induction motor is preferable, on account of its simple construction and the absence of moving contacts. In the operation of these pumps the load increases inversely as the head, and the motors should be so designed that their efficiency increases with the increasing head.

Centrifugal Pumps Gaining Favor

The main pumps, which are mostly of large capacity, are used for emptying the sumps where the water from various parts of the mine is collected. If these sumps are of sufficient size for storing the water collected during the day, the pumps can be operated at night, and the load factor considerably improved. The pumps used for this service are either of the reciprocating or centrifugal type, of which the latter, in most cases, seems to be the most desirable. Although the centrifugal pump, in the past, has been adopted for conditions where the height of lifts has been moderate, and where larger volumes of water have had to be removed, the recent installations have indicated that remarkable improvement in the multi-stage centrifugal pumps now make them especially efficient and satisfactory for delivering water against heads of 1000 to 1500 ft. or more. This type of pump is particularly well suited for direct connection to high-speed motors, preferably of the polyphase induction type, thus eliminating the friction losses of a gear device. This space occupied by the centrifugal equipment is considerably less than for the reciprocating set and the ability with which it can handle muddy and sandy water is well appreciated.

The auxiliary pumps for pumping water from places below the main pump are either of the stationary or portable type. Owing to their large number and scattered location, they are mostly driven by direct-current motors receiving the current from existing trolley circuits. Of special interest among these pumps is the portable pumping set which is mounted on a truck and can easily be hauled to any portion of the mine by a locomotive, and immediately put into service.

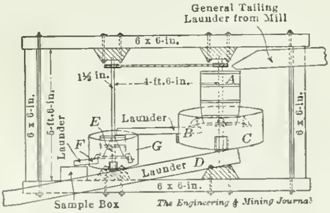
---

*Engineer, power and mining department, General Electric Company.

[1] Excerpt from an article entitled "Electricity in Mining," read before the American Mining Congress, Chicago, Oct. 24 to 18, 1911

An Automatic Tailing Sampler

All tailings from the mill of the Hudson Bay Mines, Ltd., in the Cobalt district, flow into a general collecting launder which discharges into the automatic sampling device illustrated by the accompanying sketch from the *Canadian Mining Journal*. The impact of the stream of sand, slime, overflow from the Callow cones and wash water from the floors causes the 20x30-in. barrel *A* to revolve. The tailing flows through the four 3-in. pipes in the sides near the bottom of this barrel. The outer ends of these pipes are fitted with elbows. Except when passing over the launder *B*, the pipes discharge into the circular collector *C*, thence the pulp flows into the lounder *D*, that leads to the pond.



The Engineering & Mining Journal

TAILING SAMPLER AT HUDSON BAY MILL

The pulp discharged into launder *B* flows to a second barrel *E*, driven by a belt from the vertical spindle of the first barrel *A*. In the bottom of *E*, are four 1-in. pipes which, except when passing over the launder *F*, discharge into the collector *G*, to join the bulk of the discharge in the launder *D*. The pulp caught in the launder *F*, flows into the sample box as the final 24-hr. mill-tailing sample, which is sent to the laboratory to be dried and quartered for assay.

In hand sampling a cut of the whole stream was taken every 15 min. The cuts were collected in a washtub of 20 gal. capacity and allowed to settle before decanting the water. The results as obtained on four successive days were; heads, 26.1, 29.5, 26.8 and 20.4 oz. silver; tailings, 6.5, 5.5, 6.4 and 5.4. The automatic sampler was put into service for the next four successive days when the assay results obtained were; heads, 22.1, 20.4, 19 1 and 20.3; tailings 9.9, 8.2, 9.3 and 7.0. After using the automatic sampler it was found that the losses were 10% greater than had been anticipated.

Filing Engineering Notes

The filing of notes and clippings is an excellent practice that may develop into a habit or mania with the result that an attempt is made to preserve too many "data." For filing such notes there are almost as many systems as there are engineers.

To be of service the notes must be filed so as to be readily found when needed. The system should be self-indexing, for too much time is required for writing up card indexes, and the job of indexing and filing will often be left until an overwhelming accumulation induces the engineer to cast the entire lot into the waste basket and quit.

The system here described needs no separate index. Use either the pasteboard transfer files commonly used in offices for filing letters or, better and more compact, the smaller pamphlet cases. Tear out all the "innards" of these cases and cut a number of thin bristol-board pages the exact size of the case. Label these at the upper left-hand corner with the subjects, as *Pumping, Stoping, Shaft Sinking*, etc., under which captions the classification of the notes is to be made. Put these dividers in the case and insert the clippings and notes in front of each divider, according to subjects. The large letter cases will take an unfolded sheet of the JOURNAL; for the pamphlet cases the pages are folded once with caption at the top and facing outward.

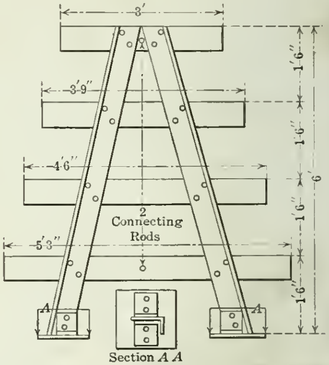
When looking for a note on any subject, remove all the notes from in front of the marker and lift one by one until the article is found. This takes but a minute and is preferable to spending time in making indexes for closer locating of an article. When the notes on any one subject have accumulated so that it takes several minutes to look them all over, reclassify the lot under two or three more specific captions, making new cards or dividers for each, and return to the place the original lot occupied in the case.

When two articles on one page are to be preserved, file under one caption; then use a sheet on which the title of the second article is written, the caption the article is filed under and the caption of the accompanying article. This sheet is to be filed under the caption of the second article. One sheet may be used for reference to a number of articles. For example, in looking for an article on pumping, this sheet will be found together with the notes on pumping and will indicate that the article "Centrifugal Mine Pumps" is filed under *Hoisting* on the same page as the article entitled "Life of Hoisting Cables."

The cases themselves are labeled on the back with a general title indicating the nature of the captions and articles and notes it contains. Thus any case may be made like a book on any subject, the captions of the bristol-board dividers being similar to chapter captions of a book. The advantage of the system is that the original filing can be done quickly, no writing of any kind being necessary except when several articles are printed on one page. The disadvantage of having to look through all the articles in one "chapter" to find the one wanted is outweighed by the time saved in the original collecting and filing. A copy of the JOURNAL can easily be torn apart and all the articles filed in five minutes.

Storing Iron and Rails

At many mine shops, storage space for iron stock and rails is limited, making it hard to find iron that is specified for certain work. Unless the blacksmith has plenty of room to spread out the iron, it will be hard for him to find the kind specified in a certain drawing. Furthermore, if the iron be stored according to lengths, the making of unnecessary scrap may be avoided by selecting stock of the approximate length required.



The Engineering & Mining Journal

A RACK FOR STORING IRON STOCK

A rack like that shown in the accompanying sketch from *Shop Notes Quarterly*, will save space, as well as time and labor, making it easy to sort the material, so that it can be found readily. These racks are cheap and strong, and can be made of any scrap material. Of course, the strength of the racks is to be governed by the weight of the material to be placed on them, although it is advisable to make them strong enough for the general run of stock used in the shop.

At the Broken Hill South Silver Mining Company in New South Wales, contractors' earnings varied as follows: Miners on development work, $4.06; stoping, $3.61; ore truckers, $2.53; muck truckers, $2.42 per day.

Notes on Pyritic Smelting

By George A. Guess*

Pyritic smelting defined as the production of a ferrous-silicate slag from iron-sulphide ore. There are two great variables, blast and silica; the first alters tonnage, the second the ratio of concentration.

What is pyritic smelting? Regarding pyritic smelting as practiced in America, several terms have been used to characterize it. We have heard of pyrite smelting and later of pyritic and of partial-pyritic smelting; the differences between the last two being characterized by an arbitrary dividing line of coke consumption. When more than so much coke is used it is partial-pyritic smelting. When so much or less is used it is pyritic smelting. I cannot see that the process is essentially changed when the amount of coke used on the charge is increased in reason, and often the increase or diminution of the coke used is as much a commercial as it is a metallurgical problem. I should like to see a more definite meaning attach to the term pyritic smelting; and in my own work, have always considered when a slag essentially high in iron is made from a charge containing its iron as a sulphide only, that pyritic smelting is being done, whether 2 or 20% of coke is being used.

Pyritic Smelting Is Slag Formation from Sulphide Iron

With low coke the metallurgist may be getting a greater pyritic effect in his blast furnace than when he is using a higher coke percentage, but his work is pyritic in both cases. It is the absolute necessity of oxidizing iron sulphide in the presence of silica, before slag formation can take place, that distinguishes pyritic smelting. If in doing this the metallurgist uses so much coke that, let us say, half of the air going into the furnace is used in burning his coke, the essentials of the process are not altered, because no matter how much coke he burns, he cannot make slag until he has oxidized his iron sulphides.

We will therefore call pyritic smelting the art or practice of smelting a charge in which all the iron present is combined with sulphur, to produce a ferrous-silicate slag. The tag on this definition is added to exclude an operation when sufficient iron sulphide is present to form matte, but the slag is high in lime and magnesia. We exclude therefore all consideration of how much coke is used in the operation. The effect of the variations in the amount of coke used in pyritic work will be spoken of later.

Blast Calculations in Coke and Sulphide Smelting

Blast-furnace ores of the Southwest are getting yearly more sulphuric in character, and the time will come when probably pyritic smelting will be practiced in several of the older plants of the West. A condition essential to success in pyritic smelting is the removal of the fine ore. With the fine ore removed, pyritic work offers such great possibilities in the reduction of the amount of coke used, that its application wherever possible is almost sure to result in diminished costs. One pound of oxygen expended in burning FeS and forming slag generates 2.46 heat units, while one pound of oxygen used in burning coke generates 3.05 heat units; so that there is not much difference in the amount of heat produced with a given volume of blast under proper conditions.

The pound of oxygen will burn approximately 1.84 lb. of FeS to slag, while the one pound of oxygen will burn approximately 0.45 lb. of ordinary coke. Therefore, in a furnace taking a uniform amount of air, which we assume is all used in burning coke, and FeS in the presence of silica to ferrous silicate, one pound of coke will take the place of four pounds of such FeS in the consumption of that air. Or, for every pound of coke burned per minute, about four pounds of FeS must remain unburned. In a furnace then, that is smelting say, a charge of sulphide ore and flux, in which the iron going into the slag forms 25% of the charge, about 10 lb., of charge remain theoretically inactive for each pound of coke burned, the consumption of air remaining constant. These are purely theoretical calculations, but such figures are useful.

In a pyritic furnace running open and hot, I have noted that when the amount of coke is reduced the furnace speeds up. This increased tonnage will be maintained until a new balance is obtained, and if the coke was properly adjusted in the first instance, the furnace may get noticeably colder in a few hours. If the furnace has a cold top, or if we neglect the temperature of the gases escaping if it has a hot top, we may assume that the pound of coke burned in the furnace, leaves its heat in the furnace. The four pounds of FeS burned in the furnace to slag produces about eight pounds of slag, with, say, 40% FeO which runs from the furnace, bearing with it approximately 30% of the heat so formed. This is a considerable item, and in a consideration of the action of the burning of the coke and of the sulphide must not be overlooked. The burning coke produces heat only, while the burning sulphide produces heat and slag, which carries off a large proportion of the heat so formed.

Adding Silica when Slag Is Too Siliceous

This generation of heat from the sulphides constitutes the basic principle of pyritic smelting. In dealing with pyrites, we will assume the formula of the reacting substance to be FeS in all cases. The equation for the reaction is therefore

$$\left\{ x\mathrm{FeS} + y\mathrm{SiO_2} + 3x\mathrm{O} = x\mathrm{FeO}.y\mathrm{SiO_2} + x\mathrm{SO_2}. \right\}$$

The three substances represented by the left-hand side of the equation must all be present, and I consider the reaction is essentially one, and does not by any manner of means take place in two stages. When not enough silica is provided, the reaction taking place will be proportional to the amount of silica that is present, until the activity per cubic foot of charge, diminishes to such an extent that the temperature of the focus of the furnace is lowered. We will then have a colder slag, more siliceous than the normal furnace slag and a lower-grade matte. The remedy for this undesired condition is to increase the amount of silica on the charge. This increase of silica to a furnace producing a slag already too siliceous in order to correct that slag, appears an anomaly to a metallurgist unfamiliar with pyritic smelting. I think I have given above what serves to explain this. To one who has done successful pyritic work, it is the natural thing to do. I do not wish, however, to be understood as saying that when a pyritic furnace is producing too siliceous a slag the proper remedy is always more silica on the charge.

Silica the Great Variable

In pyritic work, the metallurgist depends almost entirely on his silica, to change his furnace condition or ratio of concentration. If his ores are suited to the process, it may be possible to vary the ratio of concentration at will, from 4:1 to as much as 15:1 or more. From the speed of the furnaces under these varying conditions, and the amount of copper contained in the slag, will be determined the most economic conditions under which to work. Making a low ratio of concentration and resmelting the resulting matte may materially improve the copper extraction obtained by one furnace operation. The resmelting of matte to converter grade offers one of the simplest problems in pyritic work. Low-grade copper matte is much the same thing wherever you find it, with almost a definite analysis. On the other hand, ores may resemble each other in analysis, but behave differently when smelted. Some sulphides decrepitate to such an extent in the furnace that they produce a blanket of fines on the charge, interfering materially with the correct working of the furnace.

---

*Metallurgist, Napanee, Ont.

TWO-STAGE SMELTING OFTEN DESIRABLE

The resmelting of low-grade matte where it is possible to obtain clean siliceous ores and enough limerock to make a rapid running, clean slag, is accomplished with little coke, and at times with phenomenal furnace speed. A striking example of both coke and tonnage is the following tonnage which was smelted in a 56x180-in. furnace in 24 hours: Matte, 505 tons; quartz, 202 tons; limerock, 86 tons; total charge, 793 tons. The coke used was 13.5 tons which is 1.7% coke on the charge. The furnace took 21,515 cu.ft. free air per min. This is unusual running and low coke. It suggests, however, the ease with which matte may be concentrated and the low cost of the operation. Making a low-grade first matte and resmelting will in many cases make a better copper recovery and result in a greater ore tonnage through the plant than single-stage work, due to the more rapid running of the furnaces when not called on for such a high ratio of concentration.

The practice offers other advantages. If as sometimes happens, the blast-furnace ores change to such an extent that the matte going to the converters is so low-grade that that department is swamped, and despite all efforts it seems impossible to increase the grade of the matte, it often relieves matters materially, if the plant is so arranged that low-grade matte can be handled for resmelting, to make the blast furnace make even lower-grade matte, and after accumulating a stock, resmelt to a grade to suit conditions. In a plant where difficulty is experienced in maintaining the matte at converter grade, the practice of resmelting at least a part of the low-grade matte makes the unit more flexible and may enable the converter department to do better work.

POOR POLICY REFEEDING MATTE ON ORE CHARGE

The resmelting of this matte by adding it in small doses to the ore charge, regularly or when desired, serves merely to get rid of the matte. It does not enable the metallurgist to realize its fuel value and often it comes from the furnace no better grade than when it was put in. It is only when this matte is resmelted pyritically that the total metallurgical and commercial advantages are realized. The presence of considerable lead in the matte does not appear to affect the operation. Its presence in matte as in ores appears always to result in a settler slag lower in copper than is ordinarily the case, which observation, however, has nothing to do with pyritic smelting.

During four years of pyritic smelting, observations I have made have in many cases forced me gradually to abandon many accepted theories of what actually goes on in a pyritic furnace. Freeland in 1903 published a sketch, with which everyone is familiar, showing the probable structure of the interior of a pyritic furnace. This sketch has since been used wherever anyone has exploited new theories in this connection, and around it have been woven explanations of the whole physics and chemistry of the process. As regards the sketch, I have seen furnaces that when blown out lived up to it in appearances. But, I have seen many more normal-running furnaces put down, some without an attempt at running down, which showed no such structure. The generally accepted theory, I think, is that there exists in the pyritic furnace an open, porous, siliceous skeleton, over and through which molten matte trickles, and that this network of silica is used up as the matte is oxidized, being slagged by the iron oxide formed, but is constantly replenished by silica coming down the furnace shaft in the charge. The whole operation seems to be considered mechanically somewhat analogous to pouring water containing lumps of sugar into a porous vessel partly filled with such lumps. The theory is indeed a beautiful one, and can be used to explain a great deal that goes on in a pyritic furnace. To take its place, I confess, I have none at all.

SILICEOUS ZONE NOT FOUND IN BLOWN OUT FURNACES

The following observations have forced an abandonment of this theory. In digging out furnaces, I have repeatedly failed to find the siliceous zone. An analysis of the material where it should be, at times would not differ materially from the furnace charge. And these cases were most often from furnaces that had been shut down in the midst of good running. In blowing in a furnace for matte smelting with a charge of low matte, quartz and limerock, the first matte from the furnace may be made converter grade, and accompany slag in abundance without slag having been charged. In this case all possibility of the theory must be set aside. This theory presupposes a siliceous excess on hand in the furnace. Now, if we accept that as a fact and we are smelting, say, 10% matte with silica and limerock to converter grade, and find our resulting matte too low, how are we to raise it? We are told more air—that means greater pressure.

The air is really the only thing we can change if we assume that we have already in the furnace an excess of silica. But raising the blast will not raise the grade of matte. It will increase temporarily the activity of the furnace. If, however, we leave the air alone and raise the silica on the charge, we do at once change the grade of matte. In a normal-working pyritic furnace, I think that the charge sweeps through the furnace and out, and that there is no material melting of any constituent of the charge beyond a mere pastiness, until the whole charge reaches the fusion zone, where the reaction to slag takes place, to the extent permitted by the composition of the charge.

Considerable light was thrown on this question for me about a year ago. The end of a furnace, otherwise in good shape, hung up hopelessly. It was decided to try and dig that end out while the furnace was running. The furnace was 56x270 in. The end jacket was taken off, and the tuyeres on that part closed. The cold charge was taken out in the ordinary way for a distance of seven feet up to the active portion of the furnace. This wall was perfectly stable, and when picked into, appeared to hang together because it was pasty, but no molten material showed. The face was cleaned up to "the red," the jacket put on and calked. Then for 10 min. the blast was taken off while two men descended from the feed floor and made an opening on a level of the bottom of the freshly dug-out portion (about 6 in. below tuyeres) into the active part. This new part was then at once blown in and the operation was a success. The time taken was about 12 hours. The blast was off only 10 min. I had expected that we might poke through into a hot mass of slag and matte, but all we found was pasty, red-hot charge.

MATTE AN IDEAL PYRITIC MATERIAL

In the pyritic smelting of low-grade matte, we have an ideal material with which to work. Most ores are more or less complex and the nature of the gangue in the ore often interferes materially with the smooth running of a pyritic furnace. We will, therefore, assume we are smelting matte containing 10% copper carrying 95% SiO_2 and pure limerock sufficient to make 12% CaO in the slag. We have an unlimited supply of air and may run the pressure up to 50 oz. Our furnace is running normal and we are making a 35% matte and a slag as follows: SiO_2, 35%; FeO, 47%; CaO, 12%. Blast pressure, 35 oz., and furnace taking 1200 cu.ft. of free air per min. per ft. of furnace length.

Now there are two main things we can change: The silica on the charge, or the air pressure. Changing the percentage of matte on the charge is the same as changing the silica, changing the amount of limerock is not of great moment. It is there, first to make a clean, more fusible slag, and second to increase the speed of the furnace, reasonable changes in its amount do not materially affect the furnace running. Changing the weight of the charge and changing the height of the charge line in the furnace, as well as the changing of the coke, we will not consider here.

Effects of Blast Change

If we change the amount of blast, dropping the pressure to 25 oz., what happens? First, the stream from the furnace is reduced in size, and the number of charges that the furnaces takes per hour is reduced in quantity. Later on, the furnace may show the following changes. The top of the charge shows red less often, because the fusion zone is lower down in the furnace. The slag is not so hot, and the analysis may show less FeO. This will happen if the furnace has a narrow margin of heat. The activity per minute has been reduced, and until the furnace resistance has been reduced by a better tuyere condition, the furnace takes less than 1200 cu.ft. free air per min. per foot.

The daily tonnage of the furnace is less, and through that lessened tonnage, due to less heat generated per minute, the change may threaten the temperature of the slag and its analysis and consequent grade of matte, but that only if the furnace fails to keep hot. A new condition is imposed on the furnace which has greatly to do with the shape of the furnace. It may bring the fusion zone too low in the furnace or affect the mechanical side of the furnace in other particulars, but the main thing is that it changes only the rate of smelting for the reason, that with the same oxygen efficiency in the furnace, a lessened quantity of air is going to do a proportionately lessened quantity of work. The same charge is needed, but less of it.

Blowholes from Increased Blast

Similarly, if the blast pressure is raised, we increase essentially the rate of smelting the selfsame charge. But we may assume that the metallurgist running at 35 oz. has found that pressure best suited to his furnace, and that, though by increasing the pressure, he may increase his rate of smelting temporarily, still increased blast has drawbacks. It may raise the focus too high, the top gets hot, blowholes form. All these results are, however, more the commercial side, because a smelter knows exactly what a blowhole costs, and how much it costs in labor and lost time to dig out and start over again. He may also find it better to drive hard than to drive well.

Effect of Increased Silica

Now, when we change the quartz, we change the charge, and the whole process. Let us increase the amount of quartz materially, but in reason. What happens? We have so much more silica to put into slag. A proportional amount of FeS must be oxidized with it. Less iron goes into the matte, more into the slag. A proportional amount more of air is needed. We have made no change here, however, accordingly slightly less tonnage will be put through. Essentially what happens is that the furnace makes, as soon as the charge gets down, a slag higher in FeO; it looks hotter; the accompanying matte is higher grade. The oxygen ratio of the slag is changed; it is slightly more basic. We have changed the charge, and the result is a change in the type of slag and in the grade of matte made. Incidentally, we may find that the air is used more economically in the furnace; that the oxygen efficiency has gone up 1 or 2%. I have always found high oxygen efficiency goes with a high ratio of concentration. We may find the changed ratio of concentration suits the furnace; it gets hotter, the furnace resistance goes down, and consequently with our blast pressure of 35 oz. we may find the furnace taking 1300 cu.ft. per min. per ft. of furnace. The first change, however, and the one looked for is a slag higher in FeO. This change in the slag precedes the change in the grade of the matte some two or three hours.

When the extra quartz is added we have a hotter furnace, because we are doing more oxidizing per cubic foot of charge in the furnace, but not more per minute. The temperature of the focus of the furnace rises, and a slag of slightly higher formation temperature is the result. There is a vast difference between increasing the activity per cubic foot of charge in the furnace and increasing the activity per minute. The first means higher ratio of concentration and is brought about by increasing the silica. The second means faster smelting and is dependent solely on the volume of air per minute. Of course, when this increased volume of air is obtained by lessened furnace resistance instead of increased pressure, things are running smoothly.

The volume of air that a furnace will take, depends on two things, and may be expressed thus: $\frac{P}{R} = V$, where P is the pressure, R the furnace resistance and V the volume of air.

Pyritic Furnace Chooses Own Charge

A pyritic furnace is said to choose its own slag. I have also found that it has a great deal to say about the air it will take. It is one thing to say, "give the furnace more air," and another to make it take it. So much is this so, that the efforts of the smelter are continually directed to getting as many pounds of oxygen per minute into the furnace as he can for speed, and at as low a pressure as possible for power and the better working of the furnace. So that in practice the only real variable that the pyritic man has is his quartz.

In smelting iron sulphides low in copper with a low-silica content, the amount of quartz that may be added, may be from nothing up to 30%, or more. Here the range is great, and the metallurgist may make swift and sudden changes in his charge. He has a wide range through which he may vary his ratio of concentration, and the furnaces may be made to respond sharply. But, given a sulphide ore where the silica content is quite high, so high in fact, that little or no room is left for added quartz; and here surely the furnace makes its own slag and its own matte, and has, too, a great deal to say about how it will run generally.

The slag made under these conditions will not vary materially when the furnace is running well. But with the low silica, and say, 2% of copper, the slag will vary with the ratio of concentration and may run from 39% FeO where an 8% or 10% matte is made to 48% FeO where a 35% matte is made. The oxygen efficiency in the first case is possibly as low as 65% and as high as 85% in the second.

In a pyritic furnace the oxygen duty is comparatively easy to calculate. The metallurgist will arrive at a factor which he will use for his oxygen to sulphur (for all the sulphur eliminated is not burned), and his monthly metallurgical calculations of the furnace gas, from the air furnished, checked by analyses of the furnace gas made, will give him this figure. I have used 90% of the eliminated sulphur as being burned by the oxygen of the blast.

Sampling Furnace Gases

The sampling and analysis of blast-furnace gases is not always well done. I have always found free oxygen in pyritic-furnace gas, except when I drew my sample through a metal pipe which the furnace temperature had heated to redness. In this case, of course, all the oxygen of the sample was taken up by the red-hot metal, and I found next to nothing. Dampering back the furnace gases till the top takes in no false air permits the taking of a good sample. The determination of SO_2 with decinormal iodine is easy. Oxygen absorbed by phosphorus is easy, but CO_2 and SO_2 present greater difficulties. What often happens is that CO_2 and SO_2 together are reported as CO_2. CO in small quantities is very uncertain, and the analyst, when honest, often has a minus instead of a plus. One must take into consideration, of course, the conditions under which the analyses have necessarily to be performed. Calculated analyses for a month's running and average analyses taken during the month often check closely.

We will now go back to our furnace smelting matte, and calculate the analysis of the gas that it is producing. We will assume the following analyses: First matte, 10% Cu, 56% Fe, 26% S; second matte, 35% Cu, 35% Fe, 24% S; slag, 35% SiO_2, 47% FeO, 12% CaO; quartz, 95% SiO_2; limerock, 53% CaO, 42% CO_2; coke, 83% C.

To simplify matters we will neglect the copper and sulphur in the slag. We will assume 3% of coke in the charge, neglecting its ash, and that the barometer and thermometer are such that 1000 cu.ft. of free air contain 16 lb. oxygen; and that the furnace smelts 612 tons of charge per 24 hours, made up as follows: Matte, 350 tons; quartz, 162; limerock, 100; coke, 18.36 tons. Our 24-hour charge is then as follows, in tons: Cu, 35; Fe, 196; S, 91; SiO_2, 154; CaO, 53; CO_2, 42; C, 15.2; of which 35 tons Cu, 35 tons Fe, and 26 tons of S go to matte, leaving a net of 161 tons Fe to go to slag and 65 tons of S to be eliminated.

The furnace is taking 1200 cu.ft. of free air or 19.2 lb. of oxygen per min. per ft. of length, and, we will say, is 15 ft. long; the total tonnage of oxygen then per 24 hours is 207 tons.

CALCULATION OF THE OXYGEN EFFICIENCY

Then if 90% of the S is burned, i.e., 58.5 tons, there will be 58.5 tons of oxygen required, giving 117 tons of SO_2. The 161 tons of iron will require 47 tons of oxygen; 15.2 tons of carbon will require 40.5 tons oxygen, giving 55.7 tons CO_2; while the limestone will give off 42 tons of CO_2. The total oxygen used will be 146 tons, and the unused oxygen will amount to 61 tons. The nitrogen with the oxygen will be 694 tons.

The accompanying table shows the composition of the effluent gases.

	Tons, gas	% wt.	% vol.
SO_2	117.0	12.1	6.0
CO_2	97.7	10.1	7.2
O	61.0	6.3	6.2
N	694.0	71.5	80.6
	969.7	100.0	100.0

Oxygen efficiency, 70.5%.

If we were to make the same calculation for an ore furnace where the ratio of concentration is greater, and amount of coke say, 5% on the charge, we would have a resulting gas richer in SO_2, about 83% nitrogen, and about 5% CO_2. Analyses of gases from a pyritic furnace are always a good check on the coke being used.

The higher oxygen efficiency which accompanies higher ratio of concentration, appears natural when one considers that a higher ratio of concentration is a result of increased activity per unit of charge in the furnace. It is the higher oxygen efficiency that helps to maintain furnace tonnage, when the furnace is made to increase its ratio of concentration by increasing the percentage of silica on the charge. Otherwise, the tonnage duty of the furnace would drop, due to the increased oxidation necessary to make slag of the new charge being fed. If the new charge works well, it will lessen the furnace resistance, and so enable the furnace to take more air without raising the blast pressure. It may also be, that under the new conditions, it may help the furnace to stand an increase of blast pressure. In either case, the increased air will increase the activity of the furnace per unit of time, while the increased amount of silica will increase the furnace activity per unit of charge in the furnace. We may sum this up thus: Increasing the volume of air increases the furnace activity per unit of time and spells tonnage. Increasing the silica on the charge increases the furnace activity per unit of charge in the furnace and spells increased ratio of concentration or higher mattes.

HEAT CONSUMPTION OF THE PYRITIC FURNACE

The first gives us a certain number of gross heat units per unit of charge, and maintains the same grade of matte and type of slag, irrespective of the volume of air used, unless that air is reduced to such an extent that the furnace activity per minute drops so low that the radiation of heat from the furnace cools it to such a point that the temperature of the focus of the furnace falls below the formation point of the slag. Then we have trouble. For the nêt heat generated in the furnace, we have, of course, the three avenues of escape: (1) Radiated heat, jacket water; (2) slag and matte (3) gaseous products and flue dust.

The first of these, radiated heat, is almost independent of the furnace activity, and is for a pyritic furnace, much less than in ordinary smelting. It is, therefore, when the tonnage activity of the furnace reaches such a point, that the percentage of heat lost through radiation becomes much greater or much less than normal, that the temperature of the focus of the furnace is affected, and a new condition has to be met. We see then, that under a wide range of tonnage activity, the type of slag and grade of matte, will remain constant and independent of the rate of smelting, and the charge will be written to suit this condition.

LIMITS OF THE RANGE OF CONCENTRATION

A change in the ratio of concentration produces a new plane on which the furnace operates, and one may say that the ratio of concentration attainable is limited by the temperature that it is possible to maintain in the focus of the furnace, by increasing its activity per unit of furnace charge. Running to an extreme in this direction, we will generate too little heat per unit of time. The percentage of radiated heat goes up, and the furnace limit in concentration is reached.

Within reasonable limits then, we may say that the greater the activity of the furnace per unit of charge in the furnace, the higher the temperature of the focus, the higher the grade of the matte, and the more basic the type of slag produced. Just what slag the furnace will make for a given ratio of concentration, the metallurgist will find out by experiment, and then write his charge to suit the concentration desired.

A PRO FORMA CHARGE

Let us picture a furnace in operation which, when charged to the stock line contains, say, 50 tons of charge, and suppose that the stock line is 10 ft. above the tuyere line. Let us assume that the charge contains 50% of iron sulphide and is so arranged that 70% of the iron and its accompanying sulphur is being oxidized. We will then have 70% of the 25 tons of iron (or 17.5 tons of iron) which are in the furnace at a given period, which will be slagged before leaving the furnace. This work we may say is done by the air passing through the furnace. We will assume that the oxygen efficiency is known, and is 65%. Now, 100 volumes of this air, in passing through the furnace, meets the furnace charge, and does work represented by the oxidation of 17.5 tons of iron and its accompanying S. It can do no more, because the silica has been added for just this amount of oxidation. We find 35% of the oxygen in this air, however, has done no effective work. Now we will change the charge by increasing the silica so that 90% of the iron in the furnace at a given time, is going to be slagged before leaving. Is it not reasonable to expect that 100 volumes of air in passing through the furnace, now finding more work to be done in its passage, does more efficient work, and the percentage of unused air is smaller? This seems reasonable, and is exactly what is found in practice, that the increased ratio of concentration results in a higher oxygen efficiency.

For all calculations of oxygen efficiency, it is, of course, necessary to go to the blower and not to the gas analyst. This increased oxygen efficiency with increased ratio of concentration is found also in converter work. In converting 50% mattes, the ratio of concentration is 2:1 with a 30% matte, 3.3:1. I have always found a higher oxygen efficiency in the converter department during the month when the mattes were low than when the mattes were high. The cases are not parallel but similar. A concentration furnace smelting say, 10% matte to 35%, has a low ratio of concentration, and as such always has a reputation as a prodigal user of blast. This oxygen efficiency is higher than the converter oxygen efficiency, however, and at a much lessened pressure; so that only where power is cheap, might it be economy to treat a low-grade matte in a converter instead of in a blast furnace.

EFFECT OF TOO SILICEOUS A CHARGE

A normal pyritic furnace, in normal condition, produces with each change in ratio of concentration, a different type of slag. We have then a given charge, from which we obtain a fixed ratio of concentration and a certain type of slag. It is next to impossible with this given charge to change the ratio of concentration, by forcing more iron to combine with the silica of the charge than the type of slag calls for. By cooling off the furnace, perhaps dangerously, we may satisfy the silica with less iron and lower the grade of matte, in which case, we are piling up in the furnace an excess of silica, represented by the difference between the silica on the given charge, and the silica required for a charge that gives the ratio of concentration we are now making.

We have now, however, a furnace that is not normal as we have been using the term, although a condition common enough in practice. Our furnace is receiving the given charge as fast as it is smelting, but because the furnace is too cold in its focus to make the necessary concentration called for by that charge, it is doing less work per unit of furnace charge, and is as your furnaceman says, "not smelting its silica." The furnace is making a lower grade of matte, and a more siliceous slag than originally intended. Here then we have a condition that in appearance is similar to the case cited earlier in this paper, where more silica was the logical remedy. Here the obvious course is to suit the charge to the furnace until a rising temperature will permit a raising of the ratio of concentration.

From this illustration above given may be deduced many fundamentals of practice. Of these, perhaps the most important is that underlying the change in ratio of concentration. Increasing the silica on the charge is the means of raising the ratio of concentration. An increase in the ratio of concentration means an increase in the temperature of the focus of the furnace and a resulting slag higher in FeO and lower in silica. Now, if the furnace is not sufficiently active and hot, it will not respond to the demand put upon it and will not smelt this increased silica. The slag and matte will remain as they were and the silica accumulates in the furnace. Moral—always keep a hot furnace.

In the matter of silica for the furnace in pyritic smelting, the higher the percentage of silica in the quartz or siliceous ores, the better for the furnace. In matte smelting where all the silica is added it is possible to use a lower grade of silica than in ore smelting, where, possibly, the ore contains already a considerable amount of combined silica. A reasonable amount of silicates in the ore can be taken care of, but as these increase in amount, it is advisable to obtain as high grade a silica as possible for additional flux. Combined silica or a poor grade of flux naturally retards furnace activity, the decomposition takes heat, and as they increase in amount so do the difficulties attendant on maintaining a fixed ratio of concentration.

SILICA INFLUENCES CONCENTRATION; BLAST, THE TONNAGE

Silica means ratio of concentration and air means tonnage. We have glanced at the effect of a low grade of silica on the furnace; let us glance at the effect of a low grade of air. We have been smelting at an altitude where 1000 cu.ft. of free air contains 16 lb. of oxygen. Let us assume operations where 1000 cu.ft. of free air will contain only 9 lb. We have expressed the volume of air that a furnace will take as being $\frac{P}{R} = V$, where P is the pressure and R the furnace resistance. Our furnace resistance is going to be the same and so is the pressure, so that our furnace will take the same volume of air per minute. We will assume again that this volume is 1000 cu.ft. of free air per foot of furnace length per minute. This is 9 lb. of oxygen per minute instead of 16 lb. Of course, our furnace is going to run more slowly. We have noted that of the three sources of heat loss, the only one that is practically independent of the speed of the furnace is the loss from radiation.

We will here have then a greater percentage of the furnace heat lost through radiation (jacket water) in addition to a lessened activity per unit of time. These are the two great factors that determine furnace temperature. We are going to have a comparatively cold furnace also.

A pyritic furnace under these conditions will make a siliceous slag, and a comparatively low ratio of concentration which is extremely difficult to increase. Adding oxidized iron to the charge in the form of converter slag, and smelting this with coke, is a departure from what we are now considering. The pyritic furnace smelting with a poor grade of air (rarefied) is confined within narrow limits of concentration, as is a pyritic furnace smelting with a poor grade of quartz, but with the additional handicap of small furnace tonnage.

International Atomic Weights

The International Committee on Atomic Weights, 1912, composed of F. W. Clarke, T. E. Thorpe, W. Ostwald and G. Urbain, has made its report for the year[1].

A number of important determinations have been made on no less than 18 elements, but new values have been accepted only in seven cases, shown by an asterisk in the accompanying table. One of these, niton, is a "new" element. It is a radium emanation, investigated by Gray and Ramsay, and by Debierne, who used a different method.

INTERNATIONAL ATOMIC WEIGHTS, 1912

Element	Symbol	Weight
Aluminum	Al	27.1
Antimony	Sb	120.2
Argon	A	39.88
Arsenic	As	74.96
Barium	Ba	137.37
Bismuth	Bi	208.0
Boron	B	11.0
Bromine	Br	79.92
Cadmium	Cd	112.40
Caesium	Cs	132.81
Calcium*	Ca	40.07
Carbon	C	12.00
Cerium	Ce	140.25
Chlorine	Cl	35.46
Chromium	Cr	52.0
Cobalt	Co	58.97
Columbium	Cb	93.5
Copper	Cu	63.57
Dysprosium	Dy	162.5
Erbium	Er	167.7
Europium	Eu	152.0
Fluorine	F	19.0
Gadolinium	Gd	157.3
Gallium	Ga	69.9
Germanium	Ge	72.5
Glucinum	Gl	9.1
Gold	Au	197.2
Helium	He	3.99
Hydrogen	H	1.008
Indium	In	114.8
Iodine	I	126.92
Iridium	Ir	193.1
Iron*	Fe	55.84
Krypton	Kr	82.92
Lanthanum	La	139.0
Lead	Pb	207.10
Lithium	Li	6.94
Lutecium	Lu	174.0
Magnesium	Mg	24.32
Manganese	Mn	54.93
Mercury*	Hg	200.6
Molybdenum	Mo	96.0
Neodymium	Nd	144.3
Neon	Ne	20.2
Nickel	Ni	58.68
Niton*	Nt	222.4
Nitrogen	N	14.01
Osmium	Os	190.9
Oxygen	O	16.00
Palladium	Pd	106.7
Phosphorus	P	31.04
Platinum	Pt	195.2
Potassium	K	39.10
Praseodymium	Pr	140.6
Radium	Ra	226.4
Rhodium	Rh	102.9
Rubidium	Rb	85.45
Ruthenium	Ru	101.7
Samarium	Sa	150.4
Scandium	Sc	44.1
Selenium	Se	79.2
Silicon	Si	28.3
Silver	Ag	107.88
Sodium	Na	23.00
Strontium	Sr	87.63
Sulphur	S	32.07
Tantalum*	Ta	181.5
Tellurium	Te	127.5
Terbium	Tb	159.2
Thallium	Tl	204.0
Thorium	Th	232.4
Thulium	Tm	168.5
Tin	Sn	119.0
Titanium	Ti	48.1
Tungsten	W	184.0
Uranium	U	238.5
Vanadium*	V	51.0
Xenon	Xe	130.2
Ytterbium	Yb	172.0
Yttrium	Yt	89.0
Zinc	Zn	65.37
Zirconium	Zr	90.6

---

[1] Journ. Am. Chem. Soc., Nov., 1911.

American Chemical Society

The annual meeting of the American Chemical Society began in Washington, Dec. 27. On the first day there was a joint meeting of the Section on Chemical Education and the Division of Physical and Inorganic Chemistry, at which the following four papers were given: A. A. Noyes, chairman, "The Teaching of Physical Chemistry;" W. D. Bancroft, "Physical Chemistry in the Introductory Course;" H. C. Jones, "The Introduction of Physical Chemical Conceptions in the Early Stages of the Teaching of General Chemistry;" J. Howard Mathews, "Some Applications of Color Photography in the Teaching of Physical Chemistry" (illustrated).

In the afternoon the address of Vice-President Frankforter, of Section C, entitled "The Resins and their Chemical Relations to the Terpenes," was delivered before a large audience and was followed by an address by Chairman H. P. Talbot on the subject, "Privileges and Responsibilities of the Chemical Analyst." Following Doctor Talbot, Dr. A. L. Voge, of the Library of Congress, read a paper on "Ostwald's Proposed International Institute of Chemistry."

On Dec. 28, Alexander Smith, president of the society, delivered his presidential address, entitled "An Early Physical Chemist," and was followed by an interesting lecture by Frank B. Kendrick and H. E. Howe, consisting chiefly of illustrations by means of the lantern of the effect of temperature, pressure, concentration, surface tension, osmotic pressure, etc., on reactions in heterogeneous systems.

A feature of the divisional meetings was the symposium on "Mineral Wastes and their Conservation," held before the Division of Industrial Chemists and Chemical Engineers, Dec. 29. The following papers were presented and the discussion was prolonged throughout the day: J. A. Holmes, "Carbon Waste;" W. H. Bassett, "(a) Zinc Losses in Brass Manufacture, (b) Need of Special Alloys for Special Uses;" W. R. Whitney, "New Uses to Reduce Abuses in Conservation;" A. V. Bleininger, "Wastes in the Ceramic Industry;" A. D. Little, "The Abuse of Brand;" F. K. Cameron, "Waste and Conservation of Potash and Phosphoric Acid;" F. G. Cottrell, "Sulphur Fumes and Fluedust;" Charles L. Parsons, "Miscellaneous Mineral Wastes."

It was voted to donate the library of the American Chemical Society to the New York Chemists' Club on condition that members of the society have ready access thereto.

The election of the following officers was announced for 1912: A. D. Little, president; C. L. Parsons, secretary; A. P. Hallock, treasurer; W. A. Noyes, editor of the *Journal* of the American Chemical Society; A. M. Patterson, editor of *Chemical Abstracts;* M. C. Whitaker, editor of the *Journal of Industrial and Engineering Chemistry;* E. G. Love and Alexander Smith, directors for two years; S. W. Parr, W. H. Walker, W. L. Miller, W. D. Bigelow and C. H. Herty, councilors at large; E. G. Love, G. C. Stone and A. E. Hill, finance committee; Wm. McMurtrie, C. L. Parsons and B. E. Curry, membership committee.

Inspiration Consolidated Copper Company

Final announcement has been made of the formation of the Inspiration Consolidated Copper Co., with the details of the financing. The company has an authorized capital of $1,500,000 shares, par $20, and will issue $6,000,000 of 10-year, 6% bonds, convertible into stock at $25 per share. These bonds will be offered to the stockholders of the new company, of record Feb. 1, at par, and will be payable in four equal instalments of $25 each, on Mar. 1, Sept. 1, 1912, and Mar. 1 and Sept. 1, 1913.

The Guaranty Trust Co., New York, and Kidder, Peabody & Co., Boston, have made an offer, good until Jan. 29, to pay $10 per share cash for the 1,000,000 shares of stock of the Inspiration Copper Co., or to exchange for it, stock of the new Inspiration Consolidated Copper Co., on the basis of one share of new stock for two shares of the old; also to pay $40 per share for the 93,750 shares of stock of the Live Oak company or to exchange for it stock of the new Inspiration Consolidated company on the basis of two shares of new stock for one share of old. It is stated that all the stock required to effectuate the offer made by the Guaranty Trust Co., and Kidder, Peabody & Co., also the $6,000,000 of bonds, have been underwritten at par.

The board of directors is as follows: John F. Alvord, Thomas F. Cole, Edmund C. Converse, William E. Corey, Henry B. Hovland, Eugene Meyer, Jr., William G. Rockefeller, John D. Ryan, Charles H. Sabin, Charles A. Corliss, William B. Thompson, Philip L. Foster, William D. Thornton and Albert H. Wiggin. Mr. Thompson is president and Mr. Thornton vice-president. The Guaranty Trust Co., New York, and the Old Colony Trust Co., Boston, are the transfer agents; the Bankers Trust Co., New York, and the National Shawmut Bank, Boston, are the registrars. The new company, it is said, will have about $7,000,000 cash at its disposal and there is believed to be about 45,300,000 tons of ore developed that averages about 2% copper.

The company intends to proceed immediately with the erection of a concentrating plant of not less than 7500 tons daily capacity. It will have an annual output of copper of at least 65,000,000 lb., which it estimates can be produced at a net cost of 8½c. per pound.

November Operations at Goldfield Consolidated

During November, the Goldfield Consolidated Mines Co., produced 28,628 tons of ore, containing $766,351 gross, an average of $26.77 per ton. This was milled with an average extraction of 94.45%, amounting to $25.28 per ton. Total net profit was $510,596, or $17.83 per ton. Development work amounting to 3764 ft. was done.

NOVEMBER COSTS AT GOLDFIELD CONSOLIDATED

Mining:		
Development	$1.09	
Stoping	2.47	$3.56
Transportation		0.10
Milling		2.01
Marketing		0.67
General expenses		0.39
Bullion tax		0.26
Construction		0.50
Total cost of operation		$7.49
Miscellaneous earnings		0.04
Net cost per ton		$7.45

At the Clermont the 401 sill was extended and produced 36 tons of ore averaging $58.08. The 413 sill was also extended, producing 235 tons of ore that averaged $53.74 per ton. The 410-X intermediate between the third and fourth levels was driven in $15 ore. The 420 sill on the 750-ft. level was extended east and produced 183 tons of ore averaging $19.43. The 555 drift on the 510 intermediate between the 750- and 900-ft. levels produced 231 tons averaging $13.44. The 521 sill on the 900-ft. level was extended and produced 183 tons that averaged $28.11 per ton. The Grizzly Bear shaft was sunk to a point 20 ft. below the 1300-ft. level and a station was cut for that level.

At the Mohawk the 3-E sill was extended and produced 849 tons that averaged $44.44 per ton. The 3-D sill was also extended and produced 424 tons that averaged $99.63 per ton. The 354 sill produced 118 tons averaging $49.19 per ton. The 345 sill, south of the 354 stope on the 450-ft. level, produced 212 tons that averaged $14.26 per ton. From the 495-ft. intermediate between the 450- and 600-ft. levels was produced 388 tons that averaged $13.23. The 499 drift over the 413 Clermont stope produced 56 tons averaging $21.50 per ton.

In the Red Top the No. 352 crosscut in the 305 drift produced 417 tons averaging $60.56 per ton. The Hazel shaft at the Laguna was sunk 90 ft. below the 718-ft. level. The raise from the first level of the Combination opened some $15 ore. The 402 stope, near the bottom level, was extended downward and produced 802 tons of ore averaging $74.62 per ton.

The Miami District, Arizona

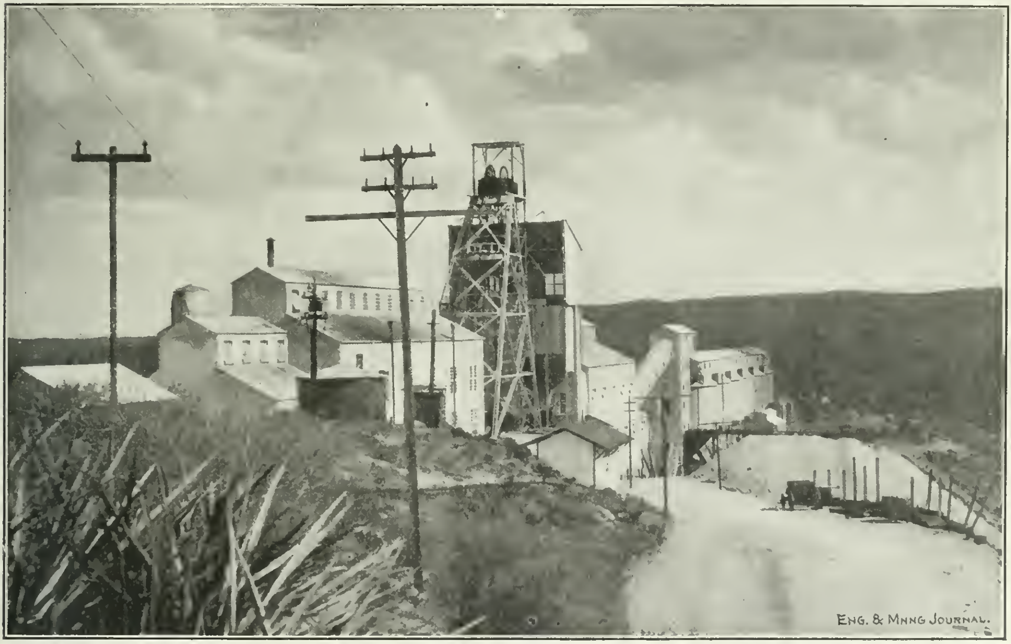
By W. R. Ingalls

Observations respecting four important porphyry mines in which an aggregate of about 66,000,000 tons of ore has been developed, the ore ranging from 1.95 to 2.58% in grade.

Four mines at Miami, Ariz., have been opened on the great deposit of disseminated copper ore that exists in that district. From east to west these are the Miami, Inspiration, Keystone and Live Oak. They are opened upon what is really the same orebody, although there are certain breaks in it, to which I shall refer. The ore is a schist mineralized chiefly with chalcocite. Up to the present time a total of about 66,000,000 tons of ore is claimed to have been developed in the four mines above mentioned.

THE MIAMI MINE

The only producer of the Miami district at present is the Miami Copper Co., which is now mining and milling from 2400 to 2500 tons of ore per day. This is being done with five sections of the mill. When the sixth section is completed and the mill is thoroughly tuned up, its capacity will undoubtedly be about 3000 tons per day. The sixth section will probably be ready for operation by the end of January, 1912. The foundations are ready for two more sections (each of 750 tons capacity), but there is no immediate plan of building upon them. Eventually, one or both of them will probably be completed for the milling of the ore of neighboring companies. With milling capacity for 3000 tons per day, the Miami itself is adequately supplied, in view of its present ore development.



SURFACE PLANT OF MIAMI COPPER CO.

According to the last official report of this company, it had developed 18,000,000 tons of ore averaging 2.58 per cent. copper. Since then no attempt to increase the reserves has been made. It would not be good policy to do so. It may be said, however, that the management expects to add to the reserves both with depth and laterally, and there seem to be sound reasons for such an expectation, especially as to the extension of payable ore to greater depth than yet estimated.

METHOD OF DEVELOPMENT

The Miami development has been chiefly by blocking out the ore in the old-fashioned way. In doing this, about 100,000 ft. of drifts, raises, etc., have been run. No other of the "porphyry" mines has done anything like so much of such work in proportion to the volume of orebody. While it is pleasant to learn at other mines that stoping is checking closely with the estimates based on drilling, nevertheless a superior confidence is bound to be felt in development that has put the ore actually in sight. Above the 420-ft. level the Miami has about 8,000,000 tons of ore, a large part of which has already been prepared for mining. If anything, the management has anticipated the requirements of mining too far ahead; in other words, has expended too much money in development in advance of mining. This, however, will all come back in course of time.

The Miami orebody occurs in the form of a submerged mountain with twin peaks. The highest horizontal section shows only two small patches of ore— the two apexes. Succeeding sections show them to be of increased size, until finally they merge together in one great area of ore. The extraction of this orebody has been begun at the top, and at present is being done chiefly by square-setting, the objects being to take out the ore cleanly below the capping and form a thick mat of timber between the capping and the ore in order to keep them separate when the caving is fairly in progress. This system of mining is designed to extract the maximum percentage of ore without dilution, and is performed at a relatively high expense for timber, the expense for which at present comes to nearly 25% of the total cost of mining. The mining of the Miami orebody is, in fact, being done at present under the most unfavorable conditions. Not only must the timber mat be formed, but also all prongs and tongues of ore extending into the capping must be extracted now, if ever. This involves a good deal of relatively costly hand mining, which will disappear when the extraction by caving is fairly in progress.

Cost of Mining

In spite of the relatively unfavorable conditions of beginning the extraction of ore and the operation at only partial (about 60%) capacity, the cost of mining has been lower than was originally estimated, having been only about $1.20 per ton (of which about 30c. is for timber), and there is no doubt whatever that this will be further reduced as operations come into full swing. It is to be remarked that the method of mining introduced in the Miami mine is designed to secure a high percentage of ore extraction, but what this will be has not yet been determined. Of course, it is possible in such mines to extract nearly 100% of the ore, but it may be less profitable to do so than to stop short of such arithmetical perfection.

I will not undertake to describe the mining methods or equipment, which doubtless will be done later by the engineers who are responsible for them. For the present it is sufficient to say that Messrs. Channing, Gottsberger and Lawton have done highly creditable work, both in their planning and in their execution. The mine is so laid out that the ore is delivered through a main gallery, at present on the 420-ft. level, to a large shaft of great capacity through which it is hoisted by compressed-air engines and delivered directly to the mill.

The Miami Mill

The Miami system differs from that of most of the porphyry mines, in that the mill is built right by the shaft, the water being pumped to it, instead of carrying the ore a more or less distance to the water. The decision between carrying the ore to water and water to ore depends, of course, upon the comparative expense. At Miami the cost of water is about 6c. per ton of ore. Such a low figure is attainable only when there is economical use of water.

In laying out the Miami mill, so excellent advantage was taken of a rather difficult and forbidding topography that the result leaves but little to be desired. The ore passes from the bins in the headframe of the shaft to the crushing house, and thence by belt conveyor to the mill proper. In the latter the first crushing is done by Burch rolls, which are followed in some sections by chile mills and in others by Hardinge mills. Originally, one section was equipped with rigid rolls, but although they gave the commonly desired granularity of product, in this case they failed to release fully the mineral, for which crushing to pass a 60-mesh screen seems to be necessary. As between the chile and Hardinge mills, it is rather strongly indicated that the latter will become the favorite.

The pulp is washed on Deister tables. The concentrates run through a tunnel to bins at the foot of the hill. The tailings go to a dewatering plant below the mill, which operates with marvelous efficiency. The total quantity of water required in milling a ton of ore is nine tons; the quantity of new water supplied is only two tons. The dewatered tailings are discharged into a commodious pond formed by a dam across a small ravine. As discharged into it their copper content is not high.

The ore delivered to the mill has been averaging about 2.5% copper. The ratio of concentration has been 20: 1 to 22: 1, the concentrates assaying about 40% copper. The extraction of copper has been about 75%. In spite of the fine grinding to which the ore must be subjected, the loss of copper in slime is low. It is expected that the extraction in milling will eventually be raised to nearly 80%. Considering the character of the ore and the excellence of the mill equipment, it is not improbable that such a remarkably high extraction will eventually be obtained when it has been learned how to operate the mill to the best advantage.

Design and Construction

In the matters of design and building, the Miami mill is at the present time the last word in mill construction. There is no other concentrating mill of which I am aware that has so much purely structural excellence, so much floor space, so much lighting (both by day and by night), so unobstructing a belt, shafting and launder plan and so much cleanliness. Here is a mill in which there is no slop, through which a visitor may go in his best clothes without fear of harming them.

Some criticisms have been directed toward the Miami engineers upon the ground of their apparent extravagance. I use the word "apparent" advisedly, the cost of the Miami mill per ton of annual capacity not having been excessive even when compared to other mills of decidedly inferior construction. But even if some apparently unnecessary outlays were made in the Miami mill, I am, nevertheless, of the opinion that the money was extremely well spent. An addition of 25c. per ton of annual capacity in the first cost, let us say, is very quickly offset by the ability to extract an extra percentage of copper from the ore. This has already been demonstrated in the phenomenally high extraction that has already been made in the Miami mill. The provision of a commodious, well constructed and well kept plant improves the *morale* of the men. Given such a plant they are likely to adapt themselves to its conception, whereas if put to work in an inconvenient, sloppy plant, they are more likely to absorb the spirit of the engineers and themselves become careless.

The Miami mill has been compared to a magnificent mansion, fitted up with appropriate furniture. If, at any time, it may be desirable, it is an easy matter to change the furniture. In the Miami mill the furniture is the machinery and special apparatus. If, at any time, it may be necessary to change the machinery because of alterations in the milling qualities of the ore, or because improvements in the art have led to the development of better forms of machinery, adaptation to either condition is easy in the Miami mill, because of the foresight and broad conception of its engineers. From this point of view the elaborate construction of this mill is not only a direct means of immediately making more money, but also is an insurance against adverse alterations in conditions in the future.

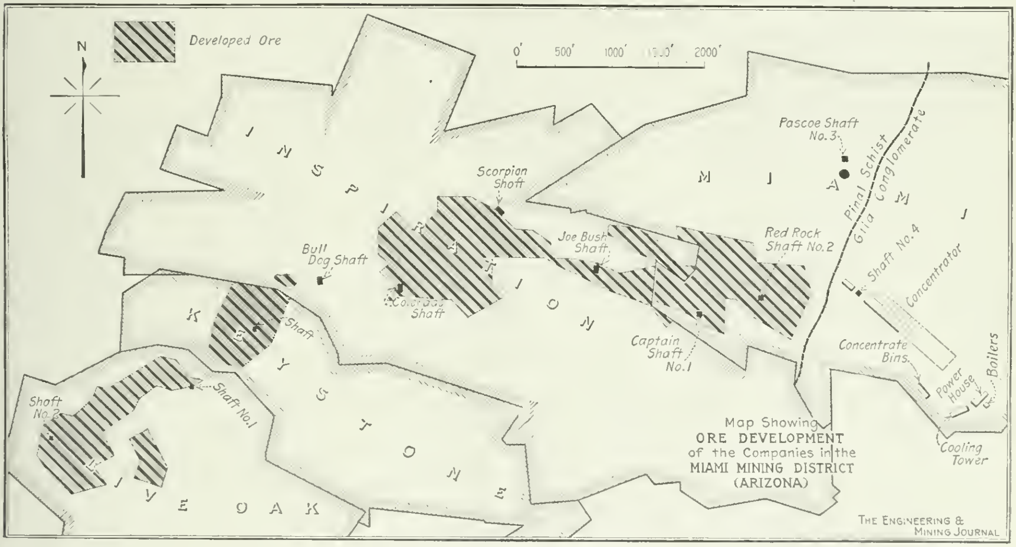
Inspiration Copper Co

Going westward from the Miami, the orebody spreads out, or at least becomes less thick than it is in the Miami, and deflects to the southwest, the general trend being shown in the accompanying map. The orebody is faulted in the Inspiration property, as may be surmised from the peculiar shape shown by the map. Toward the Keystone line the orebody is broken by a fault that has thrown it down in the Inspiration territory and produced an area on the dip of the fault wherein no ore is to be expected. Another fault is known to exist in the neighborhood of the line between the Keystone and Live Oak property. Besides a vertical dislocation at this place, there also appears to have been a heave of the Live Oak orebody to the northwest. The faulting of this district and perhaps other geological conditions have not yet been adequately studied.

Up to the present time the work of the Inspiration Copper Co. has been confined chiefly to prospecting development, which has been both by churn drilling and by underground work, chiefly the former. A good deal of underground work has been done, but nowhere near to the same extent as was done by the Miami Copper Company.

The developments in the Inspiration have disclosed the existence of an orebody of about 120 ft. average thickness, with a maximum length of about 3800 ft. and maximum width of about 1600 ft. It is estimated that this orebody contains about 30,000,000 tons of ore, averaging 1.95% copper.

The Inspiration is undoubtedly a very valuable mine, but in comparison with the Miami it is at the disadvantage of a materially lower grade of ore. It follows from this that if the extraction of the ore were to be conducted by the same methods as in the Miami mine, the cost per pound of copper product would be very materially higher. It is likely, however, that the mining of the Inspiration ore will be done by a cheaper method of caving, perhaps by suitable modifications of the methods employed at Bingham and at Ray. This will afford much cheaper ore at the expense of a lower percentage of extraction. I am, however, favorably disposed toward such systems when introduced under suitable conditions, and believe it to be not unreasonable to expect that the extraction of ore may be as high as 83 per cent. Any such result would, of course, go a long way toward offsetting the disadvantage of the lower-grade ore. However, it is not to be expected, not even under the most favorable combination of circumstances, that Inspiration can produce a pound of copper so cheaply as Miami.



Map Showing
ORE DEVELOPMENT
of the Companies in the
MIAMI MINING DISTRICT
(ARIZONA)

A considerable part of the Inspiration orebody is so situated that it can be extracted through an adit level. Just what use will be made of that entry, and, indeed, just what will be the plan for the mining and milling of the Inspiration ore, has not yet, so far as I am aware, been finally decided.

KEYSTONE

Adjoining the Inspiration on the west is the property of the New Keystone Copper Co., which is an interest of the General Development Co. The surface of the country is noteworthy at this place for a remarkable coloration of the country rock by silicate of copper. Unfortunately the copper content of the surface exposures is not sufficiently high to be commercially valuable. The lines of the Keystone property proved to have been laid out in such a way that this company did not secure a large portion of the orebody.

As in the case of the Miami, the development of the Keystone mine has been chiefly by drifts, winzes and raises. It is only recently that any drilling has been done. The underground work was laid out in a thoroughly systematic way, upon two levels, viz.: The 150-ft. and 250-ft. This work has disclosed an orebody about 400 ft. in width and 70 ft. in thickness. At the date of the last annual report of the company, last summer, it was estimated that 2,000,000 tons of ore, averaging 2.25% copper, had been substantially prepared for mining. This ore is in the part of the property adjacent to the Inspiration. In going toward the west the Keystone ore dips downward, wherefore the drifts of the 150-ft. level and then of the 250-ft. level pass out of the ore, into the oxidized capping.

A winze put down from the 250 ft. level to the west of the line beyond which the ore had dipped below that level rediscovered the ore and gave a more correct understanding of its position than was possessed when the earlier work was done on the 250-ft. level. Inasmuch as the sinking of winzes is relatively expensive, recent exploratory work has been confined to putting down churn-drill holes from the surface at the corners of 100-ft. blocks. These have been proving the western continuation of the orebody, but its amount and grade have not yet been estimated. Near the Live Oak line the fault, previously mentioned, may cut off some of the ore, but probably to no great extent. It is reasonably to be expected that about 1,500,000 tons of ore will be added to the Keystone reserves, making a total of about 3,500,000, which may be somewhat increased if the basis of estimating be reduced to 2% copper.

The Keystone mine is favorably situated for operation. The ore seems to grade off into the capping and a high percentage of extraction can perhaps advisably be effected by taking in a little of the capping at the expense of a slight diminishing of the average copper content of the product. The shaft is adequate in size for the extraction of 350,000 tons of ore per annum and from the present outlook the whole orebody can be commanded from the 350-ft. level. The Keystone mine has not sufficient ore to justify the erection of a modern mill, and its ore will probably be treated in a section of the Miami mill that may be added for this purpose. The Miami mill is in view from the Keystone shaft, about 8000 ft. distant and about 350 ft. lower, wherefore the ore may easily be delivered by aërial tramway, right-of-way for which over the Inspiration ground is possessed. The Keystone mine is under the same management as the Miami.

Live Oak

The Live Oak is the most recently developed of the mines of the Miami district, and the work in it up to date has been chiefly prospecting by drilling, although considerable underground work has also been done. A great deal more of the latter will be necessary in order to prepare the ore for mining, in which respect this property is more backward than either the Inspiration or Keystone. In the Live Oak area the orebody pitches rather sharply to the west and in the western part it lies at a depth of about 800 ft. According to the estimates of the Live Oak engineers they have developed 15,000,000 tons of ore averaging 2.1% copper.

General

So far as known, the Miami district has only one orebody, disregarding its local separation by faulting. This is situated in the flank of the mountain rising from the northern side of "Miami wash," which is a branch of Pinal Creek. This mountain is cut by transverse ravines and valleys, producing a rough and irregular topography. The Arizona Eastern Ry. Co. extended its line from Globe along Pinal Creek 10 miles to the town of Miami, above which the Miami mine is situated. The power plant of the Miami Copper Co. is at the foot of the mountain, at the terminus of the railway. The concentrates loading bins are near-by. Timber and supplies for the mine and mill are elevated to the mine by an inclined railway. The water supply for the mill is obtained from the Old Dominion mine at Globe, whence it is conveyed by pipe line, by gravity, to Burch. From Burch it is pumped to a tank above the mill, the distance being about four miles and the lift about 575 feet.

There does not seem to be any chance that the Miami-Inspiration-Keystone-Live Oak orebody will extend into any other property, except perhaps at the western end, and its existence adds no value to other properties to the north and south in the district beyond creating the hope that a similar orebody may be found. Prospecting up to the present time has given no support to such a hope. As to the western extension there is a suspicion that another fault has dislocated the orebody, and that beyond the Live Oak it is perhaps to be looked for to the north of what would otherwise be the line.

The Miami-Inspiration-Keystone-Live Oak orebody has now been rather closely delimited, but all of the companies will probably add somewhat to their reserves. In this respect the chances of the Miami Copper Co. are perhaps the best.

It is not to be doubted that a consolidation of the four adjoining mines would be of economic advantage. By agreement they have adopted the side-line principle, wherefore no litigation is to be expected, but under individual ownership there will be troublesome mining problems along joint boundaries. There would be economy in capital outlay by concentrating the milling in one plant and there would also be economy in operation. Finally, there would probably be economy in smelting the concentrates. At present the Miami product is shipped to distant Cananea. A better contract was made there than could be made at Globe, only 10 miles distant. It would seem, however, that the concentrates of the Miami district ought to be smelted at home.

Bat Guano

The finding of deposits of bat guano is by no means an uncommon thing, judging from the number of inquiries received by fertilizer makers, and by the JOURNAL. The prospector should understand that size is the first requisite in a deposit; that without the ability to ship large tonnages, say 100 tons or over, the fertilizer dealers do not wish to make contracts, nor will operating costs be low enough to make operations profitable. Next in importance is the question of moisture. A wet deposit is usually a valueless one: first, because on material of the value of guano, one cannot afford to pay handling and freight on the contained water; second, because much of the valuable constituents will probably have been leached out. However, if the deposit is large and labor cheap, it may still be advisable to have the material analyzed.

The valuable constituent in guano is ammonia, and no deposit need be considered which carries under 10 per cent. NH_3. Of subsidiary importance are phosphoric acid and potash. In case the ammonia is over 10 per cent. these compounds should also be analyzed for. In general, however, it may be stated that a material carrying 10 per cent. NH_3 will be worth about $20 per ton, f.o.b. buyers' works. This, however, is conservative, for owing to the fluctuation in the price of "ammoniates," it might be worth $25 per ton. As some bat guanos carry from 20 to 24 per cent. NH_3, the deposit may be worth much more than this.

With small deposits, or moist ones, the attempt should be made to dispose of the material to near-by truck farmers.

The Cape Copper Company declared a dividend, payable Jan. 1, 1912, amounting to $123,323 or 1s. 6d. per share on both its cumulative preference and its common stock.

Zinc Dust in 1911

By William J. Dwyer*

Notwithstanding the facts that prices rose to a high level and that a duty of 1⅜c. per lb. is now collected on importations of zinc dust, the consumption of this product in the United States in 1911 revealed a marked increase. The total consumption was probably somewhat in excess of 2500 tons.

The imports for the fiscal year totaled 2135 short tons valued at $204,836. The average import price per pound, weight and package ex-vessel, port of shipment, was $0.048. As the government did not separately classify the imports of zinc dust previous to Aug. 9, 1909, figures covering a complete previous fiscal year for comparison are not available. According to the "Statistik des Deutschen Reichs, Auswärtiger Händel," the shipments from Germany, the principal source of supply, in 1910 to the United States amounted to 1492 tons valued at $136,749.

Zinc dust was recovered in commercial quantities in the United States in 1911 by the United States Zinc Co., at Pueblo, Colo., and the Grasselli Chemical Co., at Clarksburg, W. Va. The production of the Pueblo smeltery early in the year reached 1000 lb. per day, but later on the output was considerably reduced. The production of the Grasselli company was probably much in excess of its competitor. The recovery of this product, coincident with the broadening markets, will probably receive more attention hereafter upon the part of zinc smelters in this country.

The production of zinc dust in Germany amounts to approximately 10,000 metric tons annually. Upper Silesia produces the bulk, but Westphalia and the Rheinland are also large producers. Belgium is the next important shipper to this market. In September about 17 tons arrived at New York from Austria. A large majority of the American imports came through the port of Copenhagen last year but this material was undoubtedly of Silesian origin. The exports from Germany to all parts during the first three-quarters of 1911 amounted to 2338 metric tons as against 2234 metric tons during the corresponding period of 1910.

Slightly more than 25% of the American import business is done through the port of New York. San Francisco is a large importer.

The principal use for zinc dust is now as a substitute for zinc shavings in cyaniding. Eastern importers, however, find their local markets with sherardizers, dyers and bleachers. The consumption of the product in sherardizing is increasing steadily.

---

*50 Pine St., New York.

Mining in Great Britain in 1911

By Edward Skewes*

The production of iron and copper increased; lead decreased and tin remained stationary in 1911. A new blende concentrating mill was started in Cumberland.

It seems almost an anomaly that nothing was able to injure the coal and iron businesses in any way during 1911. It is a truism that nothing is so shy as capital, yet these industries have marched by leaps and bounds. The Morocco affair, the Diaz resignation, the establishment of republics in Portugal and China, the Tripoli fiasco, and the misunderstandings of Germany and England, would each in ordinary times have been the cause of a setback, yet somehow last year, all combined were powerless. Apart from foreign affairs, there was a railway strike of such a magnitude as never before known. The congestion of traffic thereby caused would, it was stated, continue for two weeks, yet it has continued to the present. There are hundreds of loaded cars in and around the mining and manufacturing centers waiting transit, and strange to relate, some of the railway companies have new lines nearing completion which they are in no hurry to finish on account of not being able to handle the increased traffic. The railway clearing house is establishing "records" weekly, and yet there is an increased demand for cars.

Iron Ore

The iron ore industry had a good year, better than in 1910. During the summer months, business was not so brisk as at the beginning or the close of the year; prices fell, stocks accumulated, and buyers were careful (perhaps on account of the industrial unrest), only to purchase for their most pressing needs, but through December the demand was active, while the price advanced nearly 50c. per ton on Cleveland pig iron within two months. The prospects are now brighter than for many years past. Naval shipbuilding is on a record scale, some of the builders of armaments have four years of continuous work assured, and the construction of ordinary merchant vessels will continue at a good rate for the next two years.

In the Cleveland field, which employs about one-half of the 17,000 miners engaged in the iron mines of Great Britain which report monthly to the Board of Trade, the grade of the ore shows a gradual declining with development, and is now only from 22 to 23% instead of from 26 to 27%. To counterbalance this however, the efficiency of the mines has been proportionately increased by the introduction of electric drills, hand drills and better supervision. December was the boom month of the year. The shipments from Cleveland established a record, amounting to 5700 tons each working day, or double the quantity shipped in December, 1910. The prices for Cleveland pig were also high, about $12.50 per ton; Cumberland and Scottish pig have advanced still more and February delivery prices are on the upgrade. Makers at present are unwilling to enter into any new contracts.

Cumberland and Lancashire have increased the output, but not to any great extent, and the same is true of the Scottish mines. The output for 1910 was 15,226,000 tons; the estimated quantity for 1911 a little over 15,500,000 tons.

Copper Mining

Copper mining was quietly progressive. The principal mines are in North Wales. The precipitate from Anglesey sold for over $150 per ton for a little less than 200 tons. The copper from Cornwall and Devonshire, a byproduct, was almost negligible. Two new mines began operations last year; one at Alderley Edge, Cheshire, and the other in the North Riding of Yorkshire. The output for 1911 was 46,500 tons.

Fluorspar mining was confined principally to South Durham and Derbyshire, and the probability is, that there was a serious decrease from the 61,621 tons of 1910, as some of the mines were idle, as the result orders from the United States were not forthcoming.

The year 1911 saw the successful working of the most uptodate mill for the concentration of blende in England. It has a capacity of 200 tons per 12 hours, and was designated and constructed by German contractors for a mine in Cumberland. The blende mines are situated in the north of England and north Wales. Derby yields about 600 tons per year. The output was stationary as the increase in Cumberland was counterbalanced by the decreases elsewhere.

For the first time in the history of the china-clay industry has the output reached 800,000 tons, an increase of nearly 25,000 tons over 1910, and this output would have been greater if sailing vessels had not been prevented by storms from sailing during the last quarter. Prices have also ruled higher, and the pay of the laborers increased. China stone output remains stationary at about the 70,000-ton mark, as the Norwegian feldspar is a keen competitor and much cheaper.

The price of wolfram ore at the close of the year was about $500 per ton, a decrease of $50 from the beginning of 1911. The output was 300 tons, estimated. There were attempts made to float companies to mine for uranium and radium, yet the only source of supply in England was from the Saint Ives mines, Cornwall.

The Royal Mint after a series of extended experiments rejected coal and coke for the furnaces and is now using gas with a special burner. The testing plant of the mines department, Royal School of Science, was completed, and it is now one of the most complete in existence. Tests can be made on all kinds of ores. The rooms in which the crushers, stamps, pans, are fixed are all well padded, to deaden the noises.

Lead Production Decreased

The output of lead ore in 1910 was 28,534 tons. The output for 1911 did not exceed 25,000 tons. The lead mines are scattered. Derbyshire heads the list of producers. Mill Close mine, Darley Dale, is worked on a larger scale, and employs more labor than any other lead mine in England. All the machinery is uptodate. The Weardale Lead, Rookhope, Durham, can be classed among the largest producers, and owes its renewed prosperity to lateral oreshoots. The Greenside mine, Ullswater, Westmoreland, maintains its output, and is continually adopting improvements underground and at the surface, to meet the changing character of the ore. The Thornthwaite mine, Keswick, is making some needed changes to increase the output and the method of impounding sand and slime is really good and on a large scale. The Flintshire mines showed a decrease. The outlook is dark for the Shropshire mines, and not optimistic for Cumberland or Westmoreland.

The most important of all the lead-mine developments was the completion of the Milwr adit in Flintshire, which is over two miles in length and drains the water for a depth of 900 ft., although, the idle mines on its course are only 600 ft. deep. This should give an impetus to lead mining. One of the most painful events in the history of English lead mining was the closing of the Great Laxey, Isle of Man. Its overshot water wheel was a great attraction to the thousands of yearly tourists.

---

*Mining engineer, Ivy House, Lindley, Huddersfield, Eng.

BLACK TIN

The principal events of the year have been the completion of Williams' shaft, Dolcoath, at a cost of considerably over $500,000; the installation of an uptodate tube mill at East Pool; the appointment of an Australian engineer to the management of Carn Brea, and the subsequent resignation of the chairman, directors and secretary: the ever-increasing use of electricity supplied to the mines by independent power companies; the extension of the magnetic separator and consequent higher price for the concentrates; the Royal Mines Commission to investigate all the principal mines; the lowering of the death rate due to miners' phthisis; the successful working of the largest suction dredge; not to mention the bitter feelings of the miners against some members of the Metal Exchange, who, it was said, were about to penalize unduly such impurities as wolfram, antimony and arsenic.

EFFECT OF HIGH PRICE OF TIN

The year 1911 was good, the price, which averaged in 1910, $515, advanced to $563.75, taking the ticketing sales as a basis. The mines that paid dividends increased from three to seven and the amount of dividends proportionately. Dolcoath paid 12½ instead of 6¼% and South Crofty paid 25c. quarterly. The quantity of black tin sold in 1910 was 7562 tons; last year the output was practically stationary, the mines have produced less, but the quarries and surface works more.

Three suction and one bucket dredge were at work, but the quantity of black tin recovered did not exceed 70 tons, on account of the difficulties of adopting the dredges to local circumstances. The future of the dredging for tin is encouraging, and other dredges will be built to work Restrouget and other creeks during the coming year.

The Mining Industry in Germany

By O. H. Hahn*

The lower Rheinland and Westphalia district is the largest iron producer. Upper Silesia furnishes 82% of the zinc. Tin comes from two places in Saxony. Copper and lead mining has declined in recent years.

Conforming to geographical position, the German iron industry is generally dealt with under the following sections: (1) The lower Rhein country and Westphalia; (2) Siegerland and Nassau; (3) The country about the Saar; (4) Luxemburg and Lorraine; (5) Upper Silesia; (6) Scattered districts.

Lower Rheinland and Westphalia enjoy the most favorable situation as regards fuel and transportation; for an ore supply they have to draw on outside districts, as the black-band ore found in their coal mines is insufficient in quantity to support a large industry. It is stated that the ore charge of the iron furnaces in this district consists of 52% of foreign and 48% of German ore. The foreign ore comes, for the most part, from Spain, *via* Antwerp and the river Rhein; the next in importance from Sweden by way of the port of Stettin and the state railways.

Siegerland and Nassau produce excellent manganiferous spathic-iron and hematite ores, also manganiferous limonites, part of which are smelted at home; the larger portion is, however, sold to the preceding district and to upper Silesia, where it is used for the manufacture of spiegel. The Saar district produces limonite, and also *minette*, a peculiar brown-iron ore predominating in Luxemburg-Lorraine and parts of France. Luxemburg and Lorraine are the countries *par excellence* for *minette*, which is found there in such abundance that it not only supplies the home iron works, but also furnishes the largest percentage of the German ore in Rheinland The *minette* is not rich in iron, the average probably not exceeding 30% Fe. The Saar and the Luxemburg-Lorraine districts taken together nearly equal Rheinland Westphalia in production of pig iron according to the statistics published by the Verein deutscher Eisen-und Stahl-Industrieller.

UPPER SILESIA'S IRON TRADE DECLINING

Upper Silesia is dwindling into insignificance in the production of pig iron as compared with the preceding districts and its output of iron ore has been falling off from year to year. Neither its iron ore nor its coke is of desirable quality and its industrial enterprises are struggling hard against what they believe to be unjust freight rates on the state railroads. The scattered districts comprising Bavaria, Saxony, Würtemberg, Thuringia and the seaboard towns rank about the same in percentage of production with Silesia.

Bavaria discovered not long ago that it possesses in its confines quite an extensive bed of limonite ore in the Franconian Alb. Its average assay is 38.5% Fe with small quantities of P, S, Zn. As and Cu, but unfortunately 22%, SiO_2. Germany's total production of pig iron amounts to nearly 15,000,000 tons, of which Rheinland-Westphalia furnishes in round numbers about 43%, Siegerland and Nassau, 5% Saar and Luxemburg-Lorraine 38.6% Silesia 6.5%, and the scattered districts, 6.9 per cent.

The improvements made from year to year in the iron industry consist chiefly in the utilization of blast furnace gases for power purposes and the heating of Martin and other furnaces, also in utilizing blast-furnace cinder for the manufacture of cement and building stone, briquetting of ore and metallic chips, sintering ore, etc.

To quiet the German consumers of tin-plate, who have been clamoring for the abolition of the duty on their material on account of the inability of the home industry to fill their orders there are two more tin-plate mills going to be erected shortly, viz.: one in Silesia and another of 20,000 tons capacity at Wissen, Rheinland.

The ores of manganese needed for the production of spiegel and ferromanganese are mostly imported from Russia, Brazil, India and Greece. The German mines of manganese are scattered all over the country and thir output which is small is mostly sold to chemical factories in America. The ore imported amounts to 500,000 tons while only 5000 are exported.

MANSFELD CO. BIGGEST COPPER PRODUCER

The largest producer of copper in Germany, the Mansfelder Kupferschieferbauende Gewerkschaft, has just shut down two of its hoisting shafts near Eisleben and is going to dismantle them for the reason that this part of its concession is exhausted. The company is, however, keeping up vigorous prospecting on its ground and is taking up extensions on adjacent land. In November, 1911, while boring a hole to find the copper schist, it struck a big deposit of rock salt which overlies the potash salts. The same company, which owns coal mines in Langendreer, Westphalia, and is making its own coke there, purchased more coal lands near Hamm and started sinking two shafts on its new acquisition. Out of a total of 37,000 tons of copper which Germany produces the Mansfeld company makes 20,000 regularly.

---

*Metallurgist, Schillerstrasse, 6, Jena, Germany.

The center of gravity for zinc is upper Silesia which produces about 82% of all the zinc ores of Germany. Notwithstanding the excessive freight rates it is also getting 14% of the Australian ores imported. In the way of improvements in the reduction of ores it does not lag behind Rheinland. In the course of the last year reduction of zinc ore in the Imbert-Fitzgerald electric furnace has been carried on experimentally at Hohenlohehütte. The Savelsberg shaft-furnace is also reported to have given good results and it is now being tried on a larger scale. There is nothing extraordinary to be recorded on lead and the reduction of its ores.

Tin ore is mined at two places in Saxony. At Altenberg the loose rock from a caved-in mine assaying 1/3% in tin is hoisted through a shaft in solid rock and concentrated to 60% tin in a dressing works with partially antique and partially modern machinery operated by waterpower. The *schlichs* are calcined to get rid of arsenic, which is saved in flues, and leached with hydrochloric acid for bismuth. The schlichs are then sweetened by washing, dried and smelted in a primitive little blast furnace with charcoal and old slag. The resulting slag is sold to a metallurgical establishment for the tungsten and molybdenum it contains. Everything is done at as cheap a scale as possible and all the incidental products are turned into money to make a little profit. The actual output of tin is not made public. The Goldschmidt works at Essen is treating Bolivian ores entirely.

POTASH SITUATION

There are now 77 companies in the potash syndicate including Aschersleben and Sollstedt on whose account the obnoxious potash law was enacted by the Reichstag. In spite of this law new potash mines are springing up every day, only they will get into trouble when they apply for a license to put up a chloride of potassium factory. In November of last year the erection of five such factories was forbidden by the licensing commissioners of the town of Merseburg because the projectors proposed to run their waste liquors into the river Saale and would thus pollute its water. The city of Magdeburg which gets its drinking water from the river Elbe has several suits going on now against chloride of potassium factories for pollution of its water. Indignation meetings are held by farmers, manufacturers and others to protest against the potash men running their waste liquors into the rivers. So, they will have to put up evaporating plants, but what is to be done with the residues? That is another troublesome problem.

Mining in Jalisco in 1911

By Austin C. Brady*

Developments of hydro-electric power will soon make possible the profitable operation of mines from which only smelting ore was formerly shipped. Mills are planned for concentrating the low-grade ores.

The state of Jalisco was particularly free from disturbances during the period of the Madero revolution. Shortly before the signing of peace terms some armed bands made their appearance, but none of the mining camps were molested. No serious labor troubles occurred after the revolution. Some enterprises were affected in a financial way as a result of the disturbed conditions of the year in the republic.

HYDRO-ELECTRIC POWER FROM SANTIAGO RIVER

The Chapala Hydro-electric & Irrigation Co. completed its Puente Grande power plant, which will furnish power to the Etzatlan and Hostotipaquillo mining districts, and will supply any other transmission lines that may be built. It is on the Santiago River, 15 miles from Guadalajara, and represents a cost of over 3,000,000 pesos. The present capacity is 12,000 hp. The Etzatlan-Hostotipaquillo transmission line was ready for service early in the year, and since March the company supplied power from its Juanacatlan plant. The insulating system proved inadequate during the last rainy season, and will be changed.

The Amparo Mining Co., operating in the Etzatlan district, continued to pay dividends of 3% quarterly on its capital of $2,000,00. The 1911 showing probably was not so good as that of 1910, due to the power failures of the Chapala company in the rainy season. Recently two additional tube mills were placed in commission, and the company is now handling more than 1000 tons additional monthly. Development on the lower levels of the mine were attended by satisfactory results.

HOSTOTIPAQUILLO DISTRICT

Early in the year the famous old Mololoa mines in the Hostotipaquillo district were purchased from W. M. Mathews by the Makeever syndicate of New York, operating the El Favor and El Tajo properties in this state. After the purchase, development was pushed, and a big tonnage of high-grade ore shipped to the smeltery. At present 300 pack animals are in service carrying ore from Mololoa to Magdalena, the Southern Pacific shipping station. The treatment of Mololoa ore at the El Favor plant was commenced, and a high extraction obtained by direct cyaniding.

During the first half of the year much high-grade ore was shipped from the Casados mine of the Consolidated Mining Co., in the Hostotipaquillo district. The property is now under option, and attention is being concentrated on development. The year's development was extensive, and a big tonnage of milling ore was proved. It is probable that the mine will be purchased early this year.

The El Favor Mining Co. suffered from power interruptions during the rainy season. The milling of El Favor ores was suspended pending the development of sulphides, which are free from manganese, and in the meantime the plant will run on ore from Mololoa. Rich orebodies were opened in stoping on three of the upper levels, and shipments to the smeltery are in progress.

The Cinco company, controlled by the Marcus Daly estate, and owning the old Cinco Minas property in the Hostotipaquillo district, operated only a part of the year. Present development is being done with the object of proving the orebodies at depth, and it is probable that plans for a mill will be considered early in 1912. Large blocks of milling ore have been opened since the Daly estate secured control. The purchase of the mines for 500,000 pesos was made in January, 1910.

A lease on the reduction plant built by the Virginia & Mexico Mine & Smelter Corporation in the Hostotipaquillo district was arranged by the Espada Mines Co. early in 1911, and an aerial tramway to carry Espada ores to the mill was constructed. Milling will be commenced shortly. Power will be furnished by the Chapala company over a branch transmission line from the El Favor transformer station.

Disturbed conditions interferred with the plans of the Amajac Mines Co., and operations were suspended for several months. Mine development is now being resumed, and the uncompleted work of remodeling the old Amajac reduction works in the Hostotipaquillo district will be taken up later. The Mina Grande Co., controlled by French interests, carried on development work during the year, and reopened some of the old workings of the Mina Grande at depth. During the current year the question of reduction facilities will be taken up. The La Dicha Mining Co., another Hostotipaquillo-district company did development work during the greater part of the year, and is now planning to build a mill.

---

*Guadalajara, Jalisco, Mex.

Operations Near Ameca

Financial plans of the Magistral-Ameca Copper Co., owning the Magistral mine and concentrating plant in the Ameca district, failed as a result of the political upheaval, and for several months work was at a standstill. Recently the sinking of the shaft was resumed. The company expects to adjust its affairs for extensive operations in 1912. The bond, held by E. A. Montgomery, of Los Angeles, Calif., on the Zapote mines in the Ameca district, was extended during the year, and a shaft that is expected to prove the copper deposits of the Ameca district at depth is being sunk. The bond price is 100,000 pesos. Late in the year the Almoloya Mining Co., of Mexico City, bought the old Cerrito mine in the Ameca district for 50,000 pesos, and new development at this property is now in progress.

The Regina Mining Co., operating at San Martin Hidalgo, in the Ameca district, accomplished much successful development during the year, and is now ready for a concentrating plant. The Regina is the successor of the Philadelphia Copper & Gold Co., which commenced operations several years ago, and a big tonnage of copper ore awaits reduction facilities.

During 1911 the Tajo Mining Co., operating in the San Sebastian district, increased the capacity of its reduction plant, and made a big cut in the cost of delivering ore by a system of chutes and trams. Regular shipments of bullion were made.

Other Districts of Jalisco

The Mexicana Mining Co., a subsidiary of the Keystone Mining Co., of Shamokin, Penn., resumed operations at the Keystone properties in the Tapalpa district. Mine development was started in August, and later concentrating was commenced. The San Miguel Gold Mining Co., of Indianapolis, steadily developing properties near Ejutla, and imported machinery for a concentrating and amalgamating plant. The Lupita Mines Co., in the Mascota district, the Carrizo Cop[illegible]r Co., in the Ayutla district, and the Navidad Reduction & Mines Co., in the San Sebastian district, operated on a limited scale.

At the famous old Bolaños mines, in the Bolaños district the Mexican Mines Co. did some work in the upper levels. After the close of the rainy season the company took up vigorously the work of building a wagon road from the camp to Colotlan, at which point it will connect with a stage road to Zacatecas. With the completion of this road the company will be able to take in the heavy pumping machinery necessary for the unwatering of the lower workings of the Bolaños mines.

The Cyanide Industry

By William J. Dwyer*

A dull and monotonous year characterized the cyanide industry in 1911, but so far as ascertainable the consumption of both the sodium and potassium salt are about equal to that of the previous year. The imports for the fiscal year were about 48½ tons less than those of the corresponding year. A better inquiry was noted in the fall. While cyanides are manufactured in this country by several firms the foreign markets are still the chief source of supply and the imports are generally regarded as a safe criterion of market conditions. The average value of the imports, weights and package, ex-vessel, port of shipment, in 1911, was 14c. per lb.; in 1910, 13½c. per lb.; in 1909, 14c. per lb. The duty is 12½%. The imports of potassium cyanide in short tons since 1903, the earliest figures obtainable, to date are shown in an accompanying table.

POTASSIUM CYANIDE IMPORTS

Year	Tons
1903	1,509.7
1904	756.9
1905	812.1
1906	1,054.3
1907	1,535.0
1908	1,664.1
1909	1,376.4
1910	1,211.3
1911	1.163.6

Statistics covering the imports of sodium cyanide are not tabulated as most of this salt is sold as high-percentage potassium cyanide. Of the 1911 imports of potassium cyanide 1087.9 short tons valued at $304,359, or about 93% of the total imports, were brought in through the port of New York. The trade is in the hands of two firms representing German and English interests. One of the importers is likewise the largest domestic producer. Prices of both sodium and potassium salts remained unchanged throughout the year at 18c. per lb. in carload lots.

Hans Foersterling of the Roessler & Hasslacher Chemical Co., the largest domestic producers of cyanides, was granted patent No. 999,215 on Aug. 1, covering a composition of matter which will easily generate halogen cyanides in connection with an oxidizing agent. The process calls for the melting of molecular proportions of sodium cyanide and sodium bromide, which are allowed to solidify. This double salt is used instead of the mixture heretofore used consisting of sulphuric acid, sodium bromide, sodium bromate and cyanides. An oxidizing agent of a 25% hydrogen-peroxide acid solution is added. Bromocyanide is rapidly formed and the bromine is taken up by the hydrocyanic acid. It is proposed to furnish the mines with a ready-made, correctly proportioned mixture of alkali halogen with cyanide, "all that is necessary being to dissolve a certain amount of double salt and add an oxidizing agent." The inventor claims that the largest part of the alkali halogen is not lost in general mill work and it is only necessary to add so much alkali halogen to the cyanide as has been actually lost.

Cyanamide

Calcium cyanide was produced during the year by the American Cyanamide Co. at its plant in Niagara Falls, Ont., just across the Canadian border. The use of the product, almost exclusively for fertilizer purposes revealed a marked increase. The consumption of calcium cyanamide in the United States up to the end of the fiscal year was 5617 short tons valued at $295,545 comparing with 764 tons valued at $40,091 consumed from Aug. 6, 1909 to June 30, 1910. The perfecting of the Clancy process of treating gold ores promises a new outlet for the product.

Molybdenum in 1911

Special Correspondence

An active demand for molybdenum from England in 1911, stimulated investigations, but the output as far as the North American sources were concerned was very small, the most important production coming from one of the eastern states. A deposit of molybdenite in eastern Chihuahua, Mexico, was unworked because of the political disturbances. Several tons of high-grade concentrates were shipped from there in 1910. The Canadian deposits in Quebec and Ontario were exploited in a small way but with no resulting output of importance.

Various scattered deposits in the western part of the United States yielded small tonnages. A discovery of molybdenum oxide in southwestern Colorado was reported but not exploited. Successful experiments with the concentration of molybdenum ore were made in Denver. An important use for molybdenum is in connection with the making of armor plate.

---

*50 Pine St., New York.

Igneous Concentration of Zinc Ore

By F. L. Clerc*

Suggestions respecting the use of the Wetherill process, simply reducing and burning the zinc, as a method of concentrating zinc ore; the oxide product to go to spelter furnaces.

In presenting the subject of igneous, or pyrometallurgical, concentration of zinc in lean ores, for the production of a raw material for spelter making, I am not suggesting anything that is new or untried. This method of concentration has long been practiced, both incidentally, that is, in connection with processes carried on for other products, such as zinc pigment direct from the ore, and spiegeleisen from the franklinite residuums, although in these cases, the spelter is really a byproduct; and intentionally, when under peculiar conditions plants designed to produce zinc pigments, have been run as simple concentrators, and their entire output has been made into spelter. Thousands of tons of zinc ore have been treated in this way.

Fire concentration has also been advocated from theoretical grounds. It is urged that since it costs three times as much to put ore through a spelter furnace as it does to put it through an oxide furnace, there will be a saving equal to the cost of putting one ton through the spelter furnace, if three tons can be put into one, by a preliminary concentration in the oxide furnace. My reasons for returning to this old subject may be classed under two headings, economic and technical.

Economic Reasons for Igneous Concentration

On the economic side are to be considered the large deposits of lean ores, known to exist, which cannot be profitably treated by any other known mechanical or chemical method, and the inaccessibility of other ores, which are fairly susceptible to mechanical concentration, but yet cannot be brought to the richness which will stand transportation to market. The distance they can be transported depends largely on their zinc contents. The last economic condition I shall mention is the wonderful development of the smelting and mining industries, and the large amount of capital profitably engaged in them. One result of this condition is that projects, which were once thought chimerical, because of the expense of installation, are now seen to be justifiable, because they can be shown to be profitable.

Fire Concentration in Special Plants Untried

It is, however, the technical side of the question which I wish to emphasize. I know of no instance where fire concentration has been tested in a plant designed especially for that purpose. I think this test should be made, and that conditions are favorable for making it at the present time. The recorded experience, bearing on this subject, is so extensive, that I cannot do more than indicate the lines on which it has accumulated.

It is for the reason that I am convinced of the economy of fire concentration, in certain cases, that I wish to record this strong disclaimer: I do not believe, that, in any form, it is applicable to all ores, or that it will ever displace either mechanical or chemical concentration, where they are effective.

Igneous concentration is only practicable where a considerable tonnage, for a term of years, is assured. I have elsewhere called attention to the apparent paradox, that the richest concentrates sold in the open market come from ores of the Joplin district, which, as mined, are probably the leanest of any ores profitably worked for zinc, anywhere in the world.[1] This shows what can be done by mechanical concentration under favorable circumstances. Machinery can be moved, furnaces and buildings cannot.

Indicated Lines of Development

In looking into the subject of igneous concentration, two lines of development may be profitably studied, viz.: the manufacture of pigments[2], and the removal of valuable fumes from furnace gases[3], if concentration is kept in view as the definite object. Current practice in the manufacture of sublimed pigments may be represented by the Wetherill oxide furnace[4], the Lewis-Bartlett sublimed white-lead process[5], and the F. L. Bartlett zinc-lead process[6].

I will briefly indicate some modifications to adapt them to igneous concentration. The Wetherill oxide furnace is too well known to require description. For igneous concentration, I think that each pair of connected furnaces should be connected with the common overhead flue by its own iron uptake pipe. This uptake should have a sliding damper by which the two furnaces can be isolated from the others during the operations of drawing and charging with the object of excluding, as much as possible, an excess of air. This construction is found in some modern works, for the above and other reasons.

I think the furnaces could be made wider, and the thickness of the charge greater, and that the furnace can be run hotter, when the color of the concentrate is not important. From experience gained with the other processes mentioned I think it is advisable to admit a current of hot air above the grate. This additional air will be drawn from outside, will pass over the arch covering the grate, thus cooling it to some extent and prolonging its life, and under a higher arch sprung over it.

The grate bars must be protected from excessive heat to prolong their life. Since water is undesirable in the ash pit, this result may be effected by water-cooled grate bearers. Mechanical devices for bringing the charge to the furnace, and for carrying away the cinders, readily suggest themselves.

But I can think of no mechanical device, for spreading the charge on the grate, which will not force too much of the smaller pieces through the openings into the ash pit.

The Lewis-Bartlett Process

The history of the Lewis-Bartlett process is interesting. It was the natural outcome of treating oxidized zinc ores containing lead at Birmingham, Blair County, Penn., where there was a small Wetherill oxide works. The ores came from Sinking Valley, nearby. The sublimed pigment was given a thorough test, and found to be satisfactory. Further tests were made in the vicinity of Philadelphia. When it was applied at the Lone Elm works, at Joplin, Mo., the results were disappointing. As Mr. Lewis expressed it to me, "they had all of the sulphur to handle, and only a part of the lead and zinc to take care of it." The product was "as black as your hat." But success was achieved by making a two-stage operation out of a direct operation. The blue fume was revolatilized in a modified form of the single-tuyere slag-eye, long used at Granby, which was originally built of stone on three sides, with a sheet-iron breast, and was lined with brick. The modifications, and the latest form, are fully shown in the articles referred to.

But the blue fume, in addition to being black, was so light and powdery that it could hardly be shoveled. It was accidently discovered that it would burn, if ignited. In a layer a few inches thick it would continue to burn without apparent flame. The fire spread slowly but indefinitely, and left behind a bed of ash-like material, which was heavy, granular, and easily handled. This burnt fume was treated, with the gray slag from the American hearth treating unroasted galena, in the modified slag-eye, and a notable amount of oxidized lead ore was often added to the charge. An innovation in the bag rooms was the substitution of woolen bags for cotton. Another was, the suspension of the bags above nipples in the top of hopper-shaped bins, into which the fume was shaken down. An important improvement in the slag furnace was the use of water-backs, and the introduction of a hot blast at the top of the furnace, in addition to the usual blast. In the earlier forms used, the walls and lining of the shaft did not break joint with the four corner pillars, but were built in between them, so that with the water-backs in place, they could be renewed without disturbing the supporting pillars. In recent years, more secrecy has been maintained about the operation of these works, and a large proportion of their output has been paint.

---

*Metallurgist, Boulder, Colo.

[1] *Trans.* A. I. M. E., Vol. XXXVIII, p. 320.

[2] "Lead and Zinc Pigments," C. D. Holley.

[3] *Trans.* A. I. M. E., Vol. XLI, p. 631.

[4] "Metallurgy of Zinc and Cadmium," Ingalls; p. 159.

[5] Eng. and Min. Journ., July 4, 1885.

[6] "The Mineral Industry," Vol. V. 1896, p. 619.

It is from the apparatus employed in these works, rather than from the process, that anything bearing on igneous concentration can be borrowed. It is quite remarkable that the diminutive blast furnace produced, in addition to its sublimed product, a considerable amount of hard lead, and a distinct matte, which could be separated in the slag pots.

F. L. Bartlett Process

The F. L. Bartlett process is described by the inventor in "The Minera Industry," Vol. V, page 619. It is remarkable, I think, for its flexibility; the ease with which it can be adapted to changed conditions; the capacity of the furnaces in proportion to their cubic contents, and for the short distances within which the reactions take place. It is essentially a three-stage operation.

The sublimed product is heated to expel entangled gases and slightly held volatile products. In this connection I may record an experience in the Lehigh zinc works, at Bethlehem, to enforce the importance of strongly heating any sublimed product, which has to be subjected to a second melting, or to be shipped.

In the early days various means were tried for compressing the light bagroom oxide so that it could be packed, 400 lb. to the cask. Among the devices used was a pair of heavy edge rollers, built up like millstones, which revolved in a pan like a pair of chilean rolls; they were soon discarded. The squeezer afterward employed passed three sacks containing bulky oxide, resting on a roller-carried table (whose motion could be reversed), backward and forward under a revolving wooden drum. By suitable levers, this table was pressed more and more strongly against the drum, until as much as possible of the gas was forced out through the mesh of the bags. The flattened bags were so hard that thumb pressure would make a scarcely visible impression.

Prior to 1878 the oxide treated in the spelter works came from the flues and floor sweepings, and was heavy and granular. When it was decided to smelt the bagroom product, a problem was faced. From laboratory experiments it appeared that it was only necessary to heat the oxide until it became bright yellow (showing a dull red in the dark). It was, therefore, shoveled into the lower hearth of a short two-story reverberatory kiln, used for roasting small sizes of calamine. The immediate effect was striking, if not alarming. The pile shrank visibly to a fraction of its original bulk, and the men hurried to get it out, lest it should all disappear. Almost as fast as it could be pushed forward to the bridge wall and pulled out at the front door it was discharged in a satisfactory condition for mixing with coal and charging into the spelter furnaces.

This practice was regularly followed thereafter. Twenty years later I was told that it was in use at the small works which ran for a few years at Friedensville, having been introduced by a workman from Bethlehem, only four miles away. It was supposed to have always been practiced. Nevertheless it had to be learned in the school of experience many years later at the Globe works, Denver.

Device for Heating Sublimed Dust

Some form of heating sublimed concentrates has been found essential for their subsequent treatment. The following device is suggested. A conveyor belt, made up of short lengths of sheet iron linked together by steel belt hooks with the sides turned up to form a rim, can be continuously fed with a shallow layer of the sublimed concentrate, and dragged through a heated chamber over hexagonal or pentagonal drums outside the chambers. A little of the fume or clay without grit under the belt will prevent excessive wear and friction. Neither the length of the furnace nor the time of exposure required is considerable.

I have avoided the subject of the treatment of mixed sulphides for the reason that each case requires a special treatment. A concise and comprehensive review of this subject can be found in a paper by W. R. Ingalls, presented to the Canadian Mining Institute, in March, 1911, under the title of "The Problem of Mixed Sulphide Ores."

I have only this to say about pyritic smelting[8]: much may be expected from it if concentration at the top of the furnace becomes the principal object in running it. From furnaces which may be adapted to produce an igneous concentrate, I can now turn to the apparatus for collecting it. Fortunately, there is abundant testimony to the efficiency of woven fabrics in straining out solids from gases, and much published experience as to the best materials for various uses, the temperature the bags can stand, their length of service and the care and treatment they require.

I shall confine my suggestions to the functions and construction of the settling chamber. This organ was once thought necessary in zinc-oxide works, but it has been almost suppressed in the more recent works. I think it can profitably be revived in such a form as to hasten the cooling of gases, and relieve them of all the fume they can be made to drop. If a considerable deposit can be collected here, the life of the bags will be prolonged, and a moderate straining surface will suffice for a considerable daily output.

Use of the Settling Chamber

The function of the settling chamber is to collect as much of the sublimed zinc oxide as is practicable, and in this way diminish the extent of straining surface required in the bagroom, and avoid the more expensive handling of oxide collected in bags. With this object clearly in mind, the conditions which affect the rapid settling of the oxide can be profitably studied. And the conditions which are found to be favorable should control the design of the settling chamber.

The principal conditions which are known to favor the deposition of solid particles, carried along by moving gases, are as follows: (1) The cooler the gases are the more rapidly will the particles settle. The gases should be cooled as promptly as is practicable. (2) The walls of the chamber should be cooler than the gases, for solid particles, which have the property of coherence, in consequence of which larger aggregations called flakes are formed, will join when they are brought near together and their relative motion diminished by the obstruction a wall offers to this motion. There is a tendency in solid particles to stick to a cold wall, while they are repelled from a hot one. (3) Even the finest particles suspended in gases, which show little coherence or tendency to form flakes, can be deposited upon a surface against which the gas rubs, and a cold wall is more favorable than one which repels. (4) Owing to the small weight of the individual particles, the vertical component of their motion due to gravity, which pulls them down, is small, compared with the motion imparted to them by other forces also acting on the moving gases. So that in spite of their greater density, the deviation of their trajectory from the mean path of the lighter

---

[7] Eng. and Min. Journ., July 29, 1911.

[8] "Principles of Copper Smelting," Peters, pp. 213 et seq. "Practice of Copper Smelting," Peters, pp. 230 et seq.

gases, in a small period of time, is small. Conversely, the time required to fall through a certain distance is both apparently and actually increased. In a vacuum the smallest particle would fall in the same time as the largest.

But the viscosity of the gas, acting to resist any displacement of its particles, added to its inertia which also resists displacement, increases the work to be done by gravity, and therefore increases the time required to move a given weight vertically through a given distance. The surface friction of the small particles, which is generally assumed to account for the slow fall of such particles through still or moving gas, appears to be rather the intermediary by which viscosity and inertia can interact with gravity to produce equilibrium of motion.

Long Flues Promote Settling

It is better to say that the less the deviation of the solid particles from the mean path of the gases, the longer must be the course of the gases in order that the particles may settle through the required distance. This way of looking at the problem brings out the direct connection which exists between the velocity of the fume-carrying gases and the distance they must travel to allow the fume to settle out of them. But a limit is soon reached in the practical length of settling flues. It is imposed by the cost of construction and maintenance, and enforced by the working expense involved in gathering up the fume, spread over a great distance. A good idea of the effect of relatively large surface exposed by the finest solid particles, may be had when one recalls that the mass of a sphere of any substance is the product of three factors, namely, the surface area, the mass of the unit volume of the substance, and one-third of the radius of the sphere.

The weight of the particle is due to the force of gravity pulling the particles down, and opposition to this motion is developed by surface friction, which is some function of surface area.

The ratio of these opposing forces is, therefore, the weight of the particle divided by some function of its surface area; this is equal to the weight of a unit of the substance which is a constant multiplied by one-third of the radius of the sphere.

$$\frac{W}{f(S)} = U \times \tfrac{1}{3} R$$

W = weight of particle, S = surface area of particle, U = unit weight of substance, R = radius of spherical particle. With fume particles, R is small.

The flake-forming tendency seems to have been generally overlooked, in the ordinary problem of recovery of fume from furnace gases, and such a tendency might well be doubted, unless attention is called to the great disparity between the size of the smallest observed fume particle and the size of the molecules of which it is composed. This disparity stands for a great step forward in the aggregation of the solid particles.

It is when even lean zinc ores are treated purposely to volatilize and oxidize the zinc, that the result to this tendency is readily to be seen. I have often seen in the flues close to the furnace, floating flakes of zinc oxide as large as any snowflakes I have even seen. It will be profitable to study this analogy to see how far it will hold. The density of the snow flake is several times less than the density of the flake of metallic fume, just as the density of the ice molecule is less than that of the fume molecule. If we watch a snowfall, accompanied by a gale of wind, the depth of snow on the ground measures the amount deposited. The deepest drifts are formed by the action of strong winds. Here instead of a uniform deposit we see the accumulations in sheltered localities where the action of the air is relatively less. We can watch the effects of local eddies and of upward air currents, and draw from them useful lessons in the settling of solid particles.

Eddies Must Be Avoided in Flues

A few of the most obvious deductions are as follows: The tendency of the particles to fall being so slight, they should not be forced by eddies or upward gas currents to reverse the direction of this motion. The gases on their way from the furnace to the settling chamber may well be carried upward to improve the furnace draft. Thus, they will enter the chamber near its top, from this point their course should be horizontal or normally downward, and their exit should be near the bottom of the chamber. To provide a course of sufficient length, the flues should be zigzagged in a horizontal plane. Upturns should be avoided. Horizontal eddies which do not affect the draft, may be utilized to produce localities of comparatively still gas, where the fume will accumulate. The current through the chamber is produced by the pressure and exhaust fans and by the contraction of the gases in cooling. The actual velocity of translation will vary somewhat through different sections even if the flue has a uniform section throughout.

The kinetic energy in the gas issuing from the furnace is usefully employed in the uptake to increase the furnace draft, and also to carry the fume along to the place where it is desired to deposit it. That is, to a place where it will not obstruct the draft, and from which it can be economically removed. A manometer connected with this uptake would probably show less than atmospheric pressure.

But some idea of its maximum energy may be had. If this uptake were suddenly closed, and the furnace and connections were tight, and could stand the pressure, the pressure in the uptake would rise in consequence of arrested motion until it reached the point where the motion of the gas would be reversed, and it would be forced backward through the furnace and against the friction through the charge, and overcome the air pressure from the blowers.

Of this kinetic energy the blowers contribute that portion which corresponds to the velocity of influx in hydraulics. The heat generated, that is, so much of it as does mechanical work in expanding the gases, contributes another portion. Chemical forces which release gases, supply a third portion. With weights and composition constant, or assumed, in the unit of time the variables in this energy are temperature and velocity. The problem of the settling chamber is to dissipate this energy, to lower the temperature, and to reduce the velocity.

The velocity can be promptly reduced by a sudden enlargement of the flue. I shall assume for clearness that its area is increased three times at the entrance to the settling chamber. The velocity of the gases will not be uniform throughout this cross-section. Just as in the case where a rapid brook discharges into a lake, there will be established on the line of least resistance a current of more rapidly moving gas, instead of water, and out of this current the solid particles are to be allowed to fall, in order that they may settle in the stiller atmosphere, much as the finer particles of water-carried silt deposit in the quiet portions of the lake.

Cooling Methods Described

Thermal energy and mechanical energy being to some extent convertible, a separate treatment will not be attempted. Having considered the velocity factor, I will now touch upon the temperature factor. Four methods of cooling are practiced: (1) Dilution of the gases with cooler air; (2) absorption of heat, by evaporation of water, or use of water-cooling devices; (3) conduction of heat through the walls of the flues; (4) prompt removal of the settled fume, thereby abstracting the sensible heat it contains. The first two practices are only justifiable under peculiar circumstances, and they should be avoided if possible. The third method is the most effective, and I shall try to show how present practice can be much improved.

The conductivity of metals being much greater than that of any structural material composed from clay, metal plates should be substituted for brick walls when practicable. The rapidity of heat transmission being inversely proportional to the thickness of the walls, the plates should be as thin as is found practicable. The rate of transmission being directly proportional to the difference of temperature between the outer and inner surface of the plate, efficient means should be taken to cool the outer surface.

With the object of keeping the walls of the flues cooler than the gases, and at the same time getting the effects of bracing, that is, strength and stiffness with the least amount of material and also economy in space occupied (which involves a saving in the cost of buildings, and in labor to handle the product), the following type of construction is recommended. The flue is turned backward through 180 deg., so as to reverse the direction in which the gas moves, after it has reached the length which can be conveniently spanned by a roof truss.

ALL WALLS SHOULD BE EXPOSED

The partition which serves to separate these consecutive divisions of the course should not consist of a single diaphragm, like a brick wall or a riveted metal plate. It should be built on the model of a hollow wall, through which outside air can freely circulate. This effect can be obtained by the use of upright iron studding, spaced at proper intervals and braced, and sheathed on both sides with a closely riveted sheathing of metal. This metal sheathing should be connected with the hoppers at the bottom of the several sections of the flue, and with the roof which is common to all of them. A hooded pipe extending through this roof and connected with the air space included in each partition wall, will increase the draft through the wall, and help to remove hot air and gases from around the hoppers, and the continuous roof will protect the iron sheathing of the partitions from the corrosive action of acid solutions which would be formed, if water, either meteoric or from condensed steam, were allowed to run down over them.

The iron studding could be of channel or I-beams, from four to six inches deep, either would give sufficient air space to have the effect of making all partition walls of the settling chamber outside walls of a long gas flue. This studding should start six inches or a foot below the top of the hoppers to afford an opening for entrance of air. Below this point, a number of brick walls serving as a support for the studding, would be built up from the foundation. These solid cross walls would isolate each hopper and shelter the discharged oxide from the force of winds, without requiring that each hopper should be entirely closed in.

The sheets used for forming the roof of the settling chamber and the bins, should be heavier than is required for the side sheathing. It is desirable that the side sheets which form the ends of the doubled back divisions of the flue, that is, the longer sides of the settling chamber, should be on the inside of the framing which supports it. To this framing, which may be of channel or I-shapes, diagonally braced on the outside, the sheathing should be secured by horizontal metal laths, securely riveted through the sheathing to the studs of the framing. These metal laths must be at proper intervals to resist any wind pressure they may be called upon to sustain. They need not be spaced with reference to the riveted joints of the sheathing. The roof rafters, such as required, should also be above the roof sheeting, which should be fastened to them in the same way as is the side sheathing to the walls. The framing of the hoppers should be independent of the framing of the walls of the settling chamber, it should be exterior to the sheathing of the hoppers. The binding laths should be in vertical planes, in order not to obstruct the free drop of the oxide to the bottom of the bins.

The sides of the hoppers should be inclined at an angle of 50 deg. with the horizontal. This will bring them together on the sides, in a flue 8 ft. wide, in a drop of 4 ft. 9 in., and will shorten their length longitudinally with the flue by 8 ft. at the bottom. From the inverted apex of this pinacoid the oxide should be continuously withdrawn by a chain conveyor, operating in a covered sheet-metal trough. There would be as many of these conveyors as there are bends in the flue. The return of the chain need not be closely housed.

EXAMPLE OF FLUE CONSTRUCTION

To illustrate by a concrete example: An uptake pipe from the furnace to the settling chamber having a diameter of eight feet would have a cross-section of 50 sq.ft. This diameter limits the minimum width of the bends of the flue, including the thickness of one partition to 8½ ft. Allowing as suggested, three times this cross-section for the effective area of the flue, we have for its effective height, 150 sq.ft. divided by 8½ (?) ft., equal to 18¾ ft. The center line of the doubled-back flue loses 4¼ ft. in length at each turn. If 40 ft. be assumed as a practicable roof span, each section has an effective approximate length of 36 ft. Ten of these courses side by side would give a length of 85 ft. and exclusive of the thickness of exterior walls, would be contained in a building 40x85 ft., about 30 ft. high. There would be 10 conveyors 32 ft. long inside of 10 hoppers, discharging either into separate storage pockets or into a pan conveyor, moving at right angles to them, which carries their discharge to a storage bin.

Two facts must not be lost sight of: All zinc ores are likely to contain lead, salts of lead are poisonous, dust must be guarded against. Second, the expense and loss from burned out bags is so great, that any reasonable expense involved in properly cooling the gases, is fully warranted by profitable returns. To which may be added that mechanical handling is generally cheaper than manual labor.

The velocity of 30 ft. per sec. in the uptake is reduced to an average of 10 ft. per sec. in the flues, neglecting on the one hand the lesser volume of the cooling gases, which would tend still further to reduce this average value, and on the other hand the air drawn in through the joints in the chamber walls, which by increasing the volume of gas to be handled by the exhaust fans, requires an increase in its average velocity, as in some measure balancing each other, we can picture for ourselves the flakes of oxide settling, by comparison with snow flakes drifting at the rate of 3600 × 10 = 36,000 ft. per hour or in a gentle breeze of 6.82 miles per hour.

The uptake, with a velocity of 30 ft. per sec., discharges 90,000 cu.ft. per min. In addition to what I have called the available height of the flues, allowance of 6½ ft. to give working room below the hoppers, and the rise of the roof should be allowed, to be on the safe side. The sheathing should be made reasonably tight by close riveting and occasional painting. The exhaust fans should not work against an appreciable suction. A slight leak through the walls will serve to detach adherent flakes of oxide, and present clean surfaces of metal to the gases rubbing over them. With sufficient cross-section of flues in settling chamber, under the lee of the partition walls there will be a backward eddy, slack air, in which the deposit of fume drift is favored.

REQUIREMENTS OF A SETTLING CHAMBER

To sum up, the settling chamber should be designed with reference to the weight and volume of the gases issuing from the furnace so as not to retard the draft of the furnace. With reference to the bagroom it should be designed to cool the gases to a perfectly safe temperature. It should remove as much of the solids carried by the gas as is found practicable for any given furnace operation. It should not throw any unnecessary work on the fans to the bagrooms, and it should avoid dilution if possible. Cooling gases by dilution is sometimes necessary, but it is generally an expensive method of doing so.

The cellular structure I have indicated with hollow walls and exterior framing, presenting smooth interior surfaces, lee shelters favorable to settling, prompt withdrawals of hot fume, air circulation around the outside, appears to combine strength and protection from the weather, with economy of material and light sections. Sheets of $\frac{1}{16}$-in. metal so employed will outlast sheets two or three times as thick in situations where they have to sustain a transverse load made up of their own weight and an uncertain weight of possibly corroding fume. A vertical metallic screen in front of the exhaust fans, acting as a baffle plate, will prevent too strong local suction which might derange the normal working of the last section in the settling-chamber flue. The same object can be better attained by having a number of exhaust fans, properly arranged, each forcing the gases to a separate system of bags.

Mechanical Bag Shaker Desirable

The arrangement of hoppers under the bags and the discharge of these hoppers by chain conveyors, is an easily realized ideal. Mechanical shaking of the bags has been often proposed. I do not know that it has ever been accomplished in an entirely satisfactory manner. The peculiar snapping shake, which a skillful bagman uses to detach the adherent fume is difficult to effect mechanically without putting more strain on the material of the bag than it is fitted to stand. Still the proposal is not visionary, and I think it is the duty of everyone who designs a bagroom or uses one, to seek every possible means of relieving his workmen of this necessary but unhealthful work. I can find no precedent from which to estimate the proportion of fume which can be advantageously settled out of gases heavily charged with fume, in such a settling chamber as I have described.

By gases heavily charged with fume I mean those issuing from furnaces which are especially designed to volatilize and burn the zinc with the least practicable consumption of fuel, and the least possible admission of excess air. The recovery of the fume unavoidably produced in all furnace operations has little bearing on this question. Nor is much to be learned from experience gained in the manufacture of sublimed metallic pigments. For in this latter case the object is to obtain a marketable paint having the required purity, color and texture, and by comparison with this object, other considerations are of minor importance.

Moderate Sized Units Favored

A necessarily experimental design should take as a starting point a rationally constructed settling chamber, of moderate dimensions, which will serve as a unit in a system of multiple units to be developed as the business expands. The furnaces and bags connected with this chamber should have rather less capacity than may ultimately be required of them. It is a simple matter to connect additional furnaces with the settling chamber, either through the original uptake, should that be of sufficient cross-section, or by a separate uptake if it is found that the settling chamber will successfully handle more gas and fume than it is receiving.

The same thing is true of additional filtering surface of bags, and also of additional pressure and exhaust fans which may be desirable, provided these probable extensions enter into the original plan.

Conditions of the markets, ore supply, changes in the character of available ores requiring different furnace treatment, the state of the weather, necessity for repairs, all favor a system of moderate-sized units. Throughout I have used the generic term fume, to connote those solid particles carried by gases issuing from a furnace which have been volatilized or sublimed. They will be mingled with other solid particles, which may be included under the general term furnace dust; this furnace dust may be made from the fuel, as soot, coke and ash, from the ores and fluxes or from the blast, they invariably are present with the fume, no attempt is made to separate them or to consider them separately.

Classification of Fumes

Fumes might be classified, according to composition, according to size, according to density, or according to state of aggregation; in the general treatment such classification is unnecessary. In most discussions of the behavior of furnace gases, the unit most convenient to employ is that of weight. The expressions, volume, density and velocity, are used in a generally understood conventional sense. That is to say, they are calculated averages under observed conditions, or they are those averages of volume, density and velocity, reduced to standard conditions of temperature and pressure. In case they are average values, they may imperfectly represent actual conditions. An average value may be a mean between widely different values, and so stand for a condition which does not exist.

A reduced value corresponding to standard conditions for any one of these qualities, volume, density and velocity, suggests something entirely different from actually existing conditions.

Direct measurements of velocity are difficult, for anemometers would have to be rated for local densities and temperature. We have seen that manometers fail to register the kinetic energy of moving gases, just as local standpipes do not show the hydraulic head of water flowing through pipes. I think in looking into a new problem it is sometimes worth while to step aside from familiar and well beaten paths, even when we know just where these paths will safely lead us, and explore to see whether equally desirable objective points may not be reached by a little original reconnaissance.

Analyses of Commercial Tin

In connection with the new standard contracts for tin the committee of the London Metal Exchange has declared the following brands of tin deliverable in fulfillment of contracts:

Straits, Australian, Banka, Billiton

English—In ingots of about 28 lb. each of the following brands, viz: Consolidated (Bolitho, Daubuz, Michell), Cornish, Penpoll, Redruth, Williams, Harvey & Co., T. S. Sutton & Sons.

German—In ingots of about 28 lb. each of the following brands, viz: Th. Goldschmidt, Essen; Robertson & Bense, Hamburg; F. D. Bieber & Sohne, Hamburg.

Chinese—Chong Hing & Co., Wing Hong & Co.

In the course of its investigation the committee had analyses made of some of the brands, the results of which are given in the accompanying table.

ANALYSES OF COMMERCIAL BRANDS OF TIN

	Tin	Antimony	Arsenic	Lead	Bismuth	Copper	Iron	Silver	Sulphur
Banka	99.950	0.007	nil	trace	nil	0.018	0.045	nil	trace
Billiton	99.960	0.006	nil	nil	nil	0.023	nil	nil	nil
Penang	99.939	trace	0.003	trace	nil	0.016	0.028	nil	0.004
Singapore	99.870	0.008	0.045	0.034	0.003	0.052	0.003	0.006	0.005
Mt. Bischoff	99.795	0.015	0.063	0.037	0.005	0.035	0.042	trace	0.008
Pyrmont	99.938	0.017	0.019	trace	nil	0.022	trace	nil	0.004
Irvine Bank	99.580	0.062	0.034	0.221	0.025	0.126	0.002	0.018	0.004
Williams, Harvey & Co. No. 1a	99.860	0.015	0.040	0.004	0.005	0.047	0.003	nil	0.006
Williams, Harvey & Co. No. 2	99.560	0.166	0.037	0.162	0.007	0.050	0.005	trace	0.013
Williams, Harvey & Co. No. 2	99.350	0.245	0.065	0.223	0.015	0.042	0.016	trace	0.013
Williams, Harvey & Co. No. 3	99.200	0.300	0.037	0.396	0.007	0.100	0.013	0.014	0.006
Williams, Harvey & Co. No. 4	99.941	0.011	0.022	trace	0.001	0.020	trace	trace	0.005
Penpoll No. 1	99.720	0.118	0.054	0.041	0.007	0.052	0.004	0.009	0.007
Penpoll No. 2	98.710	0.569	0.042	0.546	0.055	0.103	0.007	0.015	0.004
Penpoll No. 3	99.300	0.325	0.056	0.212	0.050	0.088	0.002	0.021	0.009
Redruth*	99.160	0.176	0.053	0.177	0.017	0.445	0.014	0.006	0.008
Th. Goldschmidt No. 1	99.860	0.004	nil	0.102	nil	0.043	trace	nil	trace
Th. Goldschmidt No. 2	99.460	0.015	nil	0.425	nil	0.069	trace	nil	trace
Th. Goldschmidt No. 3	99.150	0.122	0.046	0.143	0.112	0.352	0.007	0.006	trace
Chinese No. 1	99.343	0.031	0.040	0.434	0.007	0.052	0.010	trace	0.011
Wing Hong & Co. No. 2	98.662	0.039	0.035	1.035	0.012	0.134	0.014	trace	0.011
Wing Hong & Co. No. 3	95.280	0.381	0.050	3.995	0.020	0.106	0.026	0.018	0.008

*Cobalt 0.012 per cent.

Analyses by P. Weiller of fusions of mixtures, in varying proportions, of lead oxide and silica (*Chem. Zeit.*, 1911, Vol. 35, pp. 1063-1065) resulted in the metasilicate (PbO,SiO_2) being found to be the only well defined compound formed, though a more acid compound ($PbO,2SiO_2$) was probably also formed. The existence of the orthosilicate or of a more basic compound could not be established.

Data of the World's Principal Mines

By S. F. Shaw†

Compiled from Annual Reports

Name of Mine	Situation	Year	Tonnage Produced	Profits	Dividends	Cost per Ton	Ore Reserves Toos
Abangarez	C. R.	1910	31,317	272,550	60,000	$16.01	....
Abosso Gold	W. A.	1910*	77,623	£30,991	£60,000	9.02	284,028
Alaska-Mexican	Alas.	1910	222,698	380,793	342,000	1.75	1,093,028
Alaska-Treadwell	Alas.	1910*	744,226	981,295	850,000	1.59	5,899,364
Alaska-United	Alas.	1910	420,659	252,446	135,150	1.36	2,619,573
Allouez	U. S.	1910	....	71,096	....	1.80	....
Amalgamated Zinc	Aus.	1910	160,957	£43,390	....	3.07	....
Amparo	Mex.	1910	68,217	281,527	240,418	6.03	....
Anaconda	U. S.	1910	3,253,343	5,720,902	6,930,000	......	....
Anchor Tin	Tas.	1910*	102,283	— £1,866	....	8.48	....
Arizona Copper	U. S.	1910*	754,187	£254,471	£214,518	......	....
Ashanti Goldfields	W. A.	1910	90,860	£118,878	£149,580	10.03	....
Assoc. Gold Mining	Aus.	1910	128,181	141,000	....	......	....
Assoc. Gold Mines of W. A.	Aus.	1911*	105,238	—£5,846	....	......	....
Assoc. Northern Blocks	Aus.	1910*	32,120	£7,577	....	6.55	....
Aurora West	Aus.	1910	128,163	767,939	1,000,000	4.57	339,000
Baltic	U. S.	1910	781,419	....	....	1.67	....
Batopilas	Mex.	1910	43,612	— 106,258	....	......	....
Bibiana	W. A.	1910*	57,576	£886	....	7.02	417,877
Blackwater	N. Z.	1910	39,192	£39,231	£37 498	6.70	69,000
Boleo	Mex.	1910	365,000	....	....	......	....
Boston & Montana	U. S.	1909	1,374,504	....	....	......	....
Brakpan	S. A.	1910	....	....	....	......	1,720,181
Brilliant Extended	Aus.	½-1909	31,500	£15,846	£12,500	8.13	70,000
British Broken Hill	Aus.	½-1910	58,018	£16,334	....	......	410,000
British Col. Cop. Co	B. C.	1910	441,672	256,562	....	......	....
Broken Hill Bl. No. 10	Aus.	½-1910	53,558	£3,991	£15,000	......	....
Broken Hill Bl. No. 14	Aus.	½-1910	12,420	£5,278	....	......	220,000
Broken Hill North	Aus.	½-1910	108,943	£26,785	£28,000	3.27	....
		½-1910	136,044	£61,000	£35,000	4.29	1,500,000
Broken Hill Prop	Aus.	½-1910	....	£37,864	....	......	....
Broken Hill South	Aus.	½-1910	132,757	£37,543	£20,000	4.13	....
		½-1910	179,117	£67,800	£60,000	......	3,000,000
Buffalo	Ont.	1909	33,708	402,013	320,000	9.67	74,000
Bunker Hill & Sullivan	U. S.	1910	425,160	....	917,100	......	....
Burma Mines	Burma	1910	28,772	£9,034	....	25.62	....
Butte & Boston	U. S.	1910*	372,965	751,712	399,680	6.98	....
Butte Coalition	U. S.	1909	591,737	....	250,000	......	....
Butters Salvador	Sal.	1909	21,664	£68,129	£103,125	18.37	100,000
Calumet & Arizona	Ariz.	1910	315,128	....	800,000	9.49	....
Calumet & Hecla	U. S.	1910	2,795,514	....	2,900,000	2.31	....
Camp Bird	U. S.	1910	79,714	£389,577	£178,000	9.42	83.900
Cananea Con	Mex.	1910	795,313	459,202	....	5.76	....
Cape Copper	S. A.	1910*	69,246	£124,659	£69,000	......	....
Carn Brea & Tincroft	G. B.	½-1910	38,892	£13	....	5.25	....
		½-1910	38,797	—£1,927	....	5.22	....
Caucasus Copper	Sib.	1909	30,100.	....	....	......	....
Centennial	U. S.	1910	106,095	— 20,742	....	......	....
Centennial-Eureka	U. S.	1909	109,430	....	600,000	......	....
Chaffers	Aus.	1910	46,584	23,000	....	......	....
Champion	U. S.	1910	722,051	939,205	900,000	1.90	....
Champion Reef	India	1910*	252,779	....	£60,666	7.65	322,513
Cinderella Deep	S. A.	1910	181,100	£43,225	....	5.59	421,884
City & Surburban	S. A.	1910	308,266	£89,291	£68,000	5.02	828,936
Con. Goldfields of N. Z.	N. Z.	1910	21,363	....	£21,273	4.48	25,944
Coniagas	Ont.	1910*	34,514	753,889	240,000	7.51	127,167
Con. Main Reef	S. A.	1910*	235,391	£72,575	£69,327	4.90	414,150
Copiapo	Chile	1910*	12,752	—.£16,595	....	26.18	56,425
Copper Queen	U. S.	1910	589,900	....	6,300,000	......	....
Corocoro United Copper	Bol.	1910*	57,947	£8,382	....	......	....
Creston	Mex.	1910*	107,500	....	....	4.74	284,310
Crown Mines, Limited	S. A.	1910	1,510,070	£1,182,224	£1,128,127	4.41	6,282,719
Crown Reef	S. A.	1909	172,378	£118,822	....	......	....
Crown Reserve	Ont.	1910	2,749	1,368,124	1,050,000	......	....
Daly-Judge	U. S.	1910	47,002	94,177	....	7.35	....
			9,106	....	....	......	....
Daly West	U. S.	1910	85,000	....	162,000	......	....
De Lamar	U. S.	1910*	44,961	£4,142	£4,000	9.90	....
Detroit Copper	U. S.	1910	492,593	....	1,840,000	......	....
Dharwar Reefs	Ind.	1909	21,574	....	....	......	....
Dolcoath	G. B.	½-1910	42,279	£13,018	....	6.61	....
		½-1910	44,659	£21,066	£21,500	7.18	....
Dolores	Mex.	1910	....	....	270,000	12.60	64,759
Dos Estrellas	Mex.	1909	348,580	1,893,270	....	3.54	2,018,000
Ducktown Sulphur, Copper & Iron	U, S.	1910	....	£38,376	£24,458	......	....
Durban-Roodepoort	S. A.	1910	240,530	£61,721	£33,000	6.14	867,551
East Gwanda	Rhod.	1909	91,400	— £34,884	....	6.46	....
East Rand Prop	S. A.	1909	1,830,280	£1,259,653	....	3.82	....
Elm Orlu	U. S.	1909	55,996	....	....	......	....
Eldorado Banket	Rhod.	1910*	80,566	£81,513	£75,000	......	196,458
El Oro	Mex.	1910*	316,138	1,004,816	826,100	4.93	411,639
El Rayo	Mex.	1910	....	....	62,400	6.23	53,100
Esperanza	Mex.	1910	188,108	858,669	200,313	5.60	367,303
Federal	U. S.	1910	741,650	944,705	840,000	......	....
Ferreira	S. A.	1910	346,150	£291,756	£285,000	3.84	598,671
Ferreira Deep	S. A.	1910	364,487	£528,937	£500,500	4.61	1,779,328
Franklin	U. S.	1909	170,546	....	....	2.06	1,250,000
Franklin Furnace	U. S.	1910	375,677	....	....	......	....
Frontino & Bolivia	Bol.	1910	13,140	£10,137	....	18.61	....
Gaika Gold	Rhod.	1910*	34,474	£1,352	....	7.60	23,500
Geldenhuis Deep	S. A.	1910	827,065	£251,305	....	5.32	2,521,481
Giant	Rhod.	1910*	65,953	£35,290	£36,688	5.00	307,821
Glen Deep	S. A.	1909	260,815	£121,739	£120,000	4.67	803,113
Globe & Phoenix	Rhod.	1909	41,257	£236,569	£230,000	......	178,221
Glynn's Lydenburg	S. A.	1910*	32,155	£35,009	£12,500	7.91	82,870
Golden Ridge	Aus.	1910	28,999	167,500	135,000	......	....
Golden Horseshoe	Aus.	1910	257,333	£75,294	£75,000	5.86	803,151
Goldfield Con.	U. S.	1910	266,867	7,343,691	7,118,921	11.14	....
Granby	B. C.	1910	1,175,548	561,946	270,000	3.08	6,250,000

---

†Mining engineer, 136 Liberty St., New York.

DATA ON THE WORLD'S PRINCIPAL MINES—(*Continued*)

Name of Mine	Situation	Year	Tonnage Produced	Profits	Dividends	Cost per Ton	Ore Reserves Tons
Great Boulder Proprietary	Aus.	1910	195,407	£266,610	£262,500	$8.18	760,177
Great Boulder Perseverance	Aus.	1910	91,852	— £20,913	....	4.40	772,214
Great Cobar	Aus.	1909	204,377	£42,238	....	......	2,877,000
Great Fingal	Aus.	1910	125,871	£21,642	£25,000	6.39	....
Great Fitzroy	Aus.	1910*	53,416	....	.	......	654,833
Grenville	G. B.	½-1910	21,047	£4,308	. .	5.87	....
Guanajuato Con	Mex.	1909	86,580	....		4.16	....
Guanajuato Red. & Mines	Mex.	1910	228,344	376,837	...	2.44	....
Gwalia Con	Aus.	1910*	63,338	— £6,372	......	6.63	48,690
Hainault	Aus.	1910	68,719	74,000	37,000	......	....
Hecla	U. S.	1910	129,480	....	200,000	......	....
Hedley Gold Mining	B. C.	1910	46,828	263,986	168,000	5.45	....
Hercules	U. S.	1910	25,765	....	536,000	......	....
Homestake	U. S.	1909	1,237,381	787,160	982,800	2.87	.....
Horn Silver	U. S.	1910	10,657	10,342	....	9.37	....
Hutti Gold Mines	Ind.	1910*	38,706	£9,236	£3,480	6.44	40,000
Independence (Stratton's)	U. S.	1910*	93,191	£18,107	£25,000	......	.....
Iron Blossom	U. S.	1910	35,933	299,242	280,000	......	....
Iron Silver Mining Co	U. S.	1910	58,863	138,308	200,000	4.43	.....
Ivanhoe	Aus.	1910	232,842	236,785	220,000	5.36	985,036
Jubilee	S. A.	1910	55,011	£2,428	....	......	....
Jumbo Gold	Rhod.	1910*	36,658	£18,632	....	8.52	39,249
Jumpers	S. A.	1910*	98,196	£62,435	£40,000	7.68	63,523
Jumpers Deep	S. A.	1909	92,960	£64,366	£10,000	......	60,000
Jupiter	S. A.	1910	267,398	£46,879	....	4.92	1,074,009
Kalgurli	Aus.	1910*	127,600	£134,604	£150,000	7.54	400,000
Kerr Lake	Ont.	1910	4,277	1,198,220	1,050,000	80.50	....
Komata Reefs	N. Z.	1909	13,390	£2,371	....	8.61	20,900
Knights Central	S. A.	1910	302,228	£79,011	£45,000	4.25	700,000
Knights Deep	S. A.	1910*	650,820	£300,886	....	2.98	1,700,000
Kyshtim Corporation	Sib.	1910	89,509	£64,335	....	......	1,500,000
La Blanca	Mex.	1910*	39,304	....	....	12.00	....
Lake Copper	U. S.	1909	10,124	....	....	......	....
Langlaagte Estate	S. A.	1910	629,614	£300,134	£260,850	4.22	1,267,769
La Rose	Ont.	1910	....	....	449,558	......	86,758
Le Roi	B. C.	1909	26,534	— £9,701	....	15.20	....
Le Roi No. 2	B. C.	1910*	47,329	£37,702	£36,000	7.04	....
Liberty Bell	U. S.	1910*	133,899	282,147	143,606	5.27	....
Lucky Tiger	Mex.	1910	40,690	485,304	429,000	10.06	218,280
Main Reef West	S. A.	1910*	189,649	£137,950	£112,500	4.35	430,000
Mammoth	U. S.	1909	401,244	....	....	......	....
Mason & Barry	Spain	1910	360,406	£65,458	£55,551	......	....
May Consolidated	S. A.	1909	178,845	....	£115,500	4.21	400,416
McKinley-Darragh	Ont.	1910	43,582	976,640	....	10.36	104,450
Mercur Con	U. S.	1909*	282,269	34,005	....	2.62	....
Mexico Mines of El Oro	Mex.	1910	136,372	....	£214,391	4.75	283,735
Meyer & Charlton	S. A.	1910	153,717	....	£80,000	4.61	277,029
Midas Deep	S. A.	1909	20,776	....	....	......	....
Minerals Separation	Aus	1910	179,218	....	......	1.82	....
Moctezuma	Mex.	1910	447,555	468,000	....	......	....
Mohawk	U. S.	1910	802,537	188,083	200,000	1 60	....
Montana-Tonopah	U. S.	1910	50,245	134,715	60,000	10.26	26,000
Montgomery-Shoshone	U. S.	1909	68,632	86,703	....	4.32	......
Morning	U. S.	1910	333,900	....	....	......	....
Mt. Bischoff	Tas.	½-1910	110,664	£35,311	£21,000	0.94	....
Mt. Boppy	N. S. W.	1910	78,690	....	£42,350	5.37	234,684
Mt. Elliott	Aus.	1910*	....	£6,790	....	......	440,000
Mt. Lyell	Tas.	½-1910	198,617	£90,533	£75,000	......	3,648,376
Mt. Morgan	Aus.	1910*	397,228	....	£150,000	9.63	....
Mungana	Aus.	1909	26,052	£1,096	....	9.06	....
Mysore	Ind.	1910	246,425	£384,910	£350,750	10.06	1,100,453
Nababeep	S. A.	1910*	54,050	....	....	......	219,800
Napa Consolidated	U. S.	1909	18,583	61,899	....	......	....
Namaqua Copper	S. A.	1910	30,539	£34,794	£23,583	......	94,883
Natomas Consolidated	U. S.	1909	....	870,410	....	......	....
Nevada Consolidated	U. S.	1909	2,237,028	2,345,382	....	2.76	40,360,823
New Goch	S. A.	1910	338,618	£140,626	£82,500	4.71	741,688
New Heriot	S. A.	1910	149,990	£107,504	£92,000	4.93	485,585
New Idria	U. S.	1909	67,247	109,639	120,000	......	....
New Kleinfontein	S. A.	1910	466,882	£288,577	£218,250	3.89	1,397,412
New Modderfontein	S. A.	1910	523,550	£169,972	£165,000	4.87	2,581,744
New Primrose	S. A.	1910	257,168	£210,278	£185,000	4.00	490,809
N. Y. & Honduras-Rosario	Hon.	1910*	36,634	349,476	105,000	13.00	107,575
Nigel	S. A.	1910	208,880	....	£66,931	5.21	227,304
Nipissing	Ont.	1910	6,699	2,167,103	2,100,000	......	....
North Butte	U. S.	1910	408,528	....	446,000	......	958,680
North Star, California	U. S.	1910	90,100	677,074	575,000	6.17	....
Nourse	S. A.	1910*	463,277	£191,504	£151,875	5.28	2,142,047
Nundydroog	Ind.	1910	91,000	£143,957	£117,916	10.19	141,296
Old Dominion	U. S.	1909	....	455,282	486,000	......	......
Oregum	Ind.	1910	133,407	£148,406	£129,250	7.60	164,531
Oriental Con	Chosen	1910	320,707	623,676	....	......	838,250
Original Con	U. S.	1909	226,492	181,359	....	7.29	....
Oroyo-Black Range	Aus.	1910*	54,180	£24,516	£24,986	8.39	.
Oroya-Links	Aus.	1910	100,177	125,000	71,000	......	. .
Oroville Dredging	U. S.	1910	+566,612	275,452		......	.
Osceola	U. S.	1910	1,217,720	....	961,500	1.28	. .
Otavi	W. A.	1909*	44,250	£100,360	£140,000	27.55	....
Ouro Preto	Braz.	1910*	75,612	£7,679	£6,163	6.60	169,991
Pahang Con	Malay	1910*	80,736	— £7,296	....	5.88	.
Panuco	Mex.	1909	13,411	238,419	212,500	4.15	
Parrot	U. S.	1909	122,349	....	68,954	......	
Penhalonga	Rhod.	1910	116,278	— £13,900	....	5.28	150,175
Peñoles	Mex.	1909	176,616	298,570	499,200	5.58	
Pittsburg Silver Peak	U. S.	1909	150,359	337,004	....	......	
Poderosa	Chili	1910	23,341	£38,471	....	......	35,000
Portland	U. S.	1910	67,515	372,424	240,000	......	.
Princess Estate	S. A.	1910	120,414	£58,431	£53,000	5.53	.
Progress	N. Z.	1910	50,202	— £13,220	£10,312	8.39	.
Prestea Block A	W. A.	1910	....	....	....	......	678,859
Quincy	U. S.	1910	1,373,124	725,871	550,000	1.70	....
Randfontein Central	S. A.	1910	....	....	....	......	2,822,713
Randfontein South	S. A.	1910	1,168,641	484,011	300,000	4.61	2,788,099
Rand Mines Limited	S. A.	1909	....	......	......	4.46	4,000,000
Real Del Monte	Mex.	1909	215,209	......	....	......	....
Republica	Mex.	¼-1910	3,870	....	....	19.08	....
Rezende	Rhod.	1910	43,800	£16,624	.	5.21	112,980
Rio Plata	Mex.	1909	14,580	20,046	140,037	8.18	....
Rio Tinto	Spain	1909	1,788,987	£1,515,623	£1,206,250	......	....
Robinson	S. A.	1909	550,176	£940,696	£825,000	3.05	2,788,362

DATA ON THE WORLD'S PRINCIPAL MINES—(*Continued*)

Name of Mine	Situation	Year	Tonnage Produced	Profits	Dividends,	Cost per Ton	Ore Reserves
Rooiberg Minerals Dev	S. A.	1910*	15,713	£12,681	....	...	24,300
Rose Deep	S. A.	1910	656,954	£289,813	£280,000	$4.75	3,553,474
Round Mountain	U. S.	1910	36,252	84,313	69,322	6.17	111,928
Salisbury Gold	S. A.	1909	95,057	£24,843	£25,000	3.69	162,289
San Rafael y Anexas	Mex.	½-1910	48,978	....	....	.....	....
San Toy	Mex.	1910	20,181	157,556	....	25.70	....
Selukwe	Rhod.	1910*	25,764	£8,870	....	5.84	27,000
Seoul Mining	Chosen	1910	32,793	215,151	100,000	4.66	190,100
Shannon	U. S.	1909	307,271	84,337	....	7.58	....
Sheba Gold Mining	S. A.	1910*	40,750	£1.871	....	7.28	....
Simmer & Jack	S. A.	1910*	827,530	£555,529	£525,000	3.10	2,690,000
Simmer & Jack East	S. A.	1910*	365,620	£63,989	....	4.33	950,000
Simmer Deep	S. A.	1910	480,803	£60,712	....	4.03	1,255,000
Skidoo	U. S.	1909	14,726	92,617	50,000	6.55	....
Snowstorm	U. S.	1910	62,700	.....	120,000	....	....
Sons of Gwalia	Aus.	1910	162,082	£112,360	£97,500	.....	....
South Crofty	G. B.	1910	60,916	£11,487	£7,500	5.31	....
South Kalgurli	Aus.	1910*	110,199	£20,858	£20,000	5.48	171,877
Spassky Copper	Sib.	1910	10,794	£9,522	....	....	170,100
Standard Con	U. S.	1910	23,570	......	......	...	3,275
St. John Del Rey	Braz.	½-1910	92,400	£45,846	£27,275	8.44	....
Stewart	U. S.	1910	55,347	......	...	......	....
Sudan Goldfield	S. A.	1910	14,662	— £6,227		10.31	6,010
Sulphide Corporation	Aus.	1910*	231,748	....	.	1.90	2,702,000
Superior	U. S.	1910	140,514	....		2.69	....
Superior & Pittsburg	U. S.	1909	251,042	....		10.81	....
Surprise	Rhod.	1909	29,643	— £6,853	.	6.50	....
Talisman Con	N. Z.	1909	44,800	....		.....	....
Tamarack	U. S.	1910	525,554	— 191,345	.....	2.67	....
Taquah Mining & Exp	W. A.	1910*	65,222	....	......	13.51	102,370
Tasmania Gold Mining	Tas.	1909	53,789	— £22,825	......	......	....
Temiskaming	Ont.	1910	18,456	714,319	275,000	16.61	....
Tennessee Copper	U. S.	1910	405,463	....	300,000	2.80	4,563,671
Tharsis Sulphur	Spain	1910	362,750	....	£156,250	....	....
Thistle-Etna	Rhod.	1910	37,261	£1,426	....	5.55	....
Tincroft	G. B.	½-1909	36,825	....	....	...	....
Tomboy	U. S.	1909	102,844	£59,861	£60,000	4.67	....
Tombstone Con	U. S.	1909	15,070	....	....	......	....
Tonopah-Belmont	U. S.	1911*	81,056	1,522,302	450,000	......	260,324
Tonopah Mining	U. S.	1911*	177,745	....	1,550,000	10.07	354,940
Treasury Gold	S. A.	1909	109,235	£24,896	....	5.29	201,580
Trenton	U. S.	1909	157,167	165,111	470,000	7.04	....
Trethewey	Ont.	1910	19,103	237,800	....	......	....
Tri-Mountain	U. S.	1910	317,299	32,250	150,000	......	....
Troitzk Goldfield	Sib.	1910	40,621	— £9,429	....	6.27	40,400
Tronah	Malay	1910	410,777	£72,927	£56,000	..	....
Tyee Copper	B. C.	1910*	45,760	£1,200	....	.	....
U. S. S. R. & Mining Co.	U. S.	1910	777,355	2,484,318	2,404,653		....
Utah Apex	U. S.	1908	33,407	124,185	....		80,000
Utah Con	U. S.	1910	....	65,349	150,000		381,000
Utah Copper	U. S.	1910	4,340,245	5,401,775	4,648,675	..	152,130,000
Van Roi	B. C.	1910*	32,313	£3,927	....	......	16,035
Van Ryn	S. A.	1909	358,230	£279,386	£225,000	3.76	1,419,430
Village Deep	S. A.	1910	508,540	£154,067	£106,067	4.45	1,704,226
Village Main Reef	S. A.	1910	492,446	£360,654	£330,400	4.91	1,775,175
Vivian Gold Mining	Aus.	1909	41,146	— £2,241	......	5.60	35,219
Vogelstruis Con. Deep	S. A.	1910	41,258	....	....	7.25	149,530
Waihi	N. Z.	1910	442,020	£559,191	£396,725	4.04	....
Waihi Grand Jc	N. Z.	1910	84,226	£30,646	....	3.71	....
Washoe	U. S.	1909	205,377	....	....	....	....
Wanderer	Rhod.	1910*	190,278	....	....	1.68	693,745
West Rand Prop	S. A.	1910	242,000	£46,555	....	4.78	1,124,631
Wheat Kitty	G. B.	½-1910 ½-1910	7,191 7,636	£2,659 £1,173	£664 £783	6.04 6.37	....
Witwatersrand Deep	S. A.	1910	474,600	£267,413	£271,824	4.55	1,692,922
Witwatersrand Gold	S. A.	1910	426,910	....	£148,750	3.83	1,232,784
Wolhuter	S. A.	1910*	304,360	£122,554	£86,000	4.26	753,679
Worchester Expl & Gold	S. A.	1910	55,330	£25,177	£16,751	3.87	....
Yukon Gold	Yukon	1909	+3,087,127	691,682	700,000	..	....
Zinc Corporation	Aus.	1910	270,637	£97,906	£89,513		....

NOTE.—Abbrevations used in above table: Alas., Alaska; Aus., Australia; Bol., Bolivia; Braz., Brazil; B. C., British Columbia; G. B., British Isles (Cornwall); C. R., Costa Rica; Hon., Honduras; Ind., India; Malay, Malay States; Mex., Mexico; N. S. W., New South Wales; N. Z., New Zealand; Ont., Ontario; Rhod., Rhodesia,; Sib., Siberia; S. A. South Africa; Tas., Tasmania; U. S., United States,; W. A., West Africa.

*Fiscal year. — Loss for the year. + Cubic yards. All profits and dividends are in dollars except where otherwise noted.

The above tabulation of data obtained from abstracts of annual mining reports published in the principal mining magazines, was compiled for the purpose of securing relative data on the costs of production of the various metal-mining companies operating in different parts of the world.

I have compiled this table for several years for my own use, and in the future expect to publish it annually, and if the various mining companies will send me a copy of their reports a greater degree of accuracy will be insured. It will be seen that English companies form a large percentage of those enumerated, as there is a greater tendency for these companies to make public the items of production, cost, ore reserves, etc., than is the case with American companies.

These data cover for the most part the calendar and fiscal years ending in 1910. Since the reports of many mining companies for the year 1911 will not be published before June, 1912, it is not possible to cover the year 1911 at this date.

The column headed "tonnage produced" refers to the tons of ore actually shipped to the smeltery or treated locally and does not include waste which was sorted out of the ore hoisted. It is customary among the Rand mines to note the amount of waste so hoisted and sorted out, but this applies to but few American mines. Some English companies use the long ton of 2240 lb. but as no distinction is made between the long and short ton in many of the abstracts published there has been no attempt to distinguish between same in this table.

Where sufficient data were given to enable it to be done, the profits are figured as the amount remaining after all expenses of operation, administration, depreciation, development, taxes, etc., were paid. Such money as was put into the capital account, however, is not included.

In figuring the cost per ton, all items in the nature of expenses of operation, administration, depreciation, etc., are included exactly as in the case of computing the profits.

The reserves are, of course, those given in the official report as the number of tons of ore remaining blocked out at the end of the year under review. Probable ore is not so included, neither is that portion of the vein which, though blocked out, is too low grade to return a profit.

London Tin Market in 1911

Remarkable developments occurred in this market over the New Year holidays. It had closed on Dec. 30 with a decline to £173 15s. per ton upon the announcement of increasing supplies of Banka tin for 1911: and consumers were eager to take advantage of this relapse in view of the serious shrinkage of stocks as disclosed by the December statistics. Large sales were privately effected at advancing prices, and when the market reopened on Jan. 3, there was keen competition among the buyers for the little which was on offer. The result was a rebound in the price of no less than £5 10s. for three months' delivery, and £5 for prompt. A slight and transient reaction followed, but the demand was keen from all quarters. There were liberal offerings from the East from time to time, but these were readily absorbed. The speculative market was virtually dominated by the bull faction throughout the month: it was now and again allowed to drift into a temporary relapse but only to be gripped again with increased vigor, and the advance culminated on Jan. 30 when £204 was paid.

In February fluctuations continued wide and wild. Starting with a decline price went during the month from £194 10s. down to £171 and up to £200. This was again the signal for aggressive selling, resulting in a fall to £187 per ton.

In March the market opened with prices unchanged, but these soon weakened. Fluctuations continued frequent and wild, the lowest being touched on March 16 when three months' warrants were booked at £173 10s: after which the tendency was generally upward until the end of the month when cash warrants closed at £188 17s. 6d. and three months' at £187 2s. 6d. The most notable features of the month were the constant stream of orders for consumption, the persistent diminution of stocks, the strong control of these stocks by leading operators, the occasional abstention of leading operators and the capricious attitude of Eastern sellers whose policy ranged from free selling to complete reserve.

The closing for April was £103 10s. for prompt delivery, and £190 10s. for three months; with every indication of decreased supplies from the Straits and constant drain on the available stock.

In May the market continued as active and eventful as ever. The American demand has slackened for some time past, but a reduction of 2801 tons in the visible supply during April sufficed to demonstrate the underlying strength of the market, more especially as it was known that a substantial bear account was open for June and that supplies from the East were restricted. As the month advanced the "bull" control of the market became increasingly manifest. Some effort was made to initiate business on a new basis whereby sellers reserved option to deliver Straits or Australian tin at contract price, or Banka, Billiton, English of Chinese brands at certain allowances. Some transactions passed on this basis, but it lacked official recognition by the Committee of the London Metal Exchange, and no official quotation or settlement price could therefore issue, so that the project failed to influence the speculative market to any appreciable extent. Fluctuations in price were incessant and often sensational, prices were £195 10s. per ton for spot warrants, and £192 for three months': closing prices being £210 and £190 respectively.

June, as was expected, saw the climax of the strategy so long pursued by the controlling syndicate. Opening prices were £213 per ton for prompt warrants, and £190 10s. for three months'. The artificiality of the situation was not conducive to new speculative enterprise, nor were consumers disposed to buy more than they absolutely needed in such an inflated market. Trade requirements, however, could not be ignored, and their volume gave sufficient support to maintain the foregoing prices and occasionally to augment them. The crisis came about on June 9, when "bears" became alarmed at the tightening squeeze and paid up to £233 per ton for early delivery; this representing a backwardation of £43 per ton. The syndicate then reduced its prices almost sensationally by lending tin for three months' delivery at a backwardation of £10 only, as compared with about £42 which had ruled on the previous day. Simultaneously they lifted the price of forward tin from about £186 to £190, and thus brought cash values to about £200. On June 16 further quantities of prompt metal were provided at a premium of £5, and gradually the backwardation was wiped out entirely, prices for all dates coming to about the same level round about £188. Thereafter ensued an active business with consumers, particularly in America. Eastern sellers supplied the market so liberally that short selling was encouraged and values consequently relapsed.

In July the market opened with a fall of £1 per ton in the price of the prompt metal, but with not appreciable alteration in that of forward delivery.

In August the market was sensitive at the outset, particularly for early delivery although the volume of business was restricted. A little demand would serve to raise prices, which as quickly relapsed; the Syndicate being virtually in control though relatively quiescent. Speculative enterprise generally was checked by pervading industrial unrest, complications in international politics, and particularly by the persistent depression in the stock exchanges. The consuming industries were everywhere well employed, but there was some apprehension of unfavorable statistics at the end of the month.

September statistics showed a diminution in the visible supply. There was little speculative business in the market but trade demand—especially in America—continued active, so that the market was very sensitive although the turnover was relatively small. Leading operators abstained from any overt manipulation, but their evident control of the situation deterred others from taking risks.

In October the market opened actively with an aggressive bull campaign, partly stimulated by favorable statistics; but the dealings were for the most part professional and with little incentive for private speculators to take the heavy risks involved. The main tendency, however, was upward, top prices being reached on Oct. 23, when cash warrants were quoted £191 12s. 6d. and three months' £191 7s. 6d. These figures were generally regarded as artificially inflated, business being restricted in view of the control exercised by the Syndicate.

November opened with an apparently weak market, in spite of encouraging statistics. The new form of contract for standard tin had come into vogue and was operative for transactions maturing on and after Feb. 1: under which conditions a fair volume of business took place. The three months' price drifted down to £183 10s. on Nov. 3, and this proved to be lowwater mark. Meantime business was transacted in Straits and Australian sorts for delivery up to Jan. 31 at prices considerably above those ruling for February delivery in standard grade: and the Syndicate brokers accumulated large quantities of the former with the evident intention of holding same for a substantial premium. Tin now took a decided turn upward, and the advance in values continued with little interruption to the end of the month. The advance in prices was further stimulated by strong American demand toward the end of the month. The Dutch sales took place on Nov. 29, when 2500 tons of Banka fetched the remarkable equivalent of £208 10s. per ton. The result in London was eager buying of December supplies, mostly from the Syndicate, and ranging up to £205. Standard tin was also in better request.

In Decembed fluctuations in price were moderate during the early days of the month, with increased activity in standard tin under the new contract. Business in Straits and Australian for December and January dates was confined to consumers' orders and the covering of bear engagements: the prices rising at one time to £207 for prompt cash, and £201 15s. for late January. Thereafter speculative parcels were offered by holders at declining prices, and these were bought up mostly by the Syndicate: there being at the same time an active trade in Straits with eastern sellers.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Philip Argall has returned to Denver, Colorado.

R. J. Stone is at Deadwood, Calif., examining the Ferguson mine.

J. W. Mercer has returned to New York from a long journey in the West.

W. S. Keith is at Last Chance, Calif., inspecting the Home Ticket drift gravel mine.

Arthur D. Little, of Boston, has been elected president of the American Chemical Society.

C. O. Lindberg has moved his headquarters to 527 Union League Building, Los Angeles.

H. Kenyon Burch spent the holidays at Los Angeles, and is now returning to Globe, Arizona.

Henry F. Lefevre has returned to New York from Central America, and will remain here a month.

J. R. Finlay has gone to the Southwest on professional business, expecting to be absent about three weeks.

D. Tamblyn, recently in South Africa and now of London, is investigating mining properties in northern Ontario.

J. W. Vandergrift, late manager of the Swastika mine, Ontario, is now in charge of operations at the Lucky Cross.

Robert Linton has been elected general manager of the Sierra Consolidated Mines Co., at Ocampo, Chihuahua, Mexico.

E. L. Dufourcq, of New York, has just finished an examination of the Sovereign mine, in Ladies Cañon, Sierra County, California.

F. G. Lasier, Detroit, Mich., will be in Cripple Creek, Colo., and Salt Lake City in January, returning to Detroit about February.

R. H. Clark, formerly with the Joshua Hendy Co., of San Francisco, will move to Parral, Chihuahua, Mexico, to engage in mining and ranching.

W. H. Brule is now consulting engineer and manager of the Summit Hill Mining Co., at Dobbins, Calif., with head offices in San Francisco.

E. N. Breitung, of Marquette, Mich., has acquired control of the *Banker and Investor* magazine, published in New York, which is devoted to banking.

F. Justice Grugan has just returned to Philadelphia from an examination of properties near Rama, Nicaragua. He will go to Arizona early in February.

Morril B. Spaulding is consulting engineer in active charge of the Calaveritas Consolidated placer mines, near San Andreas, Calaveras County, California.

W. E. Davis, vice-president in charge of sales of the Goulds Manufacturing Co., Seneca Falls, N. Y., has just started on an extensive trip in the interests of the company.

George E. Collins has been elected president of the Colorado Scientific Society. Mr. Collins has gone to England on professional business, expecting to return to Denver in Februrary.

W. H. Charlton has resigned as chief clerk and purchasing agent of the Winona Copper Co., King Philip Copper Co., Ojibway Mining Co., and Houghton Copper Co., at Houghton, Mich., and will locate in Detroit.

J. M. Pennington, Jr., is superintendent of the Trojan Mining Co. cyanide plant, at Trojan, S. D., having been appointed Dec. 1. He is also superintendent of the Lundberg, Dorr & Wilson cyanide mill, at Terry.

B. G. Slaughter, Jr., has resigned as chief engineer of the Tennessee Copper Co., having completed the acid and bedding plant. He has accepted a similar position with the Pennsylvania Salt Manufacturing Co., at Philadelphia.

E. A. H. Tays will in January become manager for the Compañia Minera Occidental Mexicana and will be engaged in developing some good prospects in the Fuerte district in Sinaloa. His headquarters will be at San Blas, Sinaloa, Mexico.

George Kislingbury, of Los Angeles, is examining the Hanby mine in Calaveras County, Calif. The examination will include a mill-run of 1000 or 1200 tons of ore. Mr. Kislingbury was the first superintendent of the Bully Hill copper mine in Shasta County when it was purchased by Captain De La Mar, 12 years ago.

OBITUARY

William H. Tibbals died at Salt Lake City, Utah, Dec. 27. He was for a number of years connected with the Salt Lake Mining Exchange, and also served as correspondent of several Eastern journals.

Major Clarence Edward Dutton, U. S. A., died at Englewood, N. J., Jan. 4, aged 70 years. He was born in Connecticut, served in the volunteer army in the Civil War, and later as an officer of the regular army. For a number of years he was connected with the Geological Survey. He retired from service in 1901. Major Dutton was the author of "Geology of the High Plateaus of Utah," "Tertiary History of the Grand Cañon District," "Hawaiian Volcanoes," "Mount Taylor and the Zuni Plateau," and "The Charleston Earthquake of 1886."

The death of Ed. S. McKinlay, Jr., a bright young engineer, is deeply regretted by the mining fraternity of Denver, among whom he was widely known and universally esteemed and respected. He was 28 years of age, a graduate of Cornell University and by profession a mechanical engineer; but at the time of his death was secretary of the Yampa Valley Coal Co. and general superintendent of the company's mine at Oak Creek, Colo. He fell on the track in front of a loaded coal car and was crushed under the wheels, and though rushed to Denver on a special train he died on the way.

Societies and Technical Schools

American Institute of Mining Engineers—At the monthly meeting of the New York Section on Jan. 5, Dr. Gardner F. Williams, of Washington, delivered an illustrated lecture on the "South African Diamond Fields."

Canadian Mining Institute—The Porcupine branch of the Canadian Mining Institute was organized on Dec. 16. Many prominent mining men were present, including Dr. Frank Adams, president of the Institute, J. B. Tyrrell, Dr. Barlow and A. G. Burroughs, of the Ontario Bureau of Mines.

Los Angeles Mining Society—At a meeting held at Los Angeles, Dec. 28, over 100 engineers were present, and it was resolved to form an organization of the mining engineers of southern California for the purpose of professional intercourse and the maintenance of a reading room and a professional library. A committee, headed by Dr. F. J. H. Merrill, was appointed to arrange details.

University of Idaho—This institution offers short courses extending over a period of eight weeks, combining both laboratory and lecture instruction in mining, geology, chemistry and allied subjects. These courses are designed primarily for men who are unable to take regular courses at the university. They are for the purpose of giving that special knowledge that will improve a man's work and be of assistance to him in obtaining and satisfactorily filling the higher positions of shift boss, foreman, etc., in the mines and mills of the State. The second session begins on Jan. 8, 1912, and continuing for eight weeks, will terminate Mar. 2, 1912. There are no entrance requirements nor examinations, and while there are no age limits, the work is laid out for mature students who want to make the most of the time they spend at the university. In addition to railway fare, the total expenses will run between $50 and $70, which will be for living expenses entirely, as they are no charges for tuition nor laboratory fees. Supplementing the special work offered by the departments of mining and geology, lectures of general interest will be given during the short session on subjects of present importance, which will be treated in a nontechnical way.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Jan. 1—Active mining development and exploration in Weaverville Basin, the Trinity River region and the vicinity of Carville, during the last year, will extend the mining life of Trinity County, and should attract railroad construction and resultant industries. This county has been producing gold for more than half a century, and has never produced a pound of flour. Notwithstanding that the topography of the mining sections renders the Caminetti act regulating hydraulic mining ineffective, mining investors have until within a short time seemed to ignore the possibilities of the county. The lack of rail transportation has been probably the chief cause for this inattention; but instead of waiting for the railroad to develop the gold resources the gold must now develop the railroad.

The present active condition of the mining industry in the county is due initially to the progressive and profitable operation of the Headlight mine at Carville, begun in January of the present year. The application of modern methods of extraction and treatment to an old hydraulic mine has shown that there is profit in the mining of low-grade ore. During November the Headlight extracted and treated by milling and cyanidation an average of 212 tons per day of ore that averaged $5.14 per ton, recovering about 83% of the contents. About 75 men were employed. The cost of mining was 51c. per ton; milling and cyaniding, $1.03 per ton. An interesting feature of the low cost of mining is that, notwithstanding that the continuous method of milling and cyanidation is employed and that the plant is electrically driven, the transportation of ore is by mule and tram car. The hydraulic stripping of the overburden and the gloryhole method are the economic mining features. The latest activity in the district is at the southern end, in the Weaverville Basin, where two old hydraulic mines have been taken over by a recently organized company to be operated on more extensive lines. One of these properties, the Hupp mine, has been in continuous operation by the Hupp family for 50 years; by the simple method of hydraulic mining a profit has been made every year. The reason is clear: the gravel averages 25c. per cu.yd. This mine is situated at Weaverville.

The other important purchase of this company is the Union Hill, situated six miles south. This mine has equipment that cost $300,000, and includes 12 miles of ditch and a steel bridge over which the water is carried by inverted siphon across Trinity River. The ditch, which has its supply from Grass Valley Creek, carries 3000 miners' inches of water, The present company has acquired an additional 500 in. The Union Hill cleaned up last year $37,000; the cost of operation was $15,000. The gravel averages 8c. per cu.yd.

At the annual meeting of the Ophir Silver Mining Co., held at San Francisco, Dec. 20, Franklin Leonard, Jr., was reelected president, and B. F. Shaw vice-president. W. J. O'Connor and George S. Sturgis were succeeded on the board of directors by H. L. Slosson, Jr., and G. E. Arrowsmith. What is termed the progressive element endeavored to control the Ophir as it recently did the Mexican, but failed to do more than obtain two directors. The same fight between the present control of the Mexican and the present control of the Ophir will probably occur in the annual meeting of the Savage.

Denver

Jan. 4—Ever since the earliest days at Cripple Creek, ore stealing, which out of consideration for the sensitive feelings of the thieves, has been delicately described as "high grading," has been carried on without let or hindrance. "Change rooms" and other devices for stopping it were tried, these being easily met by making a "cache" of the ore in the waste dump on the night shift, and removing it at a convenient opportunity, or as in one instance, by the foreman causing himself to be fastened down in the shaft, while the "daring robbers" carried off sacks of sylvanite and calaverite from the ore house. Now, however, the Portland, Golden Cycle and Strattons' Independence have struck at the root of the evil by destroying the ready local market, which has all along existed for the loot. On their petition Federal Judge Robert E. Lewis has issued an injunction restraining 48 Cripple Creek assayers whom it was alleged were conspirators as receivers of the stolen products, from buying ore from the miners of the district. The petitioners alleged that they were losing about $8000 per month and that about $750,000 have been stolen within a year. It is hoped that this injunction will end the practice of "high-grading."

The El Paso mine which has produced gold ore to the extent of $7,000,000, is now in good shape to duplicate its past output. According to careful estimates, the developed ore at present approximates 76,920 tons of an average grade of $25.75 per ton and a total net profit of $1,189,029. The ore ground not technically "in sight" and now being developed down to the Roosevelt tunnel, or 1350 level, includes 263,384 tons of an average grade of $30 per ton and a net worth of $2,633,240. The C. K. & N. vein has been opened on the tunnel level in the Fuller crosscut at a point 1400 ft. below the surface and the breast shows $35 ore. This mine has produced some of the most remarkable ore in the Cripple Creek district, for between the 600 and 800 level, 3000 lb. were taken out that yielded $76,000, or over $35 per lb. There are 150 men employed on company account, and 100 leasers.

Butte

Jan. 4—If the new process for treating complex zinc-sulphide ores, invented in Germany and used with success in that country for some time, should prove to be as successful in the treatment of the Butte ore, it is not unlikely that a plant will be erected soon at Butte by Ex-Senator W. A. Clark for the treatment of zinc ore from the Elm Orlu mine, which has been closed down for some time for the lack of treatment facilities.

As agent for the International Metal Co. and for W. A. Clark, Adolph Wetzstein investigated the German process last year, and later Mr. Clark made a personal inspection of the plant and methods of operation while in Europe; he was so impressed with what he saw and learned, that 100 tons of Elm Orlu ore have been sent to Germany for a final test, and a representative of Mr. Clark will be present during the treatment of the ore.

As a result of the improvement in the price of copper metal, it has been decided by the directors of the Anaconda Copper Mining Co. to increase the output of its Butte mines somewhat. During the last year the mines have been operating far below their normal capacity, the average monthly production having been about 22,250,000 lb.; several of the mines are gradually increasing the output and within two or three weeks it is expected to have the average monthly output increased to 26,000,000 lb. of copper.

For the last two years operations of the East Butte company have been confined to the Pittsmont property, comprising 267 acres of mineral rights, with a lease of the mineral rights on the Northern Pacific R.R. right-of-way crossing the property, and about 160 acres of surface rights. In making a cash payment of $688,758, Dec. 1, 1911, and giving notes for $1,625,574, the remainder due on the Pittsmont debt, the company hoped to be able to meet the notes from net earnings during the coming year rather than by issuing additional stocks or bonds; with the present improvement in the copper-metal prices, and the possibility of still further improvement, the management anticipates no trouble in thus liquidating the debt.

Salt Lake City

Jan. 4—The consolidation of a number of Alta properties, pending for some time, has been effected. The Michigan-Utah Consolidated Mining Co. was organized in this city Dec. 20, to take over the Utah Mines Coalition, City Rocks, Grizzly and Copper Prince properties, covering approximately 1200 acres of mineral ground, extending from Alta in Little Cottonwood north over the divide into Big Cottonwood Cañon. The company is capitalized for $2,500,000, divided into a million shares of stock, par $2.50. The distribution of stock to the companies forming the merger has not been officially stated, though it is said that half of the capital stock, or 500,000 shares, will be retained in the treasury. Of this, 250,000 shares are to be reserved for the conversion of a bond issue of approximately $625,000. Of the 500,000 shares to be distributed for the properties acquired, 250,000 shares will go to the Utah Mines Coalition, and the remaining 250,000 shares to the owners of the City Rocks, Grizzly and Copper Prince.

The consolidation may be the basis for taking in other operations adjoining, which can be developed advantageously through this company's ground. Operations at present can be carried on most advantageously from the Utah Mines Coalition, on the Big Cottonwood side, as this ground is most easily accessible. The Coalition company's drain and working tunnel will be extended to develop the City Rocks vein, which is said to have ore exposed at various points for 2800 ft. on the strike. A crosscut will be driven north from the same tunnel to connect with the Grizzly vein, of which the new Michigan-Utah company owns nearly 1000 ft. Connections between the tunnel and the old City Rocks workings have already been made, and it is expected to start a force of men on this ground soon. Salt Lake and Houghton, Mich., men are interested. The officers and directors are: Duncan MacVichie, president; J. P. Edwards, N. W. Haire, J. A. Pollock, R. H. Strickland, E. G. Woolley, Jr., and L. H. Farnsworth.

Negaunee, Mich.

Jan. 5—The season's iron-ore shipments from the Iron River district totaled 1,113,586 tons, and were the products from 15 mines. The four largest shippers in order, were the Dober mine of the Oliver Iron Mining Co., with 198,580 tons; Caspian mine of the Pickands, Mather & Co., with 165,660 tons; the Hiawatha mine of the Monroe Iron Mining Co., with 116,736 tons; and the Zimmerman mine of the Spring Valley Mining Co. with 111,095 tons.

It is interesting to note that the fifth in order of tonnage shipped was the Chicagon mine, with 108,947 tons, now operated by the Monroe Iron Mining Co.; this property when in the exploratory stage was abandoned by the Oliver Iron Mining Co., several years ago. The Davidson mine of the New York State Steel Co. made its initial shipment with 45,434 tons. The Wickwire mine on which the shaft was started last summer shipped 1919 tons and the Wickwire Steel Co. of Buffalo will have an opportunity to test the ore in its furnaces. The Hemlock mine of the Pickands, Mather company, situated in the Amasa district, shipped 105,320 tons. This mine has shipped ore since 1890, excepting 1894; for the last 16 years it has never shipped less than 69,000 tons per year.

In Ishpeming, the tax roll is $279,393, of which the three operating mining companies will pay 85%, or $237,140, leaving the balance, $42,253, to be borne by all other tax-paying interests. The Cleveland-Cliffs Iron Co., alone, will pay taxes amounting to $124,540; the Oliver Iron Mining Co., $100,995; Pittsburg & Lake Angeline Iron Co., which is a Jones & Laughlin company, will pay $11,604.

Joplin, Mo.

Jan. 3—The situation in the district at present is not particularly satisfactory. Prices are not as low as they have often been but there is a lack of harmony between the producers and the buyers and a wide range of prices evident at all times. There is no stability to the market and at times it is difficult to secure any bids on ore. Some producers are selling on the contract made by the American Zinc, Lead & Smelting Co. and, of course, are now highly elated over it. The unwillingness of a certain class of producers to acknowledge the justice of the claim for a larger smelting margin and the inability of the smelters to see or appreciate the total cost and risk of mining have up to the present prevented any harmonious action between the two. There is nothing to be gained by either in continuing to fight. Any advantage will be lost in the future under altered conditions. The selling of ores under a contract based upon the price of spelter with a fair smelting charge will serve to protect both producer and smelter to the best advantage.

Toronto

Jan. 5—The request for the restoration of the iron and steel bounties was renewed by an influential deputation which waited on the Government at Ottawa on Jan. 4. The delegation included Thomas J. Drummond and George E. Drummond of the Lake Superior Corporation; J. H. Plummer, president of the Dominion Steel Corporation; Robert Hobson of the Steel Co. of Canada, and Hector McInnes, of Halifax, representing Nova Scotia steel interests. A protracted conference was held, in the course of which the applicants presented voluminous statistics showing the effects of the bounties in stimulating the industry. The Government gave no assurances as to any action. It is understood in political circles that no tariff changes need be looked for during the coming session, and that it is altogether probable that the whole subject will be relegated to the Tariff Commission, whose early appointment has been promised.

Porcupine

Jan. 5—Fire has again visited Porcupine, partially destroying the town of Golden City. A large number of business places and residences were burned and at one time it was thought that the greater part of the town would be swept away. The loss will be heavy as the high insurance rate of 10% prevented the majority of business men from taking out insurance. It is doubtful if the burned section will be completely rebuilt, for since the completion of the railroad to South Porcupine, the necessity for the town of Golden City has been largely eliminated, as the majority of the larger mines are nearer the former town.

Good progress is being made with the Hollinger spur of the Temiskaming & Northern Ontario Ry. The government commission took over the construction of this work, several months ago, and although it has progressed much more slowly than anticipated it is now being pushed rapidly. The steel has been laid into Aura Lake settlement, where a station is being constructed. All the rock work is finished, and as soon as more piling has been driven for the bridge, over the end of Pearl Lake at the McIntyre property, the line will be completed as far as Timmins, the present terminus. By Feb. 1, the commission expects to have trains running.

The extension of the Temiskaming & Northern Ontario Ry., to Elk Lake, will start at a point between New Liskeard and Englehart, and it is stated that 80% of the country it will pass through is suitable for agriculture. It is evidently with this in view that the railroad will be built, because while Gowganda still holds out some promise of becoming a mining center, there is practically no hope at this time of Elk Lake ever becoming of any importance.

The Mining News

The Current History of Mining

Alaska

The steamship "Alameda" arrived in Seattle, Dec. 23, bringing gold bullion worth over $500,000, and a shipment of 800 tons of copper ore from the Bonanza mine, at the terminus of the Copper River & Northwestern Railway.

Engineer—The interests of several of the stockholders in this mine, at Atlin, have been sold to Capt. James Alexander. New machinery will be installed in the spring.

Lincoln—This placer property, in the Atlic district, has been taken over by W. H. Vance, who will improve it.

Alaska-Treadwell—During November the mills crushed 63,308 tons of ore, yielding $154,578 gross and net $49,858. Operating expenses were $89,834; construction, $14,885. The ore averaged $2.46 per ton and 765 ft. of development work were done.

Arizona

COCHISE COUNTY

Calumet & Arizona—The new smeltery to be erected at Douglas, will have all possible labor-saving devices. A bedding system for mixing ores will be installed, similar to that at the Greene-Cananea, with a capacity for 34,000 tons. The main building will be 168x508 ft., and will contain two blast and four reverberatory furnaces and six converters. The power plant will also be enlarged and production will not be decreased while construction is in progress.

GILA COUNTY

Miami—This company, under the management of B. B. Gottsberger, continues to maintain its daily tonnage of 2500 tons. The sixth and last unit is virtually ready to be placed in operation with the exception of the Hardinge mills, which will be shipped early in January, and it is expected that this unit will be running by Feb. 1. The Hardinge mills in the fourth unit are reported to be giving excellent satisfaction. Churn drilling has been resumed on the Pinal claim, near No. 3 shaft, 1500 ft. northeast of the present developed orebody.

Inspiration—It has been officially announced that construction will begin immediately on the company's dam across Pinal Creek, 16 miles from the mine. The dam is designed to store the floodwaters incident to the rainy season and will be an important if not the chief source of water supply for the proposed new concentrator. Preparations are being made to sink wells on the Inspiration ranch to develop additional water. Construction of the temporary warehouse near the mouth of the main tunnel will begin at once and excavation for the permanent steel warehouse is practically completed. J. M. Callow, consulting metallurgist, states that the experimental mill is running smoothly and that tests have thus far been satisfactory. E. J. Harrison, representing C. H. Repath, the consulting construction engineer who will design the new mill, is assisting in the supervision of the tests.

Live Oak—Churn-drilling operations continue and drifting and raising are in progress at the eastern end of the orebody, tributary to No. 1 shaft. The station at the 900-ft. level in No. 2 shaft is not yet completed.

Copper & Silver Zone—This group of claims, two miles east of Globe, continues to produce high-grade silver ore, under the operations of several groups of lessees. A drift is being run eastward from the old Clark shaft at a depth of 83 ft., and has opened 3 ft. of ore, estimated to run over 50 oz. of silver per ton. On the east end of the Old Ironsides claim, a vein 8 to 10 in. wide has been stripped for a length of 18 ft. and to a depth of 4 ft. This vein is estimated to average 15% lead and over 80 oz. of silver per ton. A shipment of six tons recently made from this group assayed 108 oz. of silver per ton.

Summit—The Gibson Copper Co. has formally taken possession of this mine, formerly known as the Gibson. This mine was taken over by the Summit Copper Co., in June, 1910. under option from the Gibson Copper Co. The Summit company worked the mine for over a year and gave up its option in December, 1911. As yet no reason for this action has been given to the stockholders, but it is generally believed that the company is without funds.

Manitou—The company is employing seven men on the Five Points group of claims, 1½ miles west of Globe. The 125-ft. Cracker Jim shaft is being unwatered preparatory to sinking to the 200-ft. level, and crosscutting to the Maverick vein at that depth.

Superior & Boston—Crosscutting north to the Great Eastern and Old Dominion veins on the 12th level is steadily progressing. A sump is being cut and a 1000-gal. Prescott pump is being set up on this level. It is believed that this pump will be able to handle any flow of water that may be encountered when the veins shall have been cut. A. C. Stoddard is superintendent.

Southwestern Miami—The company continues to develop its ground by churn-drilling. The drill is working on hole No. 2, which is now 130 ft. deep. Ore is expected at a depth of about 900 feet.

Orphan—The company is doing assessment work on its 10 claims lying southeast of the New Keystone on the edge of the schist belt near a contact of the granite porphyry and the schist. The ground is developed principally by a 560-ft. shaft from which over 600 ft. of crosscutting has been done on the 500-ft. level, by which five veins of variable width and copper content are reported to have been disclosed. The management believes that the future of the property depends upon demonstrating the existence of large bodies of disseminated ore, and future development will be conducted along that line.

Barney—This company has completed assessment work on its group of 26 claims lying west of and adjoining the Live Oak property.

California

AMADOR COUNTY

Bunker Hill—A cleanup of $30,000 for November is reported.

South Jackson—A new electric hoist is to be installed. Extensive development is planned.

Wildman-Mahoney—These mines have been taken over by the Chichizola estate. Active operation ceased about five years ago for lack of funds. Large ore reserves are said to be opened and resumption of work, it is believed, will make the property again productive.

Poundstone—A contract is reported to have been let for the construction of a 20-stamp mill for this mine, at Sutter Creek.

BUTTE COUNTY

Lakeview No. 2—This well, which had been sanded up for some time, has started flowing at the rate of 500 bbl. per day.

Santa Fé—The combined flow from wells Nos. 6 and 7 is 7000 to 8000 bbl. per day. The old 2-6 well is equipped with electric power again on the pump, making 400 bbl. per day.

Calaveras County

Leonard D. Baldwin, of New York, has purchased for Eastern interests the mining and water rights owned by Rigney & Norman, of San Andreas. The deal includes the Table Mountain mine, at Martin's flat, and the Cave City placer mines and Calaveritas properties.

Inyo County

Skidoo—Total production of this mine for October was $21,623.43; expenses, $9,123.56. The mill treated 1266 tons of company ore and 229 tons for leasers. During November the company milled 1192 tons of company ore and 144 tons of leasers' ore, a total of 1336 tons. Total receipts were $15,909; expenses, $8537; net profit, $7371. Development cost $938 and $7599 were spent for operating.

Kern County

Good Hope—A 15-hp. hoist will be installed with a 24-ft. headframe and skip. The shaft is down 150 feet.

Los Angeles County

Standard—The new refinery at El Segundo had its initial run on Nov. 27 with five stills in operation. The oil so far handled is from the Central wells at Whittier and the Fullerton wells in Brea Cañon. The pipeline from Northam to El Segunda, 21 miles long, is completed. The refinery will have a capacity of 15,000 bbl. per day when the plant is completed.

Modoc County

Sunshine—Schauer & Laughlin have moved their stamp mill to New Pine Creek, where better power facilities are obtainable. The mine will be worked all winter.

Napa County

Oathill—This quicksilver mine is reported to have been leased for five years, with a view of working the dumps. The Napa Consolidated Quicksilver Co., San Francisco, is the owner.

Nevada County

North Star—The company paid out as Christmas presents more than $4000, giving to each miner $10 in gold, and to each carman and shoveler, $5. This has been a custom for many years.

Canada Hill—Preparations are being made to sink a new shaft 500 ft., to intersect the Canada and the St. Louis veins. R. W. Gaylord, of Nevada City, is owner.

Pennsylvania—This mine and the W. Y. O. D. have been acquired under a long-term lease by the Empire and will be developed on a large scale with new machinery.

San Mateo County

Reed Zinc Co.—This company is planning the erection of a plant, near Dumbarton Point, to reduce zinc sulphide ores. The process to be used is patented by C. J. Reed and Carl Hering, and is a combination roasting-lixiviation and electrolytic-precipitation method. The company's offices are at 520 Head Building, San Francisco; Frank A. Leach, formerly superintendent of the U. S. Mint at San Francisco, is president, and C. J. Reed, formerly of Philadelphia, is general manager.

Sierra County

Gold King—A 12-ft. vein, showing free gold, has been cut in the tunnel which is being extended at this mine, near Alleghany. Cliff Weldon is manager.

Neocene—The extremely dry fall weather, resulting in a shortage of water, has forced the temporary closing of this hydraulic mine, at Scales. The hydraulic mine at Brandy City is operating with a reduced force.

Emerald—An arrastra is to be built on this group of claims, in Jim Crow Cañon. The quartz opened while doing assessment work this season shows much free gold. Smith & Shippsy are the owners.

Dodson—Good gravel is now being taken from this ranch on Little North Fork by James F. Hunt, an attorney, who has an option on the property.

Colorado

Boulder County

Discoveries of vanadium are reported in the Magnolia and Eldora districts. Samples assayed by a number of chemists are said to have shown from 1.26 to 7.33% vanadic acid.

Clear Creek and Gilpin Counties

Rockford—Sherman Harris, leasing this mine in the Russell district, is reported to have opened a vein from which ore is being shipped that carries 3½ oz. gold, 22 oz. silver and 15 per cent. copper per ton.

Baker—In this mine on McClellan Mountain, an 8-in. streak of ore has been discovered which assays $180 per ton in gold, silver, lead and copper.

Fremont County

United States Zinc Products Co.—This company has secured a 10-years' lease on the old smeltery of the United States Reduction & Refining Co. at Canon City and has put 70 men to work. It is stated that the old dump of the plant is to be worked over under a process for the chemical separation of ores devised by Sewell Truax, of Chicago. The manufacture of zinc oxide is a specialty of this company and will be carried on continuously under Superintendent Bocking.

Lake County—Leadville

Helena—It is reported that ore is being sacked at the mine in Iowa Gulch that yields about 17 oz. of gold and $20 in silver and lead per ton. This ore comes from the sixth level and is about 10 in. wide.

Silver Spoon—In the north drift at the 600-ft. level of this mine on Prospect Mountain, it is stated that a vein 4 ft. wide has been opened, that carries ore running as high as 5 oz. gold, 75 oz. silver and 10% copper per ton, and that nearby is another one about 2 ft. wide carrying ore that runs 1½ oz. gold and 25 oz. silver per ton.

Birdelia—The tunnel is now in about 1400 ft. and small streaks of fine ore are being found on the Amity vein. In about 150 ft. more the Fairplay vein will probably be cut.

Ouray County

Camp Bird—The estimated net profit for November is £47,890, and a balance of £47,590 is applicable to profit.

San Miguel County

Tomboy—During December the mill treated 9700 tons of ore, yielding $79,500 gross and net $35,000. Expenses were $44,500 and $740 were expended on permanent improvement.

Teller County—Cripple Creek

Ajax—The Colburn mill, using the Clancy process, was started Dec. 1 and is stated to be treating about 100 tons per day.

Forest Queen—An oreshoot opened recently gives returns as high as 15 oz. gold per ton for screenings. The property is being operated under lease by John Connors.

Granite—It is stated that the 1000-ft. level will be drained soon, after which it will be available for ore shipments. This company is unique in the history of Cripple Creek, inasmuch as its officers do not draw salaries.

El Paso—During the last six months of 1911 there was produced on company account, 10,269 tons of ore averaging about $20 per ton; by leasers, 7326 tons, averaging $17 per ton in gold. The development in the lowest levels made possible by the deep drainage tunnel has placed this mine in better condition than ever and has given additional evidence of the permanence of the ore grade in the district with depth, as the best ore is coming from a horizon 500 ft. deeper than any ore has been found in other veins. Allen Burris is manager.

Strattons' Independence—During November, the production was 2767 tons, averaging $19.47 per ton. Low-grade mine and dump ore amounting to 10,000 tons was milled. Net working profit at mine and mill was $14,605 and $1200 were spent on special development. On Dec. 19, cable dispatches to the home office stated that the mine was looking well and that the new discovery in the Hoodoo stope was 16 ft. wide and showed $30 ore.

Idaho

COUER D'ALENE DISTRICT

Evolution—The new concentrator which was recently constructed is now operating steadily and is giving entire satisfaction. The first shipment from the mine will be made soon, as the concentrates are being hauled to Osburn station.

Liberty—Samples of ore carrying 13% copper, 6 oz. of silver and a trace of gold have been brought to Wallace from this property. About 600 ft. of development work have been done and for the shallow depth at which the work has been done the showing is remarkable. The property is situated on the Montana side of the divide.

Tarbox—This mine, situated near Saltese, and which was swept by forest fires a year ago, is preparing to renew activities. The ore already developed is considerable and an entirely new plant will be erected.

Michigan

COPPER

Wyandot—The crosscut is reported to have reached the footwall of the lode after passing through 80 ft. of vein matter.

Wolverine—It is reported that a good showing of copper has been disclosed at the 300-ft. level of No. 5 shaft on the Osceola lode.

Mayflower—The drill is reported to have disclosed an unusually rich core recently. The new find was made at a depth of 1328 ft. and continued for about 70 ft. at an angle with the dip of the lode. It is said that the mineralization is well disseminated throughout all but 10 ft. of the core and that heavy copper shows at intervals for about 50% of the distance. The core has been compared favorably as to richness with that extracted from the Indiana property, almost exactly two years ago. This discovery is an important one and has considerable bearing on adjacent properties.

New Arcadian—Drilling has been resumed in section 31, where a depth of 700 ft. has been reached.

Franklin—It is said that the property is in readiness to produce at the rate of about 1200 tons per day. Underground forces are being increased and steam is expected to be turned into the new hoist in a few days.

Indiana—The shaft is down about 533 ft. and is said to be in felsite. A fair showing of copper was reported at about 512 ft., but is not in evidence at the present depth.

Algomah—According to a recent statement by President Dow, a crosscut is being driven west from the bottom of the shaft at a depth of 212 ft. to intercept the two lodes disclosed by Nos. 1 and 2 drill holes. As shown in those holes, both lodes were from 30 to 40 ft. wide, showing nuggets and considerable fine copper. No. 6 drill hole recently encountered an amygdaloid at a depth of 1867 ft., continuing in it for about 100 ft. and showing fine copper.

Ahmeek—Development work in 1911 made available five levels of new ground at Nos. 3 and 4 shafts. Operations at these shafts have been confined to development. Three of the four stamps in the mill are working full time and the fourth half time.

IRON

Extensive repairs are being made to the ore docks of the Chicago & Northwestern Ry. Co. at Escanaba; it is calculated that $80,000 will be spent this winter in rebuilding portions of the docks. Old No. 1 dock will be torn down and later a steel pier will be built in its place. Minor improvements are planned for the Chicago, Milwaukee & St. Paul docks at the same place. The Escanaba docks forwarded over 4¼ million tons of ore last season, from the Menominee and Marquette ranges.

Washington Iron Co.—This Breitung-Kaufman company, operating the Barron mine at Humboldt, where about 175 men are employed, is preparing to sink a shaft at its No. 10 property lying to the east of the Barron mine. A new compressor has been installed.

Oliver—The company is introducing carbide lamps for miners' use underground in its Section 16 mine at Ishpeming. These lamps have been used for several months by the Republic Iron Co., at Republic, where they have given satisfaction. If the trial works out well in the Section 16 mine, the carbide lamp may be generally adopted by the Oliver Iron Mining Company.

Mary Charlotte—This Breitung-Kaufman mine at Negaunee was closed down for 10 days commencing Dec. 25, to permit of rearrangement of sheaves for balanced hoisting, and to add about 35 ft. on the top of the smokestack for better draft. This work is at the No. 2 shaft called the Sunrise shaft.

Duluth Diamond Drill Co.—This company has secured a contract from George Holland, of Duluth, Minn., to drill on the farm of Olaf Helgemo on S. 27—T. 43 N.—R. 34 W., in the Iron River district. This property is situated five miles east of Iron River and is half way between the Chicagon mine of the Munro Iron Mining Co. and the Erickson orebody of the Cleveland-Cliffs Iron Company.

Norman—The company has given an option on 8 forties of land in S. 30—T. 47 N.—R. 30 W., to the Jones & Laughlin Ore Co., which has let a contract to the Cole & McDonald Exploration Co., to put two diamond drills on the tract. The land lies about seven miles northwest of Republic and is crossed by an arm of the Negaunee iron formation which extends quite a distance to the south, finally ending several miles east of Channing. Cole & McDonald only recently finished drilling just north of the Norman tract in the vicinity of the old Magnetic mine, for the Oliver company. In general the ore in the vicinity is hard and is high in sulphur. The Norman Iron Co. is composed of Negaunee men.

Montana

BUTTE DISTRICT

Alice—The Sherman law has been invoked by Peter Geddes and other minority stockholders to prevent the absorption of the company by the Anaconda company. Recent testimony in the suit disclosed the fact that $10,500,000 were paid to F. A. Heinze for his holdings at the conclusion of the "copper war" some years ago; also that Ex-Senator Clark received $5,000,000 for the properties that he sold to the Amalgamated two years ago.

BROADWATER COUNTY

Keating—At the Keating mine of this company in the Radersburg district, a body of high-grade ore has been opened between the 500- and 600-ft. levels, and from the last shipment of eight cars of 50 tons each, returns of about $90 per ton were obtained, which netted the company over $30,000. A large amount of development work has been done in the last six months, particularly on the 600-ft. level, in preparation for increased shipments, and the result is a large amount of ore opened at present.

Butte & Radersburg—The property is being rapidly developed and the management expects to begin shipping soon. A raise is being put up on the ore at present, and the work of sinking a winze, also on the vein, has started. A new surface plant is to be built and the foundations will be laid soon.

DEER LODGE COUNTY

Oro Fino—A vein was recently found at this mine in the Georgetown district and development work has opened up 7 ft. of ore running about $17 per ton in gold. The force at the mine has been increased and the ore is being shipped to the Washoe smeltery at Anaconda. The mine has large bodies of low-grade ore and the advent of the Butte, Anaconda & Pacific R.R. into the region will probably make it one of the largest producers in the district.

Fourth of July—This mine on upper Flint Creek has been purchased by John Lawlor and other Anaconda men, and preparations are being made to resume operations soon, after a shutdown of six years. A shaft is down 75 ft., and a well-defined vein is opened at that level. A vein of low-grade ore has also been developed in another part of the mine, which, with shipping facilities can probably be worked at a profit.

Jefferson County

King Solomon—The Calumet & Montana Mining Co. has acquired the King Solomon mine in the Clancy district, 2.5 miles from Clancy. It is a silver property and during the time of the high prices in that metal, it was one of the foremost producers in Montana. Two shafts 100 ft. apart have been sunk on the property; the first was sunk on the vein and 1100 tons of ore are said to have been produced from it, all above the 200-ft. level, which netted $100,000. The second shaft is vertical and levels were established about 50 ft. apart. The formation is a granite similar to the Butte granite, though softer, and is traversed by a porphyry dike 85 ft. wide striking northeast and southwest; the vein is at the contact of the granite and porphyry, averaging from 2 to 22 ft. in width. The company plans to put 40 men to work soon.

Corbin Copper King Mining Co.—This company has been incorporated with a capital of 200,000 shares, par $5, to take over the property of the Montana-Corbin Copper Co. in the Corbin district. The property consists of two claims carrying four veins apexing on them. A shaft has been sunk 450 ft. and levels opened at 150 ft., 250 ft. and the bottom. Some ore has been shipped in the past, the last carload having averaged 12.6% copper, 22 oz. in silver and 60c. per ton gold. The following directors for the new company have been elected: Dr. W. H. Hall, W. D. Gibson, R. B. Nuckols, E. L. Mayo, L. A. Heilbronner, William Gemmel, all of Butte, and Max H. Schultze, of New York. Mining operations will be resumed in the near future, after a shutdown under the old management, in force since June, 1910.

Nevada

Churchill County

Nevada Hills—It is reported that underground developments below the 470-ft. level, in the vicinity of the principal orebody are encouraging. The oreshoot has not yet been encountered on the 570-ft. level. It is said that the mill is operating satisfactorily and a good extraction is being made.

Comstock Lode

Ophir—The annual report of the superintendent for the fiscal year ended Nov. 30, 1911, shows that the total ore recovery for the year was 15,770 tons of second-class ore, or ore assaying under $60 per ton. The shipments to the Kinkead mill included 11,000 tons of ore yielding per battery sample, $30.62 per ton, or a gross of $428,680, and there was stored in the ore bins on Dec. 1, 1103 tons, assaying $41.09 per ton, or a gross of $45,000. The company also has stored 13,509 tons of tailings, worth $78,000. Two dividends were paid during the latter part of the year, with a good-sized surplus remaining in the treasury. The directors, it is understood, are now considering the advisability of erecting a mill and cyanide plant.

Con Virginia—The southwest prospecting drift on the 2550 level entered into pay ore recently, at a point 370 ft. south from the north boundary line of the mine; mine cars taken from the drift averaged $100 per ton, and 55 cars, $35 per ton. The metallic content of the ore ran nearly 90% in gold. This strike is considered important, as it is in the east fork of the vein, and at a point never before opened up or prospected. The formation is strong and regular and the trend is northeast and southwest, which is characteristic of the Comstock region.

Mexican—The preliminary tests made the last two weeks on the new 100-ton mill indicate that the plant is doing excellent work on low-grade ore, and is rapidly attaining the efficiency required before the regular crushing of ore from the mine starts. The various units recently were brought up to a point of efficiency where a saving of 90% was being secured.

Ward Shaft—A second diamond-drill hole has been driven through the bulkhead on the 2200 level for a distance of 115 ft., without securing an additional flow of water, and it is now proposed to follow up the drill with a drift driven through the bulkhead. Diamond drilling from the raise on the 2000 level will also be started.

Union Consolidated—The north drift on the 2500 level of the mine, being extended from the Mexican side, opened 2 ft. of quartz last week, giving from low to fair assays.

Crown Point—Mill run No. 4 has been completed at the Yellow Jacket mill, and preliminary estimates indicate successful results.

Esmeralda County

Goldfield Consolidated—The estimated December production is 29,127 tons yielding $700,000 gross and net $460,000. Operating expenses were $240,000 and Secretary Hews states that the latter included $42,000 for construction.

Lincoln County

Bamberger—H. C. Parker, until recently engineer in charge of the Day mine, and Pat Friel, foreman, have secured a lease on this property, immediately adjoining the Day mine. Work has been commenced on the Gusset Patch claim, and shipments will be started immediately, as there are several cars of shipping ore already on the dump.

Home Run—A 15-hp. engine was installed in December on this group of claims, which adjoins the Bristol Consolidated on the west. The property recently changed hands and the new owners are preparing to make shipments from it soon.

Pioche-Demijohn—The property closed down on Dec. 16, pending the completion of the railroad to the Prince mine.

Lyon County

Mason Valley—The new smeltery was blown in on Jan. 6, and it is stated that everything is working satisfactorily.

Nye County

Tonopah-Belmont—During the quarter ended Nov. 30, the receipts from sales of ore, bullion, etc., amounted to $884,161; mining, milling and administration expenses, $427,114; net profit, $457,046; miscellaneous income, $6625; total net income for quarter, $463,671. Available resources, Nov. 30, 1911, are reported as follows: Due from smelters, $211,756; due from others, $4205; loans on collateral, $150,000; cash in banks, $926,110; amounting to $1,292,072, total.

Montana-Tonopah—A new vein is reported to have been found on the 815-ft. level. The new discovery is northeast of the main shaft and 4 ft. of the vein is said to assay from $80 to $100 per ton.

White Pine County

Giroux—It is reported that the company has entered into an agreement with the Nevada Consolidated under which the latter will smelt the Giroux ore. Production is expected to start soon.

South Dakota

Homestake—Construction work on the hydroelectric plant has been completed, at an estimated expenditure of $1,250,000, which has been paid out of surplus and current earnings.

Utah

Beaver County

Majestic—Settlement has been made by the International Smelting Co. for another car from the Harrington-Hickory mine, on which the returns were as follows: 19.7% lead; 17.7 oz. silver; 0.75% copper; 7.8% iron. This brought net smeltery returns of $21 per ton. Ore carrying 27.3 oz. silver and 8.9% lead has been opened in the west drift, 67 ft. from the shaft. Another car has been shipped.

Utah Mining, Milling & Transportation—Arrangements have been made at the Lady Bryan mine for sinking the main shaft 200 ft. deeper. Conditions are reported favorable.

Horn Silver—A full face of shipping ore has been opened on the 400-ft. level in the northern part of the property. This carries lead, silver and zinc. The extent is not yet known. There is considerable unprospected ground in this vicinity.

Peacock—A lease has been taken on this property from L. F. Block by Salt Lake men.

Indian Queen—Five cars have been shipped recently by leasers.

Nevada-Ready Pay—The new tunnel is in 74 ft. and has opened ore from which assays of 42 per cent. lead, 15 oz. silver and $3 per ton in gold have been obtained.

Juab County

Tintic shipments for the week ended Dec. 22, amounted to 130 cars, which is 35 or 40 cars less than the usual amount. This difference is due to an accident on the San Pedro line, and a consequent shortage of cars.

Iron Blossom—A raise has been driven from the 600-ft. level of the No. 3 shaft in siliceous silver and lead ore. This ore was opened a short distance north of the cave found on the level above and was cut by the raise at about 40 ft.; since then about 15 ft. have been driven in ore. Assays of about 30 oz. silver and $4 in gold have been obtained. Several cars of copper ore have recently been shipped from the south end of the property.

Gemini—Arrangements for leasing the upper levels are in progress, work on company account being below the 900. Everything above the 900 will be turned over to lessees, and a number of blocks of ground have been taken. In the upper levels of the Eureka Hill and Bullion Beck, adjoining, leasers operated at a profit for several years after work on those levels on company account had been suspended.

Opohongo—An option on a block of stock, amounting to nearly 200,000 shares, has been secured by the controlling interests.

Beck Tunnel—A shipment of 100 tons was sent out recently, and the amount of ore showing remains practically unchanged. An incline is being driven south from the tunnel level on the orebody. Drifting is being done from the 175-ft. level of the shaft to cut the new orebody about 100 ft. from the point which is furnishing present shipments.

Yankee—Some difficulty has been experienced in getting cars for shipping low-grade dump ore and the teams, which were hauling, have been laid off temporarily. It is hoped to move this ore while the wagon road between the mine and the railroad is in good condition. Development is in progress on the 1800, 1900 and on a sublevel between the two.

Utah Consolidated—Development is being done northeast of the shaft on the 200-ft. level. The face of the drift is mineralized.

Salt Lake County

Utah Copper—Production in November amounted to 9,117,961 lb. copper, as compared to 8,660,729 lb. in October. The general average for the first nine months of 1911 was 7,957,533 lb. per month. The lowest month was January, the production being 6,707,116 lb. In September, 9,285,581 lb. were produced, this month showing the largest output. Six sections of the Arthur mill have been remodeled and are reported to be doing about 10 per cent. better work than other mills treating disseminated ore. Work is being done on the seventh section and all of the 13 sections will be changed as soon as practicable. The Magna mill is making a good saving, but according to report this is not up to that of the Arthur. The production for the first 11 months of 1911 totaled 89,396,862 pounds.

Ohio Copper—It is reported that the company is installing 64 Wilfley tables for the third section of the mill, which will be commissioned not later than Feb. 1. This will increase the capacity to 3000 tons per day. The Wall rolls will be placed in the crushing department of this section also.

Summit County

Park City shipments for the week ended Dec. 23, amounted to 3,320,160 lb. The shippers were: Daly West, Silver King Coalition, Daly-Judge and Silver King Consolidated.

Daly—Prospecting with a small force is being carried on in various parts of the mine.

Washington

Dead Medicine—This mine, near Colville, Stevens County, has been opened by the Clugston company, and additional machinery will be installed soon.

Lone Pine—A new body of ore has been encountered at this mine, in the Republic district, in Ferry County, assaying from $50 to $115 per ton.

San Poil Consolidated—A contract has been let for the construction of a new mill on this property, at Republic. The mill will have a capacity of 125 tons per day, and is to be completed in about 90 days.

Canada

British Columbia

Le Roi No. 2, Ltd.—Work at depth in the Josie and adjoining property has resulted in the development of the Rodney vein on the 1200-ft. level, and the finding there of a considerable quantity of ore of good grade. The 1300-ft. level is being opened, while preparations are being made to sink still deeper. Indications are favorable to ore being found on and below the 1300 level. During the fiscal year to Oct. 1, 1911, underground development work totaled 5576 ft., while nearly 15,000 ft. of diamond drilling were done. Production was about 27,100 tons of first-class ore, shipped to the smeltery, and 18,400 tons concentrated into 1600 tons. Total marketable metal contents were, approximately: Gold, 25,000 oz.; silver, 24,000 oz.; copper, 905,000 lb. Average value of ore mined was close to that of the previous fiscal year. Concentration operations were successful, and gave the best years' results yet achieved by the works. The company paid the usual dividends.

Ontario

Steel Co. of Canada—This company, at Hamilton, will immediately proceed with the erection of two new openhearth blast furnaces of 50 tons capacity each, a blooming mill, continuous billet mill and a combination rod and bar mill. The contract for the erection of the buildings has been awarded to the Hamilton Bridge Co., which undertakes to have them completed by Apr. 1. The total cost will be about $2,000,000 for these additions.

Ontario—Cobalt

Shipments from Cobalt for the week ended Jan. 6 were as follows: Coniagas, 130,522 lb.; O'Brien, 122,301; La Rose, 63,956; McKinley-Darragh, 63,895; Kerr Lake, 60,570; total, 441,224 lb. Nipissing shipped $33,304 worth of bullion.

Nipissing—During December production amounted to 407,114 oz. worth $225,156 and ore worth $303,600 was shipped. Of the latter the high-grade mill contributed $267,035. Bullion to the extent of 489,184 oz. was shipped. The production of 407,114 oz. compares with 403,408 oz. for November, 431,986 for October and 436,694 for September. Construction work on the new low-grade mill is progressing satisfactorily. A financial statement as of Jan. 6 gives cash on hand at over $1,500,000, from which the dividend of $450,000, payable Jan. 20, must be deducted.

Cobalt Townsite—During the fiscal year ended Oct. 31, 1911, silver was produced to the net amount of $393,000. A contract is in operation with the Northern Customs mill, at Cobalt, under which the latter is treating 75 tons per day of the Townsite's low-grade ore. The weekly output of the mine is now running about 21,000 oz., and there is ore blocked out estimated to carry about 1,500,000 oz. of silver.

Green-Meehan—The Santa Maria Co., lessee of this property, has shipped a 30-ton car of low-grade ore to Denver. This is the third car sent out since operations were resumed.

Beaver—It is stated that an 8-in. vein, carrying about 3500 oz. of silver per ton, has been encountered in a crosscut on the 400-ft. level.

Beacon—The prospect of the speedy construction of the Elk Lake branch of the Temiskaming & Northern Ontario Ry., has induced the management to order a resumption of operations at this property, at Elk Lake.

ONTARIO—PORCUPINE

Important discoveries of cinnabar in northern Ontario are announced. It is stated to have been found in quantity at Groundhog on the Groundhog River, east of Cochrane, where about 20 locations have been staked. As mercury is employed for the separation of silver from the metals with which the latter is associated, a ready market could probably be found for it, close at hand.

North Dome—The new power house and headframe have been completed, and when the compressor is set up, underground work will be started again. It is reported that the option held by the Temiskaming Mining Co. on this property, may be given up. There has been much dissatisfaction among the Temiskaming shareholders over the deal, and efforts are being made to overthrow the present management.

Gold Wonder—A 3-stamp mill is to be installed on this Swastika property.

Pearl Lake—The last of the electrical equipment for this property has been received, and the new compressor will be started soon. Diamond drilling has been stopped for this season, and further deep exploration work will be carried on from the main shaft at a depth of 400 ft. The shaft is now down 250 ft., and will be continued to the 800-ft. point.

Bewick-Moreing—This company will contract all its underground work in the future.

McEnaney—On this property, under option to the Crown Reserve company, the main shaft is being sunk to 300 ft. Diamond drilling below 400 ft. has shown a large body of quartz, but the assays have not been made public.

Three Nations—A 3-ton shipment has been sent to Montreal, in order to make a test of the ore.

Watson—A small plant will be installed.

Porcupine Gold—Two of the main veins have been cut from the 200-ft. level. Development work will be carried on more vigorously as soon as the new plant is running.

Swastika—The president has issued a statement denying that the mine is flooded.

Caswell—It is stated that this property in the West Shining Tree district has been purchased by Duluth men.

Sakta—This company has made the final payment on its property.

Jupiter—Another payment of $70,000 has been made on this property.

Rea—President Hill states that the pay shoot on the 200-ft. level is 170 ft. long and gives an average assay of $18. This is over a width of 42 in. The vein at the 300-ft. level is 38 ft. wide but the pay shoot has not been definitely found.

Mexico

American Smelting & Refining Co.—The physical condition of the company's mines is stated to be better at present than for several years, and the outlook for increased custom business is bright. All of the five Mexican plants, namely, Monterey. Aguascalientes, Velardena, Matehuala and Chihuahua, are reported to be in operation, also the El Paso plant at the Mexican border. During the political troubles in Mexico some months ago, it was feared that an increase in wages would be necessary both at the mines and smelteries. This was not the case, however, and the labor situation is again normal, with the men working for their usual wages and apparently satisfied.

CHIHUAHUA

Capazuya—This company will hold its annual meeting in January. Stock in a new corporation has been issued *pro rata* to the old stockholders, and a bond issue of $30,000 provided to meet present expenses. Some ore is being taken from a small vein. It is proposed to continue the shaft with the hope of striking the Palmilla orebody at depth. E. M. Pine, of Philadelphia, is secretary.

San Cristobal—This Parral mine is planning a cyanide mill. Recently 600 burros were engaged in transporting ore to the Sierra Plata mill. B. U. Gordon is manager.

Chamaquita—Leasers on this property, east of Palmilla hill, are taking out shipping gold ore. The same oreshoot is being developed on the adjoining Eureka property by a Boston company.

San Juan del Retiro—Negotiations for the sale of this recently developed mine in the Santa Eulalia district are underway with one of the large companies of Mexico.

Compañia Minera La Republica—Milling was resumed at the property on Dec. 22 after a 4 months' shutdown caused by the floods of the last rainy season, and it is expected that normal operations will soon be reëstablished. Gordon Hardy is consulting engineer.

Molola—A new strike is reported to have been made in the mine recently on the north side of the dike, which cuts the vein. In drifting toward the dike a shoot of ore was uncovered, assaying from $90 to $1800 per ton. The ore in this working has been from 5 to 6 ft. wide and all of shipping grade for some time, but the new shoot is much wider, is of better grade and has indications of permanence. W. M. Matthews, general manager, has 300 mules and burros carrying shipping ore from the mine to Magdalena, the shipping station. The machinery ordered some time ago is expected to be installed within a month, after which the output can be increased. Plans have been made for an aërial tramway to carry the ores from the mines to a central point for milling. Cyanide tests are reported as being conducted by E. M. Hamilton, and this may result in the profitable working of a large tonnage heretofore considered worthless.

Mazata—Carlos Romero, of Etzatlan, a well known mining man in this state, has organized the Compañia Minera de Mazata, to take over and work the old mine in the Etzatlan district. It is said that men identified with the Torreon smeltery and the Mexican National Dynamite Co., also well known residents of Mexico City and Guadalajara, are interested in the new enterprise. The shaft will be sunk 150 ft. further, the water pumped from the old workings and a new hoist installed and the shaft retimbered.

Soledad—Work on the shaft, started about two months ago, is going forward steadily, and about 20 men are employed. This number will be increased later on. The work is in charge of Mr. Bronniman, of Santa Rosalia.

Veta Grande—It is reported that Fred Mitchell, manager, has been transferred to La Reforma property in the State of Coahuila. W. J. Deavitt, formerly in charge of the property and for some time manager of La Reforma, has returned to his former position at this property.

Santo Nino—It is believed that this mine, situated about 2½ miles north of Parral, will soon resume operations. The property was purchased about a year ago from Parral men by Raoul Boutet of Mexico City, on the recommendation of a French engineer, who made an examination.

Amajac—C. A. Sidlers, of Sundberry, secretary and treasurer of the company, is reported to have announced that the company has completed all payments due on the Refugio Las Aninas and Tres Estrellas mines, and the Amajao reduction plant, and that full titles to the properties have been secured. Mine development, curtailed some months ago because of disturbed conditions, has been resumed.

Central America

COSTA RICA

Abangares—A riot recently occurred at this mine, between the white and native employees, resulting in the death of six men.

Asia

CHOSEN

Oriental—During October, the mill treated 31,022 tons of ore yielding $135,493 gross. Operating costs were $71,679; development, improvements, etc., $1375; total net profit, $62,440. During November 27,016 tons were crushed, yielding $137,335 gross. Scarcity of labor caused temporary cessation of milling at times during the month.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Jan. 10—The prevalence of extreme cool and stormy weather over nearly all the country east of the Mississippi has stimulated domestic trade everywhere; at the same time limiting supplies by interfering with transportation. The coal trade everywhere is consequently in an exceptional position and it will be at least a week before it can get back to normal conditions.

Coal and coke tonnage of all the Pennsylvania R.R. lines east of Pittsburg and Erie, 11 months ended Nov. 30, 1911: Anthracite, 10,742,344; bituminous, 38,437,959; coke, 9,728,136; total, 58,908,439 short tons, a decrease from 1910 of 1,139,362 tons, or 1.9 per cent. This loss was entirely in coke, coal showing a gain of 1,157,189 tons.

Exports of fuel from the United States, 11 months ended Nov. 30, 1911, in long tons: Anthracite, 3,312,755; bituminous, 12,880,342; bituminous supplied to steamships in foreign trade, 6,112,769; coke, 835,568; total, 23,141,434 tons. This is an increase of 3,637,436 tons, or 18.6 per cent., over 1910. Canada took in 1911, a total of 13,181,198 tons; Cuba and the West Indies, 1,454,799; Panama, 451,743; Mexico, 449,671 tons.

Imports of fuel into the United States, 11 months ended Nov. 30, 1911, long tons: Anthracite, 54; bituminous, 1,101,228; coke, 65,843; total, 1,167,071 tons. This is a decrease from 1910 of 795,840 tons, or 40.5 per cent. Canada furnished in 1911 a total of 873,265 tons; Australia, 207,945; Japan, 11,273 tons of coal.

IRON TRADE REVIEW

New York, Jan. 10—The iron and steel markets have hardly recovered as yet from the holiday break, and conditions are a little slower, as might have been expected. There is not the rush to buy that existed in the closing weeks of last year, and there is a little tendency to revert to small orders. There is still, however, a fair business being done, and no signs of dullness are apparent. Without any boom, it looks as if a good business would continue, and as if January might turn out a good month. There is still some competition for business and prices are not being raised beyond the point they reached 10 days ago.

Holidays at the steel plants were generally short, and many of the mills are at work, with an increased percentage of their capacity.

Orders for rails continue to come in, and there is some increase in demand for other railroad material.

In pig iron, sales have been numerous, but many of them small. The aggregate makes up a pretty good business.

Coke and Ore Rates—Iron and steel manufacturers, operating plants in the Youngstown district in Ohio, have complained to the Interstate Commerce Commission of the rates on coke over the Pittsburg & Lake Erie R.R. from the Connellsville district, and also of the rates on coal over the same road from the Pittsburg district. It is stated that these rates discriminate against the Youngstown district, and reparation is demanded. The same companies have complained in a third statement of the rates on ore over the Lake Shore & Michigan Southern and the Pittsburg & Lake Erie from Ashtabula Harbor, on Lake Erie. Reparation is demanded in this instance also.

Baltimore

Jan. 8—Exports for the week included 5,230,880 lb. rails, 526,820 lb. rail joints, 5,068,953 lb. galvanized iron, 782,452 lb. wire, 662,497 lb. miscellaneous iron and steel and 79,515 lb. tinplates to Valparaiso, Chile; 2,243,100 lb. steel billets to Liverpool. Imports included 1521 tons ferromanganese from Liverpool; 60 casks manganese ore from Hamburg; 13,840 bars spelter from Antwerp; 23,100 tons iron ore from Cuba.

Birmingham

Jan. 8—Inquiries are being received by pig-iron manufacturers in the Southern territory, which promise to result in business. Confidence is expressed by ironmakers in this section as to the prospects, and already there is a steady shipment on orders booked before the close of the past year. It is figured there will be no accumulation of iron during the first half of the year, and if the inquiries now being received result in business, the entire year will be without any surplus iron and what is still on hand will be wiped off. There are two furnaces less in operation in Southern territory now than a month ago, but preparations are being made to make up the difference. The Sloss-Sheffield Steel & Iron Co. is expending something like $150,000 on furnace repairing alone, at Sheffield.

Complaint is still being made by Southern pig-iron manufacturers that the railroads are not offering assistance in the way of freight rates. It is charged that present rates hinder the development of trade in the Central West. This matter is to be carried to the Interstate Commerce Commission.

Cast-iron pipe manufacturers, foundries and machine shops, stove producers, etc., have purchased quite liberally in this territory, and the prospects are for a steady melt of pig iron this year.

There will be no cessation at the steel plants in the Southern territory, business in hand or in sight warranting a steady operation. A large order for rails for the Southern Ry. Co. has just been received at Ensley.

Charcoal iron is in fairly good demand, with $22 the average price being obtained. Scrap is inclined to be slow.

Chicago

Jan. 9—Stock taking is about over, but foundries have hardly yet taken up the burden of 1912 business, and the current demand for pig iron is rather slow, and mostly for small lots. There are inquiries for large lots coming in, but rather slowly. The blizzard weather also has rather depressed trade this week.

Northern No. 2 foundry is still quoted at $14.25@14.75, and there does not seem to be any more $14 iron available. Southern No. 2 holds up to $10.50 Birmingham, or $14.85 Chicago, with some reports of sales at 25c. less. Sellers are inclined to believe that another week will show good business.

Finished-material sales are rather quiet for the week, but with signs of improvement not wanting. Structural business on a large scale is in sight, but much of it may wait until spring is in sight.

Cleveland

Jan. 8—There is talk about ore prices for the coming season, but no action has been taken as yet.

Pig Iron—Business was quiet over the holidays, but there are plenty of inquiries coming in. Prices are unsettled; the tendency is upward, but few actual advances have been made.

Finished Material—Inquiry for plates, sheets and bars is brisk, and mills are inclined to look for a good January business. Structural material is quiet for the time being.

Philadelphia

Jan. 10—Pig iron has continued quiet another week. Agents of furnaces report a revival of inquiries during the last two or three days. Prices are firm and confidence prevails. Furnace interests are not running after business and are awaiting the action of buyers who as a rule have a good deal of business on hand and in sight to cover with purchases of iron. The stronger quotations recently established are being adhered to on paper. The large amount of pipe line construction contracted for assures further activity in pipe iron and within a week some of the inquiries then under consideration have resulted in contracts. Low-grade makers are not forcing higher prices and are willing to accept orders for delayed delivery at easy prices. Fresh inquiry for basic developed this week without reported transactions. The inquiries for No. 2X foundry come in the main from the smaller consumers. Certain large consumers have signified their willingness to duplicate December orders at concessions of about 25c. In forge irons the tone is strong. Everything is favorable for an enlarging demand in all lines. Quotations are $15 for No. 2X foundry; $14.50 for best forge; same for basic.

Steel Billets—Both forging and rolling billets have moved up a trifle and a fair amount of business has been closed.

Bars—Bars remain at the fractional advance on small lots and it is claimed that even in large quantities the present negotiations will be closed at a slight improvement. Jobbers are more active in replenishing depleted stock and car-building requirements are looming up.

Sheets—Sheet quotations are held firmly and large buyers are not as able as they thought they would be to close contracts on early December quotations. The small-fry buyers order readily and without question, but they are ordering only for current necessities. Sheets have reached permanently a better position.

Pipes and Tubes—Some business that was counted on for December in tubes has just come along. Merchant pipe is strong. Cast-pipe work is abundant.

Plates—Shipbuilding orders throw in steadily for rather small quantities, each new job of work being covered and no more. The slight advance made a few weeks ago is being held. The mills have a larger accumulation of business than for many months.

Structural Material—Quite an amount of business for bridge and other work has reached the mills within a few days.

Scrap—Sales of scrap have fallen to small lots, but all the dealers are holding firmly to announced prices.

Pittsburg

Jan. 9—The past fortnight in the steel trade has been quiet by comparison with the activity of a few weeks preceding, in which period the tone of the market underwent a complete change. There has been a decided disposition to magnify the importance of the change which has occurred. It does not, as a matter of fact, leave the steel industry in a greatly changed condition. The change in the position covers simply: (1) A material increase in the tonnage of steel products actually specified on mill books, whereby the mills can arrange their rolling schedules to better advantage, and have work assured for several weeks; (2) an advance of $1@3 a ton in quotable prices of several important steel products, although the material to be rolled and delivered is at the old and lowest prices.

Already information is coming out that buyers have contracted for more than their normal requirements for the first quarter of the year, in order to take advantage of the low prices, but fully expecting to string out the deliveries to cover a longer period, and by the amount that such business is done, the position of the mills, as shown by figures of contracts they have booked, is inflated.

There is an increase in production this month over December, buti tt is confined almost entirely to the Steel Corporation in western Pennsylvania and Ohio, this increase being due chiefly to the needs of the car plants. The Jones & Laughlin Steel Co. this week began making steel at its new Aliquippa plant. The tinplate and wire departments at Aliquippa have been in operation for some time, but until yesterday no steel had been made there. One of the four 250-ton Talbot open-hearth furnaces was started, it being likely that the other three will be started by the end of the month, their rated capacity being about 30,000 tons of steel ingots monthly. The furnaces are being operated on the pig and scrap process, rather than on the regular Talbot process.

Pig Iron—The Alleghany Steel Co. is understood to have purchased between 6000 and 9000 tons of basic iron, for delivery over the first six months of the year, at a trifle under $12.50, Valley furnaces. The Pittsburg Steel Co. recently bought about 15,000 tons of basic iron for January delivery the major part, if not all of the iron to come from a furnace outside the Valleys. Bessemer and foundry iron have been quiet. The pig-iron averages for December, compiled by a trade interest from actual sales, have been announced at $14.19, Valley, for bessemer, and $12.44, Valley, for basic, showing increases over November of 17c. in bessemer and 16c. in basic. The basic average is considerably higher than the average quoted price during December. Current quotations are: Bessemer, $14.25; basic, $12.35@12.50; No. 2 foundry, $13; malleable, $12.75@13; forge, $12.50, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market has been quiet, consumers having covered before the recent advance, which appears to be well held, and we quote prompt and forward at $41, Baltimore.

Steel—The majority of the mills are comfortably sold up for this month and next on both billets and sheet bars, and one large mill is reported to be oversold. Prices are fairly well held at the sharp advance which has occurred, although it is possible one or two mills would shade them for delivery at certain points. We quote: Billets, $20; sheet bars, $21; rods, $24.50@25, Pittsburg.

Sheets—Mills are holding firmly to the advanced prices, and here and there a mill asks $1 over the regular market, being sufficiently well sold up to allow orders to pass by for a time. Specifications have been good, but almost wholly against contracts taken at the lowest points. The market is quotable at 1.90c. for black sheets, 28 gage; 2.90c. for galvanized, 28 gage, and 1.40c. for blue annealed, 10 gage. Corrugated roofing is selling at concessions of $2 a ton from the old list, of June 1, 1911, which makes painted corrugated about $1.33 per square for 28 gage and galvanized $2.46 per square.

St. Louis

Jan. 8—Quite an improvement has been noted with the advent of the new year, and a number of producers and jobbers are quoting $10.50, Birmingham, or $14.25, St. Louis, as the minimum price on No. 2 foundry, though a few quotations have gone out at a little under this figure for immediate acceptance. Demand for finished products is much better; a number of good orders have been received in the last 30 days, which will keep the plants working nearly full time from now on. There has been some inquiry for Northern iron and a little business done. The current figure on northern No. 2 is around $15, St. Louis, though some has gone at $14.75 to meet competition.

Iron Ore Trade

The Port Boliver Iron Ore R.R., into Ore City, Tex., has been completed, thereby connecting the ore lands of the eastern part of Texas with the coast. This affords a means whereby the iron ore mined in that part of the state can be shipped directly to Boliver, Tex., a seaport, from where it can be taken by steamship to Atlantic Coast points. Development is proceeding at the mines.

Foreign Iron Trade

German Foreign Trade—Exports and imports of iron and steel and of machinery in Germany, 11 months ended Nov. 30, metric tons:

	Exports	Imports	Excess
Iron and steel.	4,834,865	540,747	Exp. 4,294,118
Machinery.......	414,368	70,735	Exp. 343,633
Total.........	5,249,233	611,482	Exp. 4,637,751
Total, 1910......	4,754,409	574,721	Exp. 4,179,688

Exports of iron ore in 1911 were 2,389,046 tons; imports, 10,007,349 tons.

British Foreign Trade—Exports and imports of iron and steel, and of machinery, in Great Britain, 11 months ended Nov. 30, as valued by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	£40,030,465	£10,134,810	Ex. £29,895,655
Machinery...	28,326,500	5,315,556	Ex. 23,010,944
Cutlery and hardware.	9,344,333	6,063,283	Ex. 3,281,050
New ships...	4,888,032	....	Ex. 4,888,032
Total..... ..	£82,589,330	£21,513,649	Ex. £61,075,681
Total, 1910..	84,127,249	17,907,976	Ex. 66,219,273

Decrease in exports in 1912 was £1,537,919, or 1.8 per cent. Iron and steel, with machinery, showed a considerable increase, but there was a decrease of £3,752,824 in the value of new ships built for foreign countries. Increase in imports in 1912 was £3,605,673, or 20.1 per cent. The quantities of iron and steel were, in long tons:

	1910	1911	Changes
Exports............	4,215,621	4,108,991	D. 106,630
Imports............	1,218,394	1,604,102	I. 385,708

Imports in 1912 included 21,038 tons steel billets, 440,123 tons blooms, billets and slabs and 290,641 tons sheet bars and tinplate bars; a total of 751,802 tons of half-finished material, largely from Germany and the United States.

METAL MARKETS

New York, Jan. 10—The metal markets generally have been inclined to quiet, but show considerable strength.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Nov. 1911.	$13,941,093	$ 3,458,321	Exp. $10,482,772
" 1910..	1,376,011	4,313,500	Imp. 2,937,489
Year 1911.	36,188,397	52,737,854	Imp. 16,549,457
" 1910..	57,444,422	54,245,886	Exp. 3,198,536
Silver:			
Nov. 1911..	5,052,238	3,338,956	Exp. 1,713,282
" 1910.	5,265,595	4,827,254	Exp. 438,341
Year 1911..	59,667,286	40,439,844	Exp. 19,227,442
" 1910.	51,299,913	41,479,718	Exp. 9,820,195

Exports from the port of New York, week ended Jan. 6: Gold, $93,014; silver, $1,412,012, principally to London. Imports: Gold, $74,942; silver, $222,855, from the West Indies, Mexico and South America.

Gold—Prices of gold on the open market in London were at the normal level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. In New York a total of $2,700,000 gold was taken, on London account, for shipment to Argentina.

Iridium—Prices are unchanged, at $64 per oz. for pure metal.

Platinum—Trade is quiet and prices are unchanged. Dealers ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal.

Our Russian correspondent writes, under date of Dec. 24, that as usual at this season the small producers, needing money for the holidays, have been pressing their platinum for sale, and this has a relaxing influence on the market. Prices are nominally unchanged. Quotations for small lots of crude metal, 83 per cent. platinum, at Ekaterinburg are 10 rubles per zolotnik—equal to $37.60 per oz., for large lots at St. Petersburg, 38,500 rubles per pood—$37.73 per oz.—for the same grade.

Silver—The market has scarcely maintained itself at the advance and today shows a slight recession. The prospects for the New Year for silver are considered good, taking into account the many influences likely to bear on the situation.

SILVER AND STERLING EXCHANGE

Jan.	4	5	6	8	9	10
New York....	54⅞	55	55	55	55	54⅞
London.....	25 5/16	25⅜	25⅜	25⅜	25⅜	25 5/16
Sterling Ex..	4.8640	4.8645	4.8660	4.8665	4.8675	4.8680

New York quotations, cents per ounce troy, fine silver: London, pence per ounce, sterling silver, 0.925 fine.

Shipments of silver from London to the East, Jan. 1 to Dec. 28, reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India...	£7,168,200	£8,769,700	I. £1,601,500
China.......	1,424,000	990,300	D. 433,700
Total.....	£8,592,200	£9,760,000	I. £1,167,800

India Council bills in London averaged 16.04d. per rupee for the week.

Stocks of bars in Bombay are estimated at £1,580,000; of sycee and bars in Shanghai, £3,200,000; a total of £4,780,000. Besides these there is a stock of about £1,900,000 in London.

The Treasury Department estimates gold in the United States, Jan. 2, 1912, as follows: Held against gold certificates, $1,010,956,369; in Treasury current balances, $172,017,641; in circulation, $614,026,906; total, $1,797,000,916. Gold held against certificates includes bullion as well as coin.

Coined silver in the United States, Jan. 2, is estimated by the Treasury Department as follows: Standard dollars, $565,186,367; subsidiary coin, $165,789,312; total, $730,975,679. Of the silver dollars, $489,166,000 are held in the Treasury against silver certificates outstanding.

The Ansonia Brass & Copper Co., of Ansonia, the Benedict & Burnham Manufacturing Co., of Waterbury, the Coe Brass Manufacturing Co., of Torrington and Ansonia, and the Waterbury Brass Co. went out of business Jan. 1, and their operations, plants and good-will were taken over by the American Brass Co. By this process the American Brass Co., instead of controlling these companies as it has in the past, through stock ownership, will consolidate the entire business in its own hands.

Copper, Tin, Lead and Zinc

NEW YORK

Jan.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
4	14.20 @14.40	14.05 @14.10	42½	4.45	4.30 @4.35	6.30 @6.45	6.15 @6.30
5	14.30 @14.40	14.10 @14.15	43⅛	4.45	4.30 @4.35	6.30 @6.45	6.15 @6.30
6	14.30 @14.40	14.10 @14.15	43	4.45	4.30 @4.35	6.35 @6.45	6.20 @6.30
8	14.30 @14.50	14.20 @14.30	42¾	4.45	4.30 @4.35	6.40 @6.50	6.25 @6.35
9	14.30 @14.50	14.25 @14.35	42¼	4.45	4.30 @4.35	6.40 @6.55	6.25 @6.40
10	14.30 @14.50	14.20 @14.30	42	4.45	4.30 @4.35	6.40 @6.55	6.25 @6.40

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Jan.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
4	63⅜	64⅛	67½	191¼	186½	15⅝	26¾
5	63⅝	64⅜	67¾	194	189½	15⅝	26¾
6	......	....	......	......	......	......	......
8	64 3/16	64 13/16	68¼	193	188	15⅝	26¾
9	64⅛	64⅞	68¼	191½	186½	15 11/16	26¾
10	63	63¾	67½	190½	185¾	15⅝	26¼

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. £1 = ± 0.21¾c.

Copper—The expectation of favorable statistics started a heavy buying movement, and a fairly large volume of sales was made to European and domestic buyers at advancing prices. Electrolytic producers finally raised their price asked to 14½c., delivered, usual terms, and some Lake producers actually realized a full 14½c. price, although in both kinds of metal there were cheaper sellers at all times. When the statistics were published on Jan. 9, showing a reduction in the stocks of over 22,000,000 lb., it appeared that the good news had been discounted. This made itself felt by heavy liquidation in the standard market, which, after reaching £64 5s. for spot and £65 for three months on Jan. 9, reacted sharply on Jan. 10, the close being cabled at £63 for spot and £63 15s. for three months. This naturally had an effect upon the market for refined sorts and more competition to sell promptly developed with the result of a shading of prices, although quotations were not materially reduced. The close is nominal at 14.30@14.50c. for Lake copper, and 14.20@14.30c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 14@14⅛c. as the average for the week.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is higher at 15¾c. base, carload lots at mill.

Copper exports from New York for the week were 6865 long tons. Our special correspondent gives the exports from Baltimore at 2922 tons.

Tin—The demoralization of last week's London market is being ascribed to the difficulties of one of the London metal houses which led to its failure. Since then the market has steadied. Advantage was taken by domestic consumers and dealers of the severe decline in the London market, and considerable business placed, especially for future deliveries. Spot tin is exceedingly scarce, the bulk of the material being in the hands of consumers. For what little is being required, premiums up to 1½c. per lb. have to be paid. The market closes weak at £190 10s. for spot and £185 15s. for three-months tin in London, and about 42c. for January tin here.

Lead—The market is unchanged at 4.45c., New York, and somewhat easier at 4.30@4.35c., St. Louis.

The London market has been steady, and the close is cabled at £15 12s. 6d. for Spanish lead, and £15 15s. for English.

Spelter—There has been a rather better demand, not only for near-by shipment, but in some directions consumers have made up their minds that it appears advisable to anticipate their requirements for the future, so as to avoid the necessity of paying premiums for early shipments, such as have been prevailing for some time past. Futures are still obtainable at a considerable discount, causing a wide spread in prices, the close being firm at 6.25@6.40c., St. Louis, and 6.40@6.55c., New York.

The London market is unchanged and steady at £26 15s. for good ordinaries, and £27 for specials.

Zinc dust is quoted at 7⅜@7½c. per lb., New York.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business has been only on a moderate scale, though prospects are better. Quotations are unchanged, at 18½@19c. for No. 1 ingots, New York delivery.

Antimony—Business has been on a fair scale and prices are steady. Cookson's is quoted at 7¾@7⅞c. per lb. and Hallett's at 7⅜@7⅝c. For Chinese, Hungarian and other outside brands 6¾@7c. is named.

Quicksilver—The market is rather quiet and prices are a shade weaker. The New York quotation is $43 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $42.50 per flask for domestic business and $40 for export. London price is £8 per flask, with the same figure quoted by jobbers.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Imports and Exports of Metals

Exports and imports of metals in the United States, 11 months ended Nov. 30, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess	
Copper, long tons	323,502	137,655	Exp.	185,847
Copper, 1910....	281,405	138,360	Exp.	143,045
Tin, long tons....	980	43,555	Imp.	42,575
Tin, 1910......	599	43,985	Imp.	43,386
Lead, short tons.	95,811	81,533	Exp.	14,278
Lead, 1910......	65,339	96,892	Imp.	31,553
Zinc, short tons..	5,292	1,340	Exp.	3,952
Zinc, 1910......	3,453	3,139	Exp.	314
Nickel, lb........	22,780,453	26,716,643	Imp.	3,936,190
Nickel, 1910....	13,694,344	29,359,544	Imp.	15,665,200
Antimony, lb.....	160,844	9,860,037	Imp.	9,699,193
Antimony, 1910.	296,970	9,248,138	Imp.	8,951,168
Platinum, oz.....	95	110,937	Imp.	110,842
Platinum, 1910.	47	112,048	Imp.	112,001
Aluminum, value	$1,101,491	....	Exp.	$1,101,491
Aluminum, 1910	811,217	....	Exp.	811,217
Ores, etc.				
Zinc in ore, lb ..	19,439,638	34,734,814	Imp.	15,295,176
In ore 1910...	8,964,028	48,403,850	Imp.	39,439,822
Zinc oxide, lb. ..	26,459,582	....	Exp.	26,459,582
Zinc oxide, '10..	24,306,841	....	Exp.	24,306,841
Zinc dross, lb....	8,385,103	....	Exp.	8,385,103
Zinc dross, '10..	8,850,394	....	Exp.	8,850,394
Chrome ore, l.t..	5	37,529	Imp.	37,524
Chrome ore, '10	30	38,579	Imp.	38,549

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1911 was 52,956 tons; exported, 16,356 tons. Imports of aluminum July 1 to Nov. 30, 1911, were 2,912,018 lb.; not reported previous to July 1, 1911. The metal exports given above include reëxports of foreign material.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 6—This week has been similar to the first week of 1911, both years beginning with a blizzard and zero weather that put a stop to mining operations. The past two days the blizzard has raged with a fury seldom recorded here, with the thermometer ranging from zero to 6 deg. below. The highest price for zinc sulphide ore was $48 per ton, the base per ton of 60 per cent. zinc $42@45. Zinc silicate sold at $24@26 per ton of 40 per cent. zinc. The average price, all grades of zinc ore, was $42.92. The highest price paid for lead ore was $62 per ton for a couple of carloads, the general market ranging close to $60, with the average for all grades of lead ore $59.14 per ton.

The corrected shipments for 1911, adding the last week in December were as follows: Blende, 502,542,050 lb., value $10,269,902; calamine, 36,113,710 lb., value $548,684; lead ore, 91,185,340 lb., values $2,612,781; total value $13,431,467 for the year.

SHIPMENTS, WEEK ENDED JAN. 6

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,119,210	......	649,910	$86,559
Joplin........	1,814,250	......	210,210	45,310
Cave Springs.	1,123,140	......	......	25,830
Alba-Neck....	837,370	......	......	18,422
Duenweg....	712,910	65,240	......	16,238
Galena.......	387,740	......	76,020	10,650
Carl Junction	279,100	......	......	6,690
Oronogo......	85,630	......	177,920	6,534
Lawton	186,040	......	......	4,000
Carthage ...	146,240	......	......	3,071
Miami........	169,990	......	......	3,060
Granby	29,380	142,040	9,790	2,940
Jackson......	113,840	......	......	2,445
Spurgeon	56,810	65,600	......	2,055
Badger.......	65,280	......	......	1,370
Quapaw....	54,840	......	......	1,095
Totals....	9,181,770	272,880	1,123,850	$236,269
Same week last year...	6,638,480	....	942,990	$164 685

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January.....	$47.31	$41 85	$45.16	$40 55	$56.99	$55.68
February...	40.69	40 21	39.47	39 16	53.64	54 46
March......	43 60	39 85	39 71	38.45	51.26	54.57
April........	41 00	38 88	39 33	37 47	49.72	56 37
May.........	40.19	38.25	37.51	36 79	48.16	55 21
June........	40.20	40.50	37 83	38.18	48.80	56 49
July.......	39.63	40.75	36.80	38 36	48.59	58 81
August......	40 13	42 50	37 32	41 28	49.75	60 74
September ..	43.45	42 63	39.96	41 29	54.73	59 33
October.....	43.31	42.38	40.50	40.89	53.18	54.72
November..	47 20	45.40	43 20	43.25	54 80	57 19
December..	42 50	44.13	40 70	40.76	55.70	62 03
Year....	$42 43	$41.45	$39 79	$39.90	$52.12	$56.76

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Jan. 10—The general markets have not yet recovered from the holiday dullness.

Copper Sulphate—Business is fair and prices unchanged at $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Arsenic—Quiet, but rather firm at $2.25 per 100 lb. for white arsenic.

Nitrate of Soda—There is no change in the position. Quotations continue 2.20c. per lb. for both spot and futures.

Chemicals and Minerals

CURRENT WHOLESALE PRICES

Ammonium sulphate.......cwt.	3.10@3.15
Arsenic, white...............lb.	0.02¼@0.02½
Barytes, ground.. ......sh. ton	12.00@13.00
floated.........sh. ton	14.00@17.00
Calcium acetate, gray......cwt.	2.25@2.30
carbide, ton lots f.o.b. Niagara Falls, sh. ton	70.00
Carbons, good drill quality. carat	50.00@75.00
Cement, Port., Am.. .400-lb bbl.	1.33
Chrome brick, f.o.b., Pittsburg .M	175.00
ore, 50%, ex-ship, N. Y., lg. ton	14.00@16.00
Copperas, bulk.............cwt.	0.55
bbl.............cwt.	0.65@0.85
Copper sulphate..........cwt.	4.90@5.15
Fluorspar, lump, f.o.b. Pittsburg, ton	8.00@9.00
Magnesite, crude, 95%....lg. ton	7.50@8.50
calcined, powdered..	26.00@35.00
brick, dom., f.o.b. Pittsburg.......M	160@200
Paints, litharge, Am. powd...lb.	0.05½@0.06
red lead, American...lb.	0.06½@0.07
white lead, Am., dry..lb.	0.05¼@0.05¾
zinc white, Am., dry...lb.	0.05⅛@0.06¼
Phosphates, acid:	
*Fla., hard rock 77%........	5.75@6.25
land pebble 68%.......	3.70@3.80
†Tenn., 78@80%............	5.00@5.50
75%...............	4.75@5.00
68@72%............	4.25@4.50
‡So. Car. land rock 60%......	3.50@3.75
Potassium cyanide, 98@99%..lb.	0.18@0.20
Pyrite:	
Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit	0.12@0.12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines.......	0.10@0.12
Imported, non-arsenical, furnace size, ex-ship, per unit..	0.13@0.13¼
Imported, arsenical, furnace nace size, ex-ship, per unit..	0.12½@0.12¾
Imported, fines, arsenical, ex-ship.....................	0.11½@0.12
Imported, fines non-arsenical, ex-ship, per unit...........	0.12½

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

Sodium cyanide, 120 to 130% KCN.............lb.	0.18@0.20
nitrate 95% spot....cwt.	2.20
95% future..cwt.	2.20
Sulphur, Louisiana prime, N. Y., lg. ton	22.00 up
roll..............cwt.	1.85@2.15
flour.............cwt.	2.00@2.40
flowers, sublimed...cwt.	2.20@2.60
pow. com., bags....cwt.	1.50
Sicilian, crude brimstone.........lg. ton	22.50
Zinc chloride, granular.......lb.	0.04¼@0.04½

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.

Petroleum

Pipe line runs from the wells of New York, Pennsylvania, West Virginia, Kentucky, Tennessee, Ohio and Indiana in December are reported by the *Oil City Derrick* at 3,916,176 bbl. Shipments were 5,580,223 bbl. for the month.

MINING STOCKS

New York, Jan. 10—On Thursday, Jan. 4, the general stock markets were moderately active and gradually firm. Steel Corporation stocks were steady. On the Curb, mining stocks were rather active. Cobalt shares were steady and several of the copper stocks gained fractionally.

On Friday, trading on the Exchange was lighter and there were fractional declines in several leading stocks. Steel Common held its own, but Utah Copper lost a fraction. On the Curb trading was generally quiet; the copper stocks were in demand, with small gains in most of them.

On Saturday—the short session—trading was light and price changes were small. The Curb did some business in coppers. There were sales of Homestake at $87@88.50 per share.

On Jan. 8 the general market was again rather slow and showed no definite tendency. Mining shares were not active on the Curb, except Inspiration Copper, which sold freely under the effect of the new consolidation. Porcupine stocks were also sold freely.

On Jan. 9 and today the business both on the Exchange and the Curb was seriously impeded by the burning of the Equitable Building, tying up several banks and the safe-deposit concerns in which a great variety of stocks was deposited. The business was not at all on a normal basis.

Sales of mining stocks on the New York Curb market in 1911: Total transactions in mining shares are estimated at only 11,772,314 shares, less than one-third of the business done in this department in the previous year and a little more than one-fifth of the transactions in 1909.

Boston, Jan. 9—Copper shares reflect the advancing metal market moderately, yet the response from the public is not as great as conditions warrant. Considerable profit-taking has been done, causing a more or less reactionary tendency. Mayflower and Old Colony mining issues have been by all odds the features. The former has risen $5 to $8.25 and the latter $4.12½ to $6.75. Trading in each has been of large proportions, due to important discoveries with drill cores in the Mayflower within 60 ft. of the Old Colony property. The lode encountered in the Mayflower is said to be of great thickness and is expected to be found also in the Old Colony.

North Butte still continues a mystery, marketwise, and on heavy trading shows slight price changes from day to day. Inspiration has been conspicuously active, but with very slight fluctuations. The new Inspiration Consolidated stock received an initial quotation on the Curb at $21.37½, when issued. The offer to take over Inspiration at $10 and Live Oak at $40 per share by the new company is receiving liberal support. The banking support behind this new company is a good asset.

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	October	Nov.	Dec.
Alaska shipments.	2,704,802	1,274,655	4,995,008
Anaconda.........	21,400,000	20,850,000	....
Arizona, Ltd........	2,720,000	2,960,000	3,100,000
Balaklala	....	....	....
Copper Queen......	7,786,218	6,946,775	....
Calumet & Ariz....	4,784,000	4,390,000	4,486,000
Detroit............	2,086,624	1,941,498	....
East Butte..........	920,000	983,405	....
Mammoth..........	1,865,846	1,793,181	....
Miami.............	....	....	2,500,000
Nevada Con........	5,547,931	5,207,983	....
Old Dominion......	2,050,000	2,082,000	2,610,000
Roy...............	2,069,287	2,517,000	2,660,000
Shannon...........	1,124,000	1,256,000	....
South Utah........	326,578	361,681	....
United Verde*.....	2,750,000	2,500,000	....
Utah Copper Co....	8,660,729	9,117,961	....
Lake Superior*....	18,440,000	18,600,000	....
Non-rep. mines* ..	13,564,713	11,483,000	17,500,000
Total production.	98,800,728	94,265,139	....
Imports, bars, etc..	22,960,027	17,224,725	....
Total blister.....	121,760,755	111,489,864	....
Imp. in ore & matte	4,137,431	4,767,217	....
Total...	125,898,186	116,257,081	....
Brit. Col. Cos.:			
British Col. Copper	778,586	....	....
Granby	....	....	....
Mexican Cos.:			
Boleo..............	1,245,440	....	....
Cananea	5,804,000	....	3,706,000
Moctezuma	1,719,643	1,682,768	....
Other Foreign:			
Cape Cop., S. Africa	....	857,920	....
Spassky, Russia....	672,000	685,440	....
Famatina, Argen..	....	174,720	....
Exports from:			
Chile..............	4,816,000	4,704,000	....
Australia	7,056,000	7,168,000	....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
Year 1910....	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,557	53,208,739
II..............	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV..........	118,085,223	52,407,650	62,129,599
V...............	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII.............	112,167,934	56,982,582	74,880,658
VIII..........	125,493,667	59,935,364	69,855,660
IX..............	115,588,950	57,311,584	50,824,011
X...............	118,255,442	64,068,307	60,084,349
XI..............	111,876,601	68,039,776	67,049,279
XII.............	122,896,697	65,988,474	79,238,716
Year, 1911...	1,431,938,338	709,611,605	754,902,233

VISIBLE STOCKS

	United States	Europe	Total
I, 1911..........	122,030,195	236,629,120	358,649,378
II..............	142,439,490	236,992,000	379,431,134
III.............	156,637,770	233,385,600	390,023,009
IV....	162,007,934	223,014,400	385,022,434
V...............	165,555,908	212,284,800	377,840,708
VI..............	165,995,932	202,540,800	368,536,732
VII..	157,434,164	195,932,800	353,366,964
VIII............	137,738,858	191,891,840	329,630,698
IX..............	133,441,501	191,228,800	324,670,301
X...............	140,894,856	191,945,600	332,840,456
XI..............	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912.........	89,454,695	158,323,200	247,777,895

Figures are in pounds of fine copper. U. S production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Rhode Island Coal and United Verde Extension have been the Curb features. The former broke to 40c. per share, while the latter rose. A reorganization plan for the Rhode Island Coal Co. is expected to be announced shortly.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1.00
Belcher, Nev	Jan. 3	Jan. 24	0.10
Black Jack, Utah	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.50
Bruns. C. V. M., Nev	Jan. 12	Feb. 2	0 02
Bullion, Nev	Jan. 12	Jan. 29	0.05
Chollar, Nev	Jan. 3	Jan. 26	0.10
Confidence, Nev	Jan. 16	Feb. 6	0 20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Con. Virginia, Nev	Dec. 16	Jan. 6	0.25
Federal Ely, Nev	Jan. 5	Jan. 27	0.01
Fetish, Ida	Jan. 5	Jan. 23	0.001½
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Hancock Con., Mich	Jan. 10	....	1.00
Julia, Nev	Dec. 28	Jan. 16	0.05
Kentuck Con., Nev	Jan. 9	Jan. 26	0.05
Ojibway, Mich	Jan. 10	....	1 00
Raven, Mont	Feb. 1	....	0.10
San Antonia, Mex	Nov. 20	....	0.50
Seven Troughs Mon., Nev	Jan. 10	Jan. 31	0.002½
Southwestern Miami, Ariz	Jan. 15	....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea Con., Utah	Jan. 17	Feb. 8	0.01
Tintic Standard, Utah	Jan. 8	Feb. 5	0 005
Utah, Nev	Jan. 19	Feb. 9	0.05
Victoria, Mich	Aug. 21	....	1 00
Winona, Mich	Nov. 10	....	1.00
Wyandot, Mich	Dec. 14	....	1 00

Monthly Average Prices of Metals

SILVER

Month	New York 1909.	New York 1910.	New York 1911.	London 1909.	London 1910.	London 1911.
January	51 750	52 375	53 795	23.843	24.154	24 866
February	51 472	51.534	52 222	23.706	23.794	24 081
March	50 468	51.454	52 745	23.227	23.690	24 324
April	51.428	53.221	53.325	23.708	24 483	24 695
May	52 905	53.870	53.308	24.343	24 797	24 583
June	52 538	53.462	53 043	24 166	24 651	24 486
July	51.043	54.150	52 630	23.519	25 034	24 286
August	51 125	52.912	52 171	23.588	24 428	24 082
September	51 440	53.295	52 440	23.743	24 567	24 209
October	50 923	55.490	53.340	23.502	25 596	24.594
November	50 703	55 635	55.719	23.351	25 680	25.649
December	52.226	54.428	54 905	24.030	26.160	25 349
Total	51 502	53.486	53.304	23.706	24.670	24.592

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK Electrolytic 1910.	NEW YORK Electrolytic 1911.	NEW YORK Lake 1910.	NEW YORK Lake 1911.	London, Standard 1910.	London, Standard 1911.
January	13 620	12 295	13 870	12 680	60 923	55.600
February	13 332	12 256	13 719	12 611	59 388	54 974
March	13 255	12 139	13 586	12 447	59 214	54 704
April	[illegible]	12 019	13 091	12 275	57 238	54 034
May	12 550	11 989	12 885	12 214	56 313	54 313
June	12 404	12 385	12 798	12 611	55 310	56 365
July	12 215	12 463	12 570	12 720	54 194	56 673
August	12 490	12 405	12 715	12 634	55 733	56 266
September	12 379	12 201	12 668	12 508	55.207	55 253
October	12 553	12 189	12 788	12 370	56 722	55 170
November	12 742	12 616	12 914	12.769	57 634	57.253
December	12 581	12 552	12.863	13.768	56 769	62 068
Year	12 738	12 376	13.039	12 634	57 054	55.973

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32 700	41 255	July	32 695	42 100
February	32 920	41 614	August	33 972	43 319
March	32 663	40 157	September	34 982	39 755
April	32 976	42 185	October	36 190	41 185
May	[illegible] 125	43 115	November	36 517	43 125
June	[illegible] 769	44 600	December	38 199	44 655
			Av. Year	34 123	42 281

Prices are in cents per pound

LEAD

Month	New York 1910.	New York 1911	St. Louis 1910.	St. Louis 1911.	London 1910.	London 1911.
January	4 700	4 483	4.582	4 334	13.650	13.009
February	4 613	4 440	4.445	4 266	13.328	13 043
March	4.459	4.394	4.307	4 238	13.063	13 122
April	4.376	4 412	4 225	4 262	12 641	12.889
May	4.315	4.373	4.164	4.223	12 550	12 984
June	4.343	4 435	4 207	4 292	12 688	13.260
July	4 404	4 499	4 291	4.397	12 531	13 530
August	4.400	4 500	4 290	4 406	12 513	14 260
September	4.400	4 485	4.289	4 356	12.582	14 744
October	4.400	4 265	4.271	4 139	13 091	15.332
November	4 442	4.298	4 314	4.181	13 217	15.821
December	4.500	4.450	4.363	4.332	13 197	15.648
Year	4.446	4.420	4.312	4 286	12 920	13.970

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York 1910.	New York 1911.	St. Louis 1910.	St. Louis 1911.	London 1910.	London 1911.
January	6.101	5 452	5.951	5 302	23 350	23.887
February	5 569	5 518	5 419	5 368	23 188	23 276
March	5.637	5.563	5 487	5 413	23 031	23 016
April	5 439	5 399	5 289	5.219	22.469	23 743
May	5 191	5.348	5.041	5.198	22.100	24.375
June	5 128	5 520	4.978	5 370	22.094	24 612
July	5.152	5 695	5.002	5 545	22 406	25 006
August	5 279	5 953	5.129	5 803	22.800	26 801
September	5 514	5 869	5.364	5 719	23.165	27 750
October	5 628	6.102	5.478	5.951	23.900	27.256
November	5 976	6.380	5 826	6.223	24 083	26.795
December	5 624	6.301	5 474	6.151	24 019	26.849
Year	5 520	5.758	5 370	5.608	23.050	25.281

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer 1910	Bessemer 1911	Basic 1910	Basic 1911	No. 2 Foundry 1910	No. 2 Foundry 1911
January	$19.90	$15 90	$17.96	$14 40	$17.94	$14 75
February	18.96	15 90	17 21	14 50	17.38	14 81
March	18.53	15.90	16.93	14 65	17.00	14.96
April	18.28	15 90	16.84	14.65	16.75	15 00
May	17.10	15.90	15.94	14 30	16.18	14.72
June	16.52	15 90	15.60	14 06	15.53	14.56
July	16.40	15 90	15.40	14 03	15.40	14 53
August	16.09	15 90	14.89	14 00	15.16	14 47
September	15.92	15 90	14.73	13 57	14.93	14 40
October	15.90	15.43	14.05	13.44	14.88	14.34
November	15 84	14.92	14 26	13.30	14 78	14 25
December	15 90	15 15	14 15	13.10	14 65	13.90
Year	$17 10	$15 72	$15 65	$13 94	$15 83	$14 49

STOCK QUOTATIONS

COLO. SPRINGS Jan. 9

Name of Comp.	Bid.
Acacia	.04⅝
Cripple Cr'k Con.	02⅜
C. K. & N.	15
Doctor Jack Pot	.06¼
Elkton Con	.69¼
El Paso	.70½
Findlay	06
Gold Dollar	.17
Gold Sovereign	.02¾
Isabella	.17⅜
Jack Pot	.06⅜
Jennie Sample	.06¼
Lexington	01½
Moon Anchor	01¼
Old Gold	03
Mary McKinney	.52
Pharmacist	.02¼
Portland	.90
Vindicator	68
Work	.03⅛

SALT LAKE Jan. 9

Name of Comp.	Bid.
Beck Tunnel	.12
Black Jack	.09¼
Carisa	17
Cedar Talisman	03¼
Colorado Mining	30¼
Columbus Con	.23
Daly-Judge	5.20
Grand Central	.70
Iron Blossom	1 05
Little Bell	30
Lower Mammoth	.02½
Mason Valley	11.50
May Day	.13¼
Nevada Hills	2.50
New York	.07
Prince Con	82
Silver King Coal'n	1 60
Sioux Con	.11
Uncle Sam	23
Yankee	12.24

TORONTO Jan. 9

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6 50	Pearl Lake	36
Hudson Bay	80 00	Porcu. Gold	55¾
Temiskaming	35	Porcu. Tisdale	03¼
Wettlaufer-Lor.	80	Preston E. D.	10¼
Apex	.08	West Dome	70
Central	3 50	Standard	19¼
Doble	80	Foley O'Brien	35¼
Dome Exten	45¼	Rea	1 79
Hollinger	13 10	Crown Chartered	49
Imperial	07	Swastika	22

SAN FRANCISCO Jan. 9

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.02	Belmont	7.95
Belcher	60	Jim Butler	.35
Best & Belcher	.19	MacNamara	.26
Caledonia	1.27	Midway	.21
Challenge Con	.15	Mont.-Tonopah	1.05
Chollar	.15	North Star	.26
Confidence	.40	West End Con	.75
Con. Virginia	1.15	Atlanta	.18
Crown Point	.60	Booth	.06
Gould & Curry	.05	C.O.D. Con	.13
Hale & Norcross	.19	Comb. Frac	13
Mexican	4.22½	Jumbo Extension	.22
Occidental	.50	Pitts.-Silver Peak	1.30
Ophir	1.82½	Silver Pick	.06
Overman	1.07½	St. Ives	.30
Potosi	.05	Tramps Con	.01
Savage	.20	Argonaut	‡3.40
Sierra Nevada	.28	Bunker Hill	‡3 00
Union Con	1.07½	Cent. Eureka	40
Yellow Jacket	.50	So. Eureka	‡6.00

N. Y. EXCH. Jan. 9

Name of Comp.	Clg.
Amalgamated	65
Am. Agri. Chem.	62
Am. Sm. & Ref. com	71⅝
Am. Sm. & Ref. pf.	103
Am. Sm. Sec., pf. B	86¼
Anaconda	36¾
Batopilas Min	1⅜
Bethlehem Steel pf	61⅛
Chino	26
Federal M. & S., pf.	38
Goldfield Con	4¼
Great Nor., ore ctf.	41
Homestake	88½
Miami Copper	24¾
Nat'nal Lead, com.	51⅛
National Lead, pf.	106¼
Nev. Consol	19½
Pittsburg Coal, pf.	82
Ray Con	18
Republic I & S, com	25¼
Republic I & S, pf.	85¼
Sloss Sheffi'd, com.	41
Sloss Sheffield, pf.	108¼
Tennessee Copper	38
Utah Copper	56⅜
U. S. Steel, com.	66
U. S. Steel, pf.	110½
Va. Car. Chem	52⅜

BOSTON EXCH. Jan. 9

Name of Comp.	Clg.
Adventure	6⅛
Algomah	5⅜
Allouez	44
Am. Zinc	26⅜
Ariz. Com., ctfs.	2⅝
Bonanza	.46
Boston & Corbin	7⅝
Butte & Balak	4½
Calumet & Ariz	61¼
Calumet & Hecla	443
Centennial	18
Con. Mercur	.03
Copper Range	65
Daly West	5⅝
East Butte	12¾
Franklin	11¾
Granby	37½
Hancock	29¾
Hedley Gold	15½
Helvetia	1½
Indiana	14½
Island Cr'k, com.	41¼
Isle Royale	22
Keweenaw	1¼
Lake	36
La Salle	5½
Live Oak	41½
Mass	8½
Michigan	2½
Mohawk	68½
New Arcadian	4
New Idria Quick.	8½
North Butte	27½
North Lake	6⅛
Ojibway	5
Old Dominion	47
Osceola	109½
Parrot	14⅛
Quincy	76
Shannon	10½
Shattuck-Ariz	19
Superior	28½
Superior & Bost	4
Tamarack	31¾
Trinity	5½
Tuolumne	3⅝
U. S. Smelting	35¾
U. S. Smelt'g, pf.	48
Utah Apex	3⅛
Utah Con	16¾
Victoria	4¾
Winona	6¼
Wolverine	101
Wyandot	2

N. Y. CURB Jan. 9

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	.41
Braden Copper	5¾
B. C. Copper	4¼
Buffalo Mines	1 50
Butte & Vipond	58
Butte Coalition	22⅞
Cobalt Central	.01
Con. Ariz. Sm.	⅜
Davis-Daly	11/16
Diam'field-Daisy	13
Ely Con	9/16
Florence	.61
Giroux	4 11/16
Gold Hill Con	‡3/16
Greene Cananea	8½
Greenwater	06
Guggen. Exp.	184
Inspiration	10½
Internat. S. & R.	‡124
Kerr Lake	2¾
La Rose	3¾
McKinley-Dar-Sa.	1⅝
Min. Co. of A. new	4
Nev. Utah M. & S.	⅛
Nipissing Mines	6⅜
Ohio Copper	1 1/16
Pacific Sm. & M.	[illegible]
Porcupine T'nsite	47
Precious Metals	‡1⅜
Ray Central	1 1/16
Red Warrior	‡1½
South Utah M. & S.	1⅛
Standard Oil (Old)	625
Stand'd Oil of N.J.	370
Stand'd Oil Subs.	325
Stewart	90
Tonopah	6⅞
Tonopah Ex.	1 3/16
Tri-Bullion	⅛
Tularosa	½
Yukon Gold	3⅜

LONDON Jan. 10

Name of Com.	Clg.
Camp Bird	£1 12s 0d
Dolores	1 10 0
El Oro	0 16 9
Esperanza	2 0 0
Mexico Mines	8 2 6
Oroville	0 4 9
Stratton's Ind.	0 3 1½
Tomboy	1 3 9

BOSTON CURB Jan. 9

Name of Comp.	Last
Ahmeek	240
Bingham Mines	2½
Boston Ely	86
Boswyocolo	10
Cactus	18
Calaveras	1¼
Chief Cons	64
Corbin	3¼
Cortez	1 9/16
Crown Reserve	2¾
First Nat. Cop.	2¾
Majestic	46
Mazatan	½
Moneta Pore.	14
Nat'l Mine & Ex.	12
Nevada-Douglas	2¼
New Baltic	5
Oneco	2⅜
Raven Copper	27
Rhode Island Coal	52
San Antonio	‡3¼
South Lake	5¼
Trethewey	.65
Union Mines	‡¼
United Verde Ext.	.90
Vulture	‡5¾

‡Last quotation

The Engineering and Mining Journal

Vol. 93. JANUARY 20, 1912. No. 3.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9300 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Editorials:
  Governmental Metallurgical Testing 151
  Sulphuric Acid—Western Smelters 151
  Hand Sorting 152
  Mr. Carnegie and Mr. Stanley.......... 152
  Herman Frasch 152
  The Advance in Copper.......... 152
By the Way.......... 153
Mining and Metallurgical Society... 154
Mt. Lyell Report.......... 154
Correspondence and Discussion:
  The Dwight-Lloyd Sintering Process .... Cyaniding Cripple Creek Ores .... Long or Short Handled Shovels....Underground Waters and Mining....Traveling in Colombia.......... 155
Details of Practical Mining:
  *Gate for Ore Bin Chutes.... Hauling Heavy Machinery.... *Roller Frame for Incline Shafts ....Temperature Measuring Pendants .... Sheaves for Balanced Hoisting....*A Solution Clarifier .... Taper of Face of Car Wheels....*Feeding Boulders to Crushers .... *Draining Gravity Planes....*A Portable Desk....*Timber Dam for Mine Use .... Improved Coslettizing Process....*A Safety Gate for Cages 157
Tanganyika Concessions, Ltd.......... 162
*Electric Hoist at Calumet & Arizona 162
Keystone Mines, California.......... 163
Conditions at El Oro.......... 163
Mineral Resources of Kentucky.......... 164
Accidents in Cornish Mines. R. H. Coulson 165
*Metallic Zinc in Zinc Dust.......... 165
London Gold Market.......... 166
Iron and Steel in Congress.......... 166
United States Smelting to Extend Mexican Operations.......... 166
*The Position on the Comstock. George J. Young 167
American Iron Ore Developments. Bradley Stoughton 173
Electric Production of Ferro-Tungsten 173
Manufacture of Sulphuric Acid. Max Hasenclever 175
Division of Standard Oil Trade.......... 176
*The Flameless Combustion of Gas. William A. Bone 177
Standard Specifications for Copper Wire Bars 181
Plymouth Consolidated Mines, California..........Lewis H. Eddy 181
New Publications 183
Personal, Obituary and Societies.......... 184
Editorial Correspondence 185
Mining News 187
Markets 193
*Illustrated.

Governmental Metallurgical Testing

The demand from certain quarters that the Federal government engage in metallurgical testing is persistent, even if not broadly representative of the wishes of those engaged in the mining industry. Secretary Fisher has recommended it, several members have introduced bills in Congress, and a lobby is, or will be, in Washington to exert pressure. Among the bills already introduced in Congress is one amending the organic law of the Bureau of Mines. Under it there would be no limit to the power of the bureau, except insofar as Congress holds tightly on the purse strings, which is something that Congress seems never inclined to do. This pending bill is distinctly vicious.

The Bureau of Mines serves a useful purpose in studying matters pertaining to the health and safety of miners and metallurgical workers, and in representing the Federal government in its mining interests. With respect to general technical practice, there is nothing useful for it to do beyond the elucidation of conditions and principles. Any hope that it might blaze a path of progress in the art is a will-o'-the-wisp. A course of adventure in that direction would produce some nice jobs for pleasant young gentlemen, but the accomplishment would be insignificant.

If the people must be saddled with the expense of their maintenance, we suppose they must put up with it just as they do with many other unnecessary expenditures. However, there is a distinct danger to our great industry from amateurish and mischievous meddling. Congress will be well advised if it follows the sound principles laid down by the Mining & Metallurgical Society of America, reported elsewhere in this issue. It should be distinctly understood that the proposed legislation for which a demand, based upon a variety of reasons, has been more or less artificially worked up, is deprecated by the engineering profession and by the leaders of the mining industry.

Sulphuric Acid—Western Smelters

The Department of Agriculture has been investigating the potash resources of the United States, and lately has stated "That enormous stores of potassium exist in the United States and that quantities of these products will soon be utilized on a commercial scale." This seems to us different from the conclusion of the U. S. Geological Survey, but perhaps the latter does not know so much about this subject as the Department of Agriculture. An explanation of the discrepancy is possibly to be found in the remarks of the farmers' department, that "The most promising sources of potash in the United States are the beds of seaweed or kelp groves along the Pacific coast," but it is alleged that there are also important potash deposits in other sections of the country, which indicate that "conditions point to Salt Lake City and Ogden as the great fertilizer manufacturing center of the future."

The report proceeds with the remarks that "Hitherto the smelting interests have objected to converting their fumes into sulphuric acid on the twofold ground that the people in their localities do not use fertilizers, and if they did use them the production of acid would be far greater than the demand. But if the smelters of Utah were to follow the suggestions here offered, they could put high-grade fertilizer on the market so cheaply that in a few years the agricultural interests of the surrounding territory would use their entire output."

The smelters of the West are notoriously wasteful and unreceptive to new ideas. They have persistently preferred to throw away the sulphur of their ore, even at the expense of smoke damage, rather than to render it both innocuous and profitable by making sulphuric acid out of it. Is it to be expected that they will now defer to the words of wisdom from the Solomons of the Department of Agriculture, or will they continue to manifest that they are "from Missouri?"

Hand Sorting

As its readers know, the JOURNAL has long been an advocate of the more extensive use of hand sorting in the concentration of ore. We feel a natural pleasure in observing practical progress in this direction. A few years ago hand sorting was an unknown art in the Cœur d'Alene although there never was a district where better use of the principle could be made. The former practice in that district of running chunks of nearly pure galena through the crushing machinery was little short of criminal.

At present there are but few mining companies in the Cœur d'Alene that fail to practice hand sorting. As illustrative of the advantage, the remark of W. Clayton Miller, general manager of the Federal Mining & Smelting Co., in the latest report of that company, that "As a result of improvements in operation largely through sorting, the profit at the Morning mine for the year as compared with the loss of the previous year has improved in an amount equal to approximately 7% of the amount invested," is interesting. It is further interesting to report that hand sorting has lately been successfully introduced in at least one mill in the Joplin district, the application in that case being for the discarding of waste.

Mr. Carnegie and Mr. Stanley

Mr. Carnegie was not as pawky in his testimony before the committee of the Hon. Stanley and fellow wiseacres as he was before the Ways and Means Committee a few years ago; and displayed that he, like many other people, would benefit from a course of serious study of economics, especially of the conditions that establish prices. In his assertions that competition in the steel business no longer exists (compare the experiences of 1909 and 1911) and that no new steel business can now be developed (compare the operations of Mr. Schwab) and that no important new supplies of iron ore are available (Texas? Sweden? Cuba? Brazil?), we fear that his recent preoccupation in the endowment of libraries has shut his eyes to industrial progress. This is not an aspersion upon the present quality of Mr. Carnegie's eyes, because there is no reason now why he should turn them in that direction. Anyway, Mr. Carnegie furnished three days of agreeable entertainment to the Hon. Stanley and confrères, and received a check for $26 for witness fee and expenses, which he is going to frame as a memento of the occasion.

Herman Frasch

The award of the Perkin medal to Herman Frasch is an honor justly deserved. Mr. Frasch invented an absolutely new method of mining brimstone, differed from the ordinary run of inventors in his ability to put his invention into commercial application, developed in Louisiana an industry which in a few years was able to supply practically the whole American requirement of brimstone, which previously had been imported from Sicily, and won for himself and associates a large fortune. Never was there a fortune more cleanly earned. Untainted by chicanery it was obtained by the simple conversion of brains into money. Mr. Frasch is fully entitled to the honors that are conferred upon him.

The Advance in Copper

The advance in copper seems to have culminated. Even so, everybody ought to be happy. The producers who have been carrying uncomfortable stocks of metal have unloaded them. Those who have been curtailing their output have been enabled to resume at former capacity. Two new mines have been satisfactorily financed. The tired holders of some copper-mining shares have liquidated. The new owners have not paid for some of them any more than they are worth. So everybody ought to be happy, as we remarked above. It may be urged that the users of copper are not happy. Nevertheless, they ought to be. In the first place they all had an equal opportunity to buy copper cheaply only three months ago, and even on the advance they have not had to exceed what everybody admits to be a fair price. Of course, the producers ought to have an inning some of the time.

The dissolution of the important firm of Wernher, Beit & Co. is a matter of interest in Transvaal gold mining, in which the firm had a great influence owing to its large ownership in the mines. It is due to the failing health of Sir Julius Wernher, the head of the firm. The gold-mining interests of the firm have been transferred to the Central Mining Corporation and the Rand Mines, Ltd., while the firm of Breitmeyer & Co. takes the diamond business. Sir Julius Wernher was one of the earliest investors on the Rand, and he gave much time and thought to the general industrial progress of the country.

Transvaal gold production in December was slightly less than had been anticipated. It was rather less than in November for reasons which the cable does not explain. The total production for 1911 was therefore $170,273,734, or only about $200,000 less than our estimate. The increase over 1910 was $14,543,474, or 9.3 per cent.; and the total was over 36 per cent. of the total production of the world. The Transvaal was, therefore, by far the most important factor in the great production of gold in 1911; the United States, the second producer, contributing only 20 per cent. of the total.

The result for 1911 is a remarkable one, especially when we consider that 95 per cent. of it came from the narrow and limited area of the Witwatersrand.

A feature of the past year in India has been the larger demand for gold, accompanied by a decrease in that for silver; although that decrease is much smaller in proportion than the increase in gold. In the past five years it is estimated that India has absorbed, in round figures, $100,000,000 in gold; but about $39,000,000 of this amount was taken in 1911. For reasons heretofore noted, it is probable that Indian savings will be invested much more largely in silver than in gold, since gold coin or gold ornaments are beyond the means of the very great majority of the people. It seems to be evident, however, that the wealthier class is turning from its traditional preference for the white metal, and is accumulating gold to a much greater extent than formerly. This tendency may have an important effect on the silver market later.

By the Way

The 600 men employed in the large Newport mine at Ironwood, Mich., received Christmas gifts from the company, consisting of checks equal to their regular December earnings. By this plan the men receive 13 months wages per year. The custom has been maintained for several years by the owner of the mine, Ferdinand Schlesinger, of Milwaukee, Wisconsin.

The recent publicity as to Julian Hawthorne's mining schemes brought to light a reply which Hawthorne once received to one of his mining letters in which he told the recipient that he had decided to give up literature for mining, says the New York *Sun*. The man who got the letter was something of a wag and had a small printing press. So he printed a small folder with only a few leaves and one word on each leaf. This he sent to Hawthorne with a letter stating that he was much interested in the author's communication, inasmuch as he had taken an opposite course and had given up mining for literature, as the inclosed pamphlet would show. The words, one on each leaf, were as follows: "Prospect" — "Prospectus" — "Mine" — "*M i n e*" — "Minus." He never got a reply.

A new method of selecting mine inspectors is the only way to decrease the number of mine accidents, says S. D. Warriner, general manager of the Lehigh Valley Coal Co. He would put the U. S. Bureau of Mines in charge of underground workings and have inspectors appointed by that bureau and held responsible as civil-service appointees. Mr. Warriner is a member of the Pennsylvania board for examining candidates for mine inspectorships. He says that few men who apply are able to fill the place as it should be filled, and that few mine foremen are competent to be inspectors. It needs a higher grade of education, he said. The last part of Mr. Warriner's remarks is undoubtedly correct. As to the first part, he does not suggest how the U. S. Bureau of Mines could constitutionally be put in charge. Perhaps the sovereign State of Pennsylvania could make a contract with it to take charge of this department of police affairs, retaining its own rights.

The Oliver Iron Mining Co. will maintain a visiting nurse, to work among the families of its employees in Ishpeming, Mich. The nurse will be paid monthly by the company and will serve the miners and their families free of charge. The plan has given good results with the Cleveland-Cliffs Iron Co., which maintains visiting nurses in Ishpeming, Negaunee and Gwinn. It has been found that the influence of a skilled nurse in a miner's home during sickness in the family, has been in the nature of an education in sanitary conditions to the inmates.

Perhaps the most profitable business in the whole world during 1911 was that of selling Porcupine options, says the New York *Evening Post*. Only a few could engage in it, because there were only so many claims to begin with, though once the demand arose everything possible was done to enlarge the area of the gold region in order to satisfy it. The sale of an option in a majority of cases turned out to be a short sale. The original owners of the options will get them back, through the inability of the purchasers to make final payments. The claim owners, therefore, are enriched by the first payments down, and will have their property back, gold and all. Scores of Porcupine mining companies were floated on options; if enough stock could be sold to finish paying for the option, well and good; if not, the promoter had got something, the buyers of the shares had acquired experience, and no gold had been disturbed. The reputation of a mining camp fluctuates violently. That of Porcupine has had a big fall. Possibly it will rise again. Many who proclaimed that Porcupine was the greatest gold camp ever discovered in the world, without ever having been nearer to it than the Toronto hotel where practically all promotions originated, are now denying that there is any gold in Porcupine. Their information has not increased. Porcupine shares have flattened out in a speculative way. That is all.

Senator Warren has introduced a bill providing for the establishment of a mining-experiment station at Lander, Wyo., under the direction of the Bureau of Mines. It has already been proposed to establish a similar experiment station at Auburn, Calif. What is the matter with the other states and why is it that only these two important mining centers are to have experiment stations? It would seem that the senators from Texas to North Dakota and from Maine to Washington are most remiss in their duties, but amends may be made when they awake to the fact that it is proposed to appropriate $25,000 for the establishment of such stations and that a superintendent and a chemist are to be appointed at salaries of $4000 and $2500, respectively. Besides making experiments as to the treatment of all metalliferous ores, it "shall be the duty of said superintendent and chemist to receive for assay or analysis all rock, cement, clay or other mineral-bearing substance that may be deposited with them by any citizen of the United States and make proper classification or assay of each sample * * * for the purpose of ascertaining the exact amount of gold, silver, copper, iron, zinc, lead, tungsten, vanadium, uranium, wolfram (*sic*) and other rare minerals, tin, barytes, marble, manganese, coal or any other mineral known * * *." With free assays, the prospectors will doubtless call for "the whole bill of fare" from "wolfram and other rare minerals" down to marble, manganese, coal or any mineral known. We can foresee that an arbitrary or officious superintendent who limits a sovereign citizen or fails to find what the latter "knows" to be in the rock, would better prepare to meet his maker. We assume that a beneficent and paternal government will not exact a charge from its citizens for this work. If this were to be the case, how would it be an improvement on private assaying? Of course, some benefits might accrue to wildcat promoters who could thus get the stamp of the government on the assay of some particularly rich specimen rock to aid them in harvesting a new crop of "suckers" that could not be hooked without the "accompanying U. S. Government official report, which shows our King Solomon group to be the richest gold mines in the world. The price of the stock will be advanced on Feb. 1 to 75c. per share."

Capt. Bill Jones in his lifetime won a well deserved admiration. His name came up the other day before the Stanley committee. "Do you remember Bill Jones?" asked Chairman Stanley. "Do I remember Bill Jones? Of course I do," returned Mr. Carnegie. "I'll never forget him. He was the most remarkable character we ever had, not excepting even Charley Schwab. He had been a private in the war. I sent for him, told him, 'I want to make you a millionaire, to become a partner.' He replied he wanted nothing to do with business, wanted to work for a salary. 'All right,' said I, '$50,000 a year, the salary of the President, is yours.' He got more than that. The president of the Cambria Iron Works came and declared, 'You'll ruin the steel business. What do you mean by giving Jones double the salary I and Felton give?' I asked them to tell me where they could get another Bill Jones for double the salary." Chairman Stanley wanted to know if Capt. Bill was a kind-hearted person, considerate of the men who worked under him. "He was a little abrupt," replied Mr. Carnegie, "but he was able. He was not as suave as Schwab. The trouble was he had no education. Jones was the best manager of men of the old type." Mr. Stanley brought out that Capt. Bill Jones was opposed to men working more than eight hours a day, believing that, in fairness to labor and with a view to gaining greater efficiency, the men should not be worked on shifts longer than eight hours. "We tried eight hours with the men on the blast furnaces, but the men objected because they lost wages by it," said Mr. Carnegie.

Mining and Metallurgical Society

The Mining and Metallurgical Society of America has recently taken action upon several questions of public importance. It has addressed the following memorial to the President of the United States:

The Mining and Metallurgical Society of America respectfully calls your attention to the importance of carefully considering the mining industry in its relations with the Federal courts. It is a fact known to all persons connected with this industry that the provisions of the mining law at the time of its passage were few and apparently simple, but with the advance in the knowledge of ore deposits it was found that these apparently simple provisions failed to cover many occurrences, and it has devolved repeatedly upon the court of last resort to interpret the fundamental law, with the result that the legal provisions governing mining titles and rights are today in major portion those that have been established by judicial decisions.

Few matters of greater importance, either in their financial aspect or in their bearing upon the welfare of large communities, come before the courts of the United States.

It is the request and hope of the Mining and Metallurgical Society of America that jurists of distinction and noted ability and experience in this and associated industries will receive the favorable consideration of yourself in connection with the filling of the vacancy which now exists.

BUREAU OF MINES

The society was requested by the chairman of the Committee on Mines and Mining of the House of Representatives to advise that committee respecting a draft of a bill for a new organic law for the Bureau of Mines. The society prepared such a draft that was based upon the following principles:

1. That the scope of the Bureau of Mines should be enlarged so that its functions will certainly cover the preservation of health in mining as well as safety.

2. That the functions of the Bureau of Mines should be limited to the elucidation of fundamental principles and the study of questions broadly affecting the mining industry.

3. That governmental encroachment upon private enterprises should be prevented by the organic law.

4. That the engagement in private work by employees of the Bureau of Mines should be prohibited by the organic law.

The bill drafted by the society upon the above principles provided that:

Sec. 2 It shall be the province and duty of the Bureau of Mines, under the direction of the Secretary of the Interior, to conduct inquiries and scientific and technologic investigations concerning the mining, extraction, preparation, treatment and utilization of the mineral substances (including petroleum and allied substances) of the United States and its possessions, with a view to increasing the safety and preserving the health of persons engaged in mines, quarries and metallurgical works, and with a view to the elucidation of the conditions existing in the mining, quarrying and metallurgical industries: and concerning the explosives, fuels and other mineral and metal products belonging to or for the use of the government of the United States, with a view to their most efficient use; and to disseminate the information resulting from these inquiries and investigations, or from other sources, together with appropriate recommendations, in such manner as will best carry out the purposes of this Act.

The society also added the following new sections:

Sec. 4. Nothing in this Act shall be construed as in any way granting to any officer or employee of the Bureau of Mines any right or authority in connection with the inspection or supervision of mines or metallurgical plants in any State: nor as granting to the Bureau of Mines any right or authority to undertake any investigation or operation in behalf of any individual person, partnership, corporation or association except for the health and safety of persons employed in the mining, quarrying and metallurgical industries.

Sec. 5. No person who is regularly employed by the Bureau of Mines shall be permitted to undertake special engagements, or accept employment for compensation, from any person, association of persons, or corporation: nor shall the Bureau of Mines detail any such regular employee to perform such service except as above stated. Provided, that this prohibition shall not be construed to apply to such engineers or experts as may be connected with the said bureau in a consulting capacity, or in the investigation of any special matter, and whose principal professional practice is outside of such employment by the bureau.

ALASKA COAL LANDS

With respect to the question of the Alaska coal lands, the society adopted the following resolutions:

1. It is essential for the proper development of Alaska that its coal fields be opened for commercial use without further delay.

2. There are now known to exist but two relatively small fields containing high-grade naval fuel, and inasmuch as the government now possesses no original source of such supply on the Pacific coast, it is desirable in the interests of national defense that a selected area of these fields be held and operated under the direct control of the government.

3. All rights which have accrued legally under statutes heretofore existing should be recognized.

4. If it be decided by the Congress that it is to the best interests of public welfare that coal lands in Alaska be leased, we recommend that the following condidions should be embodied in the leases:

a. These leases should be made for all the coal in the ground.

b. The royalty should be low and based on percentage of selling price of the coal at the mines.

c. The minimum annual production upon which royalty is to be paid should be nominal for the first two or three years after the execution of the lease in order to permit and encourage the installation of efficient and durable equipment. After that period the minimum production upon which royalty should be paid should increase more rapidly than the area increases. For example: the minimum production upon which royalty should be paid on a tract of 5000 acres should be several times more per acre than for 1000 acres. Such a plan would prevent the tying up of large areas of undeveloped coal territory.

d. A due-diligence and forfeiture clause to effect continuous work should be included in the lease.

e. Leasehold in coal lands should include all necessary timber, mining and surface rights.

f. Leases should not be given for less than 40 acres, and in shape should be rectangular, their boundaries being east and west and north and south, and after the system of public surveys has been extended to Alaska and the land applied for is in a surveyed township, the unit areas of a lease should be those established by the government survey as subdivisions of the sections.

g. The length of a tract of land embraced within a single lease should not be more than three times as great as its width.

5. It should be clearly recognized as a basic principle that the value to the nation of coal lands in Alaska lies more in their use for industrial, commercial and naval purposes than in the royalties to be derived therefrom, and it is desirable that the revenue obtained from coal royalties inure to the benefit of the territory.

All of the actions were taken formally by the society after approval of its council and letter-ballot of its entire membership. In each case the opinion of the society was expressed by an almost unanimous vote.

Mount Lyell Report

The annual meeting of the Mount Lyell Mining & Ry. Co. was held in Melbourne, Nov. 24, 1911. The quantities of ore raised during the half year ended Sept. 30, 1911, were unsatisfactory, and costs high, owing to labor shortage and a strike begun in the period under review, but assays remain good, and the richest ore in the North Mount Lyell mine is being found in the 1100-ft. level. The ore reserves were increased to 1,023,362 tons by the six months' work.

In the half year 3797 tons of copper, 246,099 oz. of silver, and 5018 oz. of gold were produced. Costs per ton of blister produced were: Mining operations, including stripping charge on open-cut ore, $2.22; smelting, $2.32; converting, $0.33; total, $4.87. These figures in the half year ended Mar. 31, 1911, were: Mining, $1.91; smelting, $2.10; converting, $0.28; total, $4.29.

The company operates three phosphate works, Yarraville (Victoria), Port Adelaide (South Australia), and Freemantle (Western Australia). The profit from all sources for the half year amounted to £69,033, but in view of the strike the divident was passed, for the first time since 1897.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Dwight-Lloyd Sintering Process

In the JOURNAL of Jan. 6, 1912, I note an article on the "Metallurgy of Iron and Steel," by Bradley Stoughton. In his reference to sintering ore, he states it is done by the "Gayley-Dwight-Lloyd process."

I beg to advise that I am in no sense associated with this process, and am simply identified with the company which has rights from the Dwight & Lloyd Metallurgical Co., for operating in the field of iron-bearing materials. I feel it is only just to the inventors to eliminate my name in connection with this process.

JAMES GAYLEY.

New York, Jan. 11, 1912.

Cyaniding Cripple Creek Ores

In the JOURNAL of Dec. 23, 1911, there appears a statement made by R. W. Hadden, of Los Angeles, Calif., to the effect that Philip Argall is not entitled to the credit of first applying the cyanide process to the treatment of Cripple Creek ores; several other statements were offered for the purpose of proving this assertion.

In justice to one who did more for the Cripple Creek district than anyone else, I wish to make the following statements. I lived in Florence at the time and was a member of the firm which did the excavating for the Dorcas mill which is spoken of in the article in question. As near as I can remember the "Cyanide Mill" built at Cyanide, Colo., a suburb of Florence, under the supervision of Philip Argall was completed in 1895, some five years before the author conceived his scheme.

The Dorcas mill was not built at Cañon City, but at Florence, and if I remember rightly the builder's name was Hower. This last I am not absolutely sure about, however there is only one chance in a thousand that I am mistaken. If so it is in the spelling only.

R. G. MCDONALD.

Mono Lake, Calif., Jan. 8, 1912.

[Everybody knows that Mr. Argall was a pioneer in the cyaniding of Cripple Creek ore, his work dating back to about 1894. He built and operated successfully for several years the large works of the Metallic Extraction Co., at Florence. In the contest between the chlorination and cyanide mills of this district, the former were temporarily victors, but improvements in the cyanide process, rendering it able to treat a lower grade of ore, have now put the shoe on the other foot. We understood Mr. Hadden to refer only to the treatment of low-grade ore. There may be a question as to the definition of "low-grade ore."—EDITOR.]

The Use of Long and Short Handle Shovels

One would think that the practice in such a simple operation as shoveling would be uniform in metal mines, at least in the same country, but that is not the case. The iron and the copper mines of Michigan use for mucking the ore a short, D-handle shovel having a handle length of 26 in., approximately, and a total over-all length of 38 in., while in the mines of the West, with the exception of Cripple Creek, a long-handle shovel is used that the shoveler saws off to suit himself. Being from the West and accustomed to its methods, the use of the D-handle shovel looks odd to me. Indeed, it does not look to me as though in a mine a man could possibly shovel as easily with such a shovel as he can with one having a long handle. The short-handle shovel makes a man do practically all the work of shoveling with his back muscles instead of distributing the work among several sets of muscles. For instance, at every shovelful there is a slight hesitancy as the man puts the knee of his back leg against the elbow of the hand with which he has gripped the D of the shovel. When he has done that, he pushes the shovel into the pile of ore; then, without any aid of the leg muscles, he rises, turns around and throws the ore.

To push to advantage it is necessary to apply the pushing effort from a point of the body ahead of its center of gravity; so it should be the front leg that gives the push forward that sends the shovel under the pile for its load. Moreover, the force should not be applied between the knee and the elbow, two parts of the body that are easily injured; instead, the place of incidence should be some pad of muscles. Moreover, it is not so efficient a way of shoveling to load the shovel with a push from the leg transmitted through some other part of the body, as it is to drive the shovel ahead under the ore with the leg pressing directly against the shovel. In the flat dipping lodes of the Lake Superior copper district with the low car and the ore right up against the track so that in handling much of the ore the shoveler is cramped for room, the disadvantages of the short-handle shovel do not become so evident as they would otherwise, for room is essential to easy use of any shovel, but were it necessary for the man to give much of a toss to the ore to get it into the car the fallacy of putting almost all the work upon the back and arm muscles and leaving out the aid of the leg muscles, the most powerful ones in the body, would be immediately evident, I believe.

In shoveling with a long-handle shovel a man needs more lunging room than he does with a short-handled shovel of the type under discussion, but provided he has the lunging room a man can work in just as narrow if not a narrower space than can a man with the other kind of shovel. For instance, it is no uncommon sight in the West to see two men shoveling into a car in a drift as small as six by seven feet. In taking the load, the man with the long-handle shovel has the handle of it against the large muscle of his forward leg, which is slightly bent. With a push of his leg forward, at the same time giving a little spuatting motion to his whole body, as if getting ready to spring, he drives the shovel forward under the ore, and even if it meets considerable obstruction, there is no hitching to get the load on the shovel, as is quite often the case with the shoveler using the short D-handle implement.

The shovel being loaded, the man gives a slight spring upward by straightening his legs, and tears the shovel and its load clear of the pile. Then, with the momentum up, the rest of the shoveling cycle is completed with the back and arm muscles. In this way full advantage is taken of the leg muscles in shoveling. Indeed, in Western mines one can tell a shoveler by looking at the legs of his overalls and even know whether he is a left- or right-handed shoveler; but at the Lake Superior copper mines there is no way of telling a shoveler except by guessing from his nationality and looking to see whether there is any mud from water-holes on his clothes. Indeed, the weakness of the short-handle shoveling system, which as I have pointed out is in getting the load, is tacitly admitted by those mine captains that claim a short-handle, square-point shovel to be best for plat work and a long-handle, round-point for shoveling on a rough bottom. Why not the D-handle shovel for both kinds of work? And why, if the short-handle shovel is better for shoveling on a rough bottom is it not better for shoveling on the smooth sollar?

It is said that the two kinds of shovels have been tested in the iron country, and that the short-handle shovel was found to be the better. I cannot say anything in regard to that, as I have never been there and have never seen how that ore breaks, but I understand that much of it is soft, and consequently it would not be so apt to break into slabby pieces that interlock in a pile as copper ores tend to do, and surely there cannot be as many boulders in the pile as in the ore that comes from the stopes of the copper country. Moreover, a Western shoveler would not attempt to shovel without using his pick occasionally to get boulders that are buried in the pile before they interfere with his shoveling, but in the copper country the shoveler's main implements, besides the shovel, are the sledge and gad. I have never in my trips through the Lake Superior copper mines seen a trammer, as the shovelers are called, working with a pick to loosen the ore before starting to shovel it. All that I can say is that any test with the labor accustomed to present shoveling methods in the iron or copper country of Michigan would not be fair to the long-handle shovel, no more than it would be for the short-handle shovel to be tested in Butte with labor accustomed to the long-handle shovel, for there the tests have shown that the long-handle shovel is the better.

It seems to me that it would be an excellent idea if some company, instead of giving a large prize for a double-hand drilling contest, would offer as large a prize for a shoveling contest to test out, in an eight-hour shift, under actual conditions of ore as it lies broken in a mine both with and without boulders in the pile, all the ore being broken down to ordinary shoveling size, the merits between the two kinds of shovels.

There ought to be a right way and a wrong way of shoveling. It does not seem as though there should be two ways of shoveling as there are at present in the mines of this country. I predict, if any such contest is ever held (and it would be of far greater benefit to mining than a drilling contest, in spite of the spectacular effect of the latter, one of the most thrilling and beautiful musclar exhibitions that I know of) that just as the stationary seat and unaided back swing were upset in rowing by the sliding seat and the back swing with the leg drive, so will the long-handle show its supremacy over the short-handle shovel.

The only reason that I can see that short-handle shovels should be better in the mines of the copper country having a flat dip is that the shovelers have to tram their own ore to the stations. The use of the long-handle shovel, which as I have said throws a considerable part of the work on the leg muscles, might throw too much work on the legs when this tramming labor is considered.

The stoping in the Lake mines is characterized by the great size of the ore that is broken in the stopes. As a result fully 60% of the rock is coarser than four inches and probably considerably over one-third the ore is loaded into the cars by hand. Therefore it is not quite fair to use the tonnages handled in these mines, even when comparing them with figures for shoveling in drifts in Western mines in which the shovelers have had to do their own tramming, for it is generally easier to load a ton of boulders than to load a ton of fine dirt. It would be interesting to compare the two systems of shoveling with the ore broken small enough to be handled in wood-lined chutes.

The proper way to shovel is a fundamental question in mining in regard to which there is no general agreement. Undoubtedly under certain circumstances one type of shovel is much better than another. I do not believe that there is any question but that where ore has to be tossed any distance the long-handle shovel is the better of the two. But then there arises the other question, how the long-handle shovel would compare in efficiency with a short-handle shovel and a wheelbarrow for getting the ore into the chute. There is also the large question of how far it pays to throw rock with a shovel instead of loading it into a wheelbarrow. A discussion of this subject ought to appeal to engineers, and it would have much practical value. The Western miner would learn something to his advantage about shoveling, and so would the Eastern miner. In giving tonnage statements, the working conditions, the size of the ore handled, the temperature of the workings and the condition of the ventilation are of importance for making comparisons.

Claude T. Rice.

Hancock, Mich., Jan. 6, 1912.

Underground Waters and Mining

An interesting suggestion was unwittingly made in an article that was recently published, but I can recall neither the title of the article nor the paper in which it was published. In one part of this article it was stated that certain companies were sinking churn-drill holes to tap a supply of underground water for use in the mills and in another part of the article, that operations at a small mine in the same vicinity had to be abandoned on account of the great influx of water that the fairly large pumps were incapable of handling and the rate of flow of which seemed not to diminish as the mine filled with water.

It was particularly notable in this instance that complete surveys of the underground waters of the region had been made by the Geological Survey. The data had been published and the large companies that were sinking the drill holes knew that a large body of underground water could be reached at a certain depth. The mines of these companies were so situated that the deep levels had not reached the level of this water. The small mine was situated in lower country and had the owners stopped to consider that, at a comparatively shallow depth, the lower workings of the mine would be below this level, they might have foreseen the result and saved the loss of what, to them, was a considerable sum of money spent in development work.

In this case it was indeed strange that working the mine should have been attempted for the existence of the underground water was generally known in that vicinity and it would have been an easy matter to ascertain its approximate level and what would be the natural consequence of making mine openings below that level. It seems that the owners were advised to the effect that there was every possibility of their work being stopped by a great influx of water, but as the advice was given *gratis* it was probably not valued.

This experience emphasizes the prevalent negligence of many who undertake mining to take full advantage of the physical conditions of the country as have carefully been determined and made known by competent engineers. There is a large number of underground water papers that have been published by the Survey, the perusal of which might benefit those who would mine in such districts.

Observer.

Phoenix, Ariz., Jan. 8, 1912.

Traveling in Colombia

The excellent article by R. D. O. Johnson in the Journal of Dec. 30, 1911, gives many pointers on traveling in the tropics, which all those who intend to make their initial trip to such countries would do well to observe carefully.

There is one suggestion that might be elaborated to a slight extent—that pertaining to mosquito bars. Mr. Johnson recommends a bar six feet high, but from my own experiences would unhesitatingly advise using one eight or nine feet high. Most houses in the tropics are built with high ceilings, so that a high mosquito bar can almost always be used. The cloth that will effectually exclude the mosquito is of so fine a mesh that ventilation is seriously interfered with, and unless the bar be high, the heat and bad air under the bar will make sleep impossible in low districts.

J. A. Herny.

New York, Jan. 12, 1912.

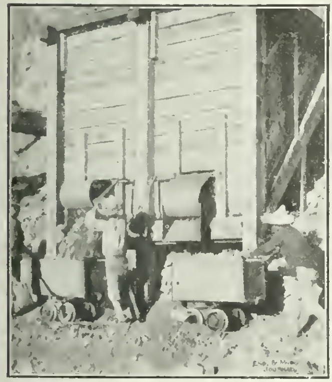
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Gate for Ore Bin Chutes

By Franklin W. Smith*



Steel Drop Gate for Ore Bin

The gate for an ore-bin chute, shown in the accompanying illustration, is in use at some of the mines near Parral, Mex. It consists of a sheet of steel of sufficient thickness to be rigid enough to resist bending under ordinary use. The lower end is bent in a semicircle, as shown; the upper end is riveted or bolted to a square bar of iron turned round at the points where it is supported by the bearings. The gate is raised and lowered by a lever attached to the square bar.

The bottom of this ore bin slopes toward the front at an angle of 45 deg. For dry ore a slope of 35 deg. would be better. The bent end of the sheet of steel should not be so large as to hold a heavy weight of ore, as in that case there might be some difficulty in lifting it. In closing the gate a quick downward stroke of the lever will check the ore.

Hauling Heavy Machinery

The moving of heavy or unwieldy pieces of machinery short distances is often a problem that the engineer engaged in construction work is called upon to solve. There is a knack to the art which is only gained by experience, a knack that is the rigger's stock in trade, but there is much hauling to be done about mines that hardly warrants the engagement of a rigger.

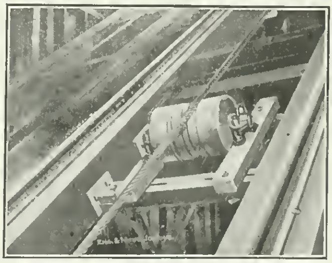
The following kinks are for use in hauling over a short stretch of fairly level road. In moving a section of a standpipe or smokestack or other bulky object that is awkward to handle, or which is too long to be put in the body of a wagon, the ends of two poles of equal length, a few feet longer than the object to be moved, are fastened to the back of the body of the wagon at a convenient distance apart, the other ends of the poles resting on the ground so that the inclination is about 30° to the horizontal. The spacing of the poles is rigidly maintained by inserting distance pieces, the ends of which are gained into the long poles and which are held in place by tie-rods passing through the long poles on each side of each distance piece. The distance pieces are placed one at each end and as many more between as may appear to be necessary. The section of pipe is hauled up the inclined poles so that it occupies a position parallel to the poles and is made fast by suitable cleats spiked to the poles. It is then hauled to the desired place, one end of the skid poles resting on the body of the cart, the other ends on the ground.

For hauling over wet, slippery, but level roads, a convenient skid or sled may be made by cutting a small tree just below the fork of two fairly long and straight branches. The forked end is trimmed with an ax, so as to curve upward somewhat like the bow of a canoe, so that it will slip forward easily when dragged over the road. The small branches are trimmed off and the side of the two large branches, which are to form the running surface of the sled, are trimmed off flat and smooth with an adze. A distance piece is gained into the extreme ends of the two branches, and tie-rods are used on each side, the distance piece being a little shorter than the distance between the ends of the branches or runners of the sled, so that the branches will have to be drawn in several inches by the tie-rods to hold the distance piece in its gains. Cross-pieces are then spiked across the runners or branches at intervals of three or four feet. An eye-bolt or clevis is then fitted into the curved, front or forked end of the sled, into which the hook of a block and tackle is placed.

This sled can be drawn directly by horses when light loads are moved; for heavy loads it is better to use a block and tackle and a snatch-block, attached to trees along the roadside. In such a sled a boiler weighing 11,000 lb. was moved over a muddy road, three-quarters of a mile long, in eight hours, with tackle, snatch-block and four yoke of oxen.

Roller Frame for Incline Shafts

In most of the shafts of the Michigan copper country the rope roller is carried on frames in which the position of the roller with respect to the rope is fixed, and where wide rollers are used, the custom is to change them to different frames in order to have them worn in three grooves before being thrown away. This necessitates the removal of the caps of the bearings each time. In the Mohawk mine a style of roller frame is used in which only four bolts must be loosened to permit the roller to be moved so that the wear will come in a new place. This allows the rollerman to change the position of the rollers more quickly and so keeps him in less danger, for all roller changes are made while the skip is running. In order to aid the rollerman in his work, a pit is cut at each roller so as to give him a small flat place where he can work with the roller coming about waist high.



Roller Frame for Inclined Shaft

---

*Mining engineer, care Alvarado Mining & Milling Co., Parral, Chih., Mex.

In the Mohawk shafts concrete stringers are used to carry the skip rails. The roller frames are bolted to carrier sockets, made by cutting a 3/8-in. sheet-iron plate so that the cut parts can be turned up to form the socket into which the carrying pieces of the roller frame can slide, and to which they are securely held by a bolt going down from a top plate through the bottom plate of the flanged socket. These sockets are held to the concrete stringers by bolts seated in the concrete when the stringer was made. The frame consists of two carrier pieces made of two 2x4-in. pieces placed on edge and bolted together with distance pieces between so that the bolts that are used to fasten down the cross pieces carrying the bearings can slide sideways between the two pieces when the bolts are loosened.

Temperature Measuring Pendants

The temperatures of gases in flues and chimneys are determined by the Green Fuel Economizer Co. by the use of the tensile strength of metal pendants instead of the melting point as the true indication of temperature. The pendants are made with a large body, having a certain definite weight, suspended from a narrow neck. The composition of the metal may be varied and the cross-section of this neck is adjusted until the body of the pendant will pull the neck in two and fall at some desired temperature.

In actual use, the pendants are hung upon a wire hook, which is introduced into the flue with the pendant at the desired point, beginning with the lowest temperature pendant, and proceeding until the one is found which will not fall off after five or ten minutes' exposure. The flue-gas temperature will then be somewhere between the temperature marked on the last pendant and the next to the last pendant used.

Pendants for three temperatures have been perfected, namely, 425°, 500 and 550° F., representing respectively the temperature at which the use of the economizer is justified with coal at commercial prices, the temperature at which an economizer is a good investment in all cases, and the temperature at which neglect to install an economizer becomes waste.

Sheaves for Balanced Hoisting

By P. B. McDonald*

At the Mary Charlotte shaft No. 2, at Negaunee, the arrangement of the two sheaves for balanced hoisting is being changed. The two skip-compartments and the hoist lie in the same line. To make room for the hoisting cables, the sheaves were put in leaning outward at a small angle; one leaned to the north, the other to the south. This made it possible for the cable going to the west sheave to escape touching the eastern sheave. However, this arrangement has not been satisfactory, and one sheave is to be elevated several feet above the other and both will be straightened to a vertical plane.

A Solution Clarifier

By C. R. Olson*

In Fig. 1 is shown the type of clarifier which was installed during the erection of the Tonopah-Liberty mill in 1910. The medium of clarification or filtration was cocoa matting covered by canvas on which were placed successive layers of sand, grading gradually from gravel next to the canvas to coarser than 20-mesh sand in the uppermost layer *B*. The frequency with which it became necessary to remove the gravel and sand, with its coating of slime, from the solutions and the time required in the operation of washing the canvas and rewashing the clean gravel and sand was such as would render this clarifier unsatisfactory.

At *E* in Fig. 1 is shown the grating which supports the clarifying medium, and at *A* is shown the space for collecting the clarified solution from which it is carried away by *C*; *D* is rope calking for the canvas.

Notwithstanding the fact that experimentation, as far as permissible during alterations, was carried on with sand of various degrees of fineness, layers of varying thickness, and vacuum at *A* of varying intensities up to 21 in., this type under the best conditions failed to give a rate of flow sufficient to handle the tonnage required of it. The passages under the grating were ample to afford ready escape of the solution and consequently did not influence the capacity.

By slight alteration, after about 10 days' trial, it was remodeled as shown in Fig. 2, after which no further difficulty was experienced. The grating *E* was raised about 11 in. in the clear, being supported by blocks *I*, 4x4 in.; vertical box launder *H* was placed in position; *C'* extended upward and was used as an overflow pipe; the excelsior *F* was covered by a screen *G* which was in turn held in place by cleats *M*. As indicated by the arrows, the solution passes from the feed pipe down through *H* to *A'*, where its velocity is reduced, permitting the settlement of a small portion of slime before the solution rises through the excelsior, finally overflowing as a clear supernatant into *C'* from which it passes to the zinc boxes. The discharge *J* is used only during cleaning and flushing out, which are necessary about once a month. While the arrangement in Fig. 2 is an original design of mine, credit is not claimed for originality in the use of excelsior in other clarifiers.

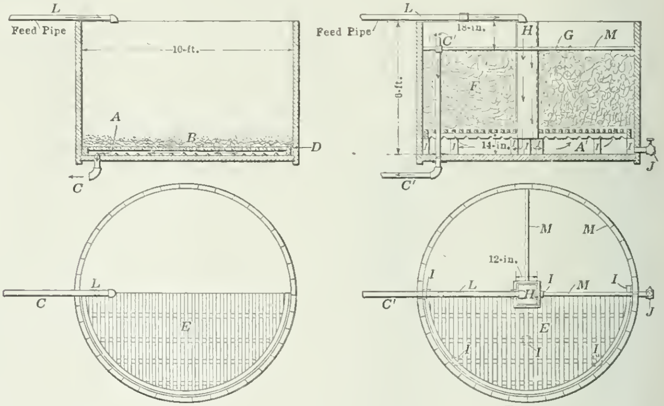


Fig. 1

Fig. 2

Remodeled Sand Clarifier Using Excelsior

In taking and recording data for underground construction of any sort, and in making computations for the direction and carrying out of such work, care should be taken to have the entire work in hand measure up to the necessary degree of accuracy, but much time is often wasted in doing certain parts of the work with too great accuracy, and not enough consideration given to the limit that can be reached by the men doing the actual construction. The planning and actual performance bear a certain definite relation to each other, and it is useless to compute to an error of 1 in 10,000 if the work cannot be done with an error less than 1 in five hundred.

---

*Mining engineer, Negaunee, Mich.

*General manager, Tonopah-Liberty Mining Co., Tonopah, Nev.

Taper of Face of Car Wheels

A flat-tread, straight-flanged wheel, in going around a curve that has a short radius, climbs out over the outside rail. It requires more energy to move a car mounted thus than is required if the wheels are properly shaped, writes A. W. J. Stewart.

In designing mine-car wheels the curve of least radius of the track should be taken to get the taper for the face of the wheels.

Take the radius of the curve of the inside rail and the diameter of the wheel; then draw an isosceles triangle whose base is equal to the diameter of the wheel and whose altitude equals the radius of the curve. Lines taken from the extremities of the base to the curve center, forming the hypotenuse, will give the cone or taper for the face of the wheel.

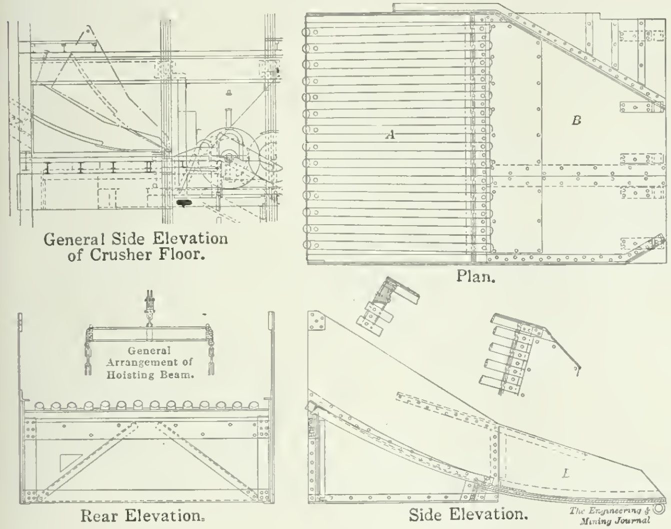
By making a drawing to scale, and setting a bevel to the drawing and using the bevel as a guide in turning out the chill and finishing the pattern, one should be able to get wheels that would give satisfaction.

Of course, one should consider the curve of least radius, if there are others around which the car is to be moved. A wheel with more taper than is absolutely needed is preferable, in fact it is advisable to put a little more taper in the face than indicated. The flange should lean back, as it were, and have a large fillet, the radius of which is greater than that of the corner of the top of the rail and which the wheel is to run.

Feeding Boulders to Crushers

By Claude T. Rice

In the mining of orebodies having strong walls, especially if the ore is not to be drawn through chutes, it is advantageous to break it as coarse as possible in the stope and do the crushing at the surface. At the Calumet & Hecla mines, where the orebodies dip at about 38 deg., the ore is loaded directly from sollars at the bottom of the stope into low tram cars of 2½ tons capacity. These are built so that large boulders, often weighing a ton or more, can be rolled into the car, and as the cars are dumped directly into the skips, which hold about 7 tons, no difficulty arises until it comes to the crushing and handling of the boulders at the surface.


A
B
L
General Arrangement of Hoisting Beam.
The Engineering & Mining Journal

General Side Elevation of Crusher Floor.

Plan.

Rear Elevation.

Side Elevation.

Grizzly and Apron for Feeding Crushers

During the last two years this difficulty has been overcome by the use of an apron grizzly on which the skip dumps and by the raising of which the ore is poured into the Blake crushers which are capable of taking a boulder 24x48 in. in section. This the crusher does without any apparent strain, and at one operation the ore is crushed to four inches.

The skip at the Red Jacket shaft, where the first of these aprons was installed, dumps at right angles to the apron grizzly so that the ore is not evenly distributed across the grizzly but tends to pile up more on the far side. At the other ore houses, where this system of handling the ore is used, the skips dump lengthwise upon an apron protected from wear by old rails.

In the apron feeder used at the Red Jacket shaft, owing to the space available, the grizzly is an integral part of the feeder, but in the later installation the grizzly bars are stationary and longer, so that the undersize is screened thoroughly before the apron of the feeder is reached. This is the more desirable design where the space available permits such an arrangement.

The apron consists of two parts, the grizzly *A* and the apron *B*, shown in the accompanying illustration, to which at the upper end is fastened the hoisting beam that is raised by a winch, belt driven from the main shaft of the ore house. These two parts are laid off on different curves. The upper part of the apron is steeper than the lower; as a result, the ore from behind pushes that in front forward when the apron is raised so that the ore works forward only as fast as the ore in front passes through the crusher. This entire device is hinged at the bottom to the frame of the ore house, while a counterbalance weighing about 3600 lb. is used to take practically all the weight of the apron from the winch that raises it during the feeding of the ore. In raising the apron a block and tackle arrangement of lifting the cable is used, and on the shaft, to which the hoisting winch is connected by a friction grip, when desired, a band brake is fitted so that the apron stays in any position as soon as the friction clutch is thrown out.

The grizzly bars are spaced 4 in. apart and are made round, as the ore is less apt to clog them than if a bar of V section were used. The ore breaks in long thin pieces which pass part way through and then topple over, causing binding on the side.

The ore from the conglomerate mines contains rock from the hanging wall, which has to be removed by sorting. This is easily done when the apron is in the lowered position, as the ore lies in a thin layer upon it. Two men do the sorting before the apron is raised to its second position about half way up. The rock is thrown aside and crushed for road metal. In the case of a boulder too large for the crushers, a chain is put around it and it is raised by a winch, with which each of the breakers is provided, and is swung aside and put on a flat sheet, where the men at odd times break it up by gad and hammer so that the pieces will be small enough to enter the crusher.

In order to prevent the ore from rushing down and jamming in the mouth of the breaker, a log is attached to the end of a chain so that the log can easily be raised out of the way as soon as the skip is dumped. As soon as the waste has been sorted, the apron is raised half way up and the ore from behind allowed to push the ore in front ahead until most of it has worked forward into the lower, flatter portion of the apron. Then the apron is raised to the limit of its motion, the upper part assuming an angle approaching 70 deg., then the rest of the ore slips ahead gradually into the breaker. The limit positions of the apron are shown in the illustration.

Two of these aprons are used, one for each skip, so that as it takes only about 2½ min. to feed a skipload of 7 tons, over 60 per cent. of which is too large to pass the grizzly; the apron is always ready before the skip returns. At the final stage of dumping the feeder attendant removes any jammed ore from the bars with hooks. In a test at one of the amygdaloid mines four men fed 104 tons per hour through the breakers for four hours.

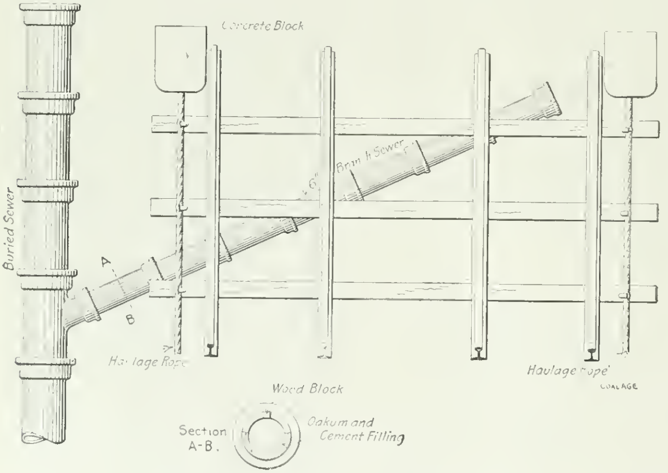
Taken as a whole, where the ore to be crushed contains large boulders and where it is necessary to remove the coarser pieces of waste, this arrangement of an apron feeder seems most admirable, and the best possible solution of the problem. It permits the waste to be sorted, the ore to be fed gradually to the crushers, any boulders too large for the crushers to be removed easily, and avoids any handling of the ore in getting it into the crushers, even when it contains boulders as large as a ton and a half in weight.

At the amygdaloid mines the aprons upon which the skips dump can be raised so that waste is dumped directly into the waste bin. No hoisting beam is used, but instead a chain with a pipe spreader-bar to make the chain pull straight upward for a sufficient distance so that boulders will not catch on it, is used. The block hooks into a ring on this chain. This is a cheaper construction and fully as good as the beam. Owing to the counterbalancing little power is required to raise the apron feeder, and so there is no apparent effect on the meter of the 100-h.p. motor that drives the crushers when the apron load is thrown on it.

Draining Gravity Planes

The best plan to drain a gravity plane and keep the track ties in place is to lay a line of tile-pipe on one side of the track with properly cemented joints. All the water that can be diverted from the head of the plane should pass down this drain. Several wyes should be put in the line and 6-in. branches run from these under the track. These branches should be cemented on the under half. The upper half should be left uncemented so as to drain the roadbed. Cover the ditches in which the branch pipes are laid, with broken stone.

Some planes are laid with anchored wood-sills into which the cross-ties are notched. The notching results in speedy rotting of the timber and the expense of such a method is considerable. The use of long ties common to both tracks as shown in the accompanying sketch is recommended by *Coal Age*, but perhaps the best security and the cheapest is the use of a haulage rope spiked to the end of ties and secured to a heavy timber, masonry or concrete support at the head of the plane. If the plane is long, two or three of these may be necessary so as to divide up the expansion from heat. Old, discarded ropes will do, and a heavy coat of tar will prevent them from rusting away; this coat being applied before and after their attachment to the ties.



Draining a Gravity Plane with Sewer Pipe

A Portable Desk

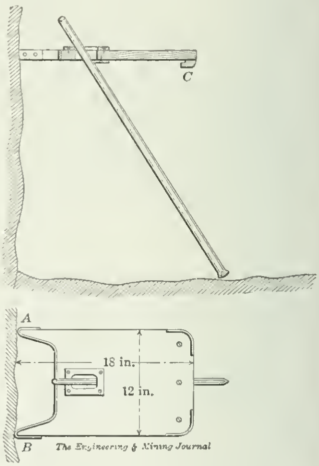
By A. Livingstone Oke*

The accompanying sketch shows a desk for use when surveying and sampling in mines. It consists of a board about 18 in. long and 12 in. wide with an oblong hole cut near one of the shorter sides. Through this hole a long piece of drill steel is passed, as shown, so that the two points *A* and *B* rest against the wall of the level or stope, as the case may be. These, with the point of the drill steel, form a three-point support for the board, on which a lamp can be placed, and it is possible to write in the notebook, when sampling or surveying, with the same facility as at an ordinary table.

In a mine it is always easy to find a suitable length of drill steel, so all that has to be carried from place to place is the board. This board requires to be strengthened by strips of iron around the points and the hole should be reinforced with an iron plate above and a strip below, where the weight of the table bears on the drill steel. The height is easily adjustable and the cutting out of the board, between the points *A* and *B* affords a steady rest on the most irregular surface.

The strip of wood shown at *C* on the lower outer edge of the board, is recessed at the back, as shown, and serves as a grip for the fingers when carrying the desk.

If desired, a small box may be attached to the lower side, in which notebooks, pencils, etc., may be placed. The desk makes a convenient stand for an acetylene lamp which may be placed at the back when writing.



Mine Surveyor's Desk

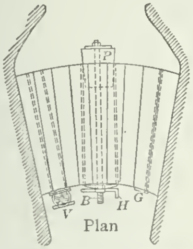
---

*Resident manager, San Juan Mines, Ltd., Rodeo, San Juan, Argentine

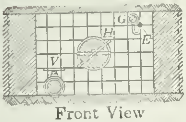
Timber Dam for Mine Use

There are several forms of underground dams used to resist a heavy pressure of water, but two types which are most common are those made of brick and cement, or of timber. For effectually withstanding a water pressure of 100 lb. per sq.in., to be put in a drift 8 ft. wide and 6 ft. high, the wooden or frame dam shown in the accompanying illustration is to be preferred says *Mining Engineering*. It is built of sound oak, thoroughly seasoned and dressed to shape and size required in wedge-shaped pieces 9 ft. long. The taper given to each piece would depend upon the proposed radius of sweep.

The dam should be built in solid ground, and the sides and roof of the site should be dressed off perfectly smooth with hammers, picks and wedges. No explosives should be used in the preparation of the site in order to avoid shattering the rock. In the end nearest the water each side should be enlarged two feet, making a total width of 12 ft. The floor and roof should be enlarged one foot, making the total height 8 ft. The area of the dam nearest to the water would then be 96 sq. ft., and the other end (8 ft. wide and 6 ft. high) 48 sq. ft. The oak pieces would be prepared, fitted together and numbered at the surface before being sent into the mine to insure good tight joints when permanently fixed.



Plan



Front View

The Engineering & Mining Journal

TIMBER DAM FOR DRIFT

Before the building of the dam is commenced, a thick layer of tarred flannel is put against the sides and bottom, on which the tapered pieces are put with the thick ends toward the water. Tarred flannel should also be put between the balks to insure the dam being watertight.

If any water is present during the construction of the dam, pipes must be provided and placed at the bottom of the dam to allow it to escape. The size of the pipe will depend on the quantity of water given off. As seen in the illustration there are three pipes, one at the bottom for the water to escape while the dam is under construction, another in the middle, of about 18 to 20 in. diameter, to provide means of ingress and egress for the workmen, while near the top a small pipe is inserted, the purpose of which is to allow the escape of any gas. The oak pieces surrounding the pipes are shaped to fit them.

When the dam is fixed in position every joint is wedged from the side nearest the water. The wedges should be of fir, two inches long, three wide and one thick. When these wedges have been driven in, small hardwood wedges should be inserted in each joint wherever possible. When the dam is completed, the lower pipe should be fitted with a valve at the outer end, a valve is better than a plug as it need not be closed until all the men are out and the manhole closed, and the water can be run off in any desired quantity at any future time. The manhole pipe is inclosed by means of a wedge-shaped wooden plug *P* the thick end of which is covered with vulcanized rubber to insure a water-tight joint. The plug should be placed in position, so that when ready it can be drawn into the back of the pipe and pulled home by means of a long bolt *B* and handle *H*. A pressure gage *G* may be fixed to the small pipe at the top of the dam to indicate the pressure of water.

Improved Coslettizing Process

An improvement in "Coslettizing" was recently patented in England in which zinc is employed. The ordinary process of Coslettizing consists in boiling the articles of iron or steel in a solution of phosphoric acid and iron phosphate in water. Phosphoric acid may be used alone, but a longer time is required in order to produce the coating as a certain quantity of iron must be in the solution to give the deposit. By this method a dead black coating is produced on iron or steel which protects it from rusting.

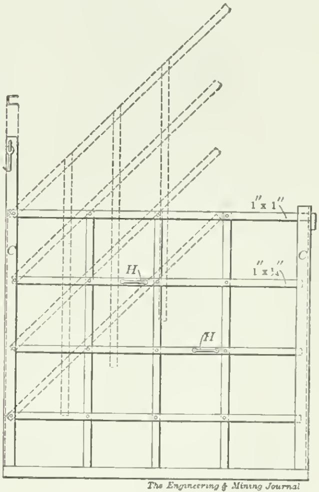
In the new process the following solution is first made up; Zinc, 6 oz., phosphoric acid, 1 pint, and water 1 pint. The solution is warmed for dissolving the zinc and is then known as the "concentrated solution." This solution is then added in the following proportion to water to produce the solution intended for regular use; Water, 1 gal., concentrated solution, 1 oz. For renewing the solution when in use, ¼ oz. of the concentrated solution is added to each gallon.

The iron or steel articles to be treated, states the *Brass World*, are boiled in the solution, contained in an iron kettle, for some time (usually about an hour) and a rustproof coating is obtained on the surface. The process may also be combined with the other in which iron phosphate is used and a combination coating obtained. The inventor states that an electric current may also be used in the operation in order to hasten it. In this case, the solution may be used cold if desired. The article to be treated is made the cathode and an iron plate is used as an anode.

A Safety Gate for Cages

By R. B. Wallace*

In vertical shafts an open cage is often used for hoisting men in preference to one inclosed with sheet metal. The accompanying sketch shows a gate for an open cage which gives a full opening and which can be used where there is not sufficient room for any up- and down-sliding gate.



The Engineering & Mining Journal

A FOLDING SAFETY GATE

The bars of the gate are hinged on one side and fold up to a vertical position where they are held by a hook that fastens into one of the handles of the gate. The top bar is 1 in. square while the other cross bars measure 1x¼ in. These are loosely riveted together. Two channels *C* made from plate and bolted or riveted to the sides of the cage hold the gate in position. Two handles *H* are placed in convenient positions on the cross strips for the cage conductor to grasp when raising the gate.

The Mount Boppy Gold Mining Company, Ltd., New South Wales, will install a 300-ton Moore filter plant.

---

*Mining engineer, Republic, Mich.

Tanganyika Concessions, Limited

At the general annual meeting of the Tanganyika Concessions, Ltd., held recently in London, optimistic forecasts of the future of this company were again made by Robert Williams, managing director and Tyndale White, chairman of the company. Mr. White quoted at length from the speech of M. Jadot, made at the meeting of the Union Minière Co., dealing with question of ore reserves. This was, in substance, as follows:

Ore Reserves

Up to the present, about 100 mines have been discovered on the concessions of the Union Minère, of which the 10 following are the most important; Kambove, which is estimated by William Frecheville to show 1,800,000 tons of proved ore with an average content of 12%, or 215,000 tons copper. Mr. Atherton estimated the same mine at 2,500,000 tons of 14% ore proved, or 350,000 tons copper. Mr. Gibb estimated 3,000,000 tons of 12% ore proved, or 360,000 tons copper. Star of the Congo, Mr. Frecheville estimated 435,000 of 14% and 9% ore proved, or 50,000 tons copper. Mr. Atherton estimated 1,500,000 tons of 11% ore proved, or 165,000 tons copper. Mr. Gibb estimated 1,200,000 tons of 15 and 6½% ore proved, or 106,000 tons copper. The following are Mr. Atherton's estimates on the others of the 10 mines. Fungurume, 1,500,000 tons of 7% ore proved, or 112,000 tons copper; Kwatabala, 1,150,000 tons of 7% ore proved, or 85,500 tons copper; Likasye, 1,000,000 tons of 12% ore proved, or 120,000 tons copper; Kabalela, 1,000,000 tons of 7% ore proved, or 75,000 tons copper; Dikurwe, 800,000 tons of 12% ore proved, or 96,000 tons copper; Musonoi, 600,000 tons of 9½% ore proved or 57,000 tons copper; Kolwezi, 450,000 tons of 13% ore proved, or 60,000 tons copper; Kakanda, 350,000 tons of 9% ore proved, or 30,000 tons copper. These 10 mines give, therefore, according to different estimates, as the amount of ore proved more than 10,000,000 tons, containing about 1,000,000 tons of copper.

The address of the managing director dealt at length with smelting conditions at Lubumbashi. No coking coal was found until recently on the Tanganyika Concessions' Luano coal field, and early negotiations with the Wankie collieries (northern Rhodesia) proved fruitless, so it was finally determined to begin smelting with European coke.

Present Copper Cost, £56 per Ton

The water-jacketed furnace was blown in on June 30, 1911. Of the copper in the ore 87% was recovered as bullion, 2½% as flue dust, and 10½% lost in slag. On Oct. 6, Mr. Studt, consulting metallurgist, advised that the cost of copper at the frontier was £56, of which no less than £39 was for coke. An agreement has been entered into with the Wankie Colliery Co. by which it is expected that a much cheaper coke supply will be obtained from the Wankie fields.

Mr. Studt also stated that difficulty was being experienced with the fine ore, of which a great proportion was blown into the dust chamber. The flue dust carried 6 to 9% copper and 8% unconsumed coke.

The Rhodesia-Katanga Co., a subsidiary, owns the Kansanshi mine, the Luongo coal fields and other properties. Operations at the Kansanshi mine showed a 5-ft. reef in the dolomite, carrying 10% copper. This mine has sent home 2000 tons of copper during the year, which, with the 1000 tons from the Lubumbashi works, makes a total of £150,000 shipped by the subsidiaries in the six months preceding the meeting.

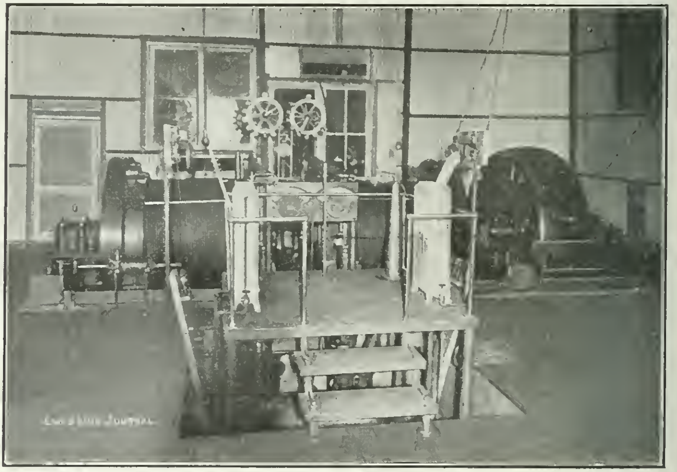
New Iron Furnaces at Buffalo

The doubling of the iron furnaces of the Rogers-Brown Iron Co., at Buffalo, N. Y., which has been underway for about a year, is nearly completed. The two older furnaces have a capacity of 300 tons of pig iron each per day and the new ones will slightly exceed that. As yet the company has not fixed a time for blowing them in, but will do so early in the year if market conditions warrant. The company mines all the coal it uses on its own property and makes its coke, not buying or selling any.

Electric Hoist at Calumet & Arizona

The Calumet & Arizona Mining Co. has recently completed an elaborate set of tests on the electric hoisting system which has been in operation since the latter part of September, 1909, at its mine in Bisbee, Ariz. The installation is reported satisfactory; the ease with which it is handled and the complete control which the operator has over it being especially noteworthy.

Tests have shown that, even under severe operating conditions where the hoist is running a great portion of the time, the average input to the system over a day's run will not exceed more than about 20 or 25% of the maximum load, and that the rate of input is practically constant.

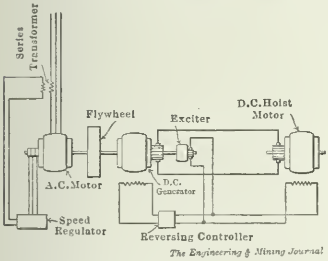


Electric Hoist at Calumet & Arizona

With small hoists, it has been found satisfactory to use alternating current induction motors directly applied, but where heavy loads are to be handled and at high speed, the peak due to the acceleration of the rapidly moving parts is always greatly in excess of the average requirements of the hoist. If the current is obtained from a line also carrying a lighting load, the resulting fluctations of voltage prove most objectionable. In most cases the hoist is at the end of a long transmission line and so an excessive amount of copper must be installed to prevent drop in the voltage during maximum demand. The result is that the line must be equipped for peak instead of average load at a greatly increased expense.

To overcome the above undesirable conditions the Westinghouse equalizer system hoisting plant was designed, the essentials of which are shown in the accompanying diagram. It consists of a direct current motor, direct connected to the hoist drum and a flywheel motor-generator set which includes a direct-current generator, a laminated flywheel, an alternating current induction motor and an exciter. The equipment also includes a reversing controller for the generator field, a speed regulator, a series transformer, and a switchboard. The hoist proper was built by the Denver Engineering Works Co. and it has a normal duty of 6000 lb. unbalanced load. Its speed is 1000 ft. per minute. The ultimate depth of the shaft is 1200 feet.

The armature of the generator and the hoist motor are electrically connected direct. The field of each machine is excited separately, constant full field being maintained in the motor. The hoist is started by gradually increasing the field of the generator and so delivering a proportional voltage to the hoist motor. When the load on the alternating current motor reaches a certain point, resistance is automatically applied to its secondary circuit, reducing the speed of the set, and the energy stored in the flywheel is used to overcome the peak of the hoisting cycle. Thus there is a minimum use of current.



The Engineering & Mining Journal

EQUALIZER HOISTING SYSTEM AT CALUMET & ARIZONA

The hoist is stopped by gradually weakening the generator field and thus allowing all excess in the descending cage, the rotating hoist motor and the drums to be returned to the flywheel through the generator which momentarily acts as a motor, receiving energy from the hoist motor which for the moment acts as a generator. The overall efficiencies of hoists of this type are generally from 50 to 60% when operated under normal operating conditions.

Because of the ease of control and the general characteristics of the set, it is a simple matter to devise reliable safety devices which do not depend on mechanical brakes. Such devices have been put in practice in Germany, where the government allows men to be hoisted at a speed of 2500 ft. per minute in this type of hoist, whereas with steam hoists provided with the best available safety devices the maximum allowed speed is but 1200 ft. per minute.

The first cost of installation is, of course, somewhat greater than a small motor hoist with rheostat control, but the manufacturers claim that the reduction of power cost due to the equalization of the load is so great that the initial expenditure becomes a secondary matter, especially when power is purchased on a maximum demand system.

The accompanying cut shows the hoist motor, the drums and the operator's platform at the plant of the Calumet & Arizona Co., Bisbee, where the set consists of a Westinghouse type EM. 220-hp., 550-volt, 63-r.p.m., shunt-wound, commutating-pole, direct current motor, direct connected to the hoist drum. This receives its power from a flywheel motor-generator set which includes a Westinghouse type EM. 180-kw., 575-volt, 1200-r.p.m., shunt-wound, commutating-pole, direct current generator; a 22,700-lb. laminated flywheel; a Westinghouse type HF., 180-hp., 2200-volt, three-phase, 60-cycle, 6-pole, 1020 to 1200-r.p.m. induction motor; a Westinghouse type S 15-kw., 125-volt exciter, and the necessary controlling and regulating devices.

Keystone Mines, California

SAN FRANCISCO CORRESPONDENCE

A new incorporation, known as the Keystone Mines, has taken over the old Keystone mining properties in Amador County, Calif., and contemplates reopening the mine below the present 1200-ft. vertical depth, for the purpose of exploration to determine if there is any good ore lower than the 900-ft. level. The property was one of the early producers on the Mother lode and is credited with a production of $16,000,000 in gold. It is composed of four lode claims situated south of the Bunker Hill mine and between Amador City and Sutter Creek. Formerly the Mahoney & Wildman mine was included in the holding. In the last 10 years the mine has been worked only intermittently, and in its last operation in 1910 by the California Consolidated Mines Co., the means for systematic exploration for new orebodies was not provided, and the mine was again closed down.

During the period of idleness the property has been kept unwatered with an electrically driven pump. There is a 60-stamp mill on the property, but not of modern type; there is also a 300-hp. compressor and other smaller compressors, steam hoist, sawmill, transformer house and other essential buildings and tools. The purpose as announced by the company is to sink 200 ft. below the 1200-ft. depth before crosscutting toward the vein. The Keystone is directly in line with the Argonaut, Kennedy, Central Eureka, Amador Consolidated, Bunker Hill and other mines, some of which are mining at a depth of 2000 ft.; others at more than 3000 ft. The new company is capitalized for $500,000, and the directors are C. R. Downs, Sutter Creek, president; Julius Chichizola, Amador City; C. L. Culbert, Jackson; W. J. McGee, San Francisco.

Conditions at El Oro

The properties of the El Oro Mining & Ry. Co., Ltd., in Mexico, were examined recently by R. T. Bayliss, chairman of the board of directors, in conjunction with Messrs. Foster, Raymond and Main. Mr. Bayliss' report contains a number of interesting and important features and his recommendations were unanimously adopted by the directors. Some important changes have occurred in the underground workings and it is stated that the recent political troubles in Mexico necessitate the consideration of the conditions which may, in the future, affect the conduct of enterprises similar to the El Oro; also, that the future policy of the company must be carefully reviewed.

THE SAN RAFAEL OR MAIN VEIN

For convenience, this vein has been separated by Mr. Bayliss into two portions; the upper half includes the workings from surface to the 486-ft. level and the lower half constitutes the workings below this level. Regarding the upper portion of this vein, Mr. Bayliss says: "The ore at present exposed above the 486-ft. level limits, in my opinion, the probable production of the upper portion of the San Rafael vein. The policy which has, therefore, been decided upon is to curtail further development work above the 486-ft. level, to break out all the ore therein which can be treated at a profit, and to abandon that portion of the vein. By this means a considerable economy will be effected in the maintenance of the many miles of lateral and other drifts in this portion of the property."

The lower portion of the vein has been opened to only a limited extent in the northern part of the property and with the exception of the 1000-ft. level south of the Somera shaft, has been practically unexplored. It is stated that while drifts opened from the 486 to the 1000 level north of the Somera shaft and extended to the northern boundary, have been somewhat disappointing, it is not safe to assume that the large area below the 486-ft. level, from the Somera shaft to the southern boundary is going to be unproductive until it has been proved so. The more recent workings on the 1000-, 1150- and 1300-ft. levels to the north of the Somera shaft show a material improvement in appearance, which is said to justify the expectation that it will be found more productive below the 1000-ft. level than between that level and the 550 above. No commercial ore has been exposed in the impoverished zone between these two levels. The first indications of improvement were on the 1000-ft. level where a small body of payable ore was found. The appearance and grade improved on the 1150, and on the 1300 the main vein contains an orebody 120 ft. long, averaging $9.50 per ton. This is the first orebody of substantial size and value that has been encountered below the 550-ft. level. Mr. Bayliss regards the persistent development of this vein on and below the present lowest levels as fully justified and as an essential feature in the future policy of exploration.

THE WEST AND SAN PATRICIO VEINS

During the last few months the developments on this vein are stated to have been most satisfactory and are continuing so. The orebody discovered on the 1000-ft. level is continuous from the 786- to the 1300-ft. level. This vein is composed of high-grade streaks occurring irregularly as to form and grade; the whole mass, as broken, including impregnated country rock, forms a fairly regular occurrence of ore that averages about $17 per ton. The relation between this and the San Rafael vein is not known, but an apparent junction at some point between the 1000- and 1150-ft. levels is indicated. Mr. Bayliss says that there is every inducement to develop this vein at further depth and that in general he regards the development of the lower portion of the northern end of the mine as offering the most attractive prospects yet presented in the San Rafael and adjacent veins.

From the No. 2 level to surface and from the San Patricio shaft to the north boundary of the Somera claim the San Patricio vein has presented a continuous orebody; between Nos. 2 and 3 levels the grade of the ore has diminished, and on No. 4 level, 150 ft. below, no orebody has so far been encountered. There is still considerable ore to be extracted between No. 3 level and surface and development on and below No. 6 level will be continued. Mr. Bayliss states, however, that he is not especially sanguine as to the speedy encountering of improved conditions. He believes that more favorable ground for operations exists in the southern portion of the vein from the shaft to the boundary of the Somera claim, providing the vein is found to continue for that distance and that he sees no reason to suppose that it will not so continue.

VICTORIA OR NO. 4 VEIN

It is his opinion, also, that the Victoria or No. 4 vein holds out prospects of being a large producer. At the point of its intersection by the main crosscut through the Somera claim, an orebody 550 ft. long and 8 ft. wide has been exposed; while this is low grade, it can be treated at a satisfactory profit. It is believed that this vein is identical with the Victoria vein developed some years ago in the southern end of the Somera claim; if this proves to be the case, it is stated that there is every reason to believe that it will make an important mine.

FUTURE POLICY

The report states that after due consideration and deliberation the conclusion has been reached that good mining practice and a recognition of the commercial aspect of the undertaking call for some modification of the policy hitherto in force. In this connection Mr. Bayliss says:

> In arriving at a decision, we have to consider (1) the physical condition of the mine; (2) the effect which the recent political upheaval in the Republic will have upon the operation of this and other similar companies; (3) the imperative necessity of so adjusting our output that time will be afforded for the complete development of the lower levels of the San Rafael vein and all other mines owned by the company. The upper portion of the San Rafael vein cannot be expected to produce large quantities of ore after, say three years from this date. We cannot rely with absolute certainty on the San Patricio vein affording relief in the immediate future. We cannot foresee, before the expiration of the period mentioned, the development of any large tonnage in the bottom of the mine to take the place of these two sources of supply.
>
> There is imposed upon us, therefore, the obligation of husbanding our resources, in order to get time for the full completion of the scheme of development which we have in view. For this reason we are of the opinion that the best interests of the company will be served by a reduction, rather than an increase, in the monthly extraction of ore from the mine.

It is further stated that there exists at present a general feeling of unrest among the laboring classes and business community in the Republic which will result in somewhat increased cost of operation; that while these conditions may not be permanent they will undoubtedly prevail for some time. Further reduction in working expenses cannot be looked forward to with prudence, or to being able to treat a lower grade of ore than exists in the mine today. Time must be given for the full scheme of development proposed and in conclusion Mr. Bayliss states:

> The history of this company has proved that no indication of the existence of a vein is too insignificant to follow. The remarkable discoveries of the past give me the greatest confidence that the energetic scheme of development which we have agreed upon, if extended over a period of three or four years, will result in the addition, during that time, of a large tonnage of ore to the resources at present at our disposal, and at its termination, to the exposure in the San Rafael and other mines belonging to the company, of reserves of ore which will enable the company to continue its operations for a period considerably in excess of that which I am now discussing. Giving careful consideration and due weight to the points I have mentioned, we have come to the decision that, as approximately from Jan. 1, 1912, the extraction of ore from the mines should be limited to about 20,000 tons per month. That, in addition thereto, approximately 15,000 tons of the accumulated tailings, which are estimated to yield a profit of $1.50 per ton, should be treated in conjunction with the ore to be taken from the mine, making in all a total monthly output of 35,000 tons.
>
> The adoption of this policy will be of twofold benefit. It will give relief to the mine and extend the life of the ore at present exposed, to an extent that will provide for the fulfillment of the scheme of development we have in view. It will further enable us to work, to the best advantage, the large pile of tailings, which are deteriorating owing to exposure, and which would not yield, in five years' time, anything like the profit which can be earned from their treatment today. Should this policy commend itself to the board, as we trust it may, it will be apparent that the present rate of profit earned by the company of, roundly, £200,000 per annum, cannot be maintained. We have no hesitation, however, in saying that if our suggestion is adopted, the profits earned, under the scale of operations we propose, will amount to £150,000 per annum.

Mineral Resources of Kentucky

The biennial report of the Kentucky Geological Survey, shortly to be issued, covers the geological, chemical, soil and topographic work done in 1910 and 1911.

The field work for reports on the Central City, Madisonville, Calhoun and Newburg quadrangles (embracing an area of about 800 square miles in the heart of the western coal field), was completed in the spring of 1910. The work revealed a larger number of workable coals in the upper series of beds and larger fields of workable thick coals than was known to exist.

The work in Rockcastle County revealed extensive beds of high-grade limestone and sandstone, valuable deposits of clay and three seams of coal estimated at 176,000,000 tons yet to be recovered.

In the region drained by the quicksand creeks lying in Breathitt and parts of Knott and Floyd Counties occur 11 beds of coal. The survey estimates that the quantity of recoverable coal is 956,000,000 tons. A partial examination of the Beattyville coal area was made. It was found that coal with an average thickness of 36 in. underlies more than half of Lee County.

Considerable work was done in the study of oil and gas possibilities in several parts of the state. Favorable structure was found in Knott, Floyd, Rockcastle, Lewis and Rowan Counties.

The rock phosphate deposits of central Kentucky were investigated and a large area of commercial phosphate determined. The barytes deposits of central Kentucky are reported to contain 150 workable veins, the average length being about one mile and average depth, 250 ft. It is claimed that this is the greatest barytes district in the United States.

Accidents in Cornish Mines

By R. H. Coulson*

The British Royal Commission on Metalliferous Mines and Quarries has not yet completed its labors. At a recent sitting, evidence was submitted by J. Paull, of the South Crofty mines, Carn Brea; William James, of the Dolcoath mine; Joseph Jennings, of East Pool and Agar United mines, Carn Brea; B. Nicholas, of the Levant mine, Pendeen. All agreed that many of the accidents are due to carelessness and familiarity, but they do not see how this class of accidents is to be prevented by anyone but the employees themselves.

Blasting Certificates Urged

Mr. Paull had something to say regarding the present law in respect of the quantity of explosives allowed to one person, and the method of conveyance and storing below ground. The law requires attention, and persons without a knowledge of charging holes and blasting should not be allowed to use explosives except under the personal direction of one who had experience, while miners should be required to have blasting certificates.

Rock drilling, in the view of Mr. Paull, is no doubt injurious unless certain precautions are taken to prevent inhaling the dust, but if the miner will take reasonable care of himself, there need be little or no danger. The present spray is bad, a jet being preferable if plenty of water is available; but if compelled to run a rock drill himself, this witness would prefer wearing a simple piece of sponge for a respirator to using either a jet or a spray. In brief, his conclusion is that drills in confined spaces should be worked with water, that respirators are a useful adjunct, and that a piece of sponge is best.

Advantages of Acetylene Lamps

He does not see that more can be done in the way of prevention against accidents beyond having stronger lights, such as acetylene. He favors the compulsory use of acetylene lamps to a certain extent, but does not think it would be well to insist upon every man having one, owing to the difficulty of fixing it while working. One of the commissioners, remarking that the cost when using acetylene lamps is only about one-third of that of candles, the president, Sir Henry Cunynghame, said it was incredible in that case that they are not more largely used. Mr. Paull added that the cost with the lamp he had in mind was more than that, but the small American lamps, as generally used, which give a much better light than the candles, consumed little carbide.

The suggestion was made that power be given to the men to appoint representatives to make an inspection of the mines, as is done in the coal mines of Great Britain. Mr. Paull can see no advantage to be gained thereby, considering that the present system of holding the chief man in each working place responsible is the better one, with, of course, frequent inspections by the managers and foremen. Mr. James also disapproves the suggestion, believing that such a provision would lead to a great deal of dissension among the miners themselves. It has to be remembered that the conditions in the tin mines of Cornwall differ considerably from those of coal mines. To this view Mr. Jennings added that the proposal would be distasteful to the men and impracticable for Cornish mines, for no one knew the sides and roof like the man in charge.

The provision of two shafts was proposed. Mr. Paull does not think this should be compulsory, provided that where there is only one outlet and there is no danger from explosive gas, it is divided into two or more compartments; and that in addition to ordinary hoisting arrangements a good ladderway is provided as a second means of egress in case of accidents to the winding arrangements.

Much the same view was expressed by the other witnesses, and while admitting that double shafts are "useful" for mines, Mr. Nicholas says that if an act of Parliament is passed compelling every mine to have two shafts, it will throw a heavy burden on a great number of them, rather more, he is afraid, than some of the mines can carry. In some cases money may be found to put down one shaft to try a mining property, but if compelled to put down two the money may not so easily be found, if at all. As far as his district is concerned, it is absolutely unnecessary. For the last 15 years Mr. Nicholas has been a mine official, having superintended mining operations in the Transvaal, Brazil, Italy, in the Camborne district, besides nearly four years in his present position. He has never seen the time nor place where this idea of two shafts would be of any benefit to the metalliferous mines or to the miners themselves.

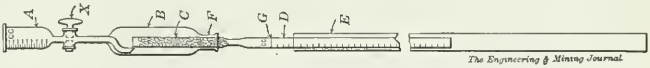
---

*20 Hornby St., Wigan, Eng.

Metallic Zinc in Zinc Dust

The value of commercial zinc dust depends on its content of metallic zinc. Various methods have been proposed for the determination of the metallic zinc without interference from the zinc oxide; among these may be mentioned the evolution of hydrogen from the dust by sulphuric-acid treatment with direct measurement of the hydrogen,[1] evolution and burning of hydrogen, and determination of the water formed,[2] reduction of standard potassium-bichromate solution in sulphuric-acid solution with titration of the residual solution with standard ferrous sulphate,[3] and reduction of potassium iodate in caustic-potash solution and determination of the reduced iodine, $3\,Zn + KIO_3 = 3\,ZnO + KI$.[4]

A works method is suggested as follows: Remove iron from the sample with a magnet, and weigh out 0.5 or 1 gram of the treated sample, or if a large amount of iron has been removed, a portion equivalent to 0.5 or 1 gram of the original sample. Treat with an excess of neutral copper-sulphate solution, stirring well with a glass rod and allowing to stand for some time. Filter over asbestos in a Gooch crucible, and wash thoroughly. Determine the copper on the filter, and calculate the zinc. (Cu = 63.57, Zn = 65.37.) Metallic lead will, of course, interfere, but owing to its high atomic weight (207.1), it requires over 3% of lead to appear equal to 1% of zinc. Moreover, in zinc dust used as a precipitant in cyanide mills, the lead would be available for precipitation and this method appears to give the true reduction equivalent of the dust.



Burette for Zinc-dust Analysis by Gas Evolution

In case the evolution method, with measurement of the evolved hydrogen, is preferred, what appears to be an elegant piece of apparatus has recently been devised by R. F. Bacon and P. B. Dunbar[5]. The instrument, shown in the accompanying illustration, is, of course, used in a vertical position. It consists of a graduated funnel tube *A;* a reaction chamber *B;* an absorption tube *C,* filled with glass beads; a eudiometer *D,* and a leveling tube *E.* The absorption tube *C* is sealed onto the eudiometer, and fits into the reaction chamber *B,* by the ground joint *F.* To use this apparatus, place a weighed quantity of zinc dust in *B*, open cock *X*, and bring the liquid, in this case dilute sulphuric acid, to the zero mark *G*. Close *X* and place about 15 c.c. dilute sulphuric acid in the reservoir *A*. Lower the leveling tube so that the air in the apparatus is under reduced pressure, and run in exactly 10 c.c. of the acid from *A*. Place an electric heating coil around *B*, and heat until the reaction is complete. Allow to stand until the apparatus has reached room temperature, bring the gas in the apparatus to normal pressure by means of the leveling tube, and the burette reading is the amount of gas evolved.

---

[1] Barnes, Journ. Soc. Chem. Ind., Vol. 5, p. 145.

[2] Fresenius, "Quantitative Analysis," II, 452, sixth edition.

[3] Ibid, II, 453.

[4] Sutton, "Volumetric Analysis," p. 382, tenth edition.

[5] Journ. Ind. and Eng. Chem., Dec., 1911, p. 931.

The London Gold Market

The annual circular of Messrs. Pixley & Abell, of London, says that there is little of interest on which to comment in the movements of gold during 1911, foreign exchanges generally not having reached a point where gold shipments from this country have been profitable, while neither the Morocco crisis nor the Italian-Turkish war had any material effect on the movements of gold in this country. As a result the price of gold has been fixed at 77s. 9d. throughout the year, with the exception of a short period of 14 days from Jan. 2 to Jan. 15 when a demand for both Germany and Holland created a premium of ⅛d. The bank rate shows a somewhat lower average for 1911 at 3.468 per cent. as against 3.723 per cent. for 1910. At the commencement of the year it stood at 4½ per cent., and was reduced on Jan. 26 to 4 per cent., on Feb. 16 to 3½ per cent. and on March 9 to 3 per cent. During September, however, the withdrawals of gold for Egypt, Turkey and Brazil began to assume large proportions, and in consequence on Sept. 21 the bank rate was raised to 4 per cent. at which figure it remained until the close of the year.

The total arrivals of gold in bars, refined and unrefined, dust, amalgam, etc., amounted during 1911 to £44,586,737, being £1,781,349 in excess of the amount received last year. The chief sources from which this gold came were: South Africa, £37,220,183; India, £2,245,011; Australia and New Zealand, £1,321,724; West Africa, £996,174. The larger purchasers were: India, £7,757,250; Germany, £5,303,697; France, £4,523,542; the Netherlands, £939,429. The Bank of England took £24,149,000 in all.

The arrivals in coined sovereigns were £4,028,905, and the exports £18,594,829; against £6,717,334 imported and £24,682,858 exported in the previous year.

Egypt in 1911 took considerably less than in 1910. On the other hand she returned less to this country than in 1910. This falling off is to be attributed to the poor cotton crop and to uneasiness in commercial circles owing to failures in that country. Egypt has also been able to send an important amount, referred to below, to India.

India again absorbed gold to an important extent. During the 10 months ended Oct. 31 she imported in bars and coin £18,988,470, of which £4,885,481 was from Egypt and £3,980,304 from Australia, while during the same period she exported £2,053,112, mostly unrefined gold produced in the country. During the last two months there have been further important amounts received in that country in bars and sovereigns, the latter from Australia. The total imports of bars and sovereigns during 1910 was £18,026,984. The shipments of small bars from London to India during 1911 were £7,757,250, against £8,150,000 during 1910, while the sovereigns shipped from London amounted to £1,430,272 against £2,128,658. The only large withdrawal of foreign gold coin from the Bank in 1911 was £500,000 taken by Germany in German coin during the last fortnight.

During the last few weeks the government of China, in order to meet its pressing needs, has taken about £400,000 of gold from the hoard held in the palace and sold it abroad. The existence of this hoard, accumulated during past centuries, has long been known, but its value can only be guessed at, some estimates placing it as high as £9,000,000. It is surprising that a larger raid has not been made on this treasure.

Iron and Steel in Congress

Washington Correspondence

The Ways and Means Committee has practically determined to report to Congress in the very near future a bill revising the tariff on iron and steel, and also the duties on lead and other metals included in the present act under the iron and steel schedule. This conclusion has been arrived at because of the recognition that Congress will not be able to do anything on woolens and cottons for a good while to come, until opportunity has been given more thoroughly to digest and understand the report of the Tariff Board on wool and woolens. Not wishing to delay all action on the tariff as long as this would imply, it has been determined to take up iron and steel first. The understanding is that the bill will place iron ore on the free list and will make reductions, running probably from 40 to 50 per cent. of existing rates of duty. It is expected to take the bill into a Democratic caucus at an early date, and secure a ratification of it there, following this by a passage in the House of Representatives after a moderate period of debate. The question whether such a bill can be passed in the Senate is an open one, but it is believed that such action is at least possible. The chief barrier to it seems to be found in the fact that the good understanding between the Democrats and progressive Republicans, which existed last spring and summer, has now been largely destroyed. Should the bill go to President Taft, it may or may not receive his signature. He had said that he would not sign any bill relating to a subject which has not been considered by the Tariff Board, but as the iron and steel schedule has been thoroughly considered by the Bureau of Corporations in connection with the general study of the iron and steel industry, the President may be brought to feel himself warranted in taking action on a bill which appeared to him reasonable in its reductions on iron and steel.

The Steel Corporation Investigation

The testimony of Andrew Carnegie before the Stanley Steel Investigating Committee during the past week is believed to close most of the public work of that committee, although a few more witnesses may be summoned to testify as to railroad rates. Mr. Stanley has expressed great regret at the departure of J. P. Morgan from the United States, it having been his desire to place Mr. Morgan on the witness stand. Some other financiers may be substituted, but there appears to be no positive intention of the sort at the present time. The Stanley committee has received a grant of $9000 more from the House of Representatives for the further prosecution of its investigations, but there is an understanding that much of this money was already payable in the form of outstanding bills, etc., due to investigators and for traveling and other expenses. The report of the committee is expected to be rendered largely on the basis of the information it now has, although it is possible that such witnesses may add slightly to the mass of material in hand. No action is expected from Congress one way or another as a result of the work of this committee.

United States Smelting to Extend Mexican Operations

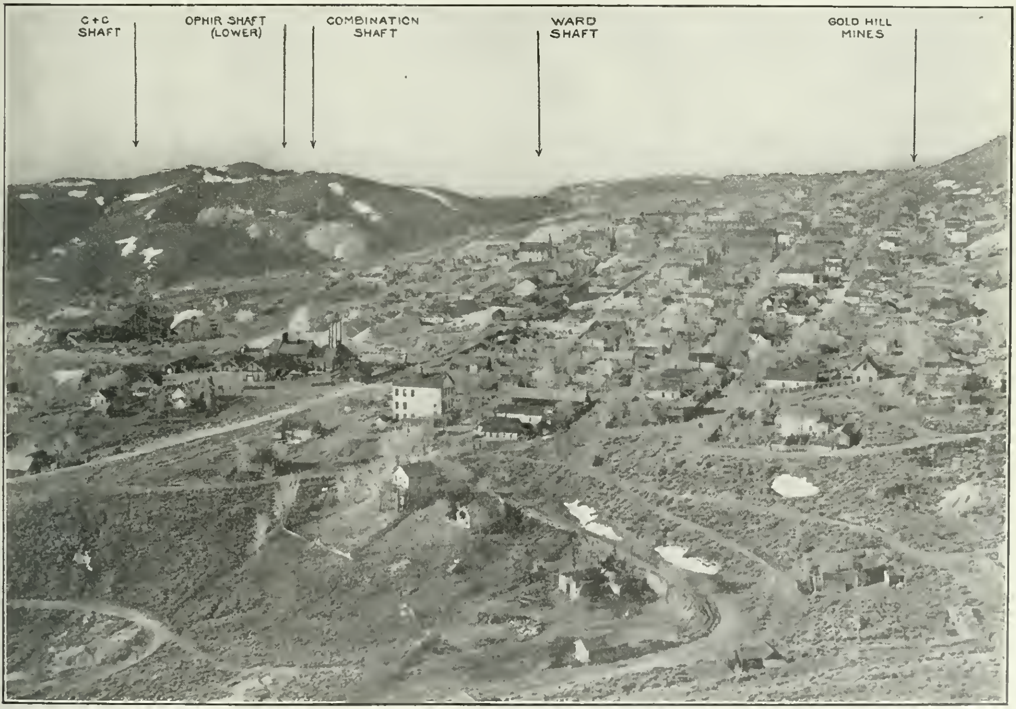
Until recently, the United States Smelting, Refining & Mining Co., owning a group of mines, smelteries and refineries in the United States, confined its operations in Mexico to the Pachuca and Real del Monte districts, in the state of Hidalgo. Of late, however, an energetic campaign of enlargement in Mexico was inaugurated, and offices were opened in the City of Mexico (Rooms 411 and 412, Mutual Building), for the receipt and consideration of any data regarding such mining properties as may be in the market. This office and the field work connected with same will be under the direction of Geologist Ezequiel Ordoñez. C. W. Van Law, director of the Compañia Real del Monte y Pachuca, is the manager of all the company's interests in Mexico.

The Position on the Comstock

By George J. Young*

The discovery of a rich orebody in the Mexican mine stimulated exploratory work in other Comstock mines. Drainage and ventilation problems are being solved by co-operative methods. High-grade ore is shipped to smelteries; low grade treated in local custom mills.

During the last year considerable attention has been directed toward Virginia City, Nev. The discovery of high-grade ore in the Mexican mine in what appears to be an orebody of some size has practically rejuvenated the Comstock. The steady, conscientious work of the last 10 years looked as if it would be for naught, and ultimate shutdown and the giving up of deep drainage and prospecting the result. It required the restoration of confidence and the invigorating with new hope not only the stockholders but also the miners and men in managerial positions. This is what the discovery of the Mexican orebody accomplished. Virginia City had redeemed itself became the current opinion.



View of Virginia City, Nev., Showing the Position of the Principal Shafts

The psychology of a run-down mining camp is of interest. Everything works against those who are endeavoring to open up the mines. The past success of the camp is often in itself the principal reason for pessimism. A small setback, which, under normal conditions, would call for slight comment, is magnified until it almost stops operations. Stockholders and men lose courage. Ordinary difficulties, which could be solved by good engineering, become insurmountable obstacles. Financial difficulties are enhanced. Such a condition calls for courageous leadership. Through such vicissitudes the old Comstock has passed many times, and at critical periods some leader has appeared to start work along the road to success. Leon M. Hall became the operating leader for a while and his work pioneered the way for the solution of the drainage problem. In his steps came Whitman Symmes. This competent engineer reviewed in a noteworthy paper[1] the conditions on the Comstock and his straight-from-the-shoulder criticisms cleared the situation and prepared the way for a fresh start.

During the interim preceding the discovery of the Mexican orebody the drainage problem was worked out, and from the mistakes and accidents incident upon the work at the Ward shaft there grew definite ideas on the limitations of the problem from physical and mechanical standpoints. Despite the careful searching of the old mine records for information relative to former discoveries of orebodies in the lower levels, but little or no trustworthy information concerning these has been found. With the information at hand of a negative character, the discovery of the Mexican orebody raised a reasonable doubt as to the thoroughness of the previous explorations on the lower levels and greatly enhanced the possibilities for the discovery of additional orebodies. Geological conditions have been studied, but it is disappointing to say that, during recent years, no comprehensive review of these has been published. That this will be done and will have the effect of centralizing the search for orebodies there is little doubt.

---

*Professor of mining and metallurgy, University of Nevada, Reno, Nev.

[1] Min. and Sci. Press, Oct. 10 and 24, 1908.

It is my purpose to review the present conditions in Virginia City. The company organizations, stock markets, etc., I do not propose to discuss. Suffice to say that the stock exchanges list about 34 mines, the stocks of which are regularly bought and sold. Large as was the Comstock lode, it is difficult to conceive of such a number of companies flourishing at the present time. It is strange indeed that the Comstock should have survived so many years with the original organizations and the separate companies.

Co-operative Drainage System

The benefits of coöperative effort were soon realized after the formation of the Comstock Pumping Association in 1898. Twenty-four companies combined, each to pay its proportional part of the expense, for establishing a general drainage system. The present United Comstock Pumping Association is the outgrowth of the original pumping organization and the Ward Shaft Pumping Association (formed in 1903). The success of these organizations is shown by the fact that the levels below the Sutro tunnel have been regained on the north-end mines to the 2500 (2650 of the C. & C. shaft) for a lateral distance extending from the Con Virginia workings through to the Union mine.

MEXICAN. OPHIR AND C. & C. PUMPING EQUIPMENT

Level	Number of Units	Gallons per Min.		Lift Feet
		Capacity of Each	Total Capacity	
2700 Mex. & Ophir	2	2250	4500	200
2650 C. & C	2	2250	4500	200
2450 C. & C.	3	1500	4500	300
2150 C. & C...	3	1500	4500	400
To Sutro tunnel	10		4500	1100

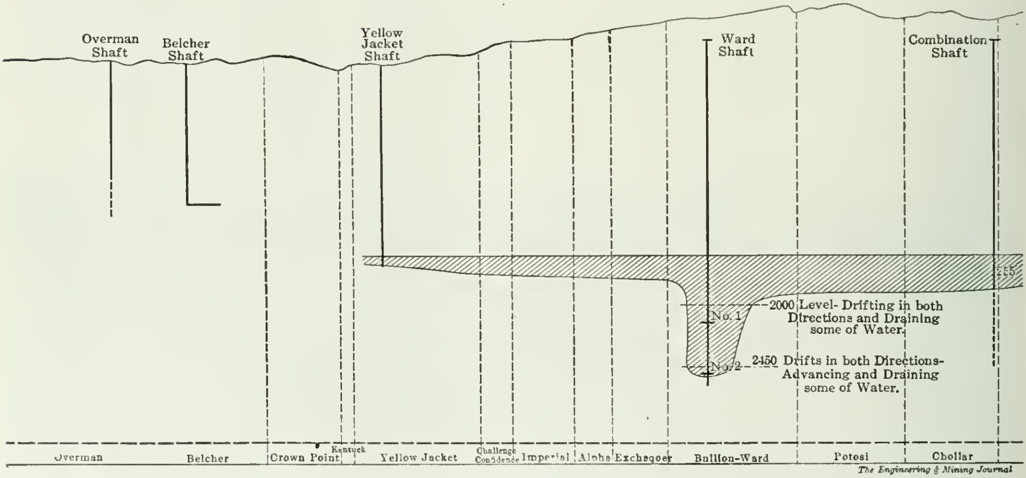


Diagram Showing the Drainage

At the C. & C. shaft the water level has been depressed to the 2650 station; at the Combination shaft to a point 240 ft. below the Sutro tunnel; at the Ward shaft to the 2475 level, and in the Crown Point and Yellow Jacket mines to the 1400 level (Sutro tunnel level of the Gold Hill mines). Pumping machinery has been ordered for the unwatering and recovery of the levels of the north-end mines to the 2700 level. At the Ward efforts are being made to tap the water in the Gold Hill mines. Thirteen years have been required for this work since the inception of the Comstock Pumping Association and, barring unlooked for accidents, the early recovery of the 3000 level from Gold Hill to the Union shaft may be expected.

The present status of the drainage problem is as follows: The Sutro tunnel, the main drainage adit, has been repaired and is in excellent condition. Wooden stave pipe has been laid throughout the main tunnel and laterals to both the Ward and C. & C. shafts. A short length only needs to be constructed to the Combination shaft in the event of that shaft being required for drainage. At the C. & C. shaft the three Riedler pumps on the 2150 level are in good condition, and almost continuously operated. They have a capacity of 4500 gal. per min. Three 1500-gal. multistage bronze pumps have been ordered for the 2450 station and two 2250-gal. pumps of the same type for the 2650 station (C. & C. shaft). Two similar pumps of 2250-gal. capacity have been ordered for the 2700 level of the joint Mexican and Ophir winze. This information is shown in the accompanying table.

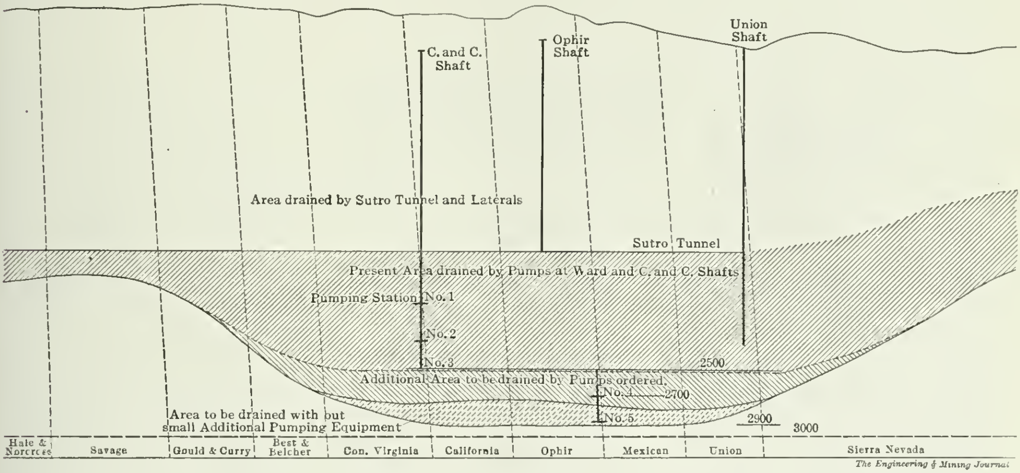
The entire installation will be electrically operated. The hydraulic elevator, at present in use, will be discarded or used only for emergency purposes as soon as the above installation is in operation.

At the Ward shaft two pumping stations have been constructed and are in operating condition. On the 2475 station are two 1000-gal. quintuplex, single-acting plunger pumps, and the foundation for a third has been constructed. The 2100 station has been equipped with three 1000-gal. pumps of the same type. These are listed in the accompanying table.

The Ward shaft pumps are also electrically driven. The shaft is equipped with bailing tanks for emergencies. An auxiliary pumping plant, together with the pumps on the 2100 station, is being operated and will be continued until the water from the south reaches the shaft. North and south drifts from the 2000 and 2450 levels of the Ward are being run and are already draining off some of the water surrounding the Ward shaft. Diamond drilling precedes the work of drifting, and every precaution to prevent and control a sudden inrush of water is being taken. The installations have been well designed and substantially constructed, and it is to be expected that they will not only serve the purpose, but will be operated with economy. The recovery and equipment of the Ward shaft reflects high credit upon Superintendent Symmes. The cost of operating the pumping equipment at the Ward and C. & C. shafts when complete will be approximately $250,000 per annum (not including maintenance of workings).

WARD PUMPING EQUIPMENT

Level or station	Number of Units	Gallons per Minute		Lift Feet
		Capacity of Each	Total Capacity	
Sump-air lift				
2475 station..........	2	1000	2000	414
2100 station.................	3	1000	3000	488
To Sutro tunnel......	5		3000	902


C. and C. Shaft
Ophir Shaft
Union Shaft
Area drained by Sutro Tunnel and Laterals
Sutro Tunnel
Present Area drained by Pumps at Ward and C. and C. Shafts
Pumping Station No. 1
No. 2
No. 3
2500
Additional Area to be drained by Pumps ordered.
No. 4
2700
Area to be drained with but small Additional Pumping Equipment
No. 5
2900
3000
Hale & Norcross
Savage
Gould & Curry
Best & Belcher
Con. Virginia
California
Ophir
Mexican
Union
Sierra Nevada
The Engineering & Mining Journal

System Used at the Comstock Mines

Ventilation Problem Important

The ventilation of the lower workings is at present not as satisfactory as it could be made. In the Mexican mine the workings are, for the most part, cool and the system well worked out. The Ophir shaft is the upcast for the north-end mines. The Union and C. & C. shafts are downcasts for the same group. The Mint and Alta shafts serve as downcasts for the Sutro tunnel laterals and the Combination is the upcast for both laterals and the main tunnel. The Sutro tunnel is well ventilated, and this is due to the use of stave pipe for the handling of the drainage water. The Gold Hill mines are ventilated through the Belcher upcast and the Yellow Jacket and Overman shafts as downcasts. The present workings of the Gold Hill mines are comparatively cool.

As greater depth is obtained on the north-end mines the necessity for better ventilation will be a critical factor in the economical operation of the workings. Some improvement can be made at the present time. The upcast and downcast areas are sufficient but the connecting crosscuts and winzes offer considerable resistance to the passage of an adequate ventilating current. By enlarging these more air can be drawn through the workings and lower temperatures obtained.

An exhaust fan is operated at the mouth of the Ophir shaft but it is doubtful whether the effect of this fan on the lower workings is great. By concreting the top of the Ophir shaft and placing iron doors over the compartments and placing concrete stops on all of the connecting openings leading into the main airways leakage could be controlled and the fan made more effective. An alternative suggests itself and that is to install high-speed multivane fans on the Sutro tunnel level, connecting them with the upcast winze and exhausting the air from the workings and forcing it up the Ophir shaft. Bypasses could be constructed so as to resort to natural ventilation in the event of shutdowns.

Local control of temperature and ventilation is effected by the use of electrically driven steel fans and air pipe. It is not unreasonable to suppose that the ventilation of the lower workings of the north-end mines by some well worked out plan will be accomplished in the near future. Just at present the development of ore and the completion of the pumping installations have prevented any radical improvements and compelled the resort to temporary expedients. Good engineering, however, will require that the miners be given such working conditions as will enable them to work as efficiently as possible.

Extent of Workings Open

It is practically impossible to tell to what extent the old workings are open. The workings which are used and maintained in working condition may be enumerated as follows: Sutro tunnel level—The Sutro tunnel, the south lateral to the Alta shaft, the north lateral to the Union shaft, connections with the Ward, Combination and C. & C. shafts; in all, 37,000 ft. of workings.

The shafts open and in use are: Alta, 1100 ft. to connection with south lateral; Overman, 1200 ft.; Belcher, 1100 ft.; Yellow Jacket, 1400 ft.; Ward, 2563 ft.; Combination, 1840 ft.; Mint, 1400 ft.; C. & C., 2650 ft.; Ophir, 1600 ft.; and Union, 2000 ft. The aggregate footage of these shafts is 16,853 ft. Of this 10,613 ft. are used for hoisting purposes and the remainder for ventilation. The Andes shaft (175 ft.) and the Golden Gate (800 ft.) are two small shafts which are open and in use but which are not of importance at the present time.

Gold Hill Mines: The Crown Point and Yellow Jacket mines are open through the old Yellow Jacket shaft to the 1400 level and in the former mine ore is being stoped from this level. The Caledonia and Overman mines are open on the 1200 level. The aggregate footage of workings on the Gold Hill group is estimated at 10,000 feet.

North-end mines: At the Ward exploratory workings are being driven on the 2000 and 2450 levels. In the Con. Virginia, the 1650, 2450 and 2550 levels are being used; in the Ophir the 2100, 2200, 2300, 2400 and 2500 levels; in the Mexican the 2200, 2300, 2400 and 2500 levels; in the Union Consolidated the 2000 and 2500 levels; in the Andes the 70 and 175 levels, and in the Utah surface workings. The aggregate footage of workings on the north-end mines which may reasonably be expected to be maintained for drainage, ventilation and mining is 15,000 feet.

The total footage of all workings is approximately 80,000 ft. The requirements of drainage, ventilation and mining are such that it is doubtful if this footage can be materially reduced. The workings are maintained in good condition and the cost of doing this is a large proportion of the total expense.

ORE PRODUCTION OF SOME COMSTOCK MINES

Week ending (1911)	Ophir		Mexican		Union Consolidated		Crown Point	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value
Aug. 5	212	$12,700	428	$13,005	145	$1,006	.....	$2,200
Aug. 12	244	11,672	382	14,609	47	485	.....	2,700
Aug. 19	214	7,398	496	34,417	128	1,056	.....	2,163
Aug. 26	335	15,420	333	23,076	84	1,599	...	4,767
Sept. 2	323	15,022	256	9,289	76	1,072	289	3,563
Sept. 9	282	13,640	273	12,187	45	261	....	2,318
Sept. 16	397	19,615	313	16,543	...	......	....	2,401
Sept. 23	405	24,146	260	9,799		......	.....	4,594
Sept. 30	366	21,297	286	17,713	.	......	357	4,755
Oct. 7	455	23,127	128	10,009		......	320	5,060
Oct. 14	393	23,737	196	11,943		....	378	4,113
Oct. 21	400	21,392	184	15,562	...	.....	537	5,204
Oct. 28	361	19,403	295	17,998	112	1,773	525	3,881
Average per week	337	$17,582	295	$15,857	91	$1,034	417	$3,670
Calculated per month	1,348	70,328	1,180	$68,716	364	4,130	1,668	14,680
Average value per ton	..	$52		$53.80		$11.40		$10

The scale of operations of many of the companies is necessarily limited by financial reasons. Many are on an assessment basis and the ability of a company to collect determines the footage of exploratory workings run. The producing mines (recording production during the last three months) are the Ophir, Mexican, Union Consolidated, Crown Point, Yellow Jacket (dump rock), Chollar and Potosi (croppings), Gould and Curry (old surface workings) and the Justice. The mines in which more or less development is reported, with the approximate footage, are: Ophir, 50 to 60 ft. per week on the 2100, 2200, 2400 and 2500 levels; Mexican, 30 to 50 ft. per week on the 2300, 2400 and 2500 levels; Con. Virginia, 20 to 40 ft. per week on the 1650, 2450 and 2550 levels; Union Consolidated, 20 to 50 ft. per week on the 2400 and 2500 levels; Chollar Brunswick, 20 to 25 ft. per week on the 800 level; Julia Consolidated, 20 to 30 ft. per week on the 2000 level; Andes, 10 ft. per week on the 175 level; Overman, 17 to 20 ft. per week on the 1200 level; Calcdonia, 10 ft. per week on the 1200 level; Crown Point, 10 to 17 ft. per week on the 1400 level; Utah, 10 ft. per week in surface tunnel.

The total footage of exploratory workings is between 1000 and 1400 ft. per month. Both the Ophir and Mexican report considerable work in ore. The most important development work is in the north-end mines in the "east vein." With the exception of the Crown Point mine the exploratory workings in the Gold Hill mines have found but little ore.

Monthly Production 15,000 Tons

The principal sources of ore production are stopes on the lower levels, mining of surface outcrops, removal of old stope fillings and the surface dumps. From the weekly reports the accompanying table has been compiled.

The calculated total per month is 4560 tons of a value of $157,860. From the lease on the Chollar and Potosi croppings about 5000 tons per month of a value in round numbers of $40,000 are being produced. From the Yellow Jacket dump 5000 tons of low-grade ore are being worked per month. From the Justice mine 750 tons are reported. The monthly production from the lode is approximately 15,000 tons of a value between $175,000 and $225,000.

MILLS IN COMSTOCK DISTRICT

Plant	Crushing Equipment	Capacity, Tons per Day	Cyanide Sand Plant, Tons per Day	Cyanide Slime Plant	Concentrator
Butters Co	20 stamps, 4 tube mills	200	100	100	Wilfleys vanners
Mexican	10 stamps, 1 chilean mill 1 tube mill	100		100	.....
Kinkead	6 Kinkead mills	40			vanners
Yellow Jacket	20 Kinkead mills	200			vanners
Diedrich	15 stamps	40	40		Wilfleys
Mills at Silver City and Dayton:					
Phillip	10 stamps	30	30		...
McTigue	15 stamps	40			vanners
Overland	10 stamps	30			...
Nevada Reduction Works	18 stamps	50			..
Nevada Reduction Works	[illegible] stamps	160			vanners
Woodbury			30		
Donovan			30		

Work has been started upon the Gould & Curry croppings and in September the Geyer lease shipped 230 tons to the Silver City mills. Preparations have been made for the testing of the outcrops of the Sierra Nevada mine. In Silver City, leasers are active and shipments totaling from 1000 to 1500 tons per month are being sent to the custom plants. The cyanide plants of Silver City treat from 1500 to 2000 tons of tailings per month. East of Virginia City the Comstock-Phoenix, Cosmopolitan and Monte Cristo mines are active. In the Comstock-Phoenix an important orebody has been opened up. The annual report of this company (Apr. 11, 1911) showed that 1800 ft. of development work had been done and 1100 tons of ore assaying $25 per ton produced. During September and October, 13 cars of ore aggregating 600 tons of a value approximating $100 per ton were shipped to the smeltery.

Three mines are producing comparatively high-grade ore, the Ophir, the Mexican and the Comstock-Phoenix. The Ophir produced ores ranging in value: From $45 to $88 per ton on the 2100 level; from $19 to $30 per ton on the 2200 level; from $9 to $96 per ton on the 2400 level. The average value for the three months given in the table was $52 per ton. The Mexican produced ores ranging in value: From $30 to $168 per ton on the 2500 level; from $7 to $33 per ton on the 2400 level; from $5 to $106 per ton on the 2300 level. The average value for the three months given in the table was $53.80 per ton. The average value per ton of the ore produced from the Union Consolidated was $11.40; from the Crown Point $10 and from the Chollar croppings from $5 to $14 per ton. The Yellow Jacket dump rock runs from $2 to $2.50 per ton. In the mine reports all rock above $5 per ton is reported as ore. While the bulk of the tonnage reported is comparatively low-grade there is sufficient high-grade produced to bring the bullion production up to a good figure.

Underground Work and Equipment

In the Mexican mine many departures from the usual Comstock methods are to be noted. The more important are: The practice of filling and using lighter timbers in the stopes; the use of stulls in the raises where shrinkage stoping is to be practiced; the use of water Leyners for drifting and crosscutting, Waugh machines for stoping and plug-drills for cutting hitches; the use of the "squirt" for clearing drill holes in all headings; the timbering of raises and winzes with shaft timbers instead of square sets; the use of the skip and storage bins on winzes; direct-connected, motor-driven, high-efficiency fans; improved ventilating-pipe construction; the general use of telephones in the principal mine workings as well as at the stations and the use of electrical hoists for winzes. The successful attempts at this mine to better operating conditions, as well as the improved methods of prospecting and development, cannot be without important influence on the other mines of the lode.

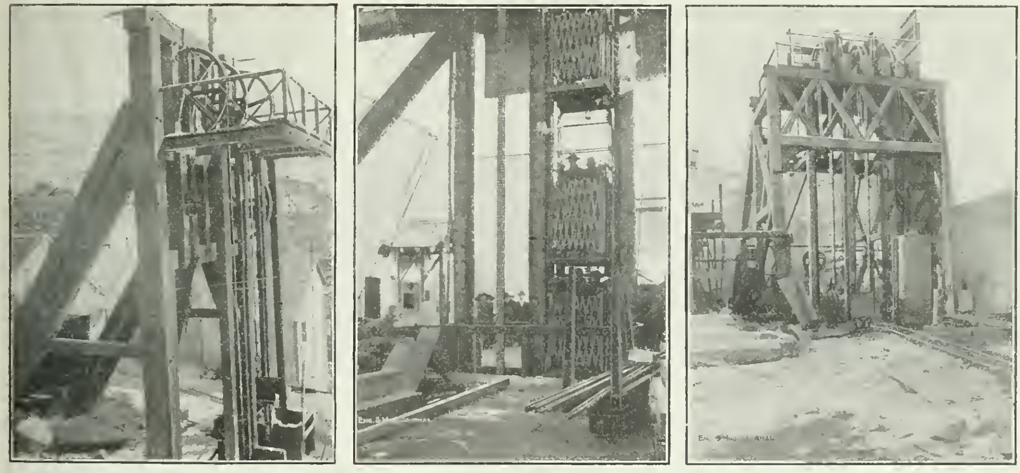
In the Sutro tunnel the storage-battery locomotive has been discarded and mule tramming resorted to. The wooden water boxes have been replaced by wooden stave pipe. All of the working mines are provided with telephones at the principal stations and incandescent lighting is generally resorted to. Flash and bell signals are in general use in all the mines. Square setting is still a feature of the stoping practice and it is doubtful whether the conditions peculiar to the lode will admit of much modification except in the case of narrow orebodies. Machine drills are used in most of the mines and hand drilling is seldom seen. In heavy ground the use of easing sets in the shafts is common.

Surface Equipment

A general movement to comply with the provisions of the Nevada mining laws is taking place although the companies are not compelled to do so in all particulars. Cages have been provided with steel doors for use in hoisting and lowering men. Signal charts have been posted at all the shafts and underground stations. The wooden buildings surrounding the C. & C., Ward, Belcher and Yellow Jacket shafts have been torn down and the shafts are open to the weather. The only wooden shaft houses on the lode are the Overman, Ophir and Alta.

Three steam hoists are operated, the C. & C., Ward and the Overman. Steam hoists are held in reserve at the Ophir, Combination and Alta shafts for repair purposes but are only occasionally used. But two electrically operated hoists of the Risdon continuous-rope type are in operation (at the Union and Yellow Jacket shafts); the Belcher, the Golden Gate and the hoists on the winzes are all of the gear-driven drum type (motor driven). Change rooms, timber-framing and blacksmith shops are maintained at all of the working shafts. At the Union, Ward and C. & C. shafts the blacksmith shops are provided with drill-sharpening machines.

Two machine shops, one at the C. & C. and the other at the Ward serve for repair work. At the same shafts are rope houses for the repair of the flat ropes used in hoisting. Compressors, all of the two-stage type, belt driven by motor, are operated at the Union, C. & C., Ward and Yellow Jacket shafts. A multivane exhaust fan, operated by a 100-hp. motor, is in use at the Ophir shaft. The steel fan, formerly used at the Ward, has been discarded. Such electrical repairing as the rewinding of motors is done at the C. & C. and Ward shafts. The general upkeep and condition of both surface and underground equipment is excellent.



Yellow Jacket, C. & C. and Ward Shafts on the Comstock Lode

Low-grade Ore Milled Locally

High-grade ores are still shipped to the Selby Smelting & Lead Co., as well as to the Mountain Copper Co.'s plant at Martinez, but the greater part of the tonnage is treated in Virginia City at custom plants. The milling plants are given in the accompanying table.

The Mexican mill, now being erected, involves all of the best features in modern silver-gold mill construction. The all-sliming system without concentration is to be used. The Chas. Butters Co. is operating a mill which is equipped for all-sliming or slime-and-sand treatment with or without concentration. At present it is being operated on ore from the Chollar and Potosi croppings. The Butters and Mexican mills are the only mills which are equipped for the complete treatment of Virginia ores. The Kinkead and Yellow Jacket mills are concentrating mills and do excellent work on medium and low-grade ores. With other ores cyanide treatment is necessary in addition to concentration. Mr. Kinkead states that he secures 85 per cent. extraction from the Ophir second-class ore. With sliming and slime-treatment plants added to both of these mills, Virginia and Gold Hill would possess milling equipment for the treatment of 500 tons per day, a quantity sufficient to handle the present output.

The Mexican mill is on the terraced plan and is arranged for continuous treatment. After preliminary breaking the ore is crushed in a 10-stamp battery in cyanide solution; the pulp then passes to a chilean mill and from this mill to an Akins classifier where the sands are removed and discharged into a tube mill while the slime is sent to the first of a series of four agitating tanks. The tube-mill product is returned by bucket elevator to the classifier or may be sent to the agitating tanks. Trent agitators are used. From the agitating tanks the pulp goes to two Dorr slime thickeners and from these to an Oliver filter. A precipitating plant and refinery complete the equipment.

MINING COSTS HIGH

No clean-cut analysis of mining costs is possible under the present system of annual reports. The Con. Virginia and the Ophir publish annual reports and, while these give in many cases detailed information, the overlapping in time of the superintendent's and secretary's reports and the joint work done by several companies together preclude the determination of accurate unit costs. In the accompanying table I have summarized the disbursements of the Ophir Mining Co. as given in the last four annual reports. The cash-balance items and the dividend paid in 1908 have been omitted. The ore produced and the value are included in the table.

SUMMARY OF REPORTS OF OPHIR MINING CO.

	Year Ending			
	Dec. 18, 1907	Dec. 16, 1908	Dec. 15, 1909	Dec. 21, 1910
Labor	$70,060	126,355	124,548	117,378
General mine expense	46,006	37,340	36,696	38,444
Timber	5,971	10,760	8,790	6,634
Surveying	1,147	730	630	150
Assaying and sampling	5,220	10,115	7,778	3,646
Taxes and insurance	5,080	3,666	1,962	1,648
Freight and treatment	14,275	52,874	95,083	40,959
Pumping	56,159	49,032	58,758	56,479
Power, electric	25,869	26,970	30,866	29,551
Sutro tunnel	15,710	15,901	31,554	8,999
Salaries	9,720	8,138	5,335	5,479
Office and general	2,560	2,476	1,972	2,356
Royalty on ore	9,624	17,244	17,149	10,093
Legal expense	5,494	2,535	610	628
All other expense	1,382	24,807	8,667	4,159
Total	274,277	388,943	430,398	326,601
Realized from ore	230,728	404,488*	413,831*	247,475
Tons produced	9,916	26,537	20,701	11,049
Realized per ton	23.26	15.20	20.00	22.40
Cost per ton	27.65	14.65	20.79	29 56

*Includes returns from treatment of tailings the tonnage of which is not included in the tonnage given.

THE MEXICAN MILL UNDER CONSTRUCTION AND THE UNION SHAFT ON THE COMSTOCK

Taking the year 1910 as an example, the proportion of the total expense for labor is 35.6 per cent.; for maintenance of workings and pumping, 32 per cent.; general mine expense and timber, 13.8 per cent.; ore treatment, assaying and sampling, 13.6 per cent.; salaries, 1.6 per cent.; and remaining, 3.3 per cent. Maintenance of workings and pumping is the most important burden of expense but it cannot be accurately segregated. Approximately 80,000 ft. of workings must be maintained throughout the lode for drainage, ventilation and mining purposes and this with pumping constitutes the great financial drain upon all of the mines. Incidentally it should be said that when the accumulated water has been removed and the drainage workings brought to first-class condition (which is practically the condition at present) the cost for maintenance and pumping will be materially lower than it is at present. The Ophir summary also indicates a movement which is quite general, namely, to reduce expenses wherever possible. The old generous management is quickly passing.

From various sources I have gathered the following information: Stoping in the Crown Point mine on the 1400 level and using square sets is done for $1.25 to 1.50 per ton. In the Mexican mine, stoping veins are from 2 to 3 ft. in thickness. The Virginia mine expense for the ore delivered at the surface was $6.50 per ton. In the Ophir mine in working around old stopes $10 rock enabled the mine to break even. In the Mexican mine the labor cost for drifting has been reduced to $3.50 per ft. and rates as high as 100 ft. per week have been obtained. Two men on a shift have obtained a rate of 50 ft. per week. From the Con. Virginia annual report of 1910 the cost of driving the joint Con. Virginia and Ophir east crosscut 374 ft. is given as $7576.78 or $20.73 per ft. Per-foot costs as high as $60 have been reached in driving exceptionally hot drifts. These figures are of interest in that they indicate the wide range in conditions pertaining in different parts of the lode. Con. Virginia and Ophir are notably hot and drifting and stoping costs are high; Mexican is comparatively cool and costs show a considerable decrease; the Crown Point is worked on the 1400 level and is cool.

The present wage scale at Virginia City is: Miners, $4; blacksmiths $5; machinists, $5; engineers, $5; firemen, $5; pumpmen, $5; shaftmen, $4 to $4.50; cagers, $4; carpenters, $5; shift bosses, $5; foremen, $6; millmen, $3 to $4. The 8-hour day prevails. Electrical power costs $5 per hp.-month; timber, from $21 to $22 per M.; powder, 12½ to 16½c. per lb. The total number employed in the mines of Virginia City and Gold Hill is estimated at 700 men.

Milling and Reduction Costs

Accurate information concerning ore-treatment charges is obtainable and from the Ophir annual reports the accompanying table has been compiled. The next to the last column shows what per cent. the gross value is of the assay value; the last column, the per cent. the net value is of the assay value.

The charges of the custom plants are as follows: Kinkead mill (crushing and concentration), $2.70 per ton; Chas. Butters Co. (crushing, concentration and cyaniding), ore $20 or less per ton, charge of $3.50 per ton; ore above $20 per ton, charge $4.50 per ton. First-class ore is shipped to the Selby Smelting works and to the Mountain Copper Co.'s plant at Martinez.

At the Yellow Jacket mill, operating on the Yellow Jacket dump and simply crushing and concentrating, the milling cost is $1 per ton; on Crown Point ore the cost is from $0.75 to $0.85 per ton.

TREATMENT CHARGES ON COMSTOCK ORES

Ore	Custom Plant	Assay Value	Per Ton		Net Value	Per Cent. of Assay	
			Gross Value	Treatment, Freight			
No. 1 (09)	Selby smeltery	$98.00	$93.53	$16.73	$76.92	95.4	78.50
No. 2 (09)	Kinkead mill	23.45	18.16	3.97	14 19	77.4	60 49
No. 2 (10)	Kinkead mill	28.21	22.72	3.41	19.31	83 9	68.38
No. 2 (09)	Chas. Butters Co.	26.01	22.12	6 00	16 12	85.[illegible]	61 95
No. 2 (10)	Chas. Butters Co	23 74	20 53	5.40	15 13	86 5	67 73

The operations on the Yellow Jacket dump afford the best example of low working costs. The rock has a value of from $2 to $2.50 per ton. It is excavated from the dump and trammed by hand to the crusher and from the crusher bins to the mill bins at a cost of 25c. In the mill an extraction of 88 per cent. at a cost of $1 per ton is reported. A profit of from $0.50 to $0.95 per ton is made.

Conclusion

An engineer cannot but be impressed by the magnitude of the work required in the opening of these mines and the difficulties, natural and financial, which confront the managements. Commendable activity is to be noted in the search for ore and no possible chance for its discovery is being overlooked. Working costs are being closely scrutinized and economies and costs unknown to previous managements are being effected. Present workings, unless required for drainage, ventilation or mining, are being promptly abandoned and closed, thus increasing the effectiveness of the ventilation and decreasing the maintenance costs. Under the leadership of Superintendent Symmes an efficient engineering staff is being built up. Taking these facts into consideration the outlook for successful and profitable mining along the lode is excellent. In securing data for this paper I am indebted to Superintendent Symmes, of the Mexican mine; to Superintendent McCormick, of the Ophir, and to the *Virginia City Chronicle* for the weekly mine reports.

American Iron Ore Developments

By Bradley Stoughton*

During 1911, the development and production of the Texas ore fields progressed along the lines mapped out the previous year, and there were also important discoveries of new orebodies in the Lake Superior ranges. This was notably so in the case of the Vermillion range, where the first shipment of ore began in 1881, and from which about 30,000,000 tons of ore, mostly bessemer grade and of superior quality, have been produced. In 1911, shipments were made from new orebodies discovered in 1907—the first and only discoveries since 1881, except the one group found in 1888,—and these aroused renewed activity in exploration. The result was a number of small dicoveries of promise and one deposit of high-grade ore, and apparently of large size east of Ely. In the Mesabi range, near Grand Rapids, strikes were made which indicate the possible existence of important new deposits; in the Marquette there were several discoveries and the Gogebic range disclosed a new producer east of the famous Newport mine and said to equal it in value and quality.

Much interest is aroused in the United States, both financially and otherwise, in iron mines in South America. It is known that abundant deposits exist in Brazil, and attempts were made recently to market them in the United States, but without success either as to purchase of the product or the mines themselves. A Brazilian attempt to finance a company for the manufacture of iron in that country was also unsuccessful, so far as known at present. It is stated, however, that an English-French company is working a deposit of magnetic ore in Brazil, said to be of high grade and as large as the Mesabi district. A United States company is contemplating expending several millions of dollars to open up the famous magnetic ore mine of Agalteca in Honduras and build a railroad to the coast, provided the report of their engineers indicates the presence of as large a deposit as is believed to be there. This "iron mountain" has been worked spasmodically, first by the Spaniards and later by the natives. American capital is also interested in the exploration of iron-ore indications of large extent in Mexico.

Iron manufacturers near the Atlantic seaboard, who are without large holdings in the Lake Superior region, took more interest in the available iron-ore supply of Europe, and some made visits abroad —especially to Sweden—to study this question. There is little doubt that a revival of activity in America would be followed shortly by a great increase in the importation of Swedish ores. Some of these rich ores can be sold to blast furnaces within about 100 miles of the Atlantic coast at a price which makes them more attractive than Lake Superior ores with the long-haulage charges added or even than Eastern iron ores upon which a high freight rate per mile is demanded.

Most of the imported Swedish ores contain less than 0.35% phosphorus—generally much less,—and over 67% iron; the price is said to be 8c. per unit, c.i.f. Philadelphia, freight from the mine being above $2 per ton. The bulk of the imports were for one large eastern Pennsylvania steel company which contracted for 3,000,000 tons of ore during the next nine years, and for a combination of eastern Pennsylvania interests who also made a long-term contract, it is believed.

---

*Consulting mining engineer, 165 Broadway, New York.

Electric Production of Ferro-Tungsten

The Ampère Co., of Berlin, now smelts scheelite direct with sulphide of iron, with an addition of carbon in the electric furnace, according the the *Mining Journal*. The sulphide of iron serves as a flux. The product is a ferro-tungsten, containing but little carbonate, in the form of uniformly smelted regulus. The reaction in this process is $CaWO_4 + FeS + 4C = FeW + CaS + 4CO$. The silica contained in the scheelite is fluxed by the addition of lime forming a fluid and easily removable slag in which is contained the calcium sulphide formed according to the reaction hereinbefore given.

Proposed Mining Legislation

Washington Correspondence

Representative Raber has introduced in Congress a bill to establish a mining-experiment station at Auburn, Placer County, Calif., to aid in the development of the mineral resources of the United States and for other purposes. The proposed station would be under the supervision of the Bureau of Mines and would be officered by an expert geologist and metallurgist at a salary of $4000 and a competent chemist at a salary of $2500. Not over $25,000 is to be expended in establishing, equipping and maintaining the station.

The work of the station is to analyze or assay rocks or mineral-bearing substances sent to it and to furnish. at a nominal charge, a complete statement of the results to the one sending the same. A further function is to carry on experiments with a view to developing and perfecting metallurgical processes.

Senator W. E. Borah, of Idaho, has offered a bill to provide for the acquiring of title to public lands classified as, and carrying, phosphate deposits. The bill requires that any person who has located, under the nonmineral-land laws of the United States, any lands which are subsequently classified as being valuable for phosphate may receive a patent therefor, which shall contain a reservation to the United States of all phosphate deposits in these lands and the right to prospect for, mine, and remove the same. All unappropriated public lands now embraced within first-form phosphate withdrawals shall be subject to location under the provisions of the agricultural public-land laws, subject to the provisions of this Act.

The phosphate deposits in these lands shall be subject to disposal by the United States in accordance with the provisions of the mining laws applicable to the acquisition of phosphate lands in force at the time of such disposal. No person shall, however, enter upon these lands to prospect or mine the phosphate without previous consent of the owner, except upon such conditions as to secure the payment of all damages to the owner caused thereby.

Coarse Battery Crushing at South Crofty, Cornwall

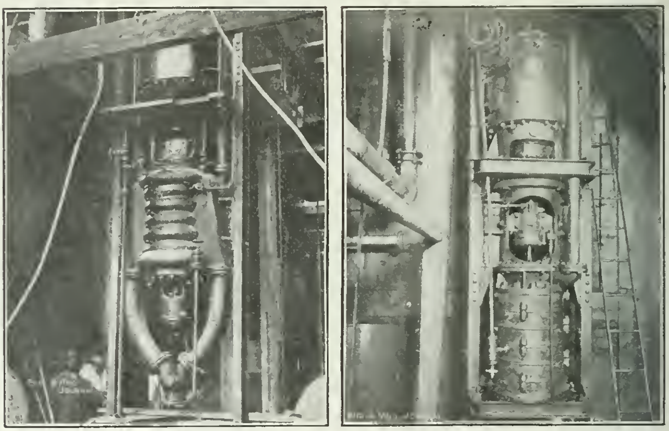
London Correspondence

After experimenting for six months on coarse crushing through a 10-mesh screen with 10 stamps, the South Crofty Co., in Cornwall, has adopted the coarse screen for the 60-stamp mill. It is expected that the change will be attended by an increase in the crushing capacity and in the recovery of tin and tungsten. Previous to the change the recovery was close to 30 lb. per ton. The value of the present production is about £41,300 per month; the profit was £150,000 for last year.

German Electric Mine Pumps

By Robert Grimshaw*

In Europe the use of electrically driven centrifugal pumps with vertical shaft, and the motor above the pump, in deep mines, is growing rapidly. This is chiefly by reason of the cheap and convenient application of power, low repair costs due to the absence of steam pipes; lack of ensuing rise of temperature in shafts and galleries; high duty; absence of shock, with its accompanying noise and wear and tear; cheap necessary attendance; small space required; and comparatively light weight. Not only this, but this type of pumps can cope with unfavorable conditions of dirty water, etc., which would be almost impossible to overcome with the ordinary horizontal reciprocating, steam-driven pump.


Electric Mine Pumps in Germany

The accompanying illustrations show such pumps built by the Siemens-Schuckert works. The motor is of the rotary-current type with short-circuit armature, and in order to be free from difficulties by reason of the wetness of the surrounding chamber, is fully water-tight encased. To prevent heating of the motor, it is water jacketed; the water for this purpose being taken from the "first pressure step" of the pump.

In order that all parts of the casing may be equally cooled, the water jacket is divided by partitions into several compartments. By means of a fan built in with the entire machine, the air in the interior of the motor is kept in circulation so as to cool off any parts where heat is developed, and yield to the shell the heat thus obtained.

To prevent obstruction in the cooling jacket, a filter is constructed in its supply pipe. The small amounts of impurity which, despite this filtering process, might collect in the jacket, are blown off from time to time through blowoff cocks. Where strong lyes are to be pumped, which cannot be used as circulation water for the motor jacket, a suitable special water supply is provided.

The motor journals are constructed with especial care. The upper one, which receives the weight of the rotor, is calculated to withstand side and end thrusts; the under one being for lateral thrust only; both have automatic lubrication.

The three cables are protected by a gas pipe screwed into the motor case, making a water-tight connection. In order to measure the load on the motor, and the amount of water delivered, there is a current meter at the point of attachment of the cable; this latter being preferably near the regulating valve of the water pipe.

The motor is started from outside the mine by a transformer with suitable step switches; this part of the equipment being inclosed in a case covered with sheet metal. The current conductor which is a flexible rubber-covered cable with wire protection and no lead covering, can carry 3000 volts. A special line of conductors enables throwing out the motor from the neighborhood of the pump, in case of necessity.

As a rule, the cable is attached to the discharge water pipe, but it can hang free and carry its own weight; in the latter case being carried by a winding drum with compound countershaft, double gears and twin brakes. The smaller motors are built for 500 volts; the larger ones, in order to reduce the necessary cross-section and weights of the cable, for 3000 volts.

---

*Engineer, Dresden, Germany.

Manufacture of Sulphuric Acid

By Max Hasenclever[*]

Modern practice in sulphur-dioxide generation tends toward the use of larger mechanical roasters for pyrites; increased use of gases from the roasting of blende, galena and copper ores. The tower's theoretical advantage over the chamber not demonstrated yet in practice.

In regard to the future of the sulphuric acid industry, the mechanical furnace will no doubt be preferred to the hand furnace for the roasting of pyrites, when new plants are erected. Recently the Wedge furnace, developed and thoroughly tried during long years of practice in the United States, has been successfully introduced in Europe. In Germany this furnace is already working satisfactorily in five of the best known chemical works, and another 15 of the furnaces are in course of construction. The work done by the largest type is six or seven times as large as that of the well known Herreshoff furnace, and amounts to about 20 tons of pyrites per 24 hours. The main feature of the Wedge furnace is that it permits of repairs being made without interruption of its working. There seems to be no particular economy in cost of construction or in working expenses. Its design, however, is much more compact and simpler than that of seven Herreshoff furnaces. For the chlorination roasting of burnt ore the mechanical furnace of Ramen Beskow of Helsingborg is being widely adopted. By utilizing the sulphur contained in the burnt pyrites for heating, it secures a considerable saving of fuel.

Utilization of Blende for Sulphur

There is slow progress in mechanical furnaces for roasting blende. Many zinc works in Germany have spent large sums of money on experimental furnaces of their own construction. I do not see, however, why Matthiessen & Hegeler's furnace, which has stood the test for many years in the United States, has not been more rapidly adopted in Europe, for it is always more expedient and cheaper to buy existing experience than to gather it at one's own expense. The main difficulty in introducing mechanical furnaces for blende in Germany seems to be the fact that most of the zinc works are obliged to buy their ore without being able, in every instance, to select the quality according to their requirements. The result is that generally part of the ores received contains more or less lead and sinters when roasted. Such ores deposit on the hearth of the furnace and stick to the rods and moving parts, causing stoppages which make economical working difficult.

Improvements in the roasting of lead ores, which are now being utilized for the manufacture of sulphuric acid, also deserve notice. The lead ores treated in Europe carry 11 to 15% of sulphur, the greater part of which is contained as lead sulphide. By the old roasting methods, the burner gases contained 0.8 to 1.0% of sulphur dioxide. The converter gases of the well known Huntington-Heberlein process, by which air is blown through a layer of lead ore one meter thick, yield up to 15% of sulphur dioxide during the stage of their most active development, while at the beginning and the end of the roasting, gases poor in sulphur dioxide are produced. The result is that a fairly continuous gas current can only be obtained by working a large number of converters charged at different times, the production of sulphurous acid being in a different stage in each of the converters. Manufacture of sulphuric acid in connection with the Huntington-Heberlein process was first introduced at the Muldenhütte in Freiberg, Winkler's contact process being used. The same roasting method is in operation at the Royal Friedrichshütte near Tarnowitz in Silesia, the roaster gases being treated by the chamber process.

Dwight-Lloyd Roaster Gives Uniform Product

As compared with the Huntington-Heberlein converters, the working of which is intermittent, the Dwight-Lloyd furnace, improved by Schlippenbach, works continuously. By this apparatus the air is not blown through the material from underneath, but sucked down from the top to the bottom. The advantage of this furnace consists in delivering a regular gas current of 4 to 6% of sulphur dioxide by separating continuously the rich from the poor gases and, in all probability, about 90% of the sulphur, contained as sulphide in the lead ore, can be utilized for the manufacture of sulphuric acid; that is to say, 4 tons of lead ore will yield one ton of sulphuric acid of 60° Bé. A large plant for the manufacture of sulphuric acid by the contact process combined with furnaces of this design is in course of erection at Stolberg and will be started in a few months. There will certainly be difficulties to overcome at the beginning, as the gases contain 5 to 6% by volume of carbon dioxide and much dust.

If all the lead ores smelted in Germany were to be treated in this way, they would yield about 40,000 tons of sulphuric acid of 60° Bé per year. In England the production would only be about 6000 tons, in Belgium 18,000 tons, in France 12,000 tons, in Spain 75,000 tons.

Yield of Acid from Chambers

It has no doubt been easily possible everywhere to improve the yield of the lead-chamber space by increasing the production. It seems however, to be advisable not to go too far in this respect and to be satisfied with a production of 5 to 6 kg. of sulphuric acid of 60° Bé per cu.m of chamber space per 24 hours, or, expressed in the English units, about 11 cu.ft. per lb. of sulphur burnt per 24 hours, as some works have had the unpleasant experience that with increased production, the cost of chamber repairs rose enormously. As regards large yields in as little space as possible, the tower processes of Opl of Hruschau and of the Griesheim-Elektron certainly deserve notice. Opl's process, with its eight towers in series, works in a similar way to the chamber process; towers one and eight—the first and the last—act together, that is to say, the nitrous vitriol flowing from tower No. 8 is run down tower No. 1, where it is denitrated. In the same way tower No. 2 works with tower No. 7, No. 3 with No. 6, and No. 4 with No. 5, the acids being raised on to the towers by the direct action of compressed burner gases, an operation which is protected by patent.

The Griesheim process differs from Opl's process inasmuch as, instead of nitrous vitriol, nitric acid is used, which has to be completely regenerated after the formation of sulphuric acid. Neither tower process, particularly the Griesheim one, has yet reached such a stage of development as to allow a definite opinion to be formed upon it. This, however, can soon be done as plants designed from the results of experience gained with provisional arrangements, are in course of construction. The tower process will no doubt have the advantage over the chamber process of saving space, and the cost of its construction will also be lower than that of chambers. It remains to be seen, however, whether the saving effected by smaller capital charges will not be counterbalanced by increased working expenses and repairs. Its working certainly requires careful supervision, as the consumption of nitric acid easily becomes heavy. In addition, the acid, through being continuously in contact with the packing material of the towers, will probably become more impure, even if the burner gases are subjected to a preliminary purification.

---

[*] Chemical manufacturer, Chemische Fabrik Rhenania, Aachen, Germany.

Note—Excerpts from the Hunter Memorial Lecture, Liverpool University, Oct. 25, 1911.

Chamber Process Costs

I believe that it will be difficult to effect further savings in the manufacture of sulphuric acid by the chamber process. On the other hand, the cost of sulphuric acid is, in my opinion, often underestimated by engineering firms who devote themselves to the construction of sulphuric-acid plants. On the basis of figures at my disposal, I have made up the following cost sheet:—

MANUFACTURING COSTS OF 100 KG. OF SULPHURIC ACID 60° BE

		Marks.	
Roasting of pyrites			
Available sulphur in pyrites ..		1.00	
Crushing and roasting		0.25	
Depreciation		0.14	
			1.39
Manufacture of sulphuric acid:			
Working of chambers including repairs		0.46	
Concentration		0.15	
Depreciation: Chambers.	0.25		
Accessory plant	0.05		
		0.30	
			0.91
			2.30
Average carriage expenses in Rheinland			0.30
Tank cars			0.10
Cost, delivered free, consumers' works			2.70
4% interest on capital invested			0.20
			2.90
			67.8c.

In the manufacturing costs of sulphuric acid, the prices of the raw material play the most important part, and the amount of the first item in my cost sheet, "Available sulphur in pyrites 1 m. per 100 kg." will probably have to be modified. (1), if the works is in a position to burn pyrites from its own mines instead of having to buy it at the market price; (2) if pyrites containing copper is treated and the yield of copper credited to sulphuric-acid account; or (3) if sulphide of iron from gas works can be had at a low price, or (4) if it is possible to buy the burner gases from zinc works on favorable terms.

Use of Blende Usually not Economical

It is a mistake, still occasionally made, to believe it cheaper to make sulphuric acid from blende than from pyrites, on the assumption that the sulphur contained in the blende is not paid for. Even old hands who ventured on roasting zinc blende have been greatly disappointed. With the high wages and prices of fuel ruling today, the charges for roasting blende by hand amount to at least 1.50 m., per 100 kg. of sulphuric acid of 60° Bé. It must besides be remembered that losses of zinc and inefficient roasting may materially increase the costs. The zinc works making sulphuric acid do not debit the total roasting expense to the sulphuric-acid account, but only that part of the charge which exceeds those incurred by the former method of roasting in the reverberatory furnace, without any production of sulphuric acid. The balance of the charge is debited to the zinc account. Owing to this way of reckoning, which, in reality, is not correct, because the zinc works are no longer permitted by European law to roast their ores without making sulphuric acid, these works are frequently willing to sell their acid at low prices.

Altogether the charges for roasting blende are higher than those for pyrites, crushing, roasting, and depreciation taken together. The latter, which amount to 1.39 m in my calculation, rae the same both with the tower and the chamber process; it therefore remains to be ascertained what the clear manufacturing costs of sulphuric acid, including amortization, will amount to by the tower process.

I still have to mention that with the plant considered in my calculation only about 10% of the total acid is concentrated in the Glover, the remainder having to be evaporated in special concentrating apparatus. A saving in the concentrating charges will be effected if a greater quantity of Glover acid can be sold.

For depreciation of the plant, I have taken a rate of 8%, which leads to about scrap value in 10 years. Interest at a rate of 4%, which, I think, should also be taken into consideration, increases the cost by another 0.30 m. per 100 kg. of sulphuric acid of 60° Bé. Finally I must point out that the value of the land has not been taken into account, and that construction and working expenses will be materially increased by railway sidings, laboratory, offices, etc., in case an entirely new factory has to be built instead of additional plant in works already existing.

The purification of the burner gases from arsenic and dust is today easy and only a question of additional cost in plant. There is nothing new to say regarding the contact processes, only it is interesting to note that well known factories working the contact process, have also adopted to a large extent Gaillard towers for concentrating chamber acid.

European Acid Consumption

The consumption of sulphuric acid is constantly increasing with the steady development of the superphosphate industry. In 1910 the production of superphosphate was: England, 1,000,000 tons; Germany, 1,400,000 tons; France, 1,600,000 tons. An equal quantity of sulphuric acid of 60° Bé is necessary for this production. During the last few years the acid consumption has experienced an enormous increase owing to the increasing number of coke ovens which manufacture byproducts. On the other hand, the selling prices of sulphuric acid have been unfavorable, considering the high prices of pyrites, fuel and wages. Manufacturers of sulphuric acid in the industrial district of Rheinland and Westphalia experience great difficulty in dealing with a syndicate of the ammonia makers from coke ovens, who, in view of their large consumption of sulphuric acid which amounts to 300,000 tons, threaten to start their own manufacture of acid and try by every means to depress the prices. Against these proceedings a combination of sulphuric acid makers is powerless.

There is at present a great scarcity of sulphuric acid in this district, and because at the low prices ruling, no one feels inclined to invest further capital in sulphuric acid plant. It is all very well for the coke ovens to make enormous profits on the byproducts, but they should not grudge other industries the smallest profit. Then there would certainly be enough acid at their disposal. It is particularly striking that the acid works are obliged to buy their coal and coke at high prices prescribed by the syndicates established by the same mines, who consume their sulphuric acid. By these remarks I intended to show the disadvantages of being dependent on syndicates or large consumers. As far as I know, the situation in England in this respect is much better than in Germany.

Division of Standard Oil Trade

The Standard Oil Co., of New Jersey, because of the Supreme Court decision, has given over its business in the Pittsburgh district to four corporations, which began operations on Dec. 23, as follows:

The South Penn Oil Co., Joseph Seep, president, assumes the leadership. This company is the chief producer in Pennsylvania and Ohio.

The second company is the Washington Oil Co., a smaller producing concern operating in the field with drillers and prospectors.

The third is the Crescent Pipe Line Co., formerly a subsidiary of the National Transit Co., which operates the trunk line for oil pipes in the Pittsburgh field, transporting oil to the refineries.

The fourth concern is the Eureka Pipe Line Co., which is what oil men call the "gathering system."

The Flameless Combustion of Gas

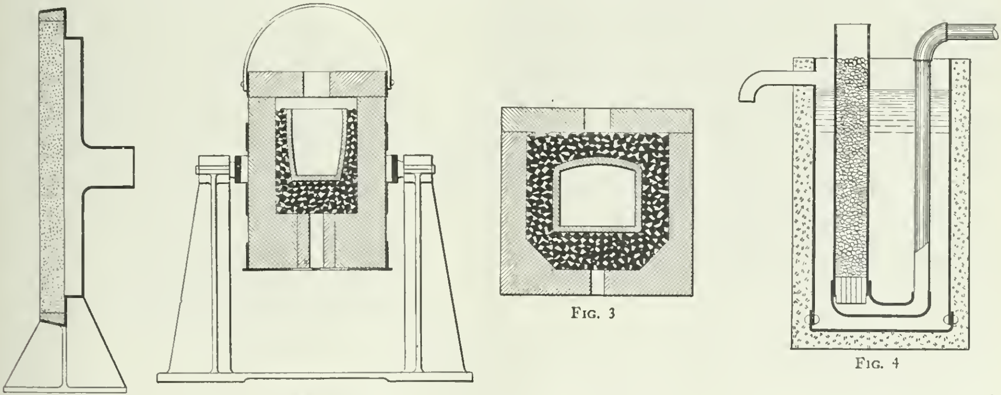
By William A. Bone*

If an explosive mixture of air and gas be caused to burn on an incandescent porous surface, high temperatures can be obtained with no flame and with a high degree of efficiency.

If an explosive gaseous mixture is either injected on or forced through the interstices of a porous refractory incandescent solid under certain conditions, a greatly accelerated combustion takes place within the interstices or pores, or in other words, within the boundary layers between the gaseous and solid phases wherever these may be in contact, and the heat developed by this intensified combustion maintains the surface in a state of incandescence without any development of flame. Such conditions realize my conception of flameless incandescent surface combustion as a means of greatly increasing the general efficiency of industrial heating operations wherever it can be conveniently applied.

Advantages of the Process

The more important features of the processes of incandescent-surface combustion were evolved at the works of Wilson & Mathiesons, Ltd., Leeds, where an experimental station has been built.



The Engineering & Mining Journal

Diaphragm of Refractory Material, Crucible and Muffle Furnaces and Tube for Lead Melting Arranged for Flameless Combustion

The distinguishing and essential feature of the new processes is that a homogeneous explosive mixture of gas and air, in the proper proportions for complete combustion, or with air in slight excess, is caused to burn without flame in contact with a granular incandescent solid, whereby a large proportion of the potential energy of the gas is immediately converted into radiant form. The advantages claimed are: The combustion is greatly accelerated by the incandescent surface, and if so desired, may be concentrated just where the heat is required; the combustion is perfect with a minimum excess of air; the attainment of very high temperatures is possible without the aid of elaborate regenerative devices, and owing to the large amount of radiant energy developed, transmission of heat from the seat of combustion to the object to be heated is rapid. These advantages are, I believe, so uniquely combined in the new system that the resultant heating effect is for many important purposes, not only preeminently economical but also easy of control.

Gas Burns on an Incandescent Diaphragm

In the first process the homogeneous mixture of gas and air is allowed to flow under slight pressure through a porous diaphragm of refractory material from a suitable feeding chamber as indicated in Fig. 1, and is caused to burn without flame at the surface of exit which is thereby maintained in a state of red-hot incandescence. The diaphragm is composed of granules of firebrick bound together into a coherent block by suitable means; the porosity of the diaphragm is graded to suit the particular kind of gas for which it is to be used, but for undiluted coal gas, or coal gas containing only a small proportion of water gas, a diaphragm so porous that the gaseous mixture will readily flow through it at a pressure of 1/8 in. water gage is employed.

The diaphragm is mounted in a suitable casing, the space enclosed between the back of the casing and the diaphragm constituting a convenient feeding chamber for the gaseous mixture which is introduced at the back. Such a mixture may be obtained in either of two ways; by means of suitable connections through a Y-piece with separate supplies of low pressure gas and air (2 or 3 in. water gage only is sufficient), or by means of an injector arrangement connected with a supply of gas at 2 lb. per sq.in. pressure, the gas in this case draws in its own air from the atmosphere in sufficient quantity for complete combustion, the proportions of gas and air being easily regulated by a simple controlling device.

To start a diaphragm, gas is first of all turned on and ignited as it issues at the surface; air is then gradually added until a fully aerated mixture is obtained. The flame soon becomes non-luminous and diminishes in size; then a moment later, it retreats to the surface of the diaphragm which at once assumes a bluish appearance; soon, however, the granules at the surface attain an incipient red heat, producing a curious mottled effect; finally, the whole of the surface layer of granules becomes red-

---

Note:—Excerpts from a lecture delivered before the American Gas Institute at St. Louis, Oct. 19, 1911 and copyrighted by the Institute. Published by permission.

*Professor, fuel and metallurgical departments, University of Leeds, England hot, and an accelerated "surface combustion" comes into play. All signs of flame disappear, and there remains an intensely glowing surface, a veritable wall of fire but without flame throwing out a radiant heat which can be readily maintained for as long as required.

The actual combustion is confined within a thin layer (⅛ in. to ¼ in. only) immediately below the surface, and no heat is developed in any other part of the apparatus. While the front of the diaphragm is intensely hot, the back of the apparatus is so cold that a person may lay their hand on it. In the second place, the combustion of the gas, although confined within such narrow limits, is perfect, for when once the relative proportions of gas and air have been properly adjusted no trace of unburnt gas ever escapes from the surface.

TEMPERATURE RANGE IS GREAT

The temperature at the surface of the diaphragm can be instantly varied at at will by altering the rate of feeding of the gaseous mixture; there is no lag in the temperature response, a circumstance of great importance in operations where a fine regulation of heat is required. The temperature of a diaphragm working on a coal-gas and air mixture, at a given rate of feeding, depends on whether or not the intense radiation from its surface is impeded; with a freely radiating surface the temperature of a properly made diaphragm may be maintained at anything up to about 850° C. (say 1550° F.) according to the rate of supply of the combustible mixture.

A plane diaphragm such as this may be used in any position, that is, at any desired angle between the horizontal and vertical planes. The diaphragm method is amendable to a variety of combustible gases. Coal or coke-oven gas (either undiluted or admixed with water gas), natural gas, petrol-air gas, carburetted water gas are all well suited in cases where unimpeded radiation is required. We have constructed and successfully operated plane diaphragms of all sizes up to 4 sq. ft. in area (2 x 2 ft.) and their durability and radiant power are unimpaired even after long continued use. The surface will maintain its incandescence unimpaired even in an atmosphere of carbon dioxide.

ADVANTAGE IN EVAPORATING LIQUIDS

The many obvious purposes to which diaphragm heating may be applied need hardly be pointed out. Grilling, roasting, toasting are all at once suggested. It will suffice to demonstrate the charm of novelty in the evaporation and concentration of liquids by means of radiant energy emitted from a diaphragm fixed in a horizontal plane above the surface of the liquid. By this means a solution of sodium silicate (water glass), can be evaporated, an operation it would be impossible to carry out satisfactorily by the ordinary means of heating the vessel by flame from below. Only the topmost layers of the liquid are heated; the radiant energy of the diaphragm is instantly transmitted to the surface of the liquid where it is absorbed and utilized for the evaporation. The sodium silicate separates out as a skin on the surface of the liquid, it is then dried by the radiant heat, and at intervals the crust of dry sodium silicate may be skimmed off. In this way, it is possible, not only to evaporate the solution with a great economy of heat, but also to complete the evaporation of highly concentrated solutions much more easily than by means of heat applied from below.

APPLICATIONS TO CRUCIBLE AND MUFFLE FURNACES.

A second process consists esentially in injecting, through a suitable orifice at a speed greater than the velocity of back firing, an explosive mixture of gas (or vapor) and air in their combining proportions into a bed of incandescent granular refractory material which is disposed around or in proximity to the body to be heated. Two diagrams show its applications to the heating of crucible and muffle furnaces. The crucible (Fig. 2.) is surrounded by a bed of highly refractory granular material. The mixture of gas and air is injected at a high velocity through a narrow orifice in the base of the furnace, and as it impinges upon the incandescent bed combustion is instantaneously completed without flame.

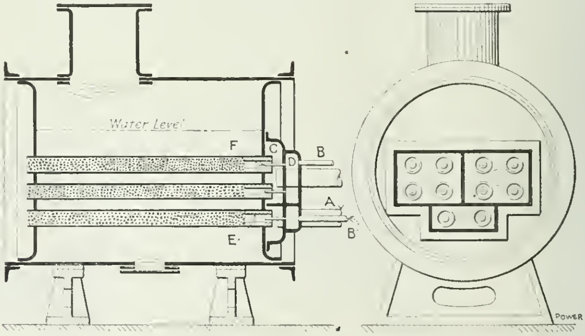


FIG. 5. EXPERIMENTAL BOILER

The seat of this active surface combustion is in the lowest part of the bed; the burnt gases, rising through the upper layers, rapidly impart their heat to the bed maintaining it in a high degree of incandescence. A similar arrangement for heating a muffle furnace is shown in Fig. 3. The process is adaptable to the heating of retorts, annealing furnaces, and the like. Moreover, it is not essential that the bed of refractory material shall be disposed around the vessel or chamber to be heated; it may be equally well packed into tubes, or the like, traversing the substance or medium to be heated. This latter modification is important in relation to the melting of metals or alloys which are fusible at temperatures below about 1100° and also in relation to steam raising in multitubular boilers. By this process much higher temperatures are attainable with a given gas than by the ordinary methods of flame combustion without a regenerative system, and as a matter of fact, it has been found that with any gas of high calorific intensity, such as coal gas, water gas, or natural gas, the upper practicable temperature limit is determined by the refractoriness of the material composing the chamber to be heated *i. e.*, the muffle or crucible or rather than by the possibilities of the actual combustion itself. When I state that in a crucible fired by coal gas on this system we have melted Seger cone No. 39, which according to the latest determination of the Reichsanstahlt in Berlin, melts at 1880° C., and also that we can easily melt platinum, the possibilities of the method in regard to high temperatures with gas fired furnaces will be appreciated.

MATERIAL IN THE DIAPHRAGMS

For the very high temperatures obtainable with coal gas, water gas or natural gas, a bed composed either of fragments of magnesia, which has been burned a at high temperature or of a neutral and highly refractory material specially prepared is employed. In cases where the temperature required does not exceed 1200° C. (2200° F.) the bed of refractory material may be composed of good quality of firebrick crushed and screened to a suitable size. While with actual coal gas, water gas, or natural gas, it is possible to attain temperatures of up to at least 2000° C., with a producer gas of low calorific intensity such as Mond gas, about 1500° C., would probably be the maximum temperature obtainable without regeneration. With some degree of heat recuperation, which in such a case would be quite practicable, in all probability this limit could be considerably exceeded.

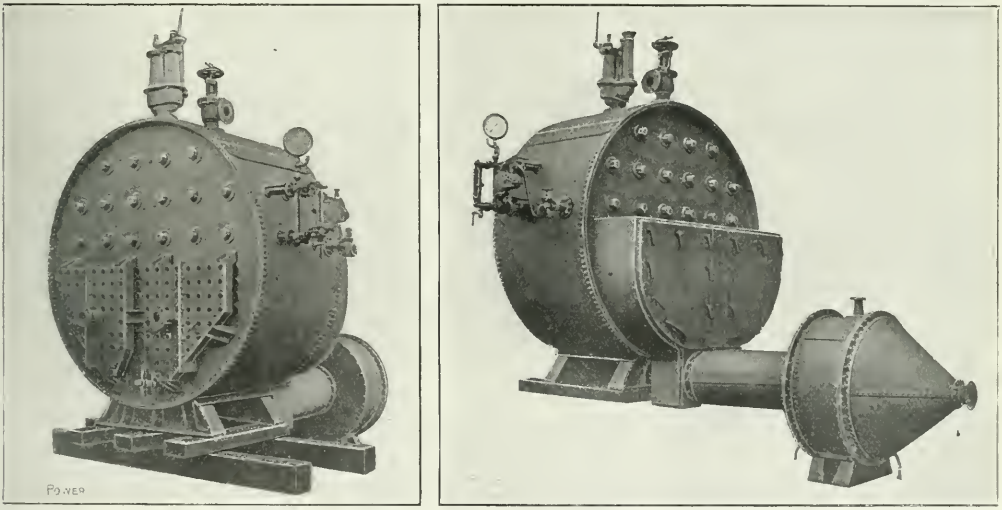
RECORD OF MUFFLE TEMPERATURES

Temp. in Middle of Muffle, ° F.	Gas Consumption Cu. Ft. per Hr.	Temp. of Products, ° F.
1499	21.0	1004
1840	35.3	1195
2201	58.0	1598
2596	79.0	1985

Volume of gas used was measured at 59° F.

Record of Muffle Temperatures

In the accompanying table are shown the results of a test on a muffle furnace in which a muffle 9½ in. long by 5¼ in. wide by 3¼ in. high (inside dimensions) was heated to temperatures between 1500 and 2600°, with a fully aërated coal gas of 540 B.t.u. (net) per cu.ft. The temperatures given in the first column are those recorded by a standard thermo-junction placed in the middle of the muffle. The temperature of the escaping products was also ascertained by means of a standard thermo-junction. The temperature of the products in every case was 500 to 650° F.. lower than that of the muffle, and even with highest muffle temperature there was no appearance of flame whatever at the top of the furnace.



Flameless Combustion, 110-tube Boiler with Water Heater and Exhaust Fan

The gas consumptions recorded in the middle column are extremely economical in comparison with ordinary heating by flame contact. In a similar test with a muffle of the same size heated by flame contact in a furnace of modern design, the gas consumption to maintain the muffle at 1930° F., which was the maximum temperature obtainable, was 105 cu.ft. per hour, whereas by interpolation in the table the consumption in the "surface combustion" furnace at the same temperature would have been about 43 cu.ft. per hour only.

Application to Tubular Boilers

The gas firing of steam boilers has not been successful from the point of view either of thermal efficiency or of rate of evaporation. In this country there are a variety of gases available for steam raising purposes, for example; blast furnace gas, the surplus gas which is obtained in the manufacture of coke in byproduct ovens, natural gas, producer gas of various compositions, but more particularly that manufactured under "ammonia recovery" conditions. All these gases have been found amenable to the system.

It has been estimated by a prominent English blast-furnace engineer that the efficiency of the best type of water-tube boiler, fired by blast-furnace gas, does not exceed about 55%. From careful observations, which were made on a battery of Lancashire boilers fired by blast-furnace gas, evaporating water previously softened to less than four degrees of hardness, with an attachment of the most approved type of economizers (so that the temperature of the gases going to the chimney was reduced to the lowest possible point consistent with good draft) it was proved that the thermal efficiency does not under the best of conditions exceed 60%. With regard to boilers fired by coke-oven gas, I think one can safely say that the average thermal efficiency of steam-raising does not exceed 65% and in exceptional cases it may amount to perhaps 70%, not more.

On applying the principle of surface combustion to the gas-firing on multitubular boilers it has been possible to obtain results corresponding to the transmission of nearly 95% of the energy represented by the net calorific value of the gas to the water in the boiler. The boiler, cylindrical section, is traversed horizontally by a series of steel tubes, each three feet only in length and three inches internal diameter. These tubes are packed throughout their whole length with fragments of a suitable refractory material, of a proper size. Into the front end of the tube, where the gaseous mixture is introduced, is fitted a fire-clay plug, through which is bored a hole of about ¾ in. diameter. This plug serves a double purpose of keeping the front end of the boiler cool, and of providing a suitable aperture through which the gaseous mixture may be introduced at a speed very much higher than the speed of back-firing.

Combustion Confined to Interior of Boiler Tubes

Attached to the front plate of the boiler is a mixing chamber of special design. The mixture fed into the boiler tubes from this chamber consists of the combustible gas with a proportion of air slightly in excess of that required for complete combustion. The mixture is injected or drawn in (either by pressure or by suction), through the orifice in this fire-clay plug, to the incandescent material in the tubes. The combustion of the mixture in contact with the incandescent material is completed before it has traversed a length of 6 inches from the point of entry to the tube. The result is that the core of the material at this part of the tube is maintained at a high temperature, although the points of actual contact between the hotter material and the walls of the tube are so rapidly cooled by the transmission of heat to the water in the boiler that they never attain a temperature even approaching red-heat.

The combustion having been completed, the remainder of the material acts as a baffle toward the burned gases as they traverse the tubes at a high velocity, causing them to impinge repeatedly on the walls of the tubes. The usual rate at which the gaseous mixture is fed into the boiler corresponds to an hourly consumption of about 100 cu.ft. of coal gas plus six times its volume of air for every tube of the boiler. In the case of a 10-tube boiler on which the original experiments were made, the consumption of coal gas was about 1000 cu.ft. per hr., plus about 5500 to 6000 cu.ft. of air. This will convey an idea of the extremely rapid rate at which the mixture is caused to traverse the tubes.

Hot Flue Gases Utilized

After the burned products have traversed the boiler-tubes, and at their point of exit therefrom, it is found that their temperature is never more than about 125° F. above that of the water in the boiler, which, of course, depends upon the pressure at which the steam is being generated. In order to increase still further the output of steam, the products are passed through a short tubular feed-water heater constructed on the same principle as the boiler. During a test carried out at the experimental station at Leeds, in which steam was being generated at a pressure of 100 lb. per sq.in. above that of the atmosphere, the temperature of the products leaving the boiler-tubes was 445° F.—the actual boiling point of the water being 337° F. These products, still containing a certain amount of valuable heat, were passed through the feed-water heater which was only one foot long, containing nine tubes of the same diameter as the tubes in the boiler. Each tube was packed with granular material. The hot products, continually baffled in their passage through the tubes, readily imparted their heat to the cold feed water surrounding them. We were thus able to reduce the temperature of the products leaving the feed-water heater to 203° F. We have worked entirely on Leeds coal gas. The temperature of the water entering the feed-water heater was 42° F., and it was heated to 136.4° F., before entering the boiler, entirely at the expense of the burned gases.

The mixture of gas and air was passed into the feed chamber of the boiler at a pressure of 17.3 in. water gage. This pressure is necessary to overcome the resistance of the packing of the tubes to the passage of the gases through them. The pressure of the products entering the tubes of the feed-water heater was 2 in. water gage so that the pressure necessary to force the gas through the zone of combustion, and thereafter through the remainder of the length of the tubes of the boiler was about 15 in. water gage.

High Efficiency in Heat Transmission

The amount of coal gas fed into the boiler expressed as dry gas under standard conditions of atmospheric pressure and at 32° F. was 996 cu.ft. per hr. The net calorific value of the gas was 562 B.t.u. per cu.ft., so that the total heat supplied to the boiler, in terms of the net calorific value of the gas, was 559,800 B.t.u. per hr. The actual amount of water evaporated from and at 212° would be 550 lb. per hr. The actual heat therefrom transmitted to the water was $450.3 \times 1172 = 527{,}800$ B.t.u. per hour. The ratio between the heat transmitted to the water and the net heat of combustion of the gas burned in the boiler, therefore was 0.943.

It is one of the outstanding merits of the new system that we are able to burn the gas completely with a minimum excess of free oxygen, and during the test in question the average proportion of carbon dioxide in the combustion products was as much as 10.6%, while the oxygen was as low as 1.6%. The remainder of the gas was nitrogen.

Boiler for Coke-Oven Gas

That the gas firing of boilers according to the new system has now been advanced beyond the merely experimental stage is proved by the recent erection of a 110-tube boiler capable of evaporating not less than 5500 lb. of water per hr., to the order of the Skinningrove Iron Co., Ltd. (the Cleveland District, Yorkshire), to be fired by gas from a new installation of Otto-Hilgenstock byproduct ovens adjacent to the blast furnaces.

The boiler itself is a cylindrical drum 10 ft. in diameter and only four feet from front to back; it is traversed by 110 tubes of three inches internal diameter which are packed with fragments of fire-brick. The boiler will be worked under the suction of a fan, capable of producing a suction of 20-in. water gage. To the front of the boiler is attached a device whereby gas at two inches water gage pressure from a suitable feeding chamber, together with a proper proportion of air from the outside atmosphere, is drawn (under the suction of the fan) through a short "mixing tube" into each of the 110 tubes of the boiler where it is burned without flame in contact with the incandescent granular material. The products of combustion, having traversed the four-foot length of packed tube, will pass outward into a semicircular chamber at the back of the boiler, and thence through a duct to the tubular feed water heater.

Under the normal working condition, the mean evaporation exceeds 20 lb. per sq.ft. of heating surface or about twice that of a locomotive boiler. Of the total evaporation no less than 70% occurs over the first part of the tubes, 22% over the next part and about 8% over the third part. Such a steep gradient causes a considerable natural circulation of the water in the boiler, a factor of great importance from the point of view of good working. In regard to thermal efficiency I venture to claim that a boiler unit which, while evaporating 20 lb. of water per sq.ft. of heating surface, transmits upwards of 90% of the net heat of combustion of the gas to the water, and which if need be, can be forced to a 50% higher duty with only a slight drop in efficiency, stands unrivaled as a steam raiser.

Heating Metals of Low Melting Points

I should like to refer briefly to the results of our experiments upon the fusion of metals; Fig. 3 represents an iron tank, efficiently lagged and filled to the top with molten lead at a temperature considerably above its melting point. In the molten bath is fixed an iron tube some two or three feet in length and of three inches internal diameter. This tube is packed, like one of the boiler tubes, with a suitable granular refractory material and there are suitable arrangements for the introduction of the explosive mixture of gas and air which is to be burned in the tube. When once the device has been started it will work continuously for days together. Solid lead is continuously fed into the apparatus and the molten metal is allowed to run over through the spout indicated in the diagram. Experiments have been carried out with tanks holding up to eight tons or more of molten metal in which a series of combustion tubes are fixed. By the means of such an apparatus, lead or other fusible metals or alloys may be melted not only rapidly but with extraordinary efficiency.

A correspondent reports that he experienced difficulty in determining the value of certain cyanide bullion due to discordant assays obtained. Upon analysis the bullion was found to contain cadmium. The zinc used in the mill is to be analyzed to determine whether this is the source of the cadmium.

Standard Specifications for Copper Wire Bars

A committee of the American Society for Testing Materials, affiliated with the International Association for Testing Materials, has presented a report on proposed standard specifications for copper wire bars, cakes, slabs, billets, ingots, and ingot bars, which reads as follows:

(1) All wire bars, cakes, slabs, and billets shall be stamped with the maker's brand and furnace-charge mark. Ingots and ingot bars shall have a brand stamped or cast in, but need have no furnace-charge mark.

(2) The refiner shall arrange carloads or lots so that as far as possible each shall contain pieces from but one furnace charge, in order to facilitate testing by the user.

(3) The copper in all shapes shall have a purity of at least 99.880% as determined by electrolytic assay, silver being counted as copper. All wire bars shall have a conductivity of at least 98.5% (annealed); all ingots and ingot bars shall have a conductivity of at least 97.5% (annealed), excepting only arsenical copper, which shall have a conductivity of not less than 90% (annealed). Cakes, slabs and billets shall come under the ingot classification, except when specified for electrical use at time of purchase, in which case wire-bar classification shall apply. The annealed copper standard, or resistance of a meter-gram of standard annealed copper at 20° C., shall be considered as 0.15302 international ohm. The per cent. conductivity for the purposes of this specification shall be calculated by dividing the resistivity of the annealed copper standard by the resistivity of the sample at 20° Centigrade.

(4) Wire bars, cakes, slabs and billets shall be substantially free from shrink holes, cold sets, pits, sloppy edges, concave tops and similar defects in set or casting. This clause shall not apply to ingots or ingot bars, in which case physical defects are of no consequence.

(5) Five per cent. variation in weight or ¼-in. variation in any dimension from the refiner's published list or purchaser's specified size shall be considered good delivery; provided, however, that wire bars may vary in length 1% from the listed or specified length, and cakes 3% from the listed or specified size in any dimension greater than 8 in. The weight of ingot and ingot-bar copper shall not exceed that specified by more than 10%, but otherwise its variation is not important.

(6) Claims must be made in writing within 30 days of receipt of copper at the customer's mill, and the results of the customer's tests shall accompany such claims. The refiner shall be given one week from date of receipt of complaint to investigate his records, and shall then either agree to replace the defective copper or send a representative to the mill. No claims will be considered unless made as above stated, and if the copper in question, unused, cannot be shown to the refiner's representative. Claims against quality will be considered as follows: (*a*) Conductivity by furnace charges, ingot lots, or ingot-bar lots. (*b*) Metal contents by furnace charges, ingot lots, or ingot-bar lots. (*c*) Physical defects by individual pieces. (*d*) Variation in weights or dimensions by individual pieces.

INVESTIGATION OF CLAIMS

(7) The refiner's representative shall inspect all pieces where physical defects or weight or dimension variation is claimed. If agreement is not reached, the question of fact shall be submitted to a mutually agreeable umpire, whose decision shall be final.

In a question of metal contents each party shall select a sample of two pieces. These shall be drilled in the presence of both parties, several holes approximately ½ in. in diameter being drilled completely through each piece, scale from set to be rejected. No lubricant shall be used and drilling shall not be forced sufficiently to cause oxidation of chips. The resulting samples shall be cut up, mixed and separated into three parts, each of which shall be placed in a sealed package, one for each party and one for the umpire if necessary. Each party shall make an analysis, and if the results do not establish or dismiss the claim to the satisfaction of both parties the third sample shall be submitted to a mutually agreeable umpire, who shall determine the question of fact, and whose determination shall be final.

In a question of conductivity each party shall select two samples, and in the presence of both parties these shall be rolled hot and drawn cold into wire of 0.08-in. diameter, which shall be annealed at approximately 500° C. Three samples shall be cut from each coil and the same procedure followed as described in the previous paragraph.

SETTLEMENT OF CLAIMS

(8) The expenses of the shipper's representative and of the umpire shall be paid by the loser, or divided in proportion to the concession made in case of compromise. In case of rejection being established, the damage shall be limited to payment of freight both ways by the refiner for substitution of an equivalent weight of copper meeting these specifications.

EXPLANATORY NOTES

These specifications are intended to allow for the fact that the refiner produces copper and gages its quality in furnace-charge lots, while the user purchases copper in carload lots, necessarily obtaining a different basis for sampling. It is intended to cover in these specifications an average grade of copper suitable for all mechanical uses and for making alloys to be used in various wrought forms. The specifications also recognize the fact that certain shapes are largely put to electrical uses where high electrical conductivity is important. They do not take into consideration the so called casting copper used for the purpose of alloying with other metals to produce cast shapes.

Plymouth Consolidated Mines, California

By Lewis H. Eddy[*]

The installation of the new electric hoist under construction for the Plymouth Consolidated mines, Amador County, Calif., should be completed by Feb. 1, 1912, when the mine will be unwatered preparatory to thorough exploration and development by the California Exploration Co., Ltd. The hoist will have a capacity for handling 300 tons per day from a depth of 2000 ft. The electric power will be obtained from the Western States Gas & Electric Co., of Stockton. An air compressor and other necessary equipment will also be installed. After the mine is unwatered the development will be proceeded with below the point where operations were terminated after the fire in 1888, which destroyed the timbering.

MINES WERE EARLY PRODUCERS

The mines are among the early and large producers of the state, being successfully worked under various mine and company names since the initial location in 1852, until June 1, 1883, when the Empire and the Pacific companies were merged into the Plymouth Consolidated Gold Mining Co. Hayward and Hobart were then the principal owners, though much of the stock of the merger was held in New York. Litigation followed the fire, and in 1903 the superior court of Amador County quieted the title in the Hobart Estate Co., Alvinza Hayward and Charles D. Lane. Some work was done toward reopening, but without effort at ore extraction or milling; the property was finally closed down.

In April, 1911, Albert Burch, of San Francisco secured an option of purchase on the property, and this option was turned over to W. J. Loring, of Bewick, Moreing & Co. The latter organized the California Exploration Co., Ltd., to reopen the property and carry it through the preliminary stages. C. A. Moreing is chairman of the board of directors of the new corporation, and Mr. Burch is the representative of the board in California. James F. Parks, of Plymouth, is superintendent at the mines.

---

[*] 2218 Peralta St., Oakland, Calif.

The initial location of these mines was made by Hooper & Co., of San Francisco, and recorded as the Southerland and the Simpson & Aden claims; they were known and operated as the Phoenix mine. The property now includes also the Oaks, Indiana, Rees, Phoenix East and the Phoenix millsite; a total of six quartz lode claims on the Mother lode embracing a lode length of 4800 ft., and containing 64.40 acres; the strike is about north and south, the dip about 60° E. The millsite comprises about five acres. Included with the quartz mines are about 1400 acres of timber land. All the lands are held under U. S. patent, the title at the time of the option being in the Hayward Estate Co., Hobart Estate Co., and the C. D. Lane Co. The mines are situated in Sec. 11—T.7 N.—R.10E., M. D. M., in the northern part of Amador County, adjoining the town of Plymouth, and are at an elevation of 1050 ft. The total output from the beginning of operations in 1852 to the closing of the mines in 1888, a period of 36 years, was $6,953,000; total dividends of $3,301,000, were paid.

Two Inclined and One Vertical Shaft

At the time of the fire, in January, 1888, the mines had three working shafts as follows: The North and South Empire shafts about 200 ft. apart on the Simpson & Aden claim, and the Pacific shaft on the Oaks, about 1000 ft. southeast of the South Empire shaft. The North Empire shaft was 1200 ft. deep and the South Empire 1280 ft.; both were inclines, sunk on the vein, dipping east at 60°. The levels were opened 100 ft. apart, the lowest being at 1200 ft. in the South Empire. The Pacific shaft, vertical, was sunk to the east of the vein in the hangingwall for 1700 ft., intersecting the vein at about 1400 ft. Levels were opened and numbered from one to seven inclusive, at the following depths; 1060, 1140, 1220, 1300, 1400, 1500 and 1600 ft., another level being opened later at 940 ft., known as New No. 1. The vein was crosscut to the northwest on levels 1, 2, 3 and 4, level No. 1 being about 150 ft. long. In 1885 the Woolford shaft on the Rees claim was sunk 600 ft. east of the North Empire.

During the period of attempted reopening of the mines, in which three men were killed by the breaking of a hemp cable, the Empire and the Pacific shafts were partially unwatered and a bulkhead put in at 1350 ft. in the Pacific; a drift 1330 ft., and a crosscut 140 ft. long were run on level No. 2, encountering rich ore; an upraise of 200 ft., a new station at 940 ft., and a drift through the country rock to the top of the upraise, constituted the balance of the work done before the mine was shut down. This record describes the physical conditions of the property at the time of the passing of the option to Mr. Burch.

Stamp Mill Built in 1871

The earnest development and equipment of these mines were begun on the Phoenix mine in 1871 when a 40-stamp mill was installed on the Simpson & Aden claim; 20 stamps were added in July, 1876, and 20 more in October, 1876; a total of 80 stamps weighing 750 lb. each, with a crushing capacity of two tons per stamp per 24 hr. In June, 1876, the mill was treating 80 tons per day of $8 ore from the 900-ft. level, and the shaft was being deepened to 1000 ft. In April, 1877, the vein had widened to between 30 and 40 ft. of pay ore. There were then 145 men on the payroll. In September, 1878, the monthly output of bullion was reported at from $30,000 to $50,000, and the vein for a length of more than 400 ft. varied from 30 to 80 ft. in width. In November, 1878, a new shaft was started.

The Phoenix mine was sold to the Empire Mining Co., in the latter part of 1878, and then became known as the Empire mine. In March, 1879, the south shaft was 1250 ft. deep with the lowest level at 1200 ft., and in the following month the north shaft was 1200 ft. deep. The Pacific Mining Co. began development of the Oaks claim in May, 1880, sinking a 3-compartment, vertical shaft, 15 ft. in the clear, and the largest and finest hoist then in the state was installed. In August the shaft was 165 ft. deep; in October, 370 ft., and in October, 1881, 1000 ft. A new 40-stamp mill was installed at the Pacific mine and began dropping stamps in February, 1882; the stamps weighed 1000 lb. each, with a crushing capacity of two tons per stamp per 24 hr.; the fall of the stamps in this, as in the Empire mill, was 7 in., at 90 to 100 drops per min. The mill was driven by water power. The shaft reached 1400 ft. in 1882, and a 40-ft. vein said to yield $16 per ton, was intersected by a crosscut at that level.

Largest Producer in 1883

The United States Mint report for 1883 credited the Plymouth Consolidated, the merged Empire and Pacific, for that year with the production of more bullion than any other gold mine in the state, and with crushing about 250 tons of ore per day in the two mills. The 80-stamp mill received its water supply from the Cosumnes River, through a ditch which was also utilized for floating timbers for the mine; the 40-stamp mill received its water from the Amador ditch. The Empire mill was first steam-driven, but was changed to water power; the Pacific mill had steam power in reserve while water was the principal power. Forty-eight Frue concentrators and a chlorination plant were a part of the equipment.

The following summary is made from the United States Mint report for 1884, containing the last annual report of the Plymouth Consolidated: Gold bullion produced in 1884, $1,033,518; operating expense, $331,163; dividends, $600,000; surplus, including surplus on hand Jan. 1, $146,914. Less than one-half of the surplus was expended for mine betterment, development and permanent improvements; the total, including ditches, real estate, reservoirs, tunnel development, shaft construction, shops, machinery, etc., was $72,619, leaving cash on hand, $74,295. The two mills ran regularly, crushing an aggregate of 80,000 tons, yielding an average of $13 gold per ton. Deducting material on hand and outlay for reconstructing the Empire mill, etc., the cost of production was for mining, $3.20 per ton; milling, 48c. per ton; cost of saving and reducing sulphurets, 21c. per ton; total average cost of production, $3.89 per ton.

In 1886 the mines produced for the nine months ended in September, $447,547; operating expense for the same period was $193,145. On Oct. 5, the 41st consecutive dividend was paid, making a total of $1,775,000. The production in 1887 was $736,304; operating expenses, $297,404; dividends, $375,000; expended for construction, $46,861; surplus, Jan. 1, 1888, $98,118. The average cost of production in 1887 was $3.07 per ton. From the organization of the Plymouth Consolidated, in June, 1883, to January, 1888, the mines produced in gold bullion $3,804,499; operating expenses in that period, $1,442,074; construction, $217,626; and $2,200,000 dividends.

All Underground Workings Timbered

The following items are of interest. The entire underground workings were timbered, at a cost of $2 to $3 per log. Round pine was used and 7000 to 8000 logs per year were necessary, the cost of transportation being reduced to a minimum by floating the logs in the company's canals. The quantity of water raised in 24 hr. was 18,000 gal. Water for power was conveyed 2½ miles; the pressure head at the Empire and Woolford shafts was 550 ft. and 561 ft. at the Pacific shaft. Waterwheels required numbered 23, of which three were Leffel turbine, and 20 were hurdy-gurdy wheels. Ditches totaling 160 miles were built. The ore consisted of soft quartz and slate, and was free milling and concentrating. Percentage of sulphurets was 1.5; value of sulphurets per ton, $125 to $200; percentage of extraction, 92 to 95. The powder used was No. 2 safety nitro. The several months' duration of fire in these mines was due to the immense quantity of timbering necessary, and to the fact that the mines made so small a quantity of water.

New Publications

Preparazione Meccanica dei Minerali. 6¼x9½, pp. 538, paper; 9.50 lire. Ulrico Hoepli, Milano, Italy.

The Granites of Connecticut. By Nelson Dale and Herbert E. Gregory. Pp. 137, illus. Bull. 484, U. S. Geological Survey, Washingon.

The Data of Geochemistry, Second Edition. By Frank Wigglesworth Clarke. Pp. 782. Bull. 491, U. S. Geological Survey, Washington, D. C.

The Forbes-Parkes Goldfield. By E. C. Andrews. Pp. 109, illustrated. Mineral Resources No. 13, New South Wales Department of Mines, Sydney.

Handbuch der Mineralchemie. By C. Doelter. Vol. 1, parts 1, 2, 3 and 4. 7x10, pp. 640, paper; 26 marks. Theodor Steinkopff, Dresden, Germany.

Report on the Gypsum Deposits of the Maritime Provinces. By William F. Jennison. Pp. 182, illus. Canada Department of Mines, Mines Branch, Ottawa.

La Metallographie Appliquee aux Produits Siderurgiques. By Umberto Savoia. 5x7½, pp. 217, illustrated, paper. Gauthier-Villars, Paris, France.

Reinforced Concrete. Mechanics and Elementary Design. By John P. Brooks. 6½x9½, pp. 220, illustrated; $2. McGraw-Hill Book Company, New York.

The Geology and Ore Deposits of the West Pilbarra Goldfield. By H. P. Woodward. Pp. 142, illustrated. Bull. 41, Western Australia Geological Survey, Perth.

Geology and Ore Deposits Near Lake City, Colorado. By John Duer Irving and Howland Bancroft. Pp. 128, illus. Bull. 478, U. S. Geological Survey, Washington.

Geology and Mineral Resources of Parts of the Alaska Peninsula. By Wallace W. Atwood. Pp. 137, illustrated. Bull. 467, U. S. Geological Survey, Washington.

Official Year Book of the Commonwealth of Australia, No. 4, 1911. By G. H. Knibbs. Pp. 1230, illus. Commonwealth Bureau of Census and Statistics, Melbourne.

Sopra Alcuni Presunti Effetti Chimici della Pressione nel Metamorfismo Minerale. By Giorgio Spezia. 6¼x9½, pp. 19, paper. Vincenzo Bona, Torino, Italy.

Quantity Surveying for the Use of Surveyors, Architects, Engineers and Builders, 5th Edition, Revised. By J. Leaning. 5¼x9, pp. 936; $10. E. & F. N. Spon, Ltd., London.

Biennial Report on the Mineral Production of Virginia during the Calendar Years 1909 and 1910. By Thomas Leonard Watson. Pp. 123. Bull. No. VI, Virginia Geological Survey, Charlottesville.

Annual Report of the Division of Mineral Resources and Statistics on the Mineral Production of Canada During 1909. By John McLeish. Pp. 290. Canada Department of Mines, Ottawa.

The Clay and Shale Deposits of Nova Scotia and Portions of New Brunswick. By Heinrich Ries and Joseph Keele. Pp. 163, illustrated. Memoir No. 16-E, Canada Department of Mines, Ottawa.

Shape Book Containing Profiles, Tables, and Data Appertaining to the Shapes, Plates, Bars, Rails and Track Accessories. 5½x8, pp. 255, illus., leather. Carnegie Steel Company, Pittsburg, Penn.

The Diamond. By W. R. Cattelle. 5¾x8½, pp. 438, illus. $2. John Lane Company, New York.

The author of this book, after a commercial acquaintance of some years in the jewelry trade, decided to write, in a popular vein, a comprehensive digest of information extant about this precious stone. The work covers the mining, and the preparation of the diamond for the trade; aims as well to clear up popular misconceptions founded upon ancient traditions and misstatements.

Rocks in the Road to Fortune, or the Unsound Side of Mining. Second edition. By Henry B. Clifford. 6x8½, pp. 492, illustrated, half leather. Gotham Press, New York.

This book is written in the style its title indicates. Its aim is to point out to the inexperienced in the mining business the pitfalls of the wildcatter and wiles of the unscrupulous promoter. The author has a breezy way of expressing himself, and gives some excellent pointers which might save many a dollar, if the book could be placed in the hands of those who need it most.

The Mineral Industry of Rhodesia. By J. P. Johnson. 5½x8½. 90 pp. cloth. Longmans, Green & Co., London, Bombay and Calcutta.

This is a condensed account of the present condition of the mineral industry of Rhodesia, and is intended also to be a guide to some of its future possibilities. It contains also some accounts of the chief mines now in operation, and the more important mining districts. The geological treatment predominates throughout the book. A brief introduction on the general geology of Rhodesia is followed by successive chapters on Gold; the Small Mine Industry; Other Metals; the Tin Deposits of South Africa; Non-metalliferous Minerals; Diamonds and Coal. The book concludes with a chapter of hints to prospectors. The book has been bound with a number of blank pages interleaved, so that additional notes can be made in the appropriate place.

Rock Drilling With Particular Reference to Open Cut Excavation and Submarine Rock Removal. By Richard T. Dana and W. L. Saunders. 6¼x9¼, pp. 319, illus. $4. John Wiley & Sons, New York.

The object of this book is to place at the disposal of engineers who employ the rock drill "the fundamental facts for determining the best way of using the drill for any given conditions." To this end a great volume of data, from actual experience in many cases and under differing conditions, has been gathered, carefully summarized and worked into shape by the authors. It is not claimed that the work is complete, since much remains to be done in the way of collecting data, but it is believed that a large part of the available information on the subject has been covered. Surface and submarine drilling are covered in the present volume; an additional one on underground work would be equally valuable and interesting.

The Mining Industry of Mexico. Compiled and edited by F. Gonzales, A. Grothe and L. Salazar S. No. 1, State of Hidalgo, part I. 8x11½, pp. 73, paper. Vda. de Bouret, Avenida Cinco de Mayo, num. 45, Mexico, D. F.

This work is intended to supply the most reliable and uptodate information concerning Mexican mining and its probable future. Though not an official publication, it has been compiled at the instigation and with the assistance of the Department of Fomento by a large group of mining engineers who have carefully revised and edited the information contained in official documents and that obtained from private sources. This being the first work of its kind in Mexico, it must naturally contain some errors and show deficiencies, which though they may not be observed by the general reader will be apparent to those having a special knowledge of any of the various districts and mines considered. Such corrections as may be received by the compilers will be given a place in the supplement and in future issues. The book will appear in about 20 parts, including the supplement, which will contain additional data obtained during the publication of the work. The first volume comprises a valuable resumé of the mining industry, in the state of Hidalgo. The lack of a suitable index is an unfortunate omission.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

B. B. Thayer is in Butte, Mont., on a periodic tour of inspection.

George E. Collins passed through New York this week on his way to London.

Fred T. Williams has recently returned to Park City, Utah, from New York and Washington.

W. C. Russell has returned to the Rawley mine, at Bonanza, Colo., after a short trip to New York.

Frederick G. Clapp is investigating certain technical problems on the oil and gas industry in the Louisiana fields.

Charles Lindmueller is in charge of the new plant of the Goldschmidt Detinning Co., at East Chicago, Ind., where it will manufacture pig tin. The plant is nearing completion and will be operating in a short time.

Herman Frasch has been awarded the Perkin medal by the Society of Chemical Industry, the presentation to be made at Rumford Hall, New York, on the evening of Jan. 19, which will be devoted to a discussion of sulphur.

Chauncey Eldridge, representing Tucker, Anthony & Co., of New York, was in San Francisco recently in conference with Eugene de Sabla and John Barneson, who are together largely interested in the Midway and the Santa Maria oil fields.

George A. Guess has been appointed to the new professorship of metallurgy in the faculty of applied science and engineering of the University of Toronto. He is a graduate of Queen's University, and has had a wide practical experience in connection with large copper-mining concerns. He was for some time at the head of experimental and metallurgical work with the Cerro de Pasco Mining Co., of Peru.

The School of Mines and Metallurgy of the University of Missouri on Oct. 24, 1911, conferred upon William Rowland Cox the honorary degree of Engineer of Mines, the highest honor it could grant. Mr. Cox entered the school in 1893 and remained there during three years. Beginning in a humble position with a mining company, he rose through all of the important positions until seven years ago he was appointed manager for all of the Mexican mining properties of the Guggenheim interests. Several years later he became a member of the firm of Spurr & Cox, consulting engineers, and at present is at the head of "W. Rowland Cox and Staff."

Frank Griffin has succeeded Eugene de Sabla as president of the Natomas Consolidated of California, operating dredges at Natoma and Oroville. Mr. Griffin has been connected with gold dredging for a number of years and was influential in the consolidation of the several Natoma companies and others; he organized and operated the Western Engineering Co. which built some of the first gold dredges in the American River field; and introduced the Holmes gold-saving tables. Mr. Griffin as president of the Natomas will make no radical change in the policy of the company. Mr. de Sabla's retirement was due chiefly to the fact that the work was more than he could continue in addition to other mining enterprises in which he is engaged.

OBITUARY

Lyman Robinson died at Cañon City, Colo., Jan. 9, aged 78 years. He was born at Dubuque, Iowa, and went to Colorado in 1878, interesting himself there in mining enterprises.

Robert J. Hawke died at Denver, Colo., Jan. 5, aged 37 years. He was born in Nebraska and went to Colorado 18 years ago. He had been engaged ever since in mining and stock raising. He lived for a number of years at Idaho Springs, but recently removed to Denver.

David C. Kane, formerly of Salt Lake City, died at Callao, Peru., Jan. 1, according to advices just received. He went to Peru about a year ago in the employ of the Cerro de Pasco Mining Co. He leaves a widow with one child, born since his departure for Peru. No particulars of his death have been received.

Karl Krug died at San Francisco, Dec. 28, aged 38 years. He was manager of the Oro Water, Light & Power Co., dredging department at Oroville. His first practical work as a mining engineer after graduating from the University of California in 1899 was in Alaska. Returning he took the position at Oroville. He was born in California.

C. H. Palmer died at Atlantic City, N. J., Dec. 27. He was well known in Boston and in Butte, Mont. He was educated as a civil engineer, and later engaged in copper mining and in company management. He was president of the Butte & Boston Copper Mining Co. for several years, up to the time it was transferred to the Amalgamated.

Franklin Farrel, Sr., died at Ansonia, Conn., Jan. 10, aged 84 years. For many years he was one of the best known manufacturers in the Naugatuck Valley. He was president of the Farrel Foundry & Machine Co., whose business had been built up by him from small beginnings. He was also well known at Butte, Mont., where he was for a number of years head of the Parrot Copper Mining Co., until it was sold to the Amalgamated Co. He was much interested in improvements in metallurgy and the introduction of the Manhes converter in this country was due to him. He leaves a son and four daughters, one of whom is the wife of Charles F. Brooker, president of the American Brass Co.

George Brooke died at Birdsboro, Penn., Jan. 15, aged 93 years. With his brother, the late Edward Brooke, he established the iron industry in Birdsboro in 1837, and he was the oldest ironmaster in continuous service in Pennsylvania. Besides the making of iron the firm owned anthracite and bituminous coal mines, ore mines and wood lands in Pennsylvania and West Virginia. In 1845 the firm, which operated forges, built Hampton charcoal furnace. In 1858 their first anthracite blast furnace was constructed, and in 1870 and 1877 two others were added. In 1856 they erected the present nail works, and later added furnaces for making pipe and bar iron. They also started the plant of the Birdsboro Steel Foundry & Machine Co. The firm employed at Birdsboro about 3500 men. Mr. Brooke was a member of the Masonic fraternity, the Union League, Manufacturers' Club, Sons of the Revolution and Sons of the Colonial War. He was president of the Pennsylvania Trust Co., the First National Bank of Reading and director in the First National Bank of Birdsboro, and was reputed to be Berks County's wealthiest resident.

Societies and Technical Schools

Colorado Scientific Society—At the recent annual meeting in Denver, the following officers were elected for 1912: President, George E. Collins; vice-presidents, E. N. Hawkins, W. P. J. Dinsmoor; treasurer, John W. Richards; secretary, H. C. Parmelee; members of executive committee to serve three years, Prof. George L. Cannon, George G. Anderson.

Canadian Mining Institute—The fourteenth annual general meeting of the institute will be held in Ottawa, on Mar. 6, 7 and 8, 1912. The Institution of Mining and Metallurgy and the American Institute of Mining Engineers have accepted invitations to hold joint meetings with the institute on the above dates. The council hope to arrange for an excursion to Cobalt and Porcupine, to start from Toronto at the close of the meeting.

Mining and Metallurgical Society of America—The annual meeting was held at the Engineers Club, in New York, on Jan. 9, followed by the annual dinner in the evening. Both meetings were largely attended. The following officers have been elected for 1912: President, J. Parke Channing; vice-president, J. R. Finlay; secretary, W. R. Ingalls; councillors, James F. Kemp, H. S. Munroe, T. H. Leggett, H. M. Chance, F. Lynwood Garrison, Waldemar Lindgren, H. V. Winchell, Philip Argall, H. F. Bain, F. W. Bradley, S. W. Mudd and C. W. Goodale.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Jan. 10—Rain and snow accompanied by extreme cold in the closing week of December followed suddenly the period of dry weather in the northern half of the state that had caused some alarm in the mining districts regarding the probable water supply. There was in some fields fear of a water famine, though not well founded. The December precipitation was general throughout the northern counties, the rain extending as far south as San Francisco and the snow as far south as Oroville in the valley sections. The snow was general in the Mother lode and other elevated districts, and not unexpected; but at elevations of from 200 to 500 ft., as at Oroville, Chico, Red Bluff and Redding, snow is unusual, and was not expected. The South Yuba River at Washington in the northern part of Nevada County was frozen to a hardness that permitted skating, a condition not before known to obtain at that point. The freezing was due not wholly to extreme low temperature, but partially to the low stage of the water, resulting from the continued dry period. In some sections the power and water supply ditches were frozen, but as the companies keep men ready in such seasons to follow the ditch lines for the purpose of preventing disturbance of the flow, there was no actual danger of disastrous suspension of the supply for mining purposes.

The suddenness and severity of this storm following so closely the warning of the water companies that unless economy were practiced and wastefulness ceased there would be danger of freezing the reservoirs in the event of sudden fall in temperature, proved the wisdom of the warning. There are a number of mines dependent on water for power, and many of them are mines of importance that have installed costly machinery, and find it greater economy to continue the use of water for power than to discard the machinery and replace it with electrical power machinery. New installations, however, are almost wholly electrical, and the number of mines dependent on water for power is not increasing, on the contrary there is good reason to believe that when the mines at present operated by water-power plants shall require new power machinery, the water-wheels employed for direct power will be displaced by electrical plants. In some instances the demand for additional or increased power has been met by the installation of an entire new electrical plant and the retention of the water power as an auxiliary or supplemental power to be used in case of emergency. But the emergency of a deficiency of electricity is infrequent, and will continue less frequent as water power is discarded. While there is always a degree of uncertainty as to the water supply for power purposes in the dry seasons, there is no cause for fear that the supply will ever be inadequate for the generation of electricity, owing to the constant preparedness of the electric companies.

Denver

Jan. 11—As a result of the meeting held recently to agitate the question of securing an appropriation from the government to provide a metallurgical testing plant for the treatment of low-grade ores, R. Kenehan, president of the Colorado Mining & Metallurgical Association, will appoint a committee of five on legislation, which will coöperate with similar committees appointed by the American Mining Congress and the Denver Chamber of Commerce. If deemed necessary, it is possible that Colorado will send a delegation to Washington to lobby for the bill. All these organizations are making united and strenuous efforts to encourage prospecting and to induce renewed interest in mining throughout Colorado.

An important discovery of ore yielding 1½ oz. of gold per ton has been made in Stratton's Independence, under the office buildings, the gold having ordinary red granite for its matrix. A car per day is being produced from this strike. It is on record that Stratton made his first discovery at this mine, in red granite, on July 4, 1891, and shipped a car of it to the Boston & Colorado smelting works to the astonishment and amusement of the then general manager, when the car of granite rolled into the yard. He was more astonished when it sampled 3 oz. of gold per ton.

The latest report from the deep drainage tunnel, of Cripple Creek, is by Engineer Countryman, Jan. 3, in which it is stated that the total flow from the portal is 9060 gal. per min., and gradually increasing with every round of shots, though no strong watercourses are being cut; the formation is solid granite, but with iron pyrite in the joint planes, indicating the possible proximity of a mineral zone. The breast of the tunnel is 1420 ft. below the surface and headed in the direction of the Elkton shaft, which is in the breccia area. The total length from portal to breast is now 16,389 feet.

The Leadville district, like other Colorado camps, is taking on new life. The large operators seem to have decided that the bodies of ore which made the output from the upper and lower contacts, originally came from the fissures, such as are now being developed in the Cord winze, Tucson, Yak tunnel, Helena, and the Cleveland and other veins; that eventually the district will become a fissure-vein district. Prospects are good for the unwatering of the Fryer Hill mines, and, later on, the downtown mines. While the total tonnage of Leadville for the last year is less than for 1910, the value of the output for 1911 exceeds that of 1910 by nearly $2,000,000, the total for 1911 being $8,227,018. This is explained by the large increase in the output of carbonate-of-zinc ore, 69,340 tons more being mined in 1911 than in 1910. The production of gold also exceeded the previous year by 4000 oz. Owing to the large decrease in smelting operations through the state, there has been a diminished demand for the oxidized iron-silver ore formerly so much in demand as a flux. The total output of the district is given at $386,228,087 for 32 years.

Butte

Jan. 10—John Gillie, general manager of the Anaconda company, testifying recently in the Peter Geddes suit involving the Alice company, stated that the Alice property has been outside of the producing area of Butte for 16 or 17 years, or ever since the drop in silver prices. He said that the Anaconda company had decided upon the absorption of the different mining companies in Butte for the purpose of avoiding expensive litigation and to effect a saving in operating expenses. Mr. Gillie stated further that between $5,000,000 and $10,000,000 had been spent in the last 10 years in Butte upon unproductive mining properties, adding, however, that there is justification for a reasonable expenditure for development in the Butte district, on a reasonable showing. Asked with regard to the abandonment of the smelteries in Butte after the companies owning them had been absorbed by the Amalgamated company, Mr. Gillie asserted that it was done in the interests of economy, stating that the ores could be treated at the Washoe smeltery at Anaconda at a saving of from $1.25 to $2 per ton, stating, as an example, that the Butte & Boston company was handling 700 tons of ore per day in 1905 and that the company saved over $500,000 yearly, by sending the ore to Anaconda for treatment. Even greater economies resulted after the Parrot, Colorado and M. O. P. smelteries were closed, he said. He gave the present production of the Butte Coalition mines at 1100 tons of ore per day, that of the Clark mines at 1100 tons and of the Trenton company at 700 tons.

On Jan. 2, in Butte, a meeting was held, at which time the properties, water-rights and improvements of the Southern Cross company in the Georgetown mining district, passed into the hands of the Anaconda company, the consideration being $450,000, which netted the former owners about 91c. per share. The property consists of the following claims: Southern Cross, Pleiades, Nellie, North Star, North Star No. 2, Keno, Sol Genzberger, Trinity, Lee Mantle, Apex Fraction and part of the Mundo.

In the suit of Richard Hancock, minor, and 16 other heirs of the late Richard Hancock, against the Anaconda, and Boston & Montana companies, which was brought some months ago for a one-tenth interest in the Wild Bill claim, and for an accounting of the profits of the ore taken out during the last 22 years, judgment was given by Judge Lynch, of Butte, on Jan. 9, in favor of the Anaconda company.

Salt Lake City

Jan. 11—The Ohio mill is at present handling 2000 tons of ore per day. The recovery on some of the ore is as low as 17 lb. copper per ton and the silver and gold in the ore is reported to bring 20c. net per ton. It is understood that the company is making some profit on its operations, at the present price of copper. Sixteen of the 20 Wall rolls are in operation. There has been some delay in their installation, but when all are in place it is expected that the mill will handle about 3000 tons per day. There are two vertical, fine-crushing sets of rolls, 42 in. in diameter and about 15 in. long. These rolls have a cast-iron core with manganese-steel shells. They have a daily capacity of 350 tons each, but at present are not being operated up to this amount. There has been trouble with improper feeders. The rolls crush fine enough to separate the mineral from the rock, without further crushing, about 20 mesh or finer, and consume less power than other crushing devices of the same capacity. The operation of the Wall rolls is being watched with interest. It was originally planned to install 10 corrugated rolls and 10 of the vertical type, but this number may be increased, so that eventually the mill will have 14 corrugated and 16 vertical rolls. The corrugated rolls do the coarse crushing, while the vertical rolls are for the finer work.

The recent snows in Salt Lake Valley and other parts of the state indicate a plentiful water supply for the coming summer. According to the local U. S. Weather Bureau, the rains and snows early in the season, with alternating temperatures, caused an ice foundation for the later snows, which are piling up. The early ice formation means that the snows are melted gradually, which is apt not to be the case when the snow is loose.

The Centennial-Eureka power plant, at the portal of the Holden tunnel in Tintic, was put in operation the first week in January to supply power for the large electrical pumping equipment in the Centennial-Eureka mine. Power has heretofore been received from the Knight company, but line trouble made it impossible to secure all the power needed. The Centennial-Eureka steam plant was built as an emergency plant for cases of this kind and is well equipped and capable of supplying power at all times. This is the first time the plant has been in operation since the final tryout following its completion.

Deadwood, S. D.

Jan. 12—Judging by present indications, the Black Hills district is to have a prosperous year during 1912, perhaps the most prosperous one since the discovery of gold, 37 years ago. The gold production is gradually growing, the last three months of the year showing a greater production than any previous quarter. According to Assayer-in-Charge L. P. Jenkins, of the U. S. Assay Office at Deadwood, bullion was purchased at that institution during the quarter ended Dec. 31, to the total of $2,043,319. The total of the year's business at that office was $7,490,864. This office does not handle the entire bullion output of the Black Hills, nor do the figures given above include smelting ores shipped to Denver, Omaha and other points. Aside from the producers now in operation, there will be several others running within the next few months, so that the year 1912 should exceed 1911 by a considerable amount.

Montreal men, represented by Wood Brothers, have taken an option on the Hidden Fortune and Columbus properties and will immediately dewater all the workings and make a systematic examination of the properties. An assay office has been rented in Deadwood, where the several thousand necessary assays will be made. Two electric pumps have been ordered for handling the mine water.

Continued cold and snow have caused inconvenience at a number of properties, and in fact have caused a suspension of construction work at one or two points. The railroads engaged in hauling ore have found it difficult to keep their lines open, and at present are using extra crews on all lines. The official measurement of the snow fall shows that 5½ ft. have fallen since winter began, and only a trifle of it has melted, as there has been but one good thaw in the last seven weeks.

Sudbury, Ont.

Jan. 8—The last year has seen a noteworthy increase in the demand for nickel, to meet which the two operating companies in this district, Mond and the International, have enlarged their plants, and the latter is now again to increase its smelting capacity by the addition of two more furnaces. Mond's new smeltery at Coniston is expected to be in operation by the end of this year, and each company is also opening up a new mine which should be in the shipping class by Jan. 1, 1913. Several nickel properties have been purchased and nearly every nickel claim that is for sale is now under option.

One great impetus in late years to mining in this district has been the extensive railroad development. Within two years the Canadian Northern R.R. will have its main line completed, thus giving Sudbury a competing line to both Toronto and Montreal. Besides this the Ontario Government road is expected to extend a line to Sudbury which will then give entrance to the Grand Trunk Pacific and will place Sudbury on the three transcontinental roads.

Parral, Mexico

Jan. 10—The opening of the American Smelting & Refining Co.'s mines in the Santa Eulalia district will probably have some effect in influencing some of the smaller mines and prospects to resume work. The smelting company's mines were shut down some time ago in order to make repairs; most of these have been completed and operations are now in progress as before. Negotiations are said to have been going on for some time for the transfer of several inoperative properties; it is believed that some of these, at least, will be successfully consummated soon. In the Perrazas district the smeltery of the Rio Tinto company is expected to resume operation soon. It has been closed temporarily for several weeks due to breakages in the machinery, which have now been repaired. In the Cusihuiriachic district a number of privately owned mines are working steadily and shipping ores to the smeltery. It is generally believed that the recent favorable turn in the political situation will have a salutary effect on mining throughout the several states, which will be noticed first, probably, in Chihuahua, and which will probably result in the resumption of activity at a number of properties.

The Mining News

The Current History of Mining

Alaska

The steamship "Northwestern" reached Seattle, Jan. 3, with 1900 oz. of gold dust and nuggets from Fairbanks, from which over $33,000 were netted.

Newsboy—The 5-stamp mill at this mine, in the Chena district, is completed, and the ore from the trial run shows an average of $22 per ton.

Lucky Hill—This company has been incorporated by Carlson Bros. & Whitely, of Fairbanks, for the purpose of operating both placer and quartz properties along Valdez Creek.

Spaulding—New machinery is to be installed on this property, at the head of Dome Creek, owned by the Reliance Mining Co., Fairbanks.

Frederick—This company is considering the installation of a compressor plant for the mine, near Ridgetop, on the Tanana Valley Railroad.

Alaska-Mexican—During November the mill crushed 19,312 tons of ore, yielding $55,521 gross and net $23,959. Operating expenses were $28,367; construction, $3195. The ore yielded $2.91 per ton and 208 ft. of development work were done.

Alaska United—During November 38,942 tons of ore were crushed, which together with 575 tons crushed in the Mexican mill yielded $92,343 gross and net $35,998. Operating expenses were $53,197; construction, $3146. The ore at the Ready Bullion mill averaged $2.32 per ton; 700-ft. Claim, $2.45. A total of 534 ft. of development work was done.

Arizona

GILA COUNTY

Two hundred white and Mexican laborers are reported to have attacked a dozen Japanese workmen recently, at Hayden. It is said that everything except their clothes was taken from the Japanese and they were then ordered to leave town.

Arizona Commercial—President Smith is at the property and is preparing to recommence development work in the Copper Hill end. A superintendent will be selected in a few days.

Inspiration—Work has started on the dam across Pinal Creek. This will be the chief source of water supply for the concentrator and will be built of concrete rubble masonry, 75 ft. long and 25 ft. high. There will be a concrete forebay and a tunnel to connect with the pumping station. The method of concentration recommended by J. M. Callow is being tested by him in the experimental mill. It is designed to be an improvement on the roughing system as practiced in many of the large mills of the country and aims, first, by means of graded crushing, to produce a comparatively small amount of slime, and second, by application of the roughing system, without classification, to remove the greatest possible amount of copper from the slime before it is separated from the sand and sent to the slime-treating machinery.

Live Oak—Churn-drilling operations have been curtailed, two drills having been closed down. The remaining drill is stated to be in ore above the average. The station on the 900-ft. level in No. 2 shaft, near the western end of the property, is virtually completed and it is intended to begin driftng on the ore soon. At the eastern end of the orebody a drift is being driven from No. 1 shaft, on the fourth level, and is reported to be faced in ore. Raises are being driven from this level on two of the churn-drill holes.

Miami—The December output amounted to nearly 3400 tons of concentrates which should yield over 2,580,000 lb. of refined copper. The grade of ore mined and milled during December averaged 2.6% copper, and the daily tonnage now being handled is about 2500 tons, of which about 12% comes from the dump, 35% from square-set and sublevel caving operations, 35% from development and the balance from shrinkage stopes. At the east side of the mine, ore is being mined by square-sets and sublevel caving, and in the northwest part by shrinkage stopes, there being in this part of the mine an available tonnage of 2,740,000 tons. The total developed tonnage above the 420-ft. or first tramming level is over 9,000,000 tons. The crosscut from the main shaft, on the 570-ft. or second tramming level, is in 475 ft. and has 250 ft. more to go to reach the orebody. The equipment of the pumping station at Burch now consists of two Aldrich triplex pumps, each driven by a 400-hp. motor and having a capacity of 1600 gal. per min. An air compressor has recently been installed to furnish air for air-lift pumping in testing some wells in the vicinity of the pumping station, one of which is now flowing at the rate of 250 gal. per min. and is increasing. The total number of men employed is over 700, of whom 370 are underground, 120 in the mill and the rest in the power house, shops, etc. B. B. Gottsberger is general manager; N. O. Lawton, mine superintendent, and F. W. Solomon, mill superintendent.

Barney Copper Co.—The General Development Co. has taken an option on the 26 claims of this company lying to the northwest of and adjoining the Live Oak, for $600,000, and is preparing to explore the ground by drilling. The principal work done by the Barney company consists of two shafts, 46 and 400 ft. deep. A drill is now being set up at the 400-ft. shaft, which is about 3000 ft. west of the east end-line of the property. E. B. Tinker, superintendent of the Keystone mine, has charge of the work.

Old Dominion—The production of fine copper for December was 2,587,000 lb., making the total for the year 26,500,000 lb., of which about 19,000,000 lb. were produced from the Old Dominion property, the balance being from United Globe and custom ores. Sinking of the A, or main, shaft to the 18th level is progressing satisfactorily, having passed the 17th level. The bottom of the shaft is now in quartzite and making considerable water. The contract has been let for lining the Kingdon shaft with concrete for 1000 feet.

California

AMADOR COUNTY

Hanby—This mine, which is being sampled and the ores from which are being tested by a mill run under the supervision of George Kislingbury, of Los Angeles, is situated near the line of Calaveras County and near Mokelumne Hill. It is reached *via* Valley Springs, through Calaveras County; this and other mines in the vicinity in Amador County are classed with the Calaveras mines.

Wildman—This property, at Sutter Creek, is reported to have been sold to William J. McGee, of San Francisco, who recently reorganized the control of the Keystone property. The Wildman and Mahoney mines, which adjoin, were worked and known as the Wildman-Mahoney, and were among the largest producers on the Mother Lode 25 years ago.

California Exploration Co.—Articles of incorporation have been filed for record. Capital stock is £50,000, divided into 50,000 shares. The directors are Lewis E. Lawton, L. J. Romer, Basil Perry Bell, E. H. Goodwin, Alfred Whittard, W. H. Nicholson, W. F. Witt, residents of England; the head office is in London. Albert Burch, of San Francisco, is the representative of the directors. The company is installing a hoist and other machinery to reopen and develop the Plymouth Consolidated mines.

BUTTE COUNTY

El Oro Dredging Co.—Dredge No. 1, at Oroville, sank on Dec. 22, bow down, in 19 ft. of water. The bow was submerged, the stern remaining above water. The boat inclined about 7° from the water line after sinking. The primary cause of the tipping was the excess weight of machinery. No damage resulted and the boat is being raised.

Pacific No. 1—This dredge, which sank in 26 ft. of water on Nov. 27, at Oroville, has been raised, and the damage to the conveyor frame repaired. The recommissioning of the dredge was delayed by the installation of new cross-system, gold-saving tables.

FRESNO COUNTY

San Joaquin—A strike of high-grade ore is reported from this mine, 20 miles above Pollasky. W. W. Gibbons is manager. Extensive development and milling operations are reported in this section, known as Temperance flats.

KERN COUNTY

Teagle Brothers—This firm has received a dry-washing machine similar to that operated by the International company, and will operate it on the placer claims near the Baltic mine.

International Manufacturing & Mining—Two tons of concentrates from the dry washer, recently installed between Randsburg and Atolia, have been milled at the Red Dog mill, and are reported to have given fair returns.

Buick Lease—Well No. 2, near Fellows, came in on Jan. 8, flowing at the rate of about 10,000 bbl. per day. The oil gushed 200 ft. above the derrick. The well is down 3319 ft. with 6¼-in. casing.

Bellridge Oil Co.—By deed of Jan. 5, 30,000 acres of oil land, embracing the Hopkins tract, between the Lost Hills and McKittrick fields, have been conveyed to this company. A mortgage for more than $500,000 accompanies the deed.

SIERRA COUNTY

Monte Cristo—In this gravel mine, near Downieville, from which nearly $400,000 were taken out during the last 10 months, by a small crew of men, a drift is being driven to strike the vein where it has been undisturbed by dikes. F. I. Phelps is manager.

Sixteen-to-One—This mine, at Alleghany, has 10 men employed, is crushing and concentrating sulphurets at the Red Star mill, and is sacking its high-grade ore for shipment to the smeltery. W. I. Smart is operating the property under bond.

Fruitvale—The tunnel, which is in more than 500 ft. on the vein, will be extended this winter to cut a chimney of high-grade ore that outcrops. J. J. Fitzgerald is manager.

Telegraph—This gravel mine, on the Mountain House-Goodyear Bar belt of serpentine, where a strike in quartz was recently made, is taking in a large supply of air pipe, steel rails and provisions, preparatory to prosecuting a large amount of development work this winter and during the coming year. John W. Finney is superintendent.

TUOLUMNE COUNTY

App—The reported sale of this and the Rawhide mines by W. A. Neville, had not developed up to a recent date. The properties have been examined by representatives of the proposed purchasers, and the abstracts and other documents inspected. The sale has been so insistently reported that the supposed plans for development have also appeared as part of the report.

New Albany—This mine, which has been disturbed by litigation, has been temporarily closed down by order of the owner, the United Mines Corporation. Mr. Hinds, president, has returned to Cleveland, Ohio.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

The total output of Gilpin County for 1911 is given as 76,745 tons, an increase of 33% over 1910. The Frontenac mill is stated to have treated 35,736 tons of ore at a total cost of $2.83 per ton, including mining. The Frontenac company owns the Frontenac and Aduddell mines in the Russell Gulch district. H. P. Lowe is manager.

Pittsburg—This mine in the Russell district is making shipments of high-grade ore, returns having been received of lots that carried 14 oz. gold per ton and good silver content. Sixteen tons of mill dirt returned $121 from the gold caught on the plates. Drifting is being done on the 800-, 1000- and 1100-ft. levels.

National—A discovery of lead ore is reported from this mine at West Argentine, the vein, where intersected by a crosscut tunnel 190 ft. long, showing 4 ft. of galena; it is 120 ft. below the surface and is being opened for stoping.

Princess of India—Two cars per month of 200-oz. silver ore are being shipped; the shoot is said to be 100 ft. long and the ore is gray copper, 18 in. wide.

Lost Treasure—High-grade silver ore has been uncovered in this mine, on Columbia Mountain.

Pulaski—This mine, on Leavenworth Mountain, has been taken over by a syndicate of Denver men, with B. F. Kelley as manager; the old workings will be cleaned out and a force of 25 men put to work. Many years ago this mine was a producer of high-grade silver ore.

Baker—In this mine on McClellan Mountain, an 8-in. streak of ore has been discovered which assays $180 per ton in gold, silver, lead and copper.

Paymaster—Heavy shipments of $90, silver-lead ore are being made by pack trains to Georgetown from the mine in East Argentine.

LAKE COUNTY—LEADVILLE

Great Hope—It is reported that a small vein of high-grade ore has been opened in this mine. It was found in a drift run from the Across-the-Ocean shaft and at a depth of about 400 ft. Thomas Gilroy is manager.

Alps—It is reported that the Cleveland fissure has been cut by a drift run from the 175-ft. level of this claim in Little South Evans Gulch, and that it is 40 ft. wide with well defined walls; on the hanging wall there is 15 ft. of iron ore of low grade. The Alps shaft is 1½ miles from the Cleveland and the vein in the intervening ground is undeveloped.

New Discovery—In this mine, on Fryer Hill, M. H. Hoffer & Co., lessees, have opened a body of carbonate-of-zinc ore at a depth of 100 ft., 2 ft. of which carry about 37% zinc; this ore will be shipped. Outside of this is ore which will run about 23%, which will be stocked, pending a market for it.

Big Chief—In the incline from the 800-ft. shaft, now down 70 ft., a body of carbonate-of-zinc ore, 12 ft. high, has been opened that averages 33%. A 22-hp. electric hoist will be installed at the top of the incline. The mine is on Carbonate Hill.

Castle View—Twenty-five tons per day of lead ore are being sent to the smeltery from this mine, and 25 tons per day of zinc ore from the Crescent and Catalpa.

MESA COUNTY

The discovery of natural gas is reported at four places in the eastern end of the county and has caused considerable excitement. A company has been formed by Pennsylvania men and wells will be drilled.

SAN JUAN COUNTY

American Placer—Dispatches state that this company is preparing to work the placers in the San Juan River. A good equipment of machinery has been freighted in and buildings erected during the last summer; the dredge is now being assembled for operation next month. It is said that $500,000 have already been spent in the undertaking.

SAN MIGUEL COUNTY

Colorado Carnotite Co.—It is reported from Telluride that Manager O. B. Wilmarth has contracted the output of these mines, and made arrangements in the East for a market for the vanadium-uranium ores.

Illinois

International Smelting Co.—This company is reported to be contemplating the construction of a $1,000,000 smeltery and lead refinery, between Hammond, Ind., and Chicago, to employ about 1000 men.

Michigan

COPPER

Victoria—A crosscut driven from the 12th level drift, encountered an exceptionally good run of copper ground. In driving the drift the copper-bearing portion of the lode was missed and the crosscut was driven to pick it up again. Good ground has also been recently opened at the 19th and 22d levels. The underground conditions at the property are more encouraging than at any time in its history. About 500 tons of rock per day are being handled at the mill.

Mayflower—Drilling of No. 17 hole has started at a point about 200 ft. east of No. 16 hole from which a good core was extracted. No. 17 hole will go down vertically and will cut this formation at a shallower depth. Upon the completion of this hole, shaft sinking will probably be started to open and develop this formation.

Houghton—The crosscut has passed through the copper-bearing formation that was at first believed to be the lode; it has been shown that it was not the main formation, but only a seam. The crosscut is being continued and should cut the main lode at any time.

Allouez—This property is rapidly developing into such shape that it will, in all probability, be the next producer at the Lake, to enter the dividend list. The surface equipment at No. 2 shaft is being rushed to completion, and as soon as this is accomplished, production will be about doubled.

Mass—This property will be able within the next few weeks to increase production materially. The shaft house at B shaft is about completed and when this is ready a larger tonnage will be handled. About 250 tons per day are being shipped to the mill. At the mill some changes have been made toward greater efficiency and everything about the property is progressing satisfactorily. The work at C shaft is necessarily slow, owing to the weather which has been unusually severe for the last two weeks.

Naumkeag Copper Co.—It is reported that the flotation of this company will soon be made by the General Development Co., a Lewisohn organization. The new company is expected to take over the Naumkeag, South Side and Dacotah properties, also some land from the St. Mary's Mineral Land Co., situated west of the Isle Royale and on the south side of Portage Lake, presumably in the southwest quarter of S.34—T54—R34. Superficial exploratory work was done on the first-named properties some years ago; developments in the Hancock company's vertical shaft during the last two years, however, have had a direct bearing on these properties, making them desirable tracts for exploration.

Hancock—The vertical shaft has encountered a branch of the main Pewabic lode, at a depth of about 3220 ft., which contained copper. This is the second copper-bearing lode encountered in the shaft during the last six weeks.

Wyandot—A strike was made recently in the crosscut at a depth of 700 ft., but details have not been announced. Development is confined largely to driving this crosscut east.

Elm River—President Fay has announced that the directors have voted to reopen the right to exchange the stock for shares of the Contact Copper Co., as outlined in a previous circular, on condition that interest at 6% from July 1, 1910, be paid on the cash payment required to cover subscription for additional shares. This offer expires Jan. 31, 1912. At the property, hole No. 10 is being drilled at an angle of 50°, and is about 200 ft. deep. This hole is expected to produce important results as it will pass through the eastern horizon of the series, where many of the recent discoveries at the Lake have been found.

IRON

Rogers—At this property of the Munro Iron Mining Co., situated three miles east of Iron River, 75 ft. were made in sinking the 11x16½-ft. shaft in rock, during December. The work is a continuation of the concrete sand shaft, sunk 140 ft. to bedrock last summer by the Foundation company. Walter Gulgren is in charge of the sinking. It was feared that the heavy water pressure in the thick overburden would give trouble when the work was begun in the rock, but little trouble was experienced.

Saux Head—Exploratory work has been resumed at the company's property near Birch, about 30 miles northwest of Marquette. Frank Krieg, formerly postmaster of Birch, is in charge of operations. The shaft was sunk to 100-ft. depth about 10 years ago by Marquette men in search of gold. It will now be sunk deeper. Indications of copper and iron are said to be present.

Newport—The company has instituted a suit protesting against the raise in the assessment of the mine, at Ironwood. The state's valuation of the mine was recently changed from $1,471,061 to $8,535,000, making a tax of approximately $100,000 to be paid.

Jones & Laughlin—The company has started sinking a permanent shaft on its 40-acre tract, one mile north of Iron River. The property has been thoroughly diamond-drilled. Will Walters is superintendent.

Moro—This Cleveland-Cliffs mine in the city of Ishpeming which will be closed down soon due to exhaustion of the orebody, has produced about 900,000 tons of hard, specular, high-grade ore. The percentage of iron in the ore regularly ran close to 60%; the moisture content was about ½ of 1%. The high phosphorus prevented the ore being bessemer. The greatest vertical depth of the shaft is 812 feet.

Montana

BUTTE DISTRICT

Anaconda—At the Mountain View mine an electric motor for ore hauling has just been installed on the 1800-ft. level, heavier steel has been laid and all of the principal crosscuts and drifts widened and retimbered on that level. The new motor weighs four tons and is capable of hauling a load at the rate of about six miles per hour. It can haul 24 loaded mine cars, whereas the ordinary load for a horse is eight cars; these cars hold 14 cu.ft., which amount to approximately 9 cu.ft. of unbroken rock. A car of first-class ore, which has a larger copper content than second-class, weighs about three-fourths of a ton, while a car of second-class ore weighs about two-thirds of a ton. Motors are now being used as ore carriers on three levels of the mine, the 800-, 1100-, and 1800-ft. levels. The air shaft is being repaired and new guides installed in a number of places where settling ground has caused the shaft to squeeze. The 1600-ft. level air-shaft station is being enlarged. At the Pennsylvania mine, motors have been in use as ore carriers for over a year on the 1600-ft. level, and now preparations are being made to install a motor on the 1000-ft. level. The flume between the Pennsylvania and Leonard mines is nearing completion.

Butte-Alex Scott—As a result of the improvement in the copper metal prices, the management has decided to double the output of the mine, and in the future about 100 tons of ore per day will be shipped to the East Butte smeltery for treatment. The Little Annie mine, also owned by this company, which is a silver property situated north of Walkerville, has been leased to R. J. Philpot and others of Butte, and they will mine it on a royalty basis.

Butte & Ballaklava—The shaft has been sunk to the 1600-ft. level, where a station has been cut, and crosscutting begun for the purpose of intersecting the vein opened above on the 1400-ft. level. This vein contains 4 ft. of ore averaging between 5 and 6% copper, and a considerable width of lower-grade ore, and the management anticipates finding a still better grade of ore at greater depth.

Deer Lodge County

Butte-Anaconda At a recent meeting of the directors it was decided to continue development work with a view to beginning shipments as soon as the snow is gone. The company owns two patented quartz claims, eight unpatented quartz claims and several placer claims, millsites and water rights, situated in the Georgetown district, near the Southern Cross property, and adjoining the Hidden Lake claims. Considerable development has been done on the property in the past and about $50,000 worth of ore shipped.

Jefferson County

Corbin Copper—A vein of silver-lead ore averaging from 4 to 7 ft. in width, has been encountered 1500 ft. from the mouth of the Bonanza tunnel; a shaft is being sunk on this ore and four raises are being put up to connect with the Dewey tunnel, which is 207 ft. above the Bonanza. A vein containing copper and silver has been opened in the Rosalie tunnel and the ore is being shipped to the smeltery. The Dow tunnel is being driven to intercept the Minah lodes at a depth of 900 ft., where, basing their expectations on the Minah claims adjoining, the management hopes to find high-grade copper ore. The concentrator has been started and will be run at the rate of one shift per day, its capacity when running full being 200 tons of ore per day.

Madison County

Pennington—A lease has been taken by C. O. Dale on this mine, which has produced considerable rich gold ore in the past; owing to the gold lying in pockets, necessitating much dead work, it has not been worked recently. Operations are expected to start soon.

Nevada

Comstock Lode

Mexican—The finishing touches are being made to the new 100-ton mill, and the plant will soon begin the treatment of higher-grade ore. The classifier was found inefficient in the experimental run made on vein rock, and two plates were defective in the tube mill, but these have been remedied and further test is now underway. In the mine, sampling is being thoroughly done, preparatory to stoping ore on the 2300-, 2400- and 2500-ft. levels.

Con Virginia—The southwest prospecting drift on the 2550 level has passed through the high-grade ore encountered recently, and the face of the drift is in a mixture of porphyry and quartz of a favorable character. The formation being followed is a strong one, and the cars have averaged about $16 per ton, recently.

Union—The extensive repairs to the shaft that have been underway for two months from the 2000-ft. point to the surface, are now practically completed, and the shaft is in excellent condition. The Mexican company works through this shaft and when stoping begins in that property, the hoisting facilities will be ample.

Ward—Diamond drilling has started from the Ward raise in the Julia connecting drift on the 2000-ft. level, toward the Gold Hill section, but no water had been tapped at last reports.

C. & C.—The transformers for the new pumping system to be installed on the 2460 station, which is now nearly completed, have arrived, and the motors from the General Electric Co. were shipped recently from the East. The new pumps, that are designed to unwater the north-end mines from the 2500 to the 2900, are expected to be installed by the first of July.

Ophir—The directors have appointed a committee to investigate the advisability of acquiring a reduction and cyanide plant for the company, but nothing definite will be done until spring, when the weather conditions will be favorable for the construction of works of this kind. The company has nearly $100,000 in tailings stored and is maintaining regular ore shipments to the Kinkead mill.

Esmeralda County

Goldfield Consolidated—An official notice issued by Secretary Howe states that the issuance of the annual report will be delayed about two weeks, to permit of a rearrangement of accounts to accord with the requirements of the federal corporation income tax.

Goldfield-Belmont—A recent shipment is reported to have averaged $77.20 per ton. This ore was not sorted but was shipped as broken in development work, some of it running up to $1700 per ton. Ore is being broken at the rate of 25 tons per week.

Humboldt County

The placer properties in American and Limerick Cañons are preparing to operate this spring; it is expected that with uptodate dredges, much more placer gold can be taken out than formerly. Limerick Cañon is in the vicinity of Lovelocks, Nevada.

Nevada Gold Crown—This company of Golconda, Nev., J. H. Playter, manager, is preparing to install heavier machinery to handle the great increase of water coming into the shaft. A body of gold ore was struck recently but the water prevented mining.

Slumbering Hills Mining Co.—This company has been formed lately with substantial backing, and will take hold of a number of placer claims in Barber Cañon, in the Humboldt Range. These claims cover the old workings of the Chinese of many years ago. The gravel runs from 10 to 35c. per yd. and there is plenty of water to enable the company to operate a dredge; the distance down to bed rock in some places is 80 ft., and is reported to be pay gravel the total distance. Denver men are interested and J. B. Truett, Mill City, Nev., is field manager.

Cortez—This mine, 50 miles south of Beowawe, Nev., is preparing to resume operations; the property was a producer years ago when silver was at a high price. J. B. Menardi, of Reno, is the principal operator.

Nye County

MacNamara—The mill is nearly completed, the last car of machinery having arrived recently. It is the intention of the management to put through the surface dumps first, as these contain some high-grade ore. While this is in progress, underground development work will be done.

Jim Butler—Shipments for five weeks ended recently, averaged as follows: First week, $70; second, $98; third, $180; fourth, $43, and $100.50 for the fifth week.

White Pine County

Nevada Consolidated—Cold weather has interfered with operations at the Steptoe concentrator, freezing of water pipes having recently reduced the number of sections in operation from eight to six. At Copper Flat four shovels are working in overburden and two in ore. One shovel is removing overburden at the Liberty pit.

Giroux—New construction is proceeding slowly. The main timbers of the 90-ft. headframe are in place, and the engine and boiler houses are inclosed, four boilers being in place. One churn drill is in operation on the ridge between the Morris and Giroux shafts. The company is experiencing trouble with the freezing water system.

New Mexico

Ernestine—A 90-day option on this property is reported to have been given to Henry B. Hovland, of New York and Duluth, Minn. It is further stated that engineers will make a complete and thorough examination of the property. The value of the monthly production is said to be about $35,000 at present, of which $16,000 are profits. This production can be easily increased.

Oregon

Agate—This company is developing the Big Creek mines, near Newport, Lincoln County. The property contains black sand, carrying gold and platinum. The plant is not completed and was manufactured by the Gold & Platinum Extraction Co., of Los Angeles, Calif. The management states that it is expected to work from 400 to 600 cu.yd. of beach sand per 24-hr. day.

Utah

Beaver County

Horn Silver—The orebody cut about a month ago on the 400 level has been drifted on 35 ft., and crosscutted for 15 ft. It is reported to run $10 to $12 per ton.

Michigan—Officers for the ensuing year have been elected, Lawrence Green being chosen president. Drifting is being done on the 200-ft. level, south of the shaft. The drift is in 275 ft., and has cut ore in a number of places. The ore carries lead and copper and occurs up to 31 in. thick. The present work is in porphyry and the drift is being extended toward the limestone contact.

Progressive—A car of about 30 tons of ore is on the local market, which assays 9.28% copper, 31.6 oz. silver and 0.04 oz. gold. The total value is about $899. This ore came largely from an incline 70 ft. below the 150-ft. level.

Juab County

Lower Mammoth—At the annual meeting, Jan. 8, the financial statement was presented, showing receipts for the year, including two assessments, to have been $37,225. There was an overdraft, Jan. 1, 1912, of $5091. Thirty-three cars of ore were shipped during the year, largely by leasers, amounting to 1334 tons, which sold for $8916. Development was done on the 200, 300, 400, 1000 and 1700 levels. Leasers worked in various parts of the property up to September.

Grand Central—New ore is reported to have been followed on the 1600-ft. level for about 80 ft. Copper ore is being mined on the 2200 level and development work is being carried on there, and in other places. The output for the week ended Dec. 15 was nine cars.

Utah Mine—A car of ore has just been marketed from this mine, at Fish Springs. Up to Jan. 1, 1912, the property has produced $1,198,000, and has paid $325,000 in dividends. During 1911, 25 cars were shipped, amounting to 730 tons. The ore averaged about $86 per ton, making the total value of the output for 1911, $62,780. The wagon haul from Fish Springs to Oasis is about 70 miles and costs $12 per ton. The property is reported to have operated steadily for the last 20 years, never having levied an assessment.

Salt Lake County

Utah Copper—The seventh section of the Arthur mill will be in operation in a few days. The third Mallet compound locomotive for the Bingham & Garfield R.R. is now in use, and 80 steel ore cars are expected to arrive in a few days, each of 60-ton capacity. More equipment will be purchased as soon as a greater tonnage can be mined.

Summit County

Park City shipments for the week ended Dec. 30 amounted to 2,840,975 lb.; for the week ended Jan. 6, to 2,570,200 lb. The shipments for December totaled 9118 tons. The Daly West shipped 2931 tons; Silver King Coalition, 2898; Daly-Judge, 2233; Ontario lease, 585; New York, 171; Grasselli Chemical Co., 163; Silver King Consolidated, 83; Little Bell, 34; Charles Moore, 20 tons.

Silver King Consolidated—New ore has been cut in drifting from a raise 60 ft. above the 1550 level. The ore is a carbonate, running well in lead and silver. What is thought to be the same orebody has been reached from lower workings at a point about 60 or 70 ft. distant.

Tooele County

Cliff—Ore has been followed 40 ft. at the bottom of the incline from the lower tunnel. An electric hoist was recently installed here. Drifting was done in two directions from the bottom of the incline in shipping ore. This property is the chief producer in the Ophir district at present.

Lion Hill Consolidated—At a meeting, Jan. 6, it was arranged to provide $2000 per month for the coming 15 months. This money will be obtained from the sale of treasury stock, and used for development. The stock of the Lion Hill Mining & Milling Co. can be exchanged for that of the Lion Hill Consolidated, after October, 1912. Development work will be done chiefly from the East Side tunnel to reach the Chloride Point vein. During 1911, eight cars of ore were shipped, bringing in about $16,000.

Washington County

Bull Valley—This property, 35 miles west of St. George, has been bought by Provo men. There are four claims, covering a contact vein between limestone and porphyry, on which good gold assays have been obtained. Development will be started soon.

Washington

Yankee Boy—The tunnel on this property in Ferry County is being extended and the company is preparing for more extensive operations. J. M. Snow, Republic, is in charge.

Blue Star—This property in Stevens County has been leased to Tom Tomstad, of Chewelah, who will work the mine on a larger scale in the spring.

United Copper—Some good ore has been encountered at this mine averaging $100 per ton. The new machinery recently installed is now in operation and steady shipments are being made. Conrad Wolff, Spokane, is manager.

Golden Eagle—A body of rich ore has been encountered at this mine near Blewett, Chelan County. F. G. Ernest is general manager.

Wisconsin

Zinc-Lead District

Frontier—This company is moving the Hoosier mill to the Sedgewick property, and has commenced sinking a shaft on the Hird land, near Benton.

Vinegar Hill—The company is assembling the Empress and Wicklow roasters at the Wilkinson spur, near Benton, and will later add the Murphy roaster, making a three-kiln equipment for treating ores from its properties.

Mineral Point Zinc Co.—Kennedy mill No. 2, at Hazel Green, was totally destroyed by fire on Dec. 18. The fire originated from an electric spark.

Joplin Separating Co.—The plant, at Galena, that was destroyed by fire last year, has been rebuilt with concrete and steel and with an enlarged capacity.

Coker—This mine, at Livingstone, has rebuilt its plant that was destroyed by fire last August. This is one of the oldest and largest producers in the northern end of the field, and employs 14 rock drills.

Canada

British Columbia

British Columbia Copper—During the fiscal year ended Nov. 30, the company produced 9,969,926 lb. copper; 130,441 oz. silver and 30,742 oz. gold as compared with 7,143,456 lb. copper, 84,180 oz. silver and 24,962 oz. gold the previous year. During the early part of the year the cost was under 9½c. per lb. of copper. This was later increased by the coal strike.

Consolidated Mining & Smelting—It is reported that the company has bonded the Tiger group of claims, at Ainsworth, for $18,000. During the last year the company bonded several properties, including the Hudson Bay group at Deer Creek and the No. 1 at Ainsworth.

Ontario

Union Natural Gas Co. Ltd.—A charter has been granted to this company, capitalized at $3,000,000, to take over the business and franchises of the Volcanic Oil & Gas Co., Ltd.; the United Fuel Supply Co., Ltd., and the Ridgetown Fuel Supply Co., Ltd. The franchises cover a wide area in the western portion of Ontario. The provisional directors are A. S. Rogers, C. E. Calvert, D. E. Coste, S. L. McKay, F. E. Ogden, P. A. Little and Louis E. Willett.

Ontario-Cobalt

Nipissing—On vein 73 a raise completed from the 250-ft. level shows 82 ft. of ore, averaging 3 in. wide and assaying 2500 oz. per ton. To the east a raise has been made from the 250-ft. level and the vein found to be 5 in. wide of 2000-oz. ore. On the 250-ft. level the drift on the main orebody is 190 ft. long on a 3-in. vein assaying from 2000 to 2500 oz.

per ton. Operations on No. 100 vein show 3 in. of 3000-oz. ore at the 200-ft. level. Four veins worked through the Fourth-of-July shaft show a combined length of 405 ft. at the 200-ft. level.

Temiskaming—A car of ore comprising 31.3 tons shipped from this mine yielded 200,723 oz. of silver, estimated to be worth $110,397. It was taken from the 500-ft. level and is claimed to be the richest car of ore ever sent out from the camp.

Green-Meehan—At the annual meeting in Toronto on Jan. 12, the shareholders authorized the sale of the property for $150,000. The payments of this amount are to be extended over a period of six years.

La Rose—A deep-mining policy has been approved of by the directors for the main property. The winze put down from the 250-ft. level has reached a depth of 120 ft., where a station is being cut for development work. The winze will be sunk 100 ft. lower, giving the mine a total depth of 470 ft., at which level extensive crosscutting and drifting will be undertaken.

Coniagas — The company is opening new territory with good results and has encountered several promising veins at the 75-ft. level. At the eastern end of the property the winze put down from the 225-ft. level is 40 ft. deep in good ore all the way. While mine ore still furnishes over half the production, the mill is treating 186 tons per day of 36-oz. ore, at a cost of only 8.8c. per ounce.

ONTARIO-PORCUPINE

Standard—A new vein carrying free gold is reported to have been discovered.

McIntyre—This property has been shut down temporarily owing to a break in the compressor. A 28-ft. vein of mineralized schist and quartz has been opened in a crosscut from No. 1 shaft at the 200-ft. level.

Hughes—The main vein has been crosscut at a depth of 50 ft. and shows good assays.

Pearl Lake—The company has ordered new equipment of sufficient capacity to carry on underground operations to a depth of 1000 feet.

Dome Lake—A small plant will be installed on this property.

Crown Chartered—The Davidson shaft is being sunk to the 200-ft. level.

Preston-East Dome—The Preston claim has reverted to the original owners, on account of the last payment not having been made.

Dome—Another 12-drill, electrically driven compressor is to be installed. W. W. Mein has been appointed consulting engineer of the property and is now engaged in thoroughly sampling it. The steel work of the mill is finished and the latter will be inclosed soon. Four diamond drills are working.

Imperial—Several small quartz veins, all carrying visible gold, have been encountered in a crosscut at the 100-ft. level.

ONTARIO—SUDBURY

Murry—This mine, together with other conveniently situated properties, is under option to a strong Canadian company, which has arranged for further development work by drilling. As this company will probably use the most of its output, it is expected to increase its holdings as fast as possible. Its advent should mean much for the future of the district.

Mt. Nickel—The mine which has been actively developed during the last year, by the Nickel Alloys Co., of New York, has shown up a large body of ore and it is reported that this mine together with the Trillabella and several more is under option to this company.

Canadian Copper Co.—The company has announced that the 8-hr. day will be adopted for all men working in the mines and the 9-hr. day for surface men. No reduction in wages will be made on account of the shorter hours.

Mexico

CHIHUAHUA

Paul Ginther, of Santa Rosalia, who has organized a syndicate to take over a number of mines in the Parral and other districts, announces that he and his associates will install a large reduction mill and cyanide plant at Minas Nuevas, Chihuahua, and will also construct an aërial tram to connect the San Patricio mine with the proposed mill.

Perros Bravos—Shipments to the smeltery average about 1000 tons per month. About 200 men are employed, but the number is expected to be increased. The property is owned by the Pittsburgh Mining Co., but is under lease to P. B. Butler, who is the manager.

Nicolas Bravo—It is reported that a producer-gas plant will be installed on this property soon, as well as a new hoist. C. Delgado is in charge.

El Rico—The stockholders of this company will meet soon, to outline a campaign of operations for the coming year, and to elect officers. Manuel E. Flores is president.

La Princesa—This property is said to be shipping from three to four cars a week to the smeltery in Chihuahua. Over 100 men are employed, under the management of W. J. Wallace.

Mexican Mines—Driving the tunnel is going forward with three shifts. It is expected to encounter the orebodies in February. E. J. Earnest is in charge.

MEXICO

El Oro—During December the mill crushed 31,030 tons of ore, yielding $206,610 gross and net $80,430. Working expenses were $112,910; development, $13,270; permanent improvement, $10,000; total profit, $86,930.

SAN LUIS POTOSI

Tiro General—The mine, which was taken over several months ago by the American Smelting & Refining Co., is being put in shape to double the output of zinc ore, which will be shipped to the American Smelting & Refining Co.'s smelteries at Aguascalientes and Matehuala. Recently a large force of peons were put to work widening the roadbed, preparatory to changing the present narrow-gauge road to standard gauge, thus eliminating ore transfer at Los Charcos, 12 miles from the mine. T. M. Hamilton is superintendent, and Leighton Stewart, mining engineer.

SONORA

Rich pay gravel is reported to have been found in La Cañada and Baboyohui rivers, about 40 miles southeast of Navojoa. Some excitement has been caused and prospectors are going in.

TEPIC

El Frontal—This property is situated east of the town of Rosamorada, about six hours' horseback ride from the railroad line, and is owned by a company of Cincinnati, Ohio. A body of ore, 7 ft. wide, was struck last month, in a crosscut 250 ft. below the tunnel level. The mill and cyanide plant, erected two years ago, but not started for lack of sufficient tonnage, are being put in shape and will commence operations in February. The company also owns La Cucaraha prospect near the Southern Pacific R.R. station, Yago. There are a number of old Spanish workings on this property.

Minitas—This property, near Rosamorada, is steadily keeping up development work. The flow of water has been controlled by the installation of a pumping plant. According to records, this company was once a large producer. The company's representative, H. J. Thomas, of Ray, Ariz., was on the ground during December and acquired some claims from I. J. Hall, situated in the neighborhood of the town of Acaponeta, near El Tigre mine, which has been shipping high-grade gold ore to San Francisco for the last two years.

Central America

COSTA RICA

A report from London indicates that an English company has purchased the lands belonging to the Valle del Condoto, and will exploit the platinum and gold deposits.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Jan. 17—Extremely cold weather still prevails over a large part of the country, with resulting activity in the demand for domestic coal. Steam coal requirements also seem to be improving. At the same time the trade has been subject to delays in transportation due to the weather, so that supplies at the larger distributing points are rather short, and there have been some temporary advances in price at several points. This is felt both in the West and in the seaboard trade. Anthracite trade is active for weather reasons. The coastwise trade has been in trouble owing to stormy weather, and rates are unusually high.

The general convention of the United Mine Workers met at Indianapolis, Jan. 15. Two or three days will be occupied in settling the claims of contesting delegations. The actual business of the convention has not been reached at the time of writing.

To bring the Lehigh Valley safely within that clause of the interstate commerce law providing that no railroad company shall have any interest in articles of commerce which it transports, the directors took action Jan. 11 to separate the coal-producing interests from the railroad's. For this purpose there is to be created the Lehigh Valley Sales Co. This concern will exist under a New Jersey charter and have an authorized capital stock of $10,000,000, of which $6,060,800 will be issued forthwith. Stockholders of the Lehigh Valley R.R. Co. will have the right to subscribe for this new stock pro rata at par, but they are not obliged to do so, and a banking syndicate will take any of the stock left. The directors also declared a special cash dividend of 10 per cent., which may be applied to payment for the new stock, or it may be drawn in cash. The Lehigh Valley and its controlled coal company will make a contract with the Lehigh Valley Coal Sales Co. by which the latter will buy at an agreed price all coal which the Lehigh Valley properties turn out. The new company will then own the coal transported, will pay the freight to the railroad and have all to do with the marketing of the coal. Between the Lehigh Valley R.R. and the new sales company there will be absolutely no legal connection.

Anthracite Shipments—Shipments of anthracite in December were 6,115,427 tons. For the full year the shipments by companies were, in long tons:

	1910	1911	Changes
Reading....	12,445,733	13,265,758	I. 820,025
Lehigh Valley....	11,195,765	12,603,000	I. 1,407,235
N. J. Central......	8,519,135	9,218,802	I. 699,667
Lackawanna......	9,589,076	9,869,620	I. 280,544
Del. & Hudson....	6,578,356	7,206,731	I. 628,375
Pennsylvania	6,250,976	6,494,733	I. 243,757
Erie..	7,554,198	8,800,179	I. 1,245,981
N. Y., Ont. & West.	2,772,547	2,495,476	D. 277,071
Total...	64,905,786	69,954,299	I. 5,048,513

The total increase in 1911 over 1910 was 7.8 per cent. Only one company showed a decrease. The shipments in 1911 were the largest on record. Of the total washery coal was 3,847,585 tons, or 5.5 per cent. of the total.

IRON TRADE REVIEW

New York, Jan. 17—The iron and steel markets continue active, and a large business has been done; perhaps not quite up to some of the highly optimistic predictions made in December, but quite enough to put the trade on a better footing than it has held for some time past.

In finished materials there is a steady demand for nearly all lines. Railroad orders for rails are being placed on a fair scale and a large tonnage is already booked. Orders for cars are coming in again, after a short period of quiet. Structural steel orders are also larger than they were.

Prices have an upward tendency, but actual advances have been small. There is still plenty of competition; and besides many sellers realize that any sharp advance would be a serious check to the present buying movement.

Pig iron is rather more active. Eastern steelmakers have contracted for a good tonnage of basic and for some bessemer pig. Foundry iron is in good remand, and prices are a shade firmer. Southern furnaces are less aggressive, though they are still on the lookout for business.

It is reported that several independent interests are planning to build large steel works at some point not far from Cleveland. The leaders in this movement are the Ohio Iron & Steel Co., of Lowellville, and Corrigan, McKinney & Co., of Cleveland. The last named company had planned to build steel works in connection with its present blast furnaces; but these plans may be merged with the larger undertaking. The reported combination will control a large body of Lake Superior ores.

The unfinished orders on the books of the Steel Corporation on Dec. 31 are reported at 5,084,761 tons. This is 942,806 tons more than on Nov. 30, and is the largest total reported since Mar. 31, 1910, when the total was 5,402,514 tons.

It is announced that the United States Steel Corporation has bought the plant of the Baltimore Bridge Co., Baltimore, and will establish a large warehouse which will be made an assembling base for export shipments for all products. The present fabricating business will be continued, but the importance of the transaction lies in giving the leading interest increased facilities for serving its export market from a favorable shipping point.

Pig Iron Production—The reports of the blast furnaces, as collected and published by the *Iron Age* show that on Jan. 1 there were 214 coke and anthracite stacks in blast, having a total daily capacity of 67,650 tons; an increase of 1050 tons over the Dec. 1 report.

Baltimore

Jan. 15—Exports for the week included 6,030,560 lb. steel rails and 760,071 lb. rail joints to Cuba. Imports included 13,165 tons iron ore from Cuba.

Birmingham

Jan. 15—Southern manufacturers of pig iron have been selling a little iron right along and are demanding a better price for the product. While the volume of business so far transacted this month has not been nearly as great as it was during the previous two months, the quotations have been firmer, very little iron being sold as low as $10 per ton, No.2 foundry. There have been several lots of iron sold in this section of the country during the present month, though many of them in two or three carlots, 100 to 200 tons, at a price equal to $10.50. There is a steady delivery of iron going on while the melt in the home territory has started out well. The make is off considerably; not only are there two furnaces out of blast, but furnaces which have been in active operation for some time have not been doing as well as heretofore. It is figured that the reduced production is likely to be felt for several weeks. However, two furnaces are about ready to blow in right now, while within the next 60 days two others will be in readiness.

Announcement is made that considerable iron has been sold into the export trade, the Tennessee and the Republic companies selling between 20,000 and 30,000 tons for delivery in England and Austria.

First-quarter iron is selling at $10@10.25, while for the first half of the year, furnace companies are asking $10.50. There is hope expressed that the accumulated stock of iron will have been entirely sold off by the end of the first half of the year.

Cast-iron pipe is in good demand and the make in the Southern territory is to be increased shortly. No change in steel is reported. The steel plants, with the exception of the rolling mills, which are turning out fabricated steel, have not yet struck their usual gait.

Scrap iron is quiet. Charcoal iron is about holding its own, orders being received from time to time. Charcoal iron is selling at $22@22.50 per ton.

Chicago

Jan. 15—Considered as a whole, the market as yet shows no striking changes. There is, however, a general strengthening both of demand and conditions, which promises better conditions in the near future. The demand for pig iron has increased, from founders; they are willing to contract more liberally for the future and they hesitate less on purchases for the needs of the next few months; the tendency is to buy for prospective demands more generally and farther into the future. Southern No. 2 pig iron is selling at $10.50, Birmingham or $14.85, Chicago, while Northern No. 2 holds to $14 minimum at the local furnaces, though much iron is selling at 25 or 50c. more.

The tendency of foundry melters, who constitute the large buying element in this market, is to contract more largely for their supplies, to be delivered up to at least six months hence, and in some cases up to the end of the third quarter. The furnace agents, however, take the bull side of the market and are not inclined to future deliveries except at higher premiums than the melters are willing to pay. The market therefore resolves itself into a program of close watching, the selling element demanding advances over current quotations. which are for delivery in the next three months, and the buying element looking for its chance to contract largely before the upward change of prices shall become decided. There have been very few sales of pig iron above 500 tons and the sale of more than 1000 tons is a rarity. In times past this market has registered as much as 50,000 tons a month; it is doubtful if it now registers 30,000 as an average of the last few weeks.

Iron and steel products, such as structural material, bars, plates and sheets, show a general increase since the first of the year, with the local bar makers strong since Pittsburg bars have been held to 1.20c., Pittsburg, which means 1.38c., Chicago. The structural market shows a number of contracts for buildings in the West and Southwest and the sales of track and general railroad supplies, despite the unfavorable weather conditions, have been fair. The outlook, on the whole, is encouraging, though no one line is booming.

Cleveland

Jan. 15—Some inquiries are being made about ore prices, and it is said that there is to be a conference on this point very soon. Shipments from ore docks to furnaces in December were 773,503 tons.

Pig Iron—A number of large inquiries are out and some good sales are reported. Quotations are $15.15 for bessemer, $13.25 for No. 2 foundry and $12.50 for forge; all Cleveland delivery.

Finished Material—New business is moderate, but specifications on contracts are heavy. Prices are a shade firmer. Negotiations are said to be going on for a large tonnage of billets for shipment to Germany, to run over three years.

Philadelphia

Jan. 16—Rather a good business has been done in pig iron, especially in basic, while there has been more call for bessemer than we usually hear in the East. Pennsylvania furnaces seem generally full and are not on the hunt for business. No. 2 X has changed hands at $15, and basic at $14.25, delivered. Forge is about $14.25. A sale of standard low-phosphorus iron is reported at $19.25 per ton.

Steel Billets—More business is on, especially for forging billets. Prices are firmer

Bars—Iron bars can still be had for 1.25c. and steel bars for 1.30c. A fair business is on hand.

Sheets—Mills are now well fixed for the next month or two, and are not making concessions.

Plates—Business has not been as heavy as expected, and 1.30c. rules, though 1.35c. is asked by some mills.

Pipes and Tubes—Pipes are quiet; tubes a little stronger on fair demand.

Structural Steel—No big orders have come up, but a better quantity of small work.

Scrap—Sales are improving and dealers are inclined to sit tight and hold for good prices.

Pittsburg

Jan. 16—The finished steel market has been very quiet since the first of the year, and particularly so in the past week. There has been very little new business placed, while specifications have been barely equal to current production with the mills faring best, and have been considerably below current production with the mills not faring so well. These conditions have caused a decided chill in some quarters, and sentiment is not nearly as strong as it was in such quarters. In other quarters, however, it is pointed out that a lull at this time was expected, on account of inventory and other annual adjustments; besides the weather throughout the North has been extremely cold, practically stopping outside operations in most sections, so that great activity by way of specifying could not reasonably be expected.

The slackness in business has not affected prices in this territory on bars, plates and shapes, which are still firmly maintained on the basis of 1.15c., Pittsburg, with some mills holding out for 1.20c., or refusing to book beyond Apr. 1 at 1.15c. The mills are well filled with specifications in these lines, and can easily stand a month or more of quietness without having their operations interfered with. In hoops there has been a little cutting, one or two mills quoting 1.25c. on prompt specifications against 1.30c. usually held. In sheets there is reported a little shading and there are predictions in some quarters that competition will grow keener in this branch. In the Chicago district there is keener competition in steel bars, and 1.25c., Chicago, is still done freely, with occasional shading from this figure, which represents 1.07c., Pittsburg.

The Carnegie Steel Co. has blown in about half a dozen blast furnaces since late in December, but has not started the Columbus furnaces and steel plant as was expected. It is possible the plant will be started about the beginning of February.

The Connellsville coke market has been very much excited, production having been insufficient since the middle of December, owing largely to the celebration of so many holidays by the foreign workmen, the last being the Greek New Year this week. Prompt furnace coke has been selling at $1.85@2 the past week, against $1.50 in November, and is hard to get at any price. Contract coke is also stiffer, and the lowest that can be done is $1.80, while some operators are holding out for $2. To the difficulty of a short supply of labor has been added the cold weather of the past 10 days, making operations more difficult and interfering with the movement.

Pig Iron—Foundry and malleable iron have grown stronger, though not quotably higher. A sale of 1000 tons of standard malleable is reported at $13, Valley, for delivery over first half, and a sale of 1000 tons of car-wheel iron for about the same delivery at $12.45, Valley, this being iron 1.50 to 2 per cent. manganese and a little over 1 per cent. silicon. While sales on attractive orders for foundry iron have been made at the old price of $13, Valley, several sales have been made in the past few days at $13.25, Valley. Bessemer and basic have been relatively quiet. We quote: Bessemer, $14.25; basic, $12.35@12.50; No. 2 foundry, $13@13.25; malleable, $12.75@13; gray forge, $12,50@12.75, all f.o.b. Valley furnaces, 90c. higher delivered to Pittsburg.

Ferromanganese—The ferromanganese market is firm at the new price, though not active, and we quote prompt and forward at $41, Baltimore.

Steel—The steel market has been quiet as to actual transactions, but the mills are very well sold up and are adhering closely to regular prices. We quote bessemer and openhearth billets at $20, Pittsburg, and sheet bars at $21, with rods at $24.50@25, Pittsburg.

Sheets—While specifications have been coming in at a fair rate for sheets, new business has been light and some of the mills with not much business ahead are reported as likely to shade prices on good business. We quote regular prices at 1.90c. for black, 28 gage; 2.90c. for galvanized, 28 gage, 1.40c. for blue annealed, 10 gage; $1.33 per square for painted, and $2.47 for galvanized corrugated roofing.

St. Louis

Jan. 15—A number of foundries which have been on slow time or closed down temporarily for the holidays and which had been intending to open up full blast have postponed it owing to the weather which has been about 20 deg. below zero for the past week. Business has been only fair during the week, running mostly to small orders though some fair-sized inquiries have been received. The current quotation is $10.50 Birmingham or $14.25 St. Louis for No. 2 foundry. The prospects for the future are quite bright as the railroads have been buying a quantity of supplies and a large number of cars. The American Car & Foundry Co. is now running nearly full capacity at its steel-car plants and will probably be pushed to fill orders before long. In quiry for Northern iron has been light. Northern No. 2 is being quoted at $14.75@15.25 St. Louis.

Iron Ore Trade

It is announced that the Nova Scotia Steel Co. has contracted for 135,000 tons of iron ore from its mines at Wabana, Newfoundland, to be delivered at Philadelphia in 1912. It is also stated that the company has made contracts to deliver 225,000 tons to German furnaces. The yearly capacity of the Wabana mines is about 450,000 tons.

It is announced that the output of iron ore made by the Ponupo Manganese Co. this year, amounting to 150,000 to 175,000 tons, will be offered in the open market to Eastern furnaces. This is the first time any considerable quantity of Cuban ore has been sold in the open market; nearly all of it has been taken by the large steel companies controlling the mines.

Foreign Iron Trade

British Iron and Steel Quotations—For the first week of January business is reported active, and some quotations given may be of interest by way of comparison: East Coast hematite (bessemer) pig, $15.84; Cleveland basic and foundry, $12.18 per ton. For finished material: Steel shipplates, $33.60 per ton; iron plates, $31.20; steel angles, $33.60; iron bars, $33.60; all less 2½ per cent. discount. Steel rails were $27 per ton, net.

METAL MARKETS

New York, Jan. 17—The metal markets generally have been fairly active. Copper seems to have reached its highest point for the present and there is some tendency to reaction.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Nov. 1911..	$13,941,093	$ 3,458,321	Exp. $10,482,772
" 1910..	1,376,011	4,313,500	Imp. 2,937,489
Year 1911.	36,188,397	52,737,854	Imp. 16,549,457
" 1910..	57,444,422	54,245,886	Exp. 3,198,536
Silver:			
Nov. 1911..	5,052,238	3,338,956	Exp. 1,713,282
" 1910..	5,265,595	4,827,254	Exp. 438,341
Year 1911..	59,667,286	40,439,844	Exp. 19,227,442
" 1910..	51,299,913	41,479,718	Exp. 9,820,195

Exports from the port of New York, week ended Jan. 13: Gold, $1,32,147, principaly to Argentina; silver, $980,133, chiefly to London. Imports: Gold, $921,508; silver, $452,902, both chiefly from Mexico and South America.

Gold—The price of gold on the open market in London continued at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Outside of moderate demands for Egypt, India and Argentina, most of the supplies arriving went to the Bank of England.

Gold production in the Transvaal in December is reported by cable at 709,908 oz. This makes for the year 1911 a total of 8,237,723 oz., or $170,273,734, which compares with $155,730,260 in 1910; showing a gain of $14,543,474 or 9.3 per cent.

Iridium—Prices remain without change, $64 per oz. being asked for pure metal.

Platinum—Trade is quiet and prices are unchanged. Dealers ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal.

Silver—Silver shows considerable strength, having advanced from 25 1/16d. during the holiday season to 25 3/16d. in London. At that price China has been a buyer for limited amounts.

SILVER AND STERLING EXCHANGE

Jan.	11	12	13	15	16	17
New York....	55¼	55⅜	55⅜	55¼	56	55¾
London......	25 7/16	25½	25½	25 9/16	25 11/16	25 11/16
Sterling Ex.	4.8700	4.8710	4.8685	4.8695	4.8685	4.8670

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

NEW YORK

Jan.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
11	14.30 @14.50	14.20 @14.30	41¼	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
12	14.30 @14.50	14.20 @14.30	41⅜	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
13	14.30 @14.50	14.20 @14.30	41½	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
15	14.30 @14.50	14.10 @14.15	43	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
16	14.30 @14.50	14.10 @14.15	42⅞	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
17	14.30 @14.50	14.10 @14.15	42⅜	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Jan.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
11	63 7/16	64 3/16	67½	187	183½	15 7/16	26¾
12	62⅝	63⅜	67	184	182¼	15 9/16	26¾
13	......	...	......	......	......	.....	......
15	61⅞	62 9/16	66½	190	188½	15 9/16	26¾
16	62 11/16	63 7/16	66¾	189	186¾	15½	26¾
17	62 13/16	63 9/16	67	188¾	186½	15 7/16	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The sharp decline in the London standard market had a very unsettling effect on sentiment. Dealers who are in a position to conduct arbitrage business between London and New York were able to sell electrolytic at very much lower prices than had been quoted previously and retain sufficient margins against standard to enable covering in London at a good profit. European buyers did not purchase in this country because they could secure their supplies to so much better advantage by way of the London market. The sharp ups and downs in London, in which liquidation and speculative and arbitrage transactions played parts, had the natural effect of weakening confidence here, especially on the side of buyers. Consequently, offerings even at sharp concessions fell upon deaf ears and the business done with domestic consumers was of but small proportions. On the other hand, many of the producers, having previously sold largely and being now in a distinctly comfortable position, have had no need to press copper for sale and have maintained their former price at 14½c., delivered, usual terms, for electrolytic. This has become, however, merely a price asked, while business in considerable volume from second hands and some first hands has been done at distinctly lower prices. Business in Lake copper during the week, so far as can be ascertained, was insignificant. A few trifling lots fetched the top price from belated consumers, but in general the market for this kind of metal was merely nominal. The market closes at 14.30@14.50c., nominally, for Lake copper; while electrolytic copper in cakes, ingots and wirebars is at 14.10@14.15c. Casting is quoted nominally at 13⅞@14⅛c. as the average for the week.

The standard market, after breaking to £61 17s. 6d. for spot and £62 11s. 3d. for three months on Jan. 15, a decline of almost £2 10s. from the high point, rallied at the close to £62 16s. 3d. for spot, and £63 11s. 3d. for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 15¾c. base, carload lots at mill.

Copper exports from New York for the week were 4577 long tons. Our special correspondent gives the exports from Baltimore at 817 tons.

Visible stocks of copper in Europe on Jan. 15 are reported as follows: England, 41,620; France, 5240; Rotterdam, 5150; Hamburg, 8300; afloat from Chile, 1430; afloat from Australia, 7300; total, 69,040 long tons, or 154,649,600 lb. This is a decrease of 1640 tons as compared with the Dec. 31 report.

Tin—The movements in the London market during the period under review have been very erratic. During the second half of last week prices in London broke, at least so far as spot tin is concerned, to the extent of about £6 per ton. Selling out on part of the Syndicate was given as the reason for the decline. When this liquidation ceased at the beginning of this week, the market quickly recovered its previous decline, not alone for spot, but also for three months tin, which is now selling at a backwardation of only about £2 5s. per ton.

Consumers in this market took advantage of last week's lower prices by placing liberal orders for February-March deliveries, but refused to follow this week's advance and stopped their purchases. The market closes easy at £188 15s. for spot, and £186 10s. for three months in London, and in New York at 42⅜c. for January delivery.

Lead—The market is unchanged at 4.45c. New York, but there has been somewhat more business in Missouri brands and St. Louis prices are firmer at 4.32½@4.37½ cents.

The London market is barely steady, and closes at £15 18s. 9d. for Spanish lead, and £16 1s. 3d. for English.

Spelter—A moderate volume of business in this metal was done during the last week, chiefly for February and March delivery at prices ranging from 6.25 to 6.35c. Occasional carloads for immediate delivery continued to realize a premium. A noteworthy feature for the week was some sales for April and later delivery at a material discount from the current quotations. Quotations at the close are steady at 6.25@6.40c., St. Louis, and 6.40@6.55c., New York.

The London market is unchanged at £26 15s. for good ordinaries, and £27 for specials.

Zinc dust is quoted at 7⅜@7½c. per lb., New York.

Other Metals

Aluminum—Business continues fair, and the market is stronger both here and abroad. Quotations have advanced to 19@19½c. per lb. for No. 1 ingots, New York. Sales of foreign metal have been made at 12c. Ex. duty.

Antimony—Business is again inclined to be quiet. Cookson's is quoted a little lower, at 7½@7¾c. per lb.; Hallett's remains at 7⅜@7⅝c., while 6¾@7c. is named for Hungarian, Chinese and other outside brands.

Quicksilver—The market is rather quiet and prices are unchanged. The New York quotation is $43 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $42.50 per flask for domestic business and $40 for export. London price is £8 per flask, with the same figure quoted by jobbers.

Zinc and Lead Ore Markets

Platteville, Wis., Jan. 6—The base price paid this week for 60 per cent. zinc ore was $44@44.50. The base price paid for 80 per cent. lead ore was $58 per ton.

SHIPMENTS, WEEK ENDED JAN 6

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Galena	774,100		....
Mineral Point	724,080		....
Benton	402,100	. .	163,000
Platteville	306,000	66,000	.....
Hazel Green	304,000	....	.
Harker	142,630	....	. .
Cuba City	88,200	60,560	59,000
Total	2,741,110	126,560	222,000

Shipped during week to separating plants, 1,151,040 lb. zinc ore.

The total shipments from the district, as corrected by adding the last week of the year were: Zinc ore, 151,688,444 lb.; lead ore, 8,981,015 lb.; sulphur ore, 28,939,440 lb. The stock of zinc ore in bins at the close of the year was 11,000 tons, the largest accumulation ever recorded in this district.

The letter for Jan. 13, delayed in the mails until too late for full use, reports zinc ore base $44@44.50; lead ore, no sales. Shipments, 2,302,050 lb. zinc ore, 120,000 lb. lead ore and 132,000 lb. sulphur ore. Deliveries to concentrating plants, 1,094,000 lb. zinc ore.

Joplin, Mo., Jan. 13—The high price paid for zinc sulphide ore was $50, the base, per ton of 60 per cent. zinc, was $44@47. Zinc silicate had no market this week, the small shipment being a previous purchase. The average price, all grades of zinc, was $44.32. The high price of lead ore was $61, with the average for all grades at $60 per ton.

All local stockholders of the Webb City smeltery have disposed of their stock, supposedly to the American Metal Co.; but there are many rumors afloat to the effect that the American Metal Co. has purchased the entire Picher Lead Co. properties, and that the Picher company has secured control of the Webb City smeltery. There is no question that the

SHIPMENTS, WEEK ENDED JAN. 13

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	2,184,160	. ....	621,710	$67,830
Joplin	1,449,000	......	51,870	34,258
Duenweg	890,820	......	67,400	22,065
Alba-Neck	557,270	......	......	12,678
Galena	251,440	......	120,730	9,260
Miami	63,920	......	143,600	5,210
Granby	77,280	155,410	1,450	3,880
Carl Junction	150,820	......	......	3,620
Jackson	116,900	......	......	2,630
Oronogo	72,940	......	......	1,121
Totals	5,814,550	155,410	1,006,760	$162,552

2 weeks . 14,996,320 428,290 2,130,610 $398,821
Blende val., the week, $130,044; 2 weeks, $329,168
Calamine, the week, 2,270; 2 weeks, 6,182
Lead value, the week, $30,238; 2 weeks, $63,471

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January....	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February..	40.69	40.21	39.47	39.16	53.64	54.46
March. ..	43.60	39.85	39.71	38.45	51.26	54.57
April...	41.00	38.88	39.33	37.47	49.72	56.37
May....	40.19	38.25	37.51	36.79	48.16	55.21
June..... ...	40.20	40.50	37.83	38.18	48.80	56.49
July.. . .	39.63	40.75	36.80	38.36	48.59	58.81
August . .	40.13	42.50	37.32	41.28	49.75	60.74
September .	43.45	42.63	39.96	41.29	54.73	59.33
October... .	43.31	42.38	40.50	40.89	53.18	54.72
November..	47.20	45.40	43.20	43.25	54.80	57.19
December	42.50	44.13	40.70	40.76	55.70	62.03
Year.	$42.43	$41.45	$39.79	$39.90	$52.12	$56.76

NOTE: Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

American company is in control, nor that frequent conferences are being held between representatives of the interested parties, but what it portends cannot be conjectured.

New Caledonia Ores

Exports of ores from New Caledonia 10 months ended Oct. 31 are reported by the *Bulletin du Commerce* of Noumea at 89,163 metric tons nickel ore and 32,760 tons chrome ore. Exports of metals were 1264 tons nickel matte and 675 tons copper matte.

Chemicals

New York, Jan. 17—The general market is in a little better condition and more activity is developing.

Copper Sulphate—Demand is quite active. Spot requirements are mainly covered, and dealers look for some advance. So far, quotations are unchanged at $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Arsenic—Trade has been active, but supplies seem about equal to demand. Prices are firm at $2.37½@2.50 per 100 lb. for white arsenic.

Nitrate of Soda—Business is rather quiet and prices unchanged at 2.20c. per lb. for both spot and futures.

Messrs. W. Montgomery & Co. write from London, Jan. 10, as follows: "In reviewing the trade of the past six months we have to note a falling off in deliveries in Europe of 8000 tons, and to this extent reducing the advantage of 53,000 tons gained during the first six months of the year. Thus the European consumption for the 12 months ended amounts to 1,696,000 tons, against 1,651,000 in 1910, an increase of 45,000 tons, or 2¾ per cent. The United States, on the other hand, for the last six months shows an increase to the extent of 15,000 tons, the figures being 229,000 tons, against 214,000, while those for the 12 months, at 550,000 tons, compare with 510,000, an increase of 49,000, or 10 per cent. Other parts for the 12 months show an increase of 16 per cent., the figures being 103,000 tons, against 89,000 tons for 1910. Thus the world's consumption for 1911 amounts to 2,349,000 tons, against 2,241,000 in 1910, an increase of 4.82 per cent. . . .

"Production for the last 12 months (estimating that for December at 4,900,000 quintals) amounted to 54,880,000 quintals, which compares with 53,596,000, an increase of 1,284,000, or 58,000 tons, while shipments to all parts for the 12 months were 2,406,000 tons, against 2,300,000, or an increase of 106,000 tons. From these figures it is noticeable that the increase in production has been slowing down. . . . Stock in Chile is today 10,400,000 quintals, against 9,909,000 a year ago. Stock in Europe today amounts to 479,000 tons, against 314,000 12 months ago."

Petroleum

Exports of mineral oils from the United States for the year ended Dec. 31 are reported at 1,395,095,440 gal. in 1910, and 1,622,644,920 gal, in 1911; increase 227,549,480 gal. or 16.3 per cent.

The *Oil City Derrick* reports new wells completed in December as follows: New York, Pennsylvania and West Virginia, 380; Lima-Indiana, 39; Kentucky, 9; Illinois, 108; total, 536, having an aggregate production of 6535 bbl. daily.

MINING STOCKS

New York, Jan. 17—On Thursday, Jan. 11, the general market was slow and inclined to be reactionary. On the Curb dealings were small, and copper stocks generally lost a little. Cobalts also declined slightly, but Porcupines were firm.

On Jan. 12, the anthracite-coal road stocks were the chief feature on the Exchange, and other stocks were slow. On the Curb mining stocks were rather neglected and weak. Dealings were started in Lehigh Valley Coal Sales Co. "when issued," sales have been made between 185 and 210, for about 1000 shares.

On Jan. 13 the market was slow and narrow, both on the Exchange and the Curb.

On Jan. 15 strength developed on the Exchange, but on moderate trading; price movements were rather narrow, but the tendency was upward. On the Curb trading in mining stocks was more active, and there were fractional advances, especially in the copper stocks.

On Jan. 16 there was some activity again and good advances in the anthracite stocks on the Exchange; industrials were generally slow and with few changes. On the Curb trading in mining stocks was fair and some of the coppers advanced, but only by small fractions. On Jan. 17 the course of the markets was much the same, and changes were small.

Boston, Jan. 16—It has been a period of profit taking in mining shares during the week. The work has been largely one of professional operations. Today, however, saw a better list of prices but practically only in the Lake Superior issues.

The recent strike in the Mayflower is now followed by news that the Hancock has cut a good lode at a depth of 3218 ft. This brought buying which caused Hancock to advance $5 to $34.75. Centennial also spurted $2.25 to $20.25. Both Mayflower and Old Colony prices have yielded after the first knowledge of rich drill cores in the first named.

Elm River, which has been reorganized into the Contact Copper Co., took a new lease of life marketwise, upon the decision to extend the time for depositing the stock until Jan. 31, with the stipulation that interest should be charged from July 1, 1910. Trinity moved up with First National, the latter being a Curb issue. President Lawson of these companies has circularized stockholders

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	October	Nov.	Dec.
Alaska shipments.	2,704,802	1,274,655	4,995,008
Anaconda	21,400,000	20,850,000	....
Arizona, Ltd.	2,720,000	2,960,000	3,100,000
Balaklala	....	....	....
Copper Queen	7,786,218	6,946,775	....
Calumet & Ariz.	4,784,000	4,390,000	4,486,000
Detroit	2,086,624	1,941,498	....
East Butte	920,000	983,405	....
Mammoth	1,865,846	1,793,181	....
Miami	....	....	2,500,000
Nevada Con.	6,547,931	5,207,983	....
Old Dominion	2,050,000	2,082,000	2,610,000
Roy	2,069,287	2,517,000	2,660,000
Shannon	1,124,000	1,256,000	....
South Utah	326,578	361,681	267,514
United Verde*	2,750,000	2,500,000	....
Utah Copper Co.	8,660,729	9,117,961	....
Lake Superior*	18,440,000	18,600,000	17,500,000
Non-rep. mines*	13,564,713	11,483,000	....
Total production.	98,800,728	94,265,139	....
Imports, bars, etc.	22,960,027	17,224,725	....
Total blister	121,760,755	111,489,864	....
Imp. in ore & matte	4,137,431	4,767,217	....
Total	125,898,186	116,257,081	....
Brit. Col. Cos.:			
British Col. Copper	778,586	....	....
Granby	....	....	....
Mexican Cos.:			
Boleo	1,245,440	....	2,645,640
Cananea	5,804,000	....	3,706,000
Moctezuma	1,719,643	1,682,768	....
Other Foreign:			
Cape Cop., S. Africa	....	857,920	....
Spassky, Russia	672,000	685,440	....
Famatina, Argen.	....	174,720	....
Exports from:			
Chile	4,816,000	4,704,000	5,824,000
Australia	7,056,000	7,168,000	11,200,000

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,557	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,654,312	61,655,561	71,460,619
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233

VISIBLE STOCKS

	United States	Europe	Total
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191 228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

to the effect that a new copper extraction process has been devised to cope with the smoke-nuisance difficulties of the California smelters.

Prices on the Curb show a general hardening tendency.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1 00
Alta, Nev	Jan. 26	Feb. 16	0.05
Andes, Nev	Feb. 7	Feb. 28	0 05
Belcher, Nev	Jan. 3	Jan. 24	0 10
Black Jack, Utah	Feb. 6	....	0 01
Boston Ely, Nev	Jan. 18	....	0 50
Bruns. C. V. M., Nev	Jan. 12	Feb. 2	0.02
Bullion, Nev	Jan. 12	Jan. 29	0 05
Chollar, Nev	Jan. 3	Jan. 26	0 10
Confidence, Nev	Jan. 16	Feb. 6	0 20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Con. Virginia, Nev	Dec. 16	Jan. 6	0 25
Federal Ely, Nev	Jan. 5	Jan. 27	0 01
Fetish, Ida	Jan. 5	Jan. 23	0 001½
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0.05
Hancock Con., Mich	Jan. 10	....	1.00
Kentuck Con., Nev	Jan. 9	Jan. 26	0.05
Ojibway, Mich	Jan. 10	....	1 00
Raven, Mont	Feb. 1	....	0.10
Seven Troughs Mon., Nev	Jan. 10	Jan. 31	0.002½
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz	Jan. 15	....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea Con., Utah	Jan. 17	Feb. 8	0 015
Tintic Standard, Utah	Jan. 8	Feb. 5	0 00
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York 1909.	New York 1910.	New York 1911.	London 1909.	London 1910.	London 1911.
January	51 750	52.375	53 795	23.843	24 154	24 865
February	51 472	51.534	52 222	23.706	23 794	24 081
March	50 468	51.454	52 745	23.227	23 690	24 324
April	51.428	53.221	53 325	23 708	24 483	24 595
May	52.905	53.870	53.308	24 343	24 797	24 583
June	52.538	53.462	53 043	24 166	24.651	24 486
July	51.043	54.150	52 630	23.519	25 034	24 286
August	51.125	52.912	52 171	23 588	24 428	24 082
September	51 440	53.295	52 440	23 743	24.567	24 209
October	50 923	55.490	53.340	23 502	25 596	24.594
November	50.703	55 635	55.719	23.351	25 680	25.649
December	52.226	54.428	54.905	24.030	25.160	25 349
Total	51.502	53.486	53.304	23.706	24.670	24.592

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York, Electrolytic 1910.	New York, Electrolytic 1911.	New York, Lake 1910.	New York, Lake 1911.	London, Standard 1910.	London, Standard 1911.
January	13 620	12 295	13 870	12 680	60 923	55.600
February	13 332	12 256	13 719	12 611	59 388	54 974
March	13 255	12 139	13 586	12.447	59 214	54 704
April	12 733	12 019	13 091	12 275	57 238	54 034
May	12 550	11 989	12 885	12 214	56 313	54 313
June	12 404	12 385	12 798	12 611	55 310	56 365
July	12 215	12 463	12 570	12 720	54 194	56 673
August	12 490	12 405	12 715	12 634	55 733	56 266
September	12 379	12 201	12 668	12 508	55 207	55 253
October	12 553	12 189	12 788	12.370	56 722	55 170
November	12 742	12 616	12 914	12.769	57 634	57 253
December	12 581	13 552	12 863	13 768	56 769	62 068
Year	12 738	12 376	13.039	12 634	57 054	55 973

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910	1911	Month	1910	1911
January	[illegible]	41 255	July	32 695	42 400
February	[illegible]	41 614	August	[illegible]	43 319
March	[illegible]	40 137	September	[illegible]	39 755
April	[illegible]	[illegible]	October	36 190	41 185
May	[illegible] 125	43 115	November	36 547	43 125
June	[illegible]	[illegible]	December	38 199	44 655
			Av. Year	[illegible]	[illegible]

Prices are in cents per pound

LEAD

Month	New York 1910.	New York 1911.	St. Louis 1910.	St. Louis 1911.	London 1910.	London 1911.
January	4 700	4 483	4 582	4 334	13 650	13 009
February	4 613	4 440	4 445	4 266	13 328	13 043
March	4 459	4 394	4 307	4 238	13 003	13 122
April	4 376	4 412	4 225	4 262	12 641	12.889
May	4.315	4 373	4 164	4.223	12.550	12 984
June	4 343	4 435	4 207	4 292	12 688	13.260
July	4 404	4 499	4 291	4 397	12 531	13 530
August	4 400	4 500	4 290	4 406	12 513	14 260
September	4 400	4 485	4 289	4 356	12 582	14 744
October	4 400	4 265	4 271	4 139	13 091	15 332
November	4 442	4 298	4 314	4 181	13 217	15.821
December	4 500	4 450	4 363	4 332	13 197	15.648
Year	4.446	4.420	4.312	4 286	12 920	13.970

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York 1910.	New York 1911.	St. Louis 1910.	St. Louis 1911.	London 1910.	London 1911.
January	6.101	5 452	5 951	5 302	23 350	23.887
February	5.569	5 518	5.419	5 368	23 188	23 276
March	5 637	5 563	5 487	5 413	23 031	23 016
April	5 439	5 399	5 289	5.249	22 469	23 743
May	5 191	5 348	5 041	5.198	22 100	24.375
June	5 128	5 520	4 978	5 370	22.094	24 612
July	5 152	5 695	5.002	5 545	22 406	25 006
August	5 279	5 953	5 129	5 803	22.800	26 801
September	5 514	5 869	5 364	5 719	23.165	27 750
October	5 628	6.102	5.478	5.951	23.900	27.256
November	5 976	6.380	5 826	6.223	24 083	26.795
December	5 624	6.301	5 474	6.151	24 019	26.849
Year	5 520	5.758	5 370	5.608	23.050	25 281

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer 1910	Bessemer 1911	Basic 1910	Basic 1911	No. 2 Foundry 1910	No. 2 Foundry 1911
January	$19.90	$15 90	$17.98	$14.40	$17.94	$14 75
February	18.96	15 90	17.21	14 50	17.38	14.81
March	18 53	15.90	16.93	14 65	17.00	14.96
April	18 28	15 90	16 84	14 65	16.75	15 00
May	17.10	15.90	15.94	14 30	16 18	14.72
June	16.52	15 90	15 60	14 06	15.53	14.56
July	16.40	15 90	15 40	14 03	15.40	14 53
August	16.09	15 90	14.89	14 00	15.16	14 47
September	15.92	15 90	14.73	13 57	14 93	14 40
October	15.90	15.43	14.05	13.44	14.88	14.34
November	15 84	14.92	14 26	13.30	14 78	14 25
December	15.90	15.15	14 15	13.10	14 65	13.90
Year	$17 10	$15.72	$15 65	$13.94	$15 83	$14.49

STOCK QUOTATIONS

COLO. SPRINGS Jan. 16

Name of Comp.	Bid.
Acacia	05
Cripple Cr'k Con.	02¼
C K & N	17
Doctor Jack Pot	06½
Elkton Con	69
El Paso	.75
Findlay	05¾
Gold Dollar	17
Gold Sovereign	.02⅞
Isabella	17½
Jack Pot	06½
Jennie Sample	.06⅞
Lexington	01¼
Moon Anchor	01
Old Gold	03
Mary McKinney	.53
Pharmacist	.02
Portland	91
Vindicator	69
Work	.03

SALT LAKE Jan. 16

Name of Comp.	Bid.
Beck Tunnel	.13
Black Jack	.09½
Carisa	‡ 17
Cedar Talisman	03
Colorado Mining	30½
Columbus Con	‡ 23
Daly-Judge	‡5 20
Grand Central	.70
Iron Blossom	1 02½
Little Bell	38
Lower Mammoth	.02½
Mason Valley	11 00
May Day	16
Nevada Hills	‡2 50
New York	‡ 07
Prince Con	78
Silver King Coal'n	1 65
Sioux Con	11
Uncle Sam	23
Yankee	‡ 24

TORONTO Jan. 16

Name of Comp.	Bid	Name of Comp.	Bid
Conlagas	‡6 50	Pearl Lake	21
Hudson Bay	‡80 00	Porcu. Gold	17½
Temiskaming	‡ 35	Porcu. Tisdale	03
Wettlaufer-Lor	76	Preston E. D.	06½
Apex	‡ 08	West Dome	10
Central	3 50	Standard	17
Dobie	70	Foley O'Brien	30
Dome Exten	38	Rea	1 50
Hollinger	12 15	Crown Chartered	12
Imperial	05	Swastika	24½

SAN FRANCISCO Jan. 16

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.02	Belmont	8 00
Belcher	60	Jim Butler	33
Best & Belcher	5	MacNamara	.26
Caledonia	1 45	Midway	22
Challenge Con	14	Mont.-Tonopah	1.00
Chollar	19	North Star	.30
Confidence	55	West End Con	.72
Con. Virginia	88	Atlanta	.18
Crown Point	60	Booth	06
Gould & Curry	04	C.O.D. Con	12
Hale & Norcross	17	Comb. Frac	13
Mexican	4 12½	Jumbo Extension	22
Occidental	50	Pitts.-Silver Peak	1 30
Ophir	1 47½	Silver Pick	.06
Overman	1 10	St. Ives	.30
Potosi	10	Tramps Con	.01
Savage	16	Argonaut	2 50
Sierra Nevada	27	Bunker Hill	‡3 00
Union Con	1 22½	Cent. Eureka	40
Yellow Jacket	45	So. Eureka	‡6.00

N. Y. EXCH. Jan. 16

Name of Comp.	Clg.
Amalgamated	65⅛
Am. Agri. Chem.	60¾
Am.Sm.&Ref.,com	71⅛
Am. Sm.&Ref., pf.	103
Am. Sm. Sec., pf. B	87
Anaconda	36
Batopilas Min	1½
BethlehemSteelpf	61⅜
Chino	25½
Federal M.&S., pf.	37
Goldfield Con	4¼
Great Nor., ore ctf.	40
Homestake	87
Miami Copper	24
Nat'nalLead,com.	53
National Lead, pf.	105⅞
Nev. Consol	19¼
Pittsburg Coal, pf	81½
Ray Con	17⅞
RepublicI&S.com	25½
Republic I & S. pf.	85
SlossSheffi'd,com.	40
Sloss Sheffield, pf	‡108¼
Tennessee Copper	‡38
Utah Copper	56⅜
U. S. Steel, com.	66¾
U. S. Steel, pf.	110⅞
Va. Car. Chem	53⅜

N. Y. CURB Jan. 16

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	42
Braden Copper	5⅝
B. C. Copper	4
Buffalo Mines	‡1 50
Butte & Vipond	53
Butte Coalition	22⅜
Cobalt Central	‡.01
Con. Ariz. Sm.	⅜
Davis-Daly	⅞
Diam'field-Daisy	13
Ely Con	[illegible]
Florence	.61
Giroux	4 9/16
Gold Hill Con	‡
Greene Cananea	8½
Greenwater	06
Guggen. Exp.	180
Inspiration	10¼
Internat. S. & R	‡124
Kerr Lake	‡2¾
La Rose	‡3¾
McKinley-Dar-Sa.	‡1⅝
Min. Co. of A. new	‡4
Nev. Utah M. & S	‡⅛
Nipissing Mines	6¼
Ohio Copper	1
Pacific Sm. & M.	
Porcupine T'nsite	47
Precious Metals	‡1⅜
Ray Central	1⅞
Red Warrior	‡1½
South Utah M. & S	[illegible]
Standard Oil (Old)	625
Stand'd Oil of N. J.	370
Stand'd Oil Subs.	325
Stewart	90
Tonopah	6⅞
Tonopah Ex.	1[illegible]
Tri-Bullion	‡½
Tularosa	‡½
Yukon Gold	3⅜

LONDON Jan. 17

Name of Com.	Clg.
Camp Bird	£1 11s 6d
Dolores	1 10 0
El Oro	0 17 3
Esperanza	2 8 9
Mexico Mines	7 15 0
Oroville	0 4 9
Stratton's Ind.	0 3 1½
Tomboy	1 3 9

BOSTON EXCH. Jan. 16

Name of Comp.	Clg.
Adventure	6
Algomah	4¼
Allouez	42
Am. Zinc	35¾
Ariz. Com., ctfs.	3½
Bonanza	45
Boston & Corbin	9
Butte & Balak	4¼
Calumet & Ariz	61½
Calumet & Hecla	442
Centennial	19¼
Con. Mercur	05
Copper Range	54
Daly West	5½
East Butte	12⅝
Franklin	12
Granby	38
Hancock	34¾
Hedley Gold	17
Helvetia	1¼
Indiana	12½
Island Cr'k, com.	41
Isle Royale	21¾
Keweenaw	1½
Lake	36½
La Salle	5
Live Oak	40½
Mass	8¼
Michigan	3
Mohawk	56⅞
New Arcadian	4
New Idria Quick.	7⅝
North Butte	27
North Lake	6
Ojibway	6¼
Old Dominion	47
Osceola	109
Parrot	13¼
Quincy	75½
Shannon	10
Shattuck-Ariz.	18
Superior	27½
Superior & Bost.	4 1/16
Tamarack	30
Trinity	6⅜
Tuolumne	3⅝
U. S. Smelting	34⅝
U. S. Smelt'g. pf.	48
Utah Apex	3
Utah Con	16
Victoria	4½
Winona	5¾
Wolverine	99
Wyandot	2½

BOSTON CURB Jan. 16

Name of Comp.	Last
Ahmeek	235
Bingham Mines	2⅞
Boston Ely	86
Boswyocolo	09
Cactus	15
Calaveras	1 9/16
Chief Cons	68
Corbin	3
Cortez	1¼
Crown Reserve	2½
First Nat. Cop.	2¼
Majestic	43
Mazatan	90
Moneta Porc.	16
Nat'l Mine & Ex.	‡ 12
Nevada-Douglas	2⅝
New Baltic	5½
Oneco	2 9/16
Raven Copper	.27
Rhode Island Coal	.46
San Antonio	‡3¼
South Lake	5¾
Trethewey	55
Union Mines	‡¼
United Verde Ext.	.70
Vulture	‡5¾

‡Last quotation

The Engineering and Mining Journal

Vol. 93. JANUARY 27, 1912. No. 4.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T McKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Enginjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9300 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE

Editorials:

The Proposed Steel Tariff........ 199
American Institute of Mining Engineers 199
Porcupine 200
Mining Dividends in 1911...... .. 200
Chispas Cyanide Plant, Sonora.... 200
By the Way......................... 201
The Canadian Mining Institute..... 202
Spelter Production of the World.... 202
New Alaskan Placer Law Proposed.. 202
Whale Oil for Dynamite Glycerin... 202

Correspondence and Discussion:

Research Work in Technical Schools....Government Aid to Mining....Gold Discoveries on the Rand....Taxation of Mineral Rights in Michigan....President Taft at the Homestake....Where is Tantalum Found?........... 203

Details of Practical Mining:

*Forging Anchor Bolts.... *Lighting Trough for Drafting Tables....Electric Hoist for Shaft Sinking....*Shaft Station in Inclined Foot Wall Shaft.... Neutralizing Towers at the Ashio Smeltery, Japan....*A New Design of Undercurrent Grizzly.... Wire Screens for Stair Treads ....*Heating Attachment for Concrete Mixers....*A Simplified Challenge Feeder....*Safety Appliances in Mines............ 205
*Iron River District, Michigan. P. B. McDonald 210
New Application of Tungsten and Molybdenum 211
Indian Currency.................... 212
Tariff Legislation........ 213
The Antelope Mine, in Southern Rhodesia 213
Recovery of Gold in Dredging. Charles Janin 214
*Chispas Cyanide Plant, Sonora. Edward L. Dufourcq 215
Tungsten in Australia............ 220
Suggestions to Mining Students..... 220
The Yellow Jacket Mine, Idaho. G. L. Sheldon 221
Beneficiating Lake Iron Ores. Dwight E. Woodbridge 222
American Institute of Mining Engineers 223
*First Aid to Mining Machinery—VI. Henry M. Lane 224
*Concentration of Molybdenite Ores. Henry E. Wood 227
Parting Platinum Silver Alloys...... 228
Wrought Iron Production. Bradley Stoughton 229
Famatina Development Corporation. 230
Patents 231
Personal, Obituary and Societies.... 232
Editorial Correspondence........... 233
Mining News...................... 235
Markets 241

*Illustrated.

The Proposed Steel Tariff

The new tariff bill, to be introduced next week in the House of Representatives at Washington, proposes to make important reductions in the duties levied on iron and steel. It meets Mr. Carnegie's doleful predictions as to approaching scarcity of raw material by putting iron ore on the free list, thus at once reducing the cost of Cuban iron ores by 12c. and of all other foreign ores by 15c. a ton; removing the barriers to that extent from the use by our furnaces of the supplies of ore from Newfoundland, Venezuela and Brazil, which are accessible to them. On pig iron the duty is to be cut to 10 per cent.; on rails to 10 per cent.; on most rolled-steel products to about 15, and the more advanced steel products to about 20 per cent.

It is hardly of advantage to go yet into a discussion of the detailed schedules of a bill which is still in the formative stage, and in which material changes may be made before it reaches or even approaches the stage of enactment. The most that can be said is that it proposes a material reduction of duties on the whole iron and steel schedule. The reduced duties, however, appear in most cases to be equal, or more than equal, to the differences between our own current quotations and those that have lately reached us from the British and German markets.

One feature of the proposed bill is that all the duties are plain *ad valorem* charges; there is none of the confusing mixture of specific and *ad valorem* duties which make the present steel schedules complicated and hard to understand. It is to be hoped that some simple plan will be adhered to, whatever changes may be made in the bill. It does not appear likely that the new schedules, if they become law, would induce any great increase in imports, though they might serve as a check on the advance of home prices.

As to the prospects of the bill, it appears altogether probable that it will pass the House of Representatives with few or no important modifications. In the Senate and with the President it will meet with different conditions, and it is not easy to make any forecast as to the result.

American Institute of Mining Engineers

The meeting of the Institute that is to be held in New York next month will doubtless prove to be of great importance in its history. It is the annual meeting and to be decided at it are some radical constitutional changes, among these being the proposals to alter the name of the organization to "American Institute of Mining and Metallurgy," to classify the members by introducing the new grade of "junior members," and to raise the dues of corporate members, i.e., the great body, to $15 per annum, plus $5 extra for those residing within 50 miles of New York.

Certain of these proposals have drawn out expressions of widely differing opinion, especially the matter of dues, and there promises to be some warm discussion at the meeting, which is likely to be no merely perfunctory affair. The election of officers for 1912 is also to take place at this meeting.

The council of the Institute and the committee of arrangements are planning to make the forthcoming meeting a noteworthy event in other respects. It is hoped that it will inspire a reawakening of the old spirit that made the Institute great and will rejuvenate its usefulness, for which President Kirchhoff has been loyally and efficiently working during the last year. The Institute has a grand history and a valuable tradition, but in order that it may live up to them there must be a general participation in its affairs by its members. The first step toward such a participation will be a large attendance at the forthcoming meeting, and the next will be a frank discussion of the affairs of the organization. It is to be hoped that both may be witnessed next month.

Porcupine

The recent relinquishment of an option by a Porcupine company and the closing down of another property in the same camp, are not surprising, and may be taken to mark a certain period in the history of the camp. A year ago, Porcupine was unquestionably in the limelight. While it is true that some exploration had been done there previous to that time, it is also true that the camp did not receive the general attention of mining men until the winter of 1910-1911. The spectacular showings in evidence then at many widespread points resulted in the raising of property prices to an unwarranted level and with an accompanying time limit for exploration work which was unjust to both buyer and seller and entirely out of keeping with the conditions of work imposed by nature and the general inaccessibility of the region. A direct result of this was the impossibility of making as thorough examinations as most engineers desired. The indirect result was that properties were hurriedly acquired and companies organized and financed overnight.

Developments have now reached a point where many of the first options on properties are expiring. It is probable that many of these will not be renewed. Further, it is likely that many companies have expended the funds originally raised for exploration, and now face new financing. While it is probable that some mines will be developed, it is certain that there will be many disappointments. For its own good, it is to be hoped that Porcupine will rapidly come into its own—a period of sound, rational development.

Mining Dividends in 1911

The year 1911 was not looked upon as a prosperous one by many persons, yet an examination of mining-dividend statistics in the United States seems to show a better state of affairs than would be assumed from current conversations. Excluding certain semi-industrials, such as the great smelting companies, an examination of the mining companies of the United States which keep the public informed concerning their dividend payments reveals the following: Sixty-four leading mining companies paid dividends in 1910 and 1911, in the former year $50,887,261; in the latter, $52,601,858. There were 27 mining companies reporting to the JOURNAL which paid no dividends in 1910, but in 1911 paid $3,502,474. There are 23 companies reporting to the JOURNAL which paid $1,711,928 in 1910, and nothing in 1911.

As to arguments to be deduced from these figures, it would be impossible to draw absolute conclusions without knowing how much of each of these amounts was drawn from previously earned surpluses, and how much money was carried forward in each of the years under discussion to profit and loss by the companies concerned. Without going so far as this, however, and arguing only from the law of averages, we would say that the dividend figures showed a healthy state for the mining industry, and that if fault is to be found with conditions here, it is not with the operating mines and their results, but with lack of capital for financing new ventures, or perhaps that the net dividend growth does not keep proportionate pace with the growth of the population of the country.

Chispas Cyanide Plant, Sonora

The description of the Chispas mill in this issue of the JOURNAL is worthy of consideration, despite the fact that it refers to a plant of comparatively small capacity. On the whole, this mill embodies many of the features of modern practice and shows that local conditions were carefully considered in its design. The cyanide mill is called upon to treat the current and accumulated tailings from the concentrating plant, the ore being crushed by stamps in the latter mill. Because certain metals, subsequently removed by concentration, are cyanicides, the crushing is done in water, which departs from the present trend and recalls that in the younger days of cyaniding, this was the rule, although crushing in solution had its advocates in the early nineties.

In this connection it is interesting to note that crushing in solution was not introduced on the Rand until 1906, although it had been largely used previously in the United States, Mexico and Australia. Improved apparatus and better methods of handling pulp are largely responsible for the change, the older procedure only being necessary in special instances. Machinery improvements have likewise eliminated some of the disadvantages formerly urged against crushing in water. Dewatering devices provide simple and efficient means of preventing too great a dilution of the cyanide solution when finally applied, and with modern agitating equipment, unless the ore is highly refractory, no great loss by poorer extraction need result by postponing the addition of cyanide solution until after the removal of the cyanicides.

Since the Chispas slime is of a crystalline character comparatively free from clayey material, the type of filter chosen should give good results. The method for insuring quick filling of the filter with either pulp or wash solution is worthy of note. As in most of the new mills, zinc-dust precipitation is used. Two forms of zinc-dust feeder are being tried which should furnish some interesting data concerning this important part of the precipitation process.

In a recent number we noted the completion of railroad communication between important ore deposits in Texas and a shipping port on the coast. This week we note that two more supplies of iron ore have been opened to merchant furnaces in the East. One of the Cuban mining companies has offered ore in the open market, which is the first ore from that country which has not been taken by the large steel companies that control most of the mines. A more important incident is the offering of the first ore from the Imataca iron mines in Venezuela. This ore is of high grade, and from all accounts the deposit is very large and the mines capable of great expansion and development.

The testimony of James J. Farrell, president of the Steel Corporation, before the Stanley Committee, does not seem to have increased the fund of information much more than that of Mr. Carnegie. It was largely a statement of individual opinion rather than of any new or illuminating facts. The main point of interest, perhaps, is in noting how Mr. Farrell, as active and responsible head of the corporation, differs from Mr. Carnegie, whose interest in the steel business has for years been merely academic. The difference is very much that between the actor and the spectator.

By The Way

That protean genius, alternately Cassandra and Gentle Shepherd of Woolly Lambs, the considerably well known Mr. Thomas Lawson, of Bawson, has not hesitated to look into the future of financial possibility, remarks the *Evening Sun.* It is unnecessary for us to report via the *Sun* what he saw.

To the common expression, "Nothing is certain except death and taxes," there might well be added, "and suits against the Anaconda company." The most recent one has just been instituted by G. J. Kohl to prove title to a one-third interest in the May claim, from which it is asserted that $3,000,000 worth of ore has been extracted.

Manager Robbins' long-looked for report on the Hollinger mine was to have been out "yesterday," says the *Montreal Star* of Jan. 16, but will be held back until the Messrs. Timmins and the other directors go to Porcupine to receive it. They leave Montreal on Thursday night, Jan. 16. The date of this writing is Jan. 23, and echo answers "when?"

The Greene-Cananea dividend of 25c. per share, payable Mar. 1, 1912, will be most welcome to the shareholders who have been holding on during the long period of fasting. It has been a long trip across the desert, and though numerous waterholes were encountered, the stockholders have at last reached an oasis where a more substantial diet is offered.

John Ferrell, a rescue worker of the Bureau of Mines, was killed, on Jan. 19, while exploring a mine in which a fire was raging at Cherry Valley, Penn. The conditions in the mine, says a Washington dispatch, have so far made it impossible to recover Ferrell's body. It is stated that at the mine disaster at Briceville, Tenn., a few weeks ago, Ferrell rescued five men. A later dispatch announces the finding of Ferrel's body two miles from the entrance to the mine. He left a widow and a son.

A San Francisco dispatch states that "Clarence Mackay, of New York, is planning to raise an endowment fund of $1,000,000 for the University of Nevada. It is proposed to raise the sum by subscription among the heirs of John W. Mackay, James Flood, James Fair, James O'Brien and others who dug wealth from the Comstock mines in the early days. Clarence Mackay and Ogden Mills, son of the late D. O. Mills, are to confer regarding the endowment fund in New York soon. Among those who will aid the plan are Mrs. William K. Vanderbilt, Jr., formerly Virginia Fair, and James Flood, of San Francisco."

Another "chicken-crop" gold rush has been precipitated in Manitoba according to a dispatch from Winnipeg. After finding gold in the crops of fowls killed near Minitonas, the stores of the town are reported to have been closed while their proprietors joined in the rush, and over 600 claims are stated to have been staked. Those states that are endeavoring to stir up a revival of mining should get "hep" to this idea and start a poultry farm. Each prospector might then be supplied with a Brown Leghorn with whom he can discuss geological and attrition problems. Suggestion respectfully referred to the Denver Chamber of Commerce and the Grubstake Committee.

In his annual report, Robert S. Sharp, chief inspector of the Post Office Department makes the following interesting disclosures: "The work of the last year has uncovered a condition among the swindling class which shows the astounding extent of their operations and the enormous amount of their ill-gotten gains. As shown elsewhere, only the few swindling promoters who were arrested last year obtained approximately $77,000,000. * * * * The policy of the Department in attempting first to crush out the strong and powerful criminals who have grown rich at the game has proved exceedingly effective in eliminating the smaller ones." During the fiscal year, 522 individuals were indicted on charges of using the mails to defraud, 196 persons were tried and 184 were convicted. It is interesting to note that in grouping the schemes under which these convictions were obtained the inspector places first in the list: "The promotion and sale of worthless mining or other stocks." It would be still more interesting to know what proportion of those $77,000,000 is traceable to mining frauds.

Up in the Lake Superior gold country, it appears that a lot of simple people are wasting their time digging out of the earth iron ore that is worth only a few dollars per ton, while from statements in the Duluth *Herald,* we note that it is claimed that one of the shafts on the Vermilion range has rock at the bottom that "assays over $210 in gold per ton." To quote further: "More than 150 assays of this rock hitherto made by various assayers have shown an average of $22 a ton in gold and $7 in silver. This ore is being stockpiled. The shaft to reach the iron orebody is being sunk through the gold and silver ore. . . . . The directors and officers of the company were reelected." What in the name of Midas are the shareholders doing? Have they been holding the sack so long that they have acquired the habit? Think of stockpiling $29 ore, while your hard-earned dollars are being poured forth to sink an expensive shaft to encounter a $4 or $5 orebody that you haven't yet seen, and of which you have only had a sort of whiff or *soupçon,* or whatever it is that these French chefs put in their highly flavored soups. To be sure the United States Steel Corporation stupidly continues to devote its entire attention to iron ore, but then it is able to raise some, whereas the company in question is only sinking to encounter the iron formation and engaging in various other commercial enterprises, while it is reported to have $29 ore lying around idle and going to stockpile. Moreover, this is a small and, one might think, mobile corporation, while the Steel Corporation, though it has a fairly competent and experienced department of exploration, has the disadvantage of the complex and cumbersome machinery of a "trust" and presumably will not be able to change its iron-mining policy until after the next annual meeting. But it does seem as though some enterprising Porcupiner might go up and "develop" the Lake Superior gold field.

Besides electing John P. White, of Iowa, as president of the United Mine Workers of America, the annual convention in Indianapolis last week voted to reject a resolution committing the organization to the Socialist party by a vote of 515 to 155. It approved, however, the substitute measure of the resolutions committee declaring "it would be well if the workers would unite on the political as well as the industrial field." This, it appears, was merely an entering wedge of the socialist element to secure later the amendment to permit the organization to indorse a political party. During the same week, the British coal miners were voting on a resolution to strike if the demand for a fixed minimum wage were not granted on Mar. 1, 445,801 voting in favor of a strike and 115,921 against. A struggle beginning Apr. 1 between the coal miners and operators in this country is quite within the range of possibilities.

The craze for free assay stations, to be conducted by the government, the duty of which will be "to analyze or assay rocks or mineral-bearing substances sent to them, and to furnish, at a nominal charge, a complete statement of the results to the one sending the same," recalls to our mind the experience of a certain Western mining school which, under its annual appropriation from the state, was required to do this. An enterprising, but unprincipled, assayer of the state advertised that he would make assays and render bills according to a certain schedule of charges. The data of his schedule need not here be repeated. It is sufficient to mention that they were materially below the commonly charged rates. The enterprising, but unprincipled, assayer sent the samples to the state mining school, where they were done for him for nothing, or perhaps at a nominal charge. The enterprising, but unprincipled, assayer rendered his own bills at the rate advertised. Our memory does not enable us to state how this scandal was checked.

The Canadian Mining Institute

Notice is given that the fourteenth annual general meeting will be held at Ottawa, March 6, 7 and 8. Headquarters will be at the New Russell House.

The provisional program of papers for this meeting is as follows:

"The Gold Fields of Nova Scotia," by T. A. Rickard, London, England.

"The Domes of Nova Scotia," by T. A. Rickard, London, England.

"The Occurrence and Mining of Platinum in the Urals," by Dr. A. L. Simon, London, England.

"Mining in Russia" (illustrated by lantern slides), by Dr. A. L. Simon.

(Title to be announced.) J. D. Kendall, London.

(Title to be announced.) J. Parke Channing, New York.

"Monel Metal," by Dr. W. Campbell, New York.

"Recent Improvements and Additions at the Canadian Copper Company's Works, Copper Cliff, Ont.," by David H. Browne, Copper Cliff, Ont.

"The Evans-Stansfield Electric Furnace" (with practical demonstrations), by J. W. Evans, Belleville, Ont.

"Concentration of Silver Ores, with Special Reference to those of the Cobalt District," by Prof. Robt. H. Richards, Boston, Mass.

"Concentration of Silver-Lead Ores in British Columbia," by S. S. Fowler, Nelson, B. C.

"The Decrease in Value of Ore Shoots with Depth," by F. L. Garrison, Philadelphia.

"Artificial Ventilation in Metal Mines," by Frank C. Loring, Toronto.

"The Origin of the Quartz Veins of the Cobalt District," by Dr. A. E. Barlow, Montreal.

"The Development of Fine Grinding in the Treatment of Gold Ores," by Henry Hanson, Porcupine, Ont.

"Methods of Sampling in the Porcupine District," by G. C. Bateman, Porcupine, Ont.

"Economic Geology of the Porcupine District," by A. G. Burrows, Toronto, Ont.

"The Evolution of the Mining and Milling of Asbestos," by John J. Penhale, Sherbrooke, Quebec.

"The Ore and Coal-bearing Formations of the Yukon," by D. D. Cairnes, Ottawa.

"The Copper Mine Country" (illustrated by lantern slides), by J. B. Tyrrell, Toronto.

"The Fallacy of the Anticlinal Theory of Petroleum Deposits," by Eugene Coste, Toronto.

"The Occurrence of Manganese at New Ross in Nova Scotia," by H. E. Kramm, Ithaca, N. Y.

"Glaciation, and its Effect on Mineral Veins" (illustrated by lantern slides), by J. B. Tyrrell, Toronto.

"The Coal-bearing Formation of the Nanaimo District, B. C.," by C. H. Clapp, Ottawa.

"Pitching Coal Seams," by Alexander Sharp, Vancouver, B. C.

"The Development of a Coal Prospect," by Wm. Hutchison, Hillcrest, Alberta.

"International Coal Competition," by Allan Greenwell, London.

"A New Departure in Mining Education," by H. G. Carmichael, Sudbury, Ont.

"Safety Appliances for Prevention of Accidents in Mines," by Dr. W. H. Tolman, New York.

(Title to be announced.) Frederic Keffer, Greenwood, B. C.

"Some Geological Principles Relating to Iron Ore Exploration," by Dr. C. K. Leith, Madison, Wis.

"The Pilgrims of Early Mining on the Columbia River, British Columbia," by Frank L. Nason, West Haven, Conn.

"Company Law," by J. M. Clark, K. C., Toronto.

Other papers have also been promised, the titles of which will be announced later.

Spelter Production of the World

The world's production of spelter is estimated by Messrs. Henry R. Merton & Co., of London, as in the accompanying table. These estimates have been sent out by the Merton house for a number of years, and are generally very close to the later official figures, long familiarity with the trade having enabled them to attain remarkable accuracy. The figures are in long tons, of 2240 lb. each.

WORLD'S PRODUCTION OF SPELTER

	1909	1910	1911
Belgium	164,470	169,860	192,020
Holland	19,240	20,645	22,375
Germany, East	137,490	138,040	153,715
Germany, West	79,125	86,120	92,735
Great Britain	58,415	62,085	65,900
France and Spain	55,235	58,210	63,210
Austria and Italy	12,440	13,095	13,705
Poland	7,820	8,495	9,500
Total Europe	534,235	556,550	613,160
Australia		500	1,000
United States	236,660	246,680	263,260
Total, long tons	770,895	803,730	877,420
Total, metric tons	783,229	816,690	891,459

The total increase in 1911 over 1910 was 73,690 tons, or 9.2 per cent.; over 1909 it was 106,525 tons, or 13.8 per cent. In 1911 all the producing countries showed increases over the previous year, the larger gains being in Belgium, Germany and the United States. Since 1902 the gain in zinc production has been nearly continuous, 1908 having been the only year showing a smaller production than the preceding one. The increase in 1911 over 1902 was 340,660 tons, or 63.5 per cent. The demand for zinc seems to have kept pace fully with the production. The average price in London for 1911 was the highest in 10 years, with one exception, 1906. This average price, which was £22 3s. per ton in 1909, increased to £23 in 1910, and to £25 3s. 2d. last year.

New Alaskan Placer Law Proposed

WASHINGTON CORRESPONDENCE

Delegate Wickersham has offered a bill to modify and amend the mining laws in their application to the territory of Alaska. The main provision of the bill is as follows:

> That no association placer-mining claim shall hereafter be located in Alaska in excess of 40 acres, and on every placer-mining claim hereafter located in Alaska, until a patent has been issued, not less than $100 worth of labor shall be performed or improvements made during each year, including the year of location, for each 20 acres or fraction thereof. . . .
>
> That no person shall hereafter locate any placer-mining claim in Alaska as attorney for another unless he is duly authorized by a written power of attorney, duly acknowledged and recorded in any recorder's office in the judicial division where the location is made. Any person so authorized may locate placer-mining claims under such power of attorney for not more than two principals or associations, but no such agent or attorney shall be permitted to locate more than two placer-mining claims for any one principal or association during any calendar month, and no placer-mining claim shall hereafter be located in Alaska except under the provisions of this act. No person shall hereafter locate, or cause to be located, for himself more than two placer-mining claims in any calendar month: Provided, that one or both of such locations may be included in an association claim.

Whale Oil for Dynamite Glycerin

The setback which the South African explosives' industry recently received at the hands of the inspector of explosives of the Union government has at last been removed, states the *Mining Journal*. It is reported that the government chemist has proved, or has admitted that the local whale oil contains nothing which would render it unsuitable for the manufacture of dynamite glycerin. The glycerin plant of Messrs. Kynoch, Ltd., at Durban, had to be closed down in consequence of the refusal of the government to sanction the use of glycerin made from whale oil. In connection with the whaling industry it is rumored that it is the intention of the Union government to enforce a five years' close season for whale fishing.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Research Work in Technical Schools

Under the title of "Coöperation in Research Work," several articles have recently been published in the JOURNAL in which the subject of research work in technical educational institutions have been discussed. These and a pamphlet on "The Futility of Technical Schools," recently distributed by the late R. T. Crane, offer an opportunity to comment on the systems of education now in vogue at most American technical training institutions.

Mr. Crane undoubtedly was over-bitter in his denunciation of such schools. I believe it is the general consensus of opinion that the systems of training engineers can be greatly improved, but that they do not deserve the stigma that Mr. Crane would cast upon them. He offered no explanation of why the systems are unsatisfactory, or it might better be said, inefficient. He suggests no better way of training an engineer than making him serve a long apprenticeship in shops, or mines where it must be acknowledged those who are in a position to teach are too busy to do so.

The function of the technical school is to teach the students the fundamentals of their professions. Certainly that is not the function of large industrial institutions. One would naturally suppose that if the schools fail in their purpose that there is something in the educational system that needs correction. Mr. Crane's chief complaint seemed to be that few graduates of a technical school were fit to step in and fill a position. In no branch of their profession had they become proficient enough to take up some line of work without at first undergoing a period of apprenticeship under their first employer.

The first position that a graduate of a mining school is most apt to find is that of surveyor or assayer. Knowing this then, why should not the schools equip their graduates with enough training in either or both these branches so that they could take such positions upon graduation with at least a small fund of experience? The young engineer, well trained as a surveyor or assayer, could then fill his position with more satisfaction to his employer. I do not mean that the schools should produce only surveyors and assayers, but that they should give the students sufficient training in these branches to enable them to make a living. It is while holding such positions that most young engineers are brought first in contact with the work they have chosen to make their life profession. Their technical training should enable them to learn enough by observation to fill minor positions that would bring them in closer contact with the other branches of work such as the actual operations of mining, drilling or running a blast furnace, as the case may be.

In one of our mining schools of high rank the course in surveying is excellent and just falls short of equipping its students to fill a position as mine surveyor. On the other hand, the course in assaying is a waste of time to the average student. This course comprises making 30 or 40 determinations of silver and gold by fire assay, a few determinations of tin, and a smattering of other work such as mint methods. The students make assays in duplicate of one sample at a time and half a dozen men use the same furnace. The course drags through a half year, laboratory work being done only on alternate weeks. At the end of the course the student makes determinations on ten different samples of ore, all run at the same time.

Such a course gives the student a fair idea of the principles of the methods used and the variations that must be made in assaying ores but it does not equip him with any facility in manipulation, the importance of which receives little attention from his instructors. Such a student will naturally be overwhelmed if his first job consists in running 30 or 50 samples in triplicate the first day he goes to work.

To properly train a student in assaying he should receive personal instruction at the start, and at once be taught the ways of assaying as he will find them in a mine or smeltery assay office. It is this lack of personal instruction that makes most college assaying courses futile. The student certainly does not receive the training he should, and the reason often is that the instructors and teachers are too much absorbed in research work to devote the time necessary for the proper amount of personal instruction to each individual. Many of the instructors value their position chiefly because of the opportunities it creates for research work.

It is my contention that if efficiently prepared men for the engineering professions are to be graduated from the technical schools, the business of the professors and instructors should be to teach the students the fundamentals of mining and give them special training in one subject so that they are competent to hold a position in that line. If attention be devoted to such instruction there will be little time for research work. Such work could be delegated with advantage to the students, to post-graduate courses only, or better yet, to a special department, the teachers confining themselves to teaching the students and not dividing their attention between teaching and research work.

The average student from such an institution would be better equipped to serve his first employer and would I believe, stand better chances of rapid promotion and increasing responsibility than one who had received as little personal instruction as is now given in some of the technical schools.

AN ASSAYER.

New York, Jan. 21, 1912.

Government Aid to Mining

The editorial, "Government Aid to Mining," in the JOURNAL of Jan. 13, 1912, I have read with interest, as it voices the opinions of the real mining men of Colorado.

There is, and has been in existence for many years at Denver, a testing plant, one of the most complete of its kind in the world, and, from my own experience, I can say that in it can be determined the proper methods of treatment of 99% of the ores of Colorado and the West. This plant is owned and maintained by Henry E. Wood, one of our reliable pioneer assayers and metallurgists.

The State School of Mines, at Golden, about 15 miles from Denver, has built and is equipping a modern steel and concrete building with facilities for making tests of all the most approved methods of ore treatment; original research is carried on continuously and the students are drilled in this work in the school course.

Now, if our "practical" men wish work done, they can do it here, but it costs money, and I think that they are trying to get something for nothing. Denver is the permanent home of more processes of ore treatment than any other place I know. Some of the processes that have been tested are "rotten," others have a ray of merit, and the best are those about which the least is said. They are being worked out by men trained in the science of metallurgy.

The trouble with Denver is that it is inflicted with some sensational newspapers and men that are ready to attack anything that they think will bring grist to their mill. This spirit has become, in a measure, epidemic here for the time being. For instance, one red-page sheet made some time ago a vicious attack on our State School of Mines; one of the greatest institutions of its kind in the world. The paper has a large circulation, as it feeds a "frenzied food" relished in this highly nervous climate—consequence—the School of Mines had an entrance of only 35 students in September, 1911. There could be written pages of such instances. The real mining men of Colorado are not crying for free this or that pabulum, but are still grinding away and working out their own particular problems.

J. A. Snedaker.

Denver, Colo., Jan. 19, 1912.

Gold Discoveries on the Rand

It is a little more than a year ago that the discovery of gold ore in a drill hole that was sunk on the Cyferfontein farm on the Rand occasioned much discussion as to whether or not the Main Reef Series extended that far to the southwest from the hitherto known gold-bearing area. Many arguments for and against accepting this discovery as indicating the presence of the series were aired, based mostly upon geological facts or conceptions. Many claims were staked and several companies were organized to carry on development work to determine at once if a gold-bearing member of the series did exist at the place and if it could be profitably worked.

Recently several of these companies passed out of existence without having found anything of value as a return for the money spent on exploration work. More drill holes were sunk during the year 1911, one of which was started close to the one from which the gold ore had been taken, but none of these holes intersected gold-bearing conglomerate. A shaft was sunk, which, it was calculated, would intersect the ore at a shallow depth, but after passing a considerable distance below the calculated depth no ore was found, and crosscuts driven into the country failed to reassure those who had placed so much upon the discovery of gold in one drill hole.

At the present time there is more excitement evident over the recent discoveries of high-grade ore in the vicinity of Witpoortje on the North Rand than was observable a year ago when the Cyferfontein find was first reported. The ore found at Witpoortje and Roodepoort is reported to assay as high as 58 oz. gold on the outcrop, and one prospector has already cleaned up a small fortune by hand crushing the surface ore while building up at the same time a dump of $7 ore. The vein seems to be workable over a width of 12 inches.

De Launay obtained samples of ore from this same vicinity which he, in his "Les Mines du Transvaal," states assayed from 20 to 120 oz. per ton, but that the vein from which they were taken petered out at a depth of about 60 ft. These veins or those in the same vicinity, but belonging to a lower horizon were prospected by the Comte de Waru, but without his coming to any conclusion, except that the rich veins were associated with a zone of dislocation, but it was never settled whether the gold existed by virtue of the proximity of the veins to fissures or whether the rich ore was characteristic of the upper portion of the sandstones and conglomerates, as is the case in the Witwatersrand formation. The failure of the Comte de Waru is principally responsible for the neglect of continuing work along the North Rand.

Whether these discoveries are of any value, of course, remains to be seen. Exploration may fail to show any workable extent of profitable ore, but it can be said that from what was previously known of the North Rand, the companies now forming to do exploratory work have a better grounded hope for success than characterized the similar flotations for work at Cyferfontein a year ago.

Prospector.

Johannesburg, Transvaal, Dec. 6, 1911.

Taxation of Mineral Rights in Michigan

In the Journal of Jan. 13, 1912, P. B. McDonald made a statement in reference to taxes at Ishpeming which is misleading. It has been stated that the Oliver Iron Mining Co.'s taxes were 40c. per ton on ore shipped last season, the Cleveland-Cliffs Iron Co., 26c. and the Jones & Laughlin, which is the Lake Angeline mine, 5c. per ton. I do not know how much per ton the Oliver and Cleveland-Cliffs companies are assessed on their ores in the mines, but I do know that the Lake Angeline is assessed over $1 per ton for all available ore in the property.

The Lake Angeline is working 3 eight-hour shifts and mining all the ore that it is possible to get out from this mine, whereas, the Oliver Iron Mining Co., at Ishpeming, is feehold property, working only small forces and then only four days a week. The Cleveland-Cliffs Iron Co. is not a consumer on a large scale, except for ore to be smelted in charcoal furnaces, and this being a dull season for selling ore, the company did not ship what was mined, but carried over large stock-piles. The mines were not worked to full capacity.

To show further the unreliability of Mr. McDonald's information, our tax for Lake Angeline was 7c. per ton on ore shipped. We shipped from the Lake Angeline mine, 167,258 tons, a portion of which was carried over from the previous year, shipping more than we mined; the remainder of 21,387 tons was shipped from the Mitchell mine, which is assessed in Tilden township. This was shipped as Lake Angeline ore, hence the injustice in the statement of computing the variation in taxes.

Thomas Walters,
Agent, Jones & Laughlin Ore Co.
Ishpeming, Mich., Jan. 18, 1912.

President Taft at the Homestake

I note in a paragraph in the "By the Way" columns of the Journal, of Oct. 28, 1911, that the recent visit to the Homestake underground workings was the first occasion of the President having been underground in a gold mine.

In the autumn of 1907, Mr. Taft, then Secretary of War, went through the workings of the Minnesota mine of the Benguet Consolidated company at Baguio, in the Philippine Islands. He then told me, while I was in charge of that property, that it was his first experience underground in a gold mine.

Of course, it would be presumptuous to make any comparison between the Minnesota mine and the great Homestake, which produces more ore daily than the Baguio mine did in a month, but the fact that it was at the time producing gold at a profit entitles it to the designation of a gold mine.

This correction may appear trivial, but as a statement of fact may be worthy of publication, as we engineers in the field have formed the habit of believing implicitly in the statements published in the Journal.

C. M. Eye.

Aroroy, Masbate Island, P. I., Dec. 13, 1911.

[We think that the Journal did not deviate from accuracy when it published the statement that the visit of Mr. Taft to the Homestake was the first time a President of the United States had been underground in a gold mine. It is interesting to learn, however, that while Secretary of War, Mr. Taft was underground in a Philippine gold mine.—Editor.]

Where Is Tantalum Found?

I would like to inquire through the columns of the Journal if there exist in the United States, either mines or prospects in which tantalum minerals occur in appreciable quantities. The only records of the production of tantalum minerals that I have been able to find, refer to some work done in an amblygonite mine at Keystone, S. D., which, for a short time, produced a small quantity of tantalum, but which, I understand, is not now being operated.

Engineer.

New York, Jan. 23, 1912.

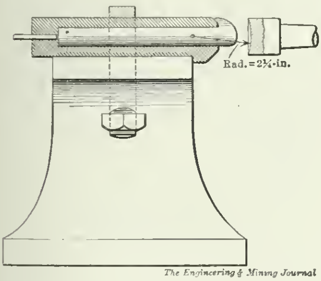
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Forging Anchor Bolts

The bolts for fastening the rails to the shaft stringers in the Mohawk type of concrete-stringer construction can easily be made from ¾-in. rods by the following method: A rod of this size is cut into 14-in. lengths as two inches of metal is required to make the head of the anchoring bolts. A length of this rod, after being heated at one end in the forge, is put in the form shown in the accompanying sketch, which is bolted to the tail of an anvil by a special clamp that comes over the form and goes through the hardie hole.



Die and Dolly for Shaping Anchor Bolts

In upsetting the head of the bolt a riveter is used which is fitted with a striking piece the end of which is turned to a segment of a sphere having a radius of 2¼ in. so as to form a hook on the end of the bolt that will have a low, round top surface upon which the wheels of the skip will not catch. The angle of the form shapes the under side of the hook so that, when the bolt is in the stringer, the hook will come in immediate contact with the rail throughout its whole under surface. This angle of the form is, of course, obtained by adding to 45°, the angle that the anchoring bolts make with the upper surface of the stringer, the angle of the flange of the rail that is used on the skip tracks.

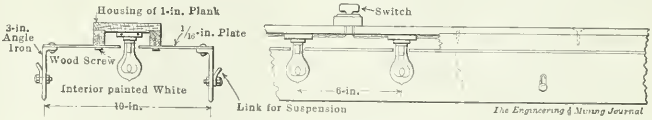
Sometimes the bolts after they are formed stick in the form. A small pin is, therefore, inserted in the bottom so that the bolt can be driven out by a light tap of a hammer as soon as it is finished. The striking piece on the riveter heats quickly owing to the speed at which the bolts are made, so a stream of water is kept playing on it. The threads, of course, are put on the anchoring bolts after the hook has been formed.

Lighting Trough for Drafting Tables

By W. R. Hodge*

The system of lighting the drafting tables of the mechanical department at the Michigan College of Mines practically obviates the bothersome shadows which come with the turning on of the incandescent lights on winter afternoons.

Above each range of tables is suspended an inverted trough, the details of which are shown in the accompanying sketch. The inside of the trough is painted white and contains tungsten lamps of four candle-power each. These lamps are set on six-inch centers and are connected in parallel. A switch controls the lamps of the individual tables.



Illuminator for Drafting Room

The trough itself is made of 3-in. angle iron and $\frac{1}{16}$ in. plate. One of the legs of the angle is shortened to decrease the weight of the trough. The angles are riveted to the plate which is 10 in. wide and extends the full length of the tables. This plate is pierced at six-inch intervals with holes sufficiently large to admit the shanks of the lamps used. Fastened above and directly to the metal part of the trough by wood-screws is a wooden housing of one-inch plank which contains the lamp sockets and wiring. Trough and housing are suspended from the ceiling by chains fastened to the angle-iron sides.

Electric Hoist for Shaft Sinking

Small electric hoists are now coming into use on the Rand for hoisting while a shaft is being sunk. The conditions during shaft sinking are such that it is not desirable to install and use the permanent hoisting equipment. An example of this practice is that of the central shaft of the Cinderella Consolidated mine at Boksburg, which is being sunk to a depth of 3000 ft. and will be 43 ft. 6 in. long by 7 ft. 6 in. wide, with six hoisting compartments and one pipe and ladder way.

The shaft was sunk to a depth of 10 or 12 ft. by using portable steam cranes; then the collar set was placed and the permanent headframe erected, but with four light sheaves over four of these compartments. Two double-drum electric hoists were then erected in a temporary building. Each hoist is equipped with two drums 8 ft. diameter by 2 ft. 3 in. face, with a capacity for 3000 ft. of 1-in. rope. There are hand-operated post brakes on each drum, and a foot-operated band brake on the first-motion shaft. The gearing is double reduction. The total load is 10,000 lb., as follows: Skip, 2500; rope, 4500, and rock, 3000 lb. The hoisting speed is 1000 ft. per min. Each hoist is driven through an elastic coupling by a 180-hp., three-phase, 50-cycle 500-volt, Westinghouse-type slip-ring induction motor, capable of carrying a load of 450 hp. for short periods. The control of the hoist is effected by standard Westinghouse liquid controllers. By means of these controllers the hoists are stopped, started and reversed at any speed from zero to full speed in either direction.

A power-storage set is provided to insure safety in case the line power should fail at the time when the shots in the bottom of the shaft are to be fired. This power-storage set consists of an exciter, a synchronous motor which may act as a generator, a heavy flywheel running in heavy bearings with forced lubrication, and a starting motor for bringing the synchronous motor up to full speed. The synchronous motor is connected directly to the power line, and automatic devices are arranged so that a failure of the power supply causes the main circuit to be interrupted. The power for driving the hoist is then derived from the flywheel until power supply is restored. In this case the generator is of 150 kw. capacity, running at 750 r.p.m., and the flywheel in slowing to 375 r.p.m. gives out sufficient energy to run the set light for five minutes and then hoist a load of 700 lb. in the skip through a distance of 400 ft. This power-storage set, according to the *South African Mining Journal*, is only used at blasting time; that is, seldom for more than half an hour at a time, three times in 24 hours.

---

*Mining engineer, 134 College Ave., Houghton, Mich.

When all the holes are drilled in the shaft, the workmen ascend and the blaster loads the holes. About 15 minutes before he is ready to light the fuses, he sends a special signal to start the power-storage set. Another signal is sent as soon as he is ready to fire the holes, whereupon the engine driver raises and lowers the skip about two feet to show that all is right. The blaster then lights the fuses, gives the hoist-away signal, and is carried out of danger whether the power supply from the main line has failed or not. In case of failure of the main power supply the power-storage set keeps the skip rising until the blaster is out of the danger zone.

These interruptions of power are frequent, due, of course, to the great difficulties under which the Victoria Falls & Transvaal Power Co. operates its stations, for there are few places in the world where thunder storms are more violent or frequent than in South Africa. These difficulties will not be experienced to such a degree in other countries.

The cost of power varies, but averages 1.17c. per kilowatt-hour. The cost of the two hoists and flywheel sets delivered in South Africa, but not including erection or cables, was approximately $24,000. Records show that the cost of sinking 148 ft. with a steam sinking hoist was approximately $850 for power under conditions similar to those in which 142 ft. was sunk by the electric hoist at a cost of $260, a saving of about $4 per ft. in power alone. In addition to this it is estimated that there is a further saving of about $5 per ft., due to the delicate control of the electric hoist which enables them to carry out maneuvers impossible with a steam hoist. On this basis the hoists and power-storage sets, according to their advocates, will pay for themselves before the shaft is completed, and even then would possess considerable value at second-hand, as such hoists are by no means worn out in three years. In January, 1911, 142 ft. of shaft was sunk at a cost for electric power for hoisting of $260; in February, 84 ft., at a cost of $149; in March, 75 ft., at a cost of $154; in April, 116 ft., at a cost of $282; and 153 ft., at a cost of $384 in May.

Shaft Station in Inclined Foot Wall Shaft

By Claude T. Rice

At the mines with a flat-dipping vein, in the Michigan copper district, the skips are almost universally loaded by dumping the cars directly into them. Turntables are used for switching the cars, which are made to hold approximately 2½ tons. Generally the shafts are sunk in the vein, and the spur tracks come up to the sides of the shaft; the main track continues through to the other side of the plat, along the hanging wall, and the turntables are placed in front of the shaft on the main track as shown in Fig. 1. The skips generally hold seven tons so that it takes three cars to make a load. Two cars stand ready to be dumped, while a third car is on the main track.

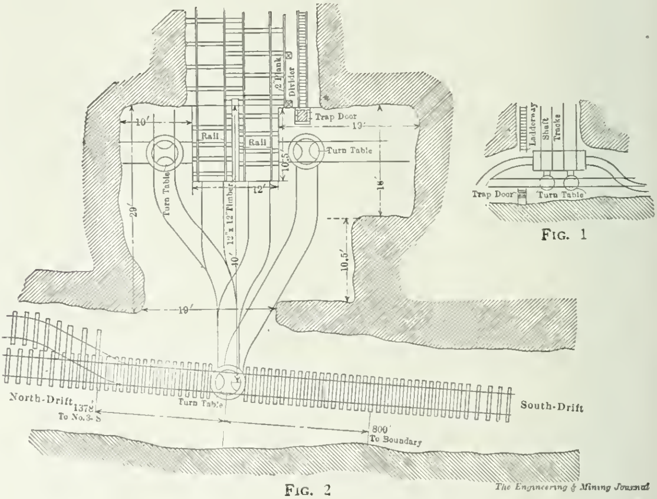


Fig. 1

Fig. 2

The Engineering & Mining Journal

Shaft Stations in Inclined Shafts

Fig. 2 shows the arrangement of the station at the 31st level of Wolverine No. 4, shaft which is sunk in the foot wall about 25 ft. from the vein. On the south side of the shaft a recess is cut so that two of the cars can be dumped on the side, the third car being dumped from behind; on the north side only one car is dumped from the side turntable and the other two are dumped from behind, the empty car being switched over to the side-dump track to get it out of the way.

On the south side, in the back part of the station, it will be noticed that there is a square corner cut out. This was for the small hoist used in sinking the shaft deeper from that level. When the station is cut in this way a brow of ground is left under the crosscut; to support this a reinforced concrete pillar is put in at the Mohawk mine before the brow has begun to give any trouble, and the floor of the station is laid with reinforced concrete, 6 in. thick, designed to stand a load of 400 lb. per square foot.

Neutralizing Towers at the Ashio Smeltery, Japan

At the Ashio smeltery of the Furukawa Mining Co., in Japan, the copper-furnace gases are passed through four neutralizing towers placed in series on the side of the mountain between the works and the chimney. This works was visited by the American Institute of Mining Engineers on its recent trip, and the towers are described by Prof. J. W. Richards (*Met. and Chem. Eng.*, Jan., 1912), as follows:

> The towers are of brick, 12 ft. square by 42 ft. high, down which (through 200 holes of 0.4-in. diameter) lime is showered. The gases average 0.8 per cent. SO_2 and 0.3 per cent. SO_3. By using 40 cu.ft. of water per minute and 300 lb of burnt lime per hour in the towers, all the SO_3 is intercepted and 40 per cent. of the SO_2, reducing the latter to 0.5 per cent. The water containing much SO_2 in solution is run into settling ponds, more lime there added, and the clear waste water filtered through sand be-

fore being discharged into the river. The government evidently considered this a fairly satisfactory solution of the smoke and fume question at this particular smeltery.

A New Design of Undercurrent Grizzly

By F. H. Hazard*

The idea of an undercurrent grizzly with rocking bars was first tried out in one of the hydraulic mines of northern California where much difficulty had previously been experienced in keeping the grizzlies from clogging with pebbles and wedge-shaped slabs of rock from the gravel bank and bedrock. The practicability of such a grizzly for undercurrent sizing was clearly proved, but, in this particular instance, the grizzly was not an entire success on account of poor design and construction.

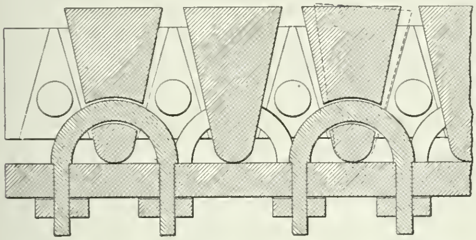


Fig. 1

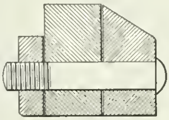


Fig. 2

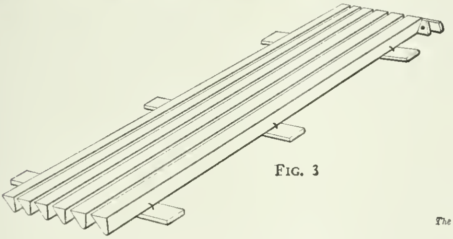


Fig. 3

The Engineering & Mining Journal

A Rocking Bar Undercurrent Grizzly

The clogging of grizzlies has always been a serious problem in undercurrent practice since the bars cannot be cleaned by hand while the mine is in operation. The sluice is in constant service weeks or months at a time and even a partial clogging is the cause of serious loss and greatly lessens the advantage gained by the use of the undercurrent.

The ill effects caused by the presence of clogged material in the spaces between the grizzly bars are twofold:

(1) The space occupied by the clogged material is rendered useless for passing the gold-bearing sands. In order not to rob the sluice of that water necessary to carry the coarse gravel and boulders to the dump, grizzlies must of necessity occupy only a limited length in one of the boxes of the sluice line. It is evident, therefore, that increasing the length of grizzly surface in the sluice, to provide for space lost by any clogging which may take place, is not feasible.

(2) Clogged material on the grizzly bars makes a rough surface on the floor of the sluice box. This roughness not only causes a swirl or eddying movement in the water that raises considerable quantities of the sand from the bottom of the sluice, but also causes a large proportion of the sand to be thrown upward by its impact upon the clogged material. Large quantities of sand are thus lifted by both these means into the upper currents of the sluice stream, the water of which here passes over the bars of the dump. Thus any sand contained in these upper currents is swept over the bars and lost for undercurrent treatment. The heavier black sand, with which the greater proportion of the fine and rusty gold travel, naturally hugs the bottom of the sluice and anything that tends to disturb this condition, particularly at the point where the sand is to be drawn off, will occasion loss. Clogged material on the bars frequently is the cause of mine wash becoming banked at the grizzly and if banking does occur here all the sand coming down the sluice is lost either by being swept over the now totally ineffective grizzly or over the sides of the sluice.

The accompanying description and drawings are of a rocking bar grizzly embodying the main features of the California installation already referred to, but with details of construction modified considerably by me. These modifications, I believe will overcome the principal weak points discovered in the operation of the grizzly.

The undercurrent grizzly as shown consists of a series of parallel steel bars six feet in length, 2¾ in. in depth and 1½ in. wide, across the top. In cross-section each bar tapers inward from the top down and at the bottom is rounded to a semicircular shape, as shown in Fig. 1. Through the thin part of the bars holes are drilled to receive U-bolts, the bends of which are semicircular. These bolts hold the bars in place on steel cross plates upon which the bars rest. The diameter of the holes through the bars is slightly larger than the diameter necessary to take the U-bolts in order that the bars will not bind on the bolts but have ample play to rock freely in a sideways direction. The points of contact of the bars on the cross plates act as pivots and each bar may swing sidewise on the arcs of circles of which these pivots are the centers. At the upstream end of the undercurrent a steel bar shown in Fig. 3 is placed crosswise to the grizzly bars and attached to the framework of the sluice box. This bar butts up close to the ends of the grizzly bars. Upon it are bolted lugs as shown in Fig. 1 which extend into the spaces between the grizzly bars for a distance of about an inch. The object of the lugs is to limit the sidewise swing of the grizzly bars. The upstream end of the grizzly is overlapped by the bottom boards of the sluice for several inches to shield these lugs from sand and small pebbles which otherwise might have a tendency to lodge between the lugs and the bars and stop the rocking of the bars.

When the sluice is in operation the grizzly bars receive a sidewise oscillatory motion from the force of the water, gravel and boulders passing over them. This rocking motion does not to any notable degree prevent pebbles and rock slabs from becoming lodged as these materials are constantly filling the spaces between the bars. However the movement of the grizzly bars produces an action similar to that of a shaking screen which keeps the oversize in motion and traveling forward and thus the oversize, although occupying the surface of the screen, is prevented from rendering the screening surface useless.

In its trial at the California property the grizzly proved a great success as a prevention against clogging. It was found that as much sand and water passed to the undercurrent box after several weeks constant operation as passed a few minutes after piping started and the sluice was carrying its normal capacity of mine wash.

Its chief difficulty lay in the fact that it allowed much coarse gravel to pass between the bars and occasionally robbed the sluice of too much water when the openings between two adjoining bars, at full side swing and in opposite directions, became temporarily held stationary by lodged material.

---

*Mining engineer, 1314 Park Road, Washington, D. C.

My idea in the construction of this grizzly has been to give a limited sidewise rock to the bars and to make this rocking as free as possible. I believe all that is necessary to produce the results hoped for is a design that will allow a short side rocking movement of the grizzly bars. The effect produced by a grizzly thus constructed, when in operation in the sluice box, will be that of a grizzly composed of rapidly vibrating bars. This constant vibration will wear on any lodged material which, if small pebbles, will soon work them through the spaces between the bars or, if wedge-shaped pieces and slabs of bedrock, will wear them quickly to an extent such that they will become loosened and picked up by the onward rush of the water going to the dump.

I have never heard of a grizzly, constructed along the lines of the one described, being tried for the sizing of ore. However I believe that with bars of suitable cross-section a grizzly of this type could be used to advantage for such work, particularly where mucky and other ores liable to clog are handled. I do not wish to assert that a grizzly so constructed would not clog when used with either dry or mucky ores, but I do believe it would not clog as readily as a grizzly of the ordinary type and it certainly could be more easily and quickly cleaned.

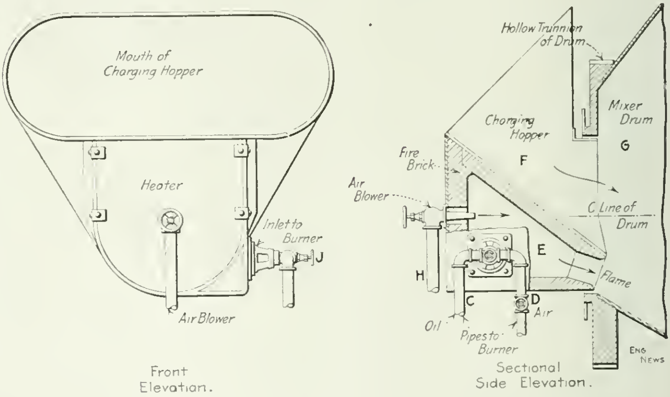
Wire Screens for Stair Treads

In all mills where wire screens are used there is rapidly accumulated a quantity of worn out screens which must be scrapped or some use found for them. If brass- or copper-wire screens are used, the worn out screens may be cleaned, rolled into wads and melted down for casting into bars. These bars can be used in making small copper or brass castings in the shop.

At the Ray Consolidated mill in Arizona, some of the worn out screens are used for covering the stairways. The screens are cut to a size a little larger than the stair tread and the rough edges are folded under. The screen is then tacked in place. The stairways about a mill are apt to be dangerously slippery and the old screens have proven efficacious in obtaining a tread on which the men will not slip. The screen will, of course, accumulate dirt which cannot readily be removed, but this dirt does not interfere with the function of the screen in giving a tread upon which a man can walk with little danger of slipping. The same use of screens can be extended to runways and walks about the mill.

A Heating Attachment for Concrete Mixers

With the extending use of asphaltic and bituminous concrete, mixing machines have been utilized for the preparation of these materials. This necessitates the application of some form of heating system to the mixer drum in order to dry the aggregate and to maintain the necessary temperature for softening and mixing the materials. Such a heating system may be used also in making concrete during cold weather. In some cases, heat has been applied to the exterior of the drum, but the accompanying illustration, from *Engineering News*, Jan. 18, 1912, shows a mixing machine in which the heat is applied to the interior, where it acts directly upon the contents.



Heater Attachment for Concrete Mixers

On the frame of the machine is mounted an air compressor, belted to the main engine (or motor). The air is delivered to the top of a receiver, which forms a tank for both air and oil; the capacity is 48 gal. and the normal supply of oil is 32 gal. The air pressure forces the oil out through a pipe which extends to the bottom of the tank, thus preventing air bubbles in the oil. Two $1\frac{1}{4}$-in. hose pipes *C* and *D* deliver the oil and air, respectively, to the burner or atomizer of the combustion chamber *E* which is placed beneath the charging hopper *F*; this chamber is a steel box with firebrick lining. The flame from the burner is blown across the chamber, and at the rear of the chamber is an air blower which diverts the flame and drives it forcibly through an opening which registers with the charging opening of the drum *G*. This blower is fed by a small hose pipe *H* which is connected to the main air pipe back of the burner. The combustion chamber is practically a part of the charging hopper, and tilts with the motion of the mixer drum.

The oil and air pipes unite at the burner and the flame is regulated by a single needle valve *J*, so as to obtain the desired intensity of heat. The outlet of the burner is so formed as to give the flame a whirling motion in the chamber so that it does not reflect directly back upon the burner from the opposite wall. The air jet from the blower *H* strikes the firebrick lining of the combustion chamber and is deflected downward to the nozzle opening, causing a sharp current which delivers the flame into the drum. The material in this revolving drum falls through this zone of heat.

When the machine is in use for making paving composition, the rock is first charged into the drum and in a few minutes is dried and heated; the asphalt is then added and the materials are mixed and heated simultaneously. With a charge consisting of 9 cu.ft. of broken rock and 10 gal. of liquid asphalt, a batch can be delivered in about three minutes when the rock is thoroughly dry before being charged into the machine. With rock that is very wet, a batch can be delivered in five minutes: in this case the rock is thoroughly dried and is too hot to be held in the hand before the asphalt is charged into the drum. The heater can be attached to machines already built, and it is an easy matter to learn how to adjust the burner to meet the desired conditions. It is stated that tests show that there is no liability of setting fire to the mixture. A modified form of heater has been designed, in which the air blower is dispensed with, the burner being placed at the rear of the chamber (in approximately the position of the air blower) and blowing the flame directly forward to the mixer drum.

A Simplified Challenge Feeder

By J. C. S. Whittuck*

In the Journal of Nov. 18, 1911, H. B. Kaeding describes a simplified Challenge ore feeder. In the Journal of the Chemical, Metallurgical & Mining Society of South Africa, November, 1907, there appeared two illustrations, herewith reproduced, of simplified driving devices of which that shown in Fig. 2 is to all intents and purposes the same as that described by Mr. Kaeding.

Quoting from the above mentioned journal, R. G. Bevington in a discussion of a paper entitled "Notes on Feeders with a Description of a New Driving Device" says:—"I was interested on reading a paper given before the Institution of Mining & Metallurgy, describing certain mills in Western Australia, to see that the author gave a sketch of a driving device (also utilizing the old friction disk with the arm cut off) which he claimed to be an excellent one, and which very closely resembles some devices which are in use upon these fields." In Fig. 1 is shown a sketch of the device.

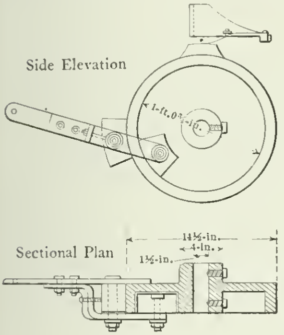


Fig. 1

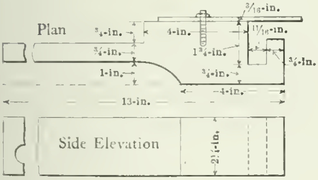


Fig. 2

The Engineering & Mining Journal

Two Types of Simplified Feeder Drives

With reference to Fig. 2, Mr. Bevington says:—"In the discussion upon the above mentioned paper I see that W. McDermott, who is one of the highest authorities upon milling matters, mentions a driving device brought out by Mr. Nelson in Western Australia, and which he says is of the simplest possible character, consisting merely of a loose fitting groove in the lever which grips the feed plate (I presume he alludes to what we call the friction disk) by the canting of the lever. No sketch accompanied Mr. McDermott's description, but I have had a driving device made on these lines and find that it works exceedingly well. Anything simpler and less expensive would, I think, be hard to find. I have had one running now for a fortnight and its performance is perfectly satisfactory."

---

*Fassett Road, Kingston on Thames, England.

Safety Appliances in Mines

By Lee L. Wilcox*

The idea that the large corporation is a merciless machine organized and conducted entirely for making large profits for its stockholders, having absolutely no regard for the comfort and safety of its employees is a common one. Whenever an accident happens the sympathy of the general public is for the unfortunate victims and often the corporation comes in for undeserved criticism. This idea may have had some foundation in the past, but at present every large mining company on the Mesabi range is spending annually thousands of dollars in providing for the comfort and safety of its employees.

It is the purpose of this article to describe the various means and devices used at the mines of the Republic Iron & Steel Co.

They naturally divide themselves into two classes; those tending to prevent accidents and minimize the dangers to which workmen are subjected, and those which relieve suffering and lessen the attendant dangers after an accident has occurred.

The first class, being preventive, has occupied most of the time and has included every phase of work about the mines. It was started by the appointment of a committee from among the mining captains and mechanics, whose duty it is to make regular monthly inspection trips, to report on the condition of the various mines and to recommend means for improving the conditions where in their judgment it seemed necessary. This committee performs its work faithfully and efficiently, and the result has been the extensive adoption of safety appliances.

This can be best described by citing some of the devices employed. In the shops all pulleys, belts, gears, and such equipment are enclosed with strong wire-cloth guards. Line shafts and jack shafts are provided with overhead walks for the operators when repairing or oiling. Hoisting engines, compressors, and other machines are protected by substantial handrails wherever moving parts might endanger the employees, also stairs, ladders and elevator platforms. In fact, during a recent visit, the state factory inspector expressed himself as being favorably impressed with the work that has been done.

In the matter of underground protection the company is very particular. All openings, such as shafts or raises, are thoroughly protected by gates, railings or bars, making it practically impossible for a man to step into them accidentally. In addition to this ore chutes are equipped with grates, and ladderways are provided with permanent platforms at intervals of about 12 ft., through which are left openings only large enough to allow a man to pass. Ladderways in hoisting shafts and air shafts are electric lighted wherever possible, and no one is allowed to carry a lighted candle in them, thus insuring protection against fire.

The shafts are also equipped with sprinkling devices for use in case of fire. These are made by running a 2-in. pipe the entire depth of the shaft, leaving openings about every 10 ft. Into these openings are connected pipes which extend horizontally around the shaft and which are drilled with ¼ holes at intervals of four inches. The stations and pump-rooms in the mines, where there is little water, are protected in the same manner. The places so protected can be thoroughly sprinkled in a short time.

In dealing with the second class of safety appliances, which have to do with conditions after an accident, the company has installed two complete sets of the Draeger rescue apparatus, 1910 type, one pulmotor and the necessary secondary equipment to keep this apparatus in perfect working order all the time.

Rescue parties consisting of from four to eight men, who are entirely familiar with the underground workings, have been organized at each mine. These parties are drilled regularly in the use of the apparatus. The drills consist of climbing ladders, using picks and shovels, carrying men and other such work. They will be varied from time to time as the instructor may direct. Together with the rescue parties first-aid parties are being organized. These will hold their regular meetings and drills. The company will endeavor to have a physician at these meetings to instruct the men how to handle injured men and how to apply bandages.

It will be seen from this that the company is not unmindful of the safety and comfort of its employees. Every official is watchful of the safety of the workmen, and no expense is spared where protection is promoted.

---

*Chief engineer, Republic Iron & Steel Co., Gilbert, Minn.

Iron River District, Michigan

By P. B. McDonald*

This district was neglected for a long time but has witnessed rapid development during the last five years and now more than 15 independent companies are operating there. The ore is a medium-soft, red hematite and requires crushing.

The Iron River district of Michigan has experienced a rapid growth in the last five years. Before that time there were known to be two or three medium-sized orebodies in the district and more or less desultory exploration was made. In 1911 there were 20 active mines operated by almost as many different companies, with an immense tonnage of ore proved. J. R. Finlay's appraisal of Michigan mines states that a comparison with the other districts would lead one to believe that "this district would produce 110,000,000 tons by the time it reaches the state of development in which the other districts are now. It contains one of the greatest ore reserves in Michigan, if not quite the largest. The annual tonnage expected is 1,290,000 tons. The present value of mines is $17,042,000."

CHARACTER OF ORE AND COSTS

The ore is a medium-soft, red hematite, much of which requires crushing, and is nonbessemer; it is used for pig iron and openhearth steel. The expected average cost per ton of ore delivered at Cleveland is $2.65; the expected average value per ton of ore in Cleveland is $3.23; making an expected average profit of $0.58 per ton. As a basis of comparison the expected average profit per ton for several other districts follows: Crystal Falls district, $1.16; Iron Mountain, $0.82; Marquette Range hard-ore mines, $0.98; Marquette Range soft-ore mines $1.08; and $0.66 in the Gwinn district. Following is a table showing the analysis of cargo shipments from the mines in the Iron River district in 1909, as published annually by the Lake Superior Iron Ore Association, of Cleveland, Ohio. The upper line of figures represents the analysis when the ore is dried at 212° F.; the lower line when in its natural condition.

MUCH DRILLING IN RECENT YEARS

There are few outcrops in the district; the country is deeply drift-covered and rolling. Practically all of the preliminary exploration is by diamond and churn drilling, at a cost of about $3 per ft. There has been a great deal of drilling in the last few years and remarkable results have followed in many cases. The early mines were located in the river valley southeast of town; in addition it was known that iron formation exists seven miles to the east at the Chicagon mine and there were a few indications north of the village. A farmer living half way between the Chicagon mine and Iron River finally succeeded in inducing a company to drill his 80 acres. He had previously given a blacksmith a one-quarter interest in his mineral right, in payment for a second-hand reaper worth $25. The farm now comprises the large Rogers mine, where the Foundation Co. of New York, has finished a concrete shaft; that part of the orebody so far proved is estimated on a conservative basis at 2½ million tons.

The Houlihan property, north of the Caspian mine, could have been bought six years age for that many thousands of dollars. Today it is believed to contain 5 million tons of ore. About 1½ miles north of the town of Iron River, Escanaba men spent several thousand dollars in drilling and discovered the present Gleason mine, with an orebody estimated in the millions. In several instances, furnace men in the East, hearing of developments in the Iron River field, have sent a representative to buy likely looking land as close to operating mines as could be purchased without spending too much money in one place. Not a few of them were agreeably surprised to discover by diamond-drilling, that the property acquired as a casual venture was worth several hundred thousand dollars.

CARGO ANALYSES OF IRON RIVER ORES

Ore		Iron	Phosphorus	Silica	Manganese	Alumina	Lime	Magnesia	Sulphur	Loss hy Ignition	Moisture
Baker . . .	dried	56 67	0.313	7.460	0 280	1.470	1.630	0.920	0.009	5.150	
	natural	51.875	0.2860	6.8169	0.2558	1.3432	1.4895	0.8406	0.0082	4.7060	8.620
Baltic group (Baltic, Caspian, Fogarty)	dried	55.40	0.493	7.88	0.36	3.08	1.50	1.87	0.033	5.01	
	natural	49.83	0.4435	7.088	0.32	2.770	1.349	1.682	0.0297	4.506	10.05
Berkshire	dried	54.45	0.709	8.25	0.18	4.23	2.79	2.40	0.031	2.45	
	natural	48 10	0.626	7.29	0.16	3.74	2.46	2.12	0.027	2.16	11.66
Chatham . . .	dried	54.50	0.346	9.39	0.21	2.73	0.79	1.05	0.088	6.71	. . .
	natural	51.37	0.326	8.85	0.20	2.57	0.74	0.99	0.083	6.32	5.75
Dober lump. . . .	dried	55.826	0.633	5.35	0.349						
	natural	53.760	0.61	5.16	0.336	......	......	......	......	......	3 70
Hiawatha. . . .	dried	49.87	0.35	14 16	0.234	4.20	1.30	1.75	0.084		
	natural	46 34	0 325	13.15	0.217	3.90	1.21	1.63	0.078	......	7.08
James	dried	54 89	0.480	9.60	0.30	0.99	0.40	0.20	0.015	9.02	
	natural	50 50	0 442	8 832	0.276	0 911	0.368	0.184	0.0138	8.298	8.00
Tully	dried	56 100	0.580	8.00	0.360	2.20	2.120	1 650	0.008	3 200	
	natural	50.490	0.522	7.20	0.324	1 98	1.908	1.485	0.0072	2 880	10.000
Youngs . . .	dried	56 05	0.50	7.60	0.16	3.20	0.82	0.71	0.04	5.45	
	natural	52.1265	0.465	7.068	0 1488	2.976	0 7626	0 6603	0.0372	5.068	7.03

DISTRICT DISCREDITED AT FIRST

As far back as the oldest miners in the district can recall it was sagely prophesied that "all the good land has been taken up by the big companies." If an enterprising spirit suggested that there might be ore on a certain tract, it was pointed out that some company had drilled two holes and sunk four testpits on the place several years before. Yet in many cases land which had been scratched a little in half-hearted exploration, was later optioned by people willing to risk more, and in some cases large mines were discovered. In fact there has lately been a regular business in acquiring abandoned and "black-eyed" properties, for systematic exploration. Several of the companies that came into the field last secured better properties than the older established companies, because having no prejudices they took chances that the others would not.

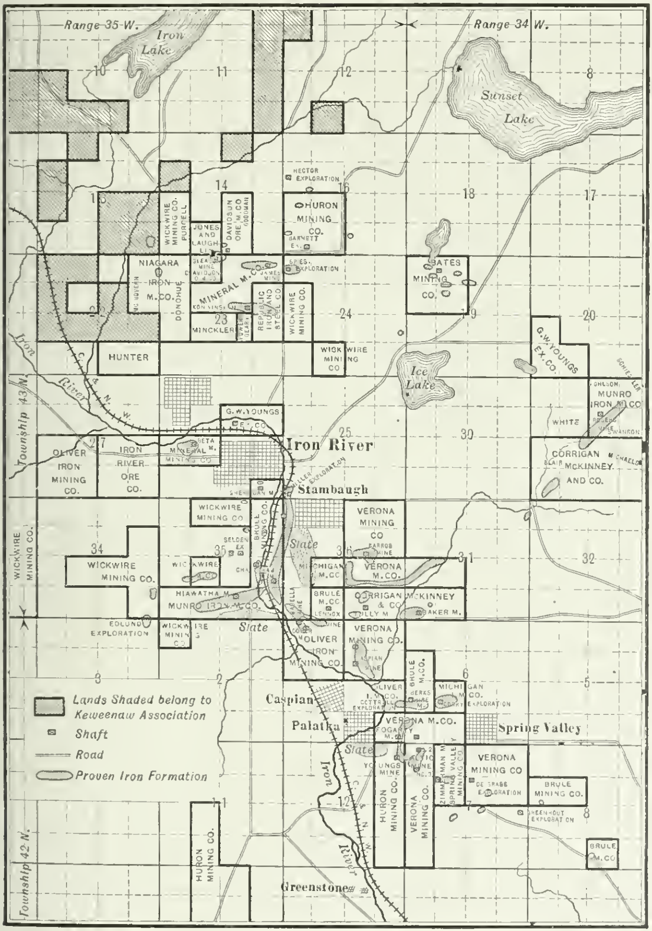
Later exploration has been deeper and much more systematic than the early attempts. The iron-bearing formation is said to be less than 300 ft. wide, and in general it stands nearly vertically. However, so intricately has it been folded and crossfolded that it covers a wide area. W. H. Selden has shown the ore formation to extend considerably to the west of the Hiawatha mine; the Iron River Ore Co. and others are succeeding in finding ore to the west of the town, and it is not known how far in this direction the formation lies. It is thought, however, that the ore-bearing area converges west of Iron River. The Bates Mining Co. has found an orebody on section 19, south of Sunset Lake, and exploration is tending in this direction. The Gleason exploration on section 35, south of the Chicagon mine, indicates the possibility of the area between Chicagon Lake and the Rogers mine. There has even been talk of the possibility of a connection of the Chicagon orebody with the Crystal Falls district, as the two are but nine miles apart.

---

*102 West Main St., Negaunee, Mich.

Wide Distribution of Ownerships

The district is unique in that the holdings are divided among about 15 independent operating companies. This is in contrast to other mining towns in the iron regions, where one, two or three companies have usually monopolized the field. Exploration in the Iron River district has in general been successful, and the results obtained have many times repaid the capital invested in drilling and underground work. As compared to precious-metal mining, the principal point of difference affecting the financing of an exploration company, lies in the fact that a relatively large quantity of ore has to be shown to warrant the expenditures necessary for economically mining the product. Thus, such a result as a mine paying for itself "from the grassroots down" is a foregone impossibility.



The Engineering & Mining Journal

Map of Iron River District, Michigan

Capital Required

The amount of capital required by an exploration company is larger than that necessary in many Western ventures, and $25,000 might be spent in diamond-drilling a property with no greater results than several boxes of drill cores of black slate. On the other hand, if the $25,000 was successful in finding a good-sized orebody, the property could probably be sold for several hundred thousand dollars. The iron ore usually occurs in large deposits and is fairly homogeneous throughout. An investor in iron-ore exploration must be prepared to lose the entire amount contributed, but if the project succeeds, and a great many do, there is little doubt about the immense profits that will accrue. As James J. Hill has said, "iron-ore deposits don't run away, nor go out of fashion."

The royalties paid in the Iron River district vary from 10 to 50c. per ton; the present average rate of royalty is about 25c. per ton. The prevalent manner of exploration is under an option drawn up for perhaps one year and signed by the exploration company and the owner of the land; at the same time a lease also is drawn up for perhaps 25 years (but not signed), stating the royalty per ton, minimum tonnage on which royalty shall be paid, etc., but this is not signed at that time. The exploration company may drill the land and at any time before the expiration of the year in which the option holds may sign the lease if the results from the drilling warrant.

New Application of Tungsten and Molybdenum

Prior to their production in ductile form, the two metals tungsten and molybdenum had but two applications each: in steel making, and in electric lamps, the tungsten for filaments, and the molybdenum for filament supports. This last use[1] is even better served by the drawn wires, and the majority of the tungsten lights now made in this country contain drawn filaments.

The tungsten- or molybdenum-wound electric furnace[2] has proved both cheaper than and superior to the platinum-wound furnace, both because of higher temperatures and quicker heating. Both metals form good substitutes for platinum, platinum-iridium, or iridium, in various contact-making-and-breaking devices. That this is the case, is the result of the good heat conductivity of the ductile forms of these metals, their relative cheapness allowing the use of comparatively large masses, both of these factors preventing the formation of a heavy non-conducting oxide coating, while under the conditions existing in these contacts the thin oxide coatings are conductors.

In the Röntgen tube tungsten has opened a new field. Owing to its higher melting point, as compared with platinum, tungsten gives the Röntgen ray operator an indestructible target, upon which the cathode rays may be more closely focused, resulting in sharper definition and shorter exposure.

The use of wrought tungsten for projectiles is being carefully considered. Its high specific gravity, 19.3, as compared with lead, appears to give it the theoretical advantages of a flatter trajectory and longer range. Its hardness and high tensile strength should give it high penetrating power. Its high melting point will prevent fusion due to the heat from the charge and consequent erratic flight. Against this, however, is the possibility that the smaller tungsten bullet of the same weight as a copper-nickel-jacketed lead one will possess in an aggravated degree the disadvantage of the latter—unless it hits a man in a vital spot it doesn't stop him.

---

[1] Journ. Ind. and Eng. Chem., Jan. 1912.

[2] Journ. Ind. and Eng. Chem., Dec., 1911.

Indian Currency

The question of the currency standard for India has been much discussed during the last year. London naturally leans toward the full adoption of a gold standard, and there is a certain advocacy of it in India; the party advocating it there being in a position to make its arguments heard. On this point Messrs. Samuel Montagu & Co., of London, say in their annual circular:

Advocacy of the Gold Standard

The instant adoption of the gold standard is urged by a strong body of native opinion, but the pressure arises mainly from sentimental rather than practical reasons. So great a wave of prosperity is passing over the Indian Empire that the native bankers and merchants who are fortunate enough to ride on the crest of the wave, are prone to overlook the requirements of the vessel that bears them. Their ability to profit by the recent years of plenty depended on the maintenance of the "Pax Britannica," the vigilant care of the Raj minimizing famine, enhancing water supplies, financing railways and other means of communication, and—by no means least of all—holding a stable exchange between India and the outside world ever since the closure of the mint to the free coinage of silver was necessitated by the abandonment of bimetallism on the part of the Great Powers.

The Silver Rupee

It must be remembered that silver rupees have been from ancient times the only coins familiar to the varied and populous nations of India. The Indian authorities, therefore, have held before them the practical object of holding exchange steady with the West rather than the establishment of a theoretical single standard, and by the expedients adopted, the natives are becoming accustomed to sovereigns passing current as equal to 15 rupees, and having the choice of either gold or silver. The fact remains that gold is, at the present time, available, although for a limited period it was not. No demand on the treasury is made for it now, for, as in all other countries, when once it is known that gold is available, notes are preferred as being the more convenient. Notwithstanding the vast amount of rupees coined, occasions have arisen at subsidiary currency offices when silver rupees were temporarily not obtainable.

Chief Obstacle to a Gold Standard

The native Indian bankers seemingly ignore the chief hindrance to a prompt adoption of a gold standard. This lies in the enormous population of India and their relative poverty, which necessitate rapid expansion and contraction of the currency handled by the masses according as the harvests happen to be successful or not. Ceres does not empty her cornucopia into the lap of a favored few, but she lifts a large proportion of 300,000,000 of people from extreme poverty into a position to pay off old debts, and even to provide a little for the future, or by the withdrawal of her favor, she deprives them of their all. To such poor folk gold is superfluous, their earnings must be paid in a coin of small value, a coin also to which they are accustomed by ancient usage, such as the silver rupee. A year of exceptional harvests may mean a demand for a sum equal to 20 crores of rupees, or £13,000,000, for the payment of crops, and of this by far the larger proportion is disbursed to the tiller of the soil. Herein is the crux of the difficulty which confronts the Indian government. The treasury must be prepared to expand the currency by huge amounts of silver rupees at a few months' notice, and also, perhaps at equally short notice, to receive them back, so that when times are bad India can be in a position to pay her debts to other countries in gold.

The Present Currency System

The methods adopted by the Indian government, if persisted in long enough to accumulate an adequate reserve, obviate the necessity of a large loan to form a gold reserve, and safeguard the estimation of the silver rupee in the public mind, for, when a gold basis is fixed, silver rupees will be relegated by a stroke of the pen to a position of inferiority. In times of scarcity a prejudice would be created against the coin of the poorer classes, who would thus suffer much hardship at a time when least able to bear it.

The special facilities which the Indian government possesses of drawing either rupees on India or sterling on London enable it to maintain the rupee as a hybrid coin, neither a mere token nor the basis of the currency, and yet exchangeable for sovereigns at a fixed ratio of 15 to 1 at the present time.

Effects of Gold Standard

Were a gold standard established tomorrow it would not put a pie into the waistcloth of the ryot, whose interests should weigh more with the rulers of India than those of the prosperous bunnia or native banker. If a gold standard were announced, and no restriction were placed on the amount of rupees legally tenderable to the treasury in exchange for gold, the government could not avoid similar methods to those now used unless a loan were launched and a wasteful stock of gold provided. Inasmuch as the equilibrium of the exchange is maintained in any case, it is difficult to see what further advantage would accrue to India than what is enjoyed already. The wise course lies in accustoming the public to use sovereigns and rupees side by side, and in building up a sufficient reserve from the profits on coinage silver. It is evident that the sovereign is actually entering into general use, and when the proportion in which sovereigns and rupees are circulating becomes reduced, the inflation or deflation of silver currency will cease to be a cause of embarrassment to the treasury.

Suggested System

If it seemed desirable to assist the utilization of gold, and to retard the demand for silver, notes of large denominations might be made payable in sovereigns (15 rupees to the sovereign) and the government might reserve the right to demand sufficient notice to allow of the purchase and coinage of silver, whenever gold was tendered on a large scale for exchange into silver rupees. This would place the treasury in a position to feel the pulse of the circulation and to prescribe the necessary remedies.

Meanwhile the profit of coining silver rupees, whenever the depletion of the stock in the currency reserve renders such a step necessary, is building up a handsome reserve, the securities of which can be realized, and the gold thus obtained can be replaced temporarily by any redundance of silver rupees consequent on the period of dearth, until such time as the turn of the tide carries the silver surplus back into circulation.

The contention advanced in Indian financial circles that gold reserves should be kept more liquid is well founded. This condition could be effected if short-dated government obligations were substituted for the consols now held by the treasury. Thus not only would the nearness of the due dates curtail depreciation in case of a forced sale, but the capital, if held thus invested until due date, would remain intact, and the interest, being compound, would place the currency, in course of time, on an unassailable basis. The enormous annual importation of gold bars and sovereigns in late years has relieved the treasury of pressure to which it might otherwise have been exposed, and the existence of such huge hoards of gold in the country cannot fail to be a source of support when perfectly free circulation of gold becomes an accomplished fact.

Tariff Legislation

Washington Correspondence

The Democrats of the Ways and Means Committee have made public their revised bill relating to the iron and steel duties. This bill places iron ore on the free list. Pig iron is 8%; scrap iron, 15%; the provision as to "melting" in the case of scrap iron is eliminated. Slab, bar and bloom iron is 10%; beams, girders, etc., 15; boiler iron, 20; iron and steel sheets, 15; anchors and forgings, 15; hoop, band and scroll iron, 15; steel rails, 10; iron and steel sheets, 20; steel ingots, 10; rivet, screw and fence wire, 10; round iron and steel wire, 20 per cent.

Definition of Steel

An interesting provision is as follows: "(16) All metal produced from iron or its ores, which is cast and malleable, of whatever description or form, without regard to the percentage of carbon contained therein, whether produced by cementation, or converted, cast, or made from iron or its ores, by the crucible, Bessemer, Clapp-Griffith, pneumatic, Thomas-Gilchrist, basic, Siemens-Martin or openhearth process, or by the equivalent of either, or by a combination of two or more of the processes, or their equivalents, or by any fusion or other process which produces from iron or its ores a metal either granular or fibrous in structure, which is cast and malleable, excepting what is known as malleable-iron castings, shall be classed and denominated as steel."

Steel alloys, such as ferromanganese, chrome or chromium metal, ferrochrome or ferrochromium, ferromolybdenum, ferrophosphorus, ferrotitanium, ferrotungsten, ferrovanadium, molybdenum, titanium, tantalum, tungsten and ferrosilicon are 15 per cent.

Throughout the bill a characteristic feature is the abandonment of the old specific and combined specific and *ad valorem* rates, and the substitution of plain *ad valorem* duties.

Other Metals

Included with the changes in the iron and steel schedule, which are to be made by the forthcoming bill, are revisions of the paragraphs relating to lead, antimony and other metals. A general reduction has been made in these, just as in the items of the iron and steel schedule. Considerable criticism is being manifested because the unsatisfactory smelting and bond provisions of the law have not been eliminated or changed. It does not appear likely, so far as can be learned, that much if any alteration will be introduced in these particulars, even when the bill goes to the Senate. The plans of the Democrats who are working on the subject of tariff revision are to make as few changes in classification as they can and to confine themselves largely to rates of duty except in those instances where experience has made it plain that there are "jokers" or excess protection which, in their judgment, need to be eliminated. Some changes in the provisions relating to smelting have been talked of, but it seems exceedingly doubtful whether anything of the kind will be attempted at any time this session. The more changes of this sort are made, the more objection is usually offered to the enactment of a new piece of legislation, and consequently the more difficult it is to secure action on the plan suggested. It has been considered wisest, so far as practicable, where the meaning of provisions in existing tariff legislation is known as a result of court decisions, etc., not to make any innovations in present legislation.

In the tentative bill as it stands, aluminum of all grades and kinds is 25 %; antimony, 10% on the antimonial contents; bauxite, 10; copper plate, 5; lead ore, dross, etc., 25 on the lead contents; lead bullion, pig lead, etc., 25; crude metallic mineral substances, 10; thorium, monazite sand, etc., 25; nickel of all kinds, 10; nickel in sheets, 20; quicksilver, 10; type metal, 15 % on the lead content; zinc ore, free; zinc in pigs, 15%, and tungsten ores are free.

Transvaal Mining Supplies

Johannesburg Correspondence

Some idea of the market open for American manufactures in the Transvaal in connection with the gold, base metal and diamond mines, is shown by the following consumption for 1910: Belting, £119,942; bags, £30,649; bolts, nuts, washers and rivets, £52,674; candles, £237,599; calcium carbide, £29,349; iron and brass castings, £117,200; cement, £120,735; chemical and assay supplies, £155,478; coal-cutting machines, £5471; cyanide, 10,825,186 lb., valued at £447,494; electrical machinery, £826,848; explosives (blasting gelatin), 487,160 cases, valued at £1,109,299; gelatin dynamite and gelignite, 140,587 cases, valued at £252,739; No. 1 dynamite, 6693 cases, valued at £8701; No. 2 dynamite, 54,976 cases, valued at £7092; other explosives, 4713 cases. (Blasting gelatin is used almost exclusively by the gold mines except in some places, where gelignite is employed.) Detonators, 333,567 boxes; electric detonators, 286,335 boxes, safety fuse, 7,923,226 coils; steam, construction and rock-drill hose, £57,751; hand tools, picks, shovels, hammers, etc., £85,820; oils, 1,141,799 gal.; grease and tallow, 4,266,236 lb.; machinery and machine tools, £1,622,691; mill screens, £35,058; mill repair parts, £115,927; anti-friction metals, 287,557 lb.; packing, 491,343 lb., valued at £47,747; paint, tar, etc., £25,517; paraffin, 58,370 lb., valued at £33,938; pipes and fittings, £458,076; rails, etc., £321,339; rock drills, 3086, valued at £61,514; spare parts for rock drills, £152,152; wire rope, £132,706; cotton and manila rope, 375,823 lb., valued at £18,711; shoes and dies, 14,814,504 lb., valued at £133,148; bar, tool and cast steel, 2,195,409 lb., valued at £30,718; sheet steel, 13,410,952 lb., valued at £96,258; hand-drill steel, 5,216,117 lb., valued at £81,605; rock-drill steel, 6,285,966 lb., valued at £95,802; Oregon and pitch-pine timber, 1,945,586 cu.ft., valued at £357,314; deal timber, 6,979,170 cu.ft., valued at £201,390; trucks, £123,949, and zinc sheet, 8,467,113 pounds.

The Antelope Mine, in Southern Rhodesia

Johannesburg Correspondence

The Antelope mine at Gwanda, Southern Rhodesia is about 75 miles south from Bulawayo. The vein occurs in a narrow belt of schist about 16 miles long, which belt is bordered by granite. The ore is, at depth, a highly pyritic banded ironstone containing much pyrrhotite. The capital of the company consists of 1,600,000 shares at 5s., of which 1,100,000 were issued on an option.

The vein outcrops over a length of 2½ miles and there are numerous ancient workings on it. Shafts have been sunk along the strike for a distance of 1300 ft. The reef dips about 50° to the north and has been cut by a 13½ by 5-ft. vertical shaft at 700-ft. level. On No. 1 level 560 ft. of the main vein assays 9 dwt. over a stoping width of 36 in. On the eighth level the vein which has been driven on for 82 ft. shows 12½ dwt. over 43 in. The ore in sight is estimated at 60,000 tons containng an average of 10 dwt. gold per ton. It is intended to adopt the all-roasting process which, it is estimated, will give an extraction of 90 to 95% of the gold at a total cost of about 30s. per ton. Suction gas engines are used to supply electrical power.

Proposed Phosphate Land Law

A recent bill introduced in Congress (H. R. bill 17,247) provides that any *bona fide* locations made under nonmineral land laws, on lands subsequently found to contain phosphate deposits, shall hold, except that the United States shall have the right to dispose of the phosphate under the mineral laws in force at that time. Any miner of the phosphate, under these conditions, must give suitable security for any damage which may be caused the surface owner.

Recovery of Gold in Dredging

By Charles Janin*

In calculations of recovery most engineers take a percentage of the average gold content indicated by drilling, generally 75 to 80 per cent., as the recoverable amount, if preliminary work has been carefully done. Recoveries as high as 90 per cent. are unusual and sometimes range as low as 40 per cent. when spotty ground and careless prospecting prevail.

The percentage of recovery made by a dredge of the average content indicated by prospecting a gravel area, is always an interesting question. Obviously to determine the difference between the actual gold content of the ground and the recovery of the dredge, it is necessary to know: (1) either the actual gold content of the ground previous to dredging, or (2) the actual loss in the tailing.

The thorough sampling of a placer property is by no means the simple matter the uninitiated often believe it to be, and much depends upon the care taken and the experience of the engineer in charge of the work whether the average value determined for the property will be representative or not of the total gold content. If the greatest care has been exercised in taking a sample, the work being properly done in every detail, the sample will then represent as nearly as possible the value per cubic yard of the place sampled. While each hole may then be taken as indicative of the value of that portion of the ground where it is sunk, the placing of holes is an important feature.

Sampling the Ground

The location and distances apart at which samples should be taken can be determined only after a study of the ground is made. Preliminary holes are generally sunk and carefully sampled to determine if the gold occurs in wide or in narrow channels, and if it is fairly evenly distributed throughout the deposit, or occurs in irregular pay streaks. There is no rule as to the number of holes to be sunk, but on ground that shows spotted or irregular contents, obviously more tests will be necessary than where fairly uniform values are obtained. Much time can be saved, in this respect, when the work is carefully planned and directed.

Sometimes it is feasible to segregate certain sections of a property, eliminating low-grade areas, and on larger areas, where time for the examination is limited, tests to confirm the value indicated by preliminary prospecting may be concentrated on a piece of sufficient size to determine the advisability of purchasing the property and installing at least one dredge. The accuracy of the average value of placer ground indicated by the examination, depends, therefore, upon the care taken in sampling, the number of samples taken, and the situation of the holes in relation to the character of the deposit. All hinges upon the experience and judgment of the man in charge.

Recovery in Dredging

In estimating the value of dredging ground after determining the average value indicated by prospecting, most engineers take a percentage of this indicated value, generally 75 or 80%, as the amount of gold content recoverable by the dredge. These figures are based upon actual tests made to determine the dredge recovery and also upon the percentages of the prospecting value recovered from certain dredged areas.

Use of a Recovery Factor

Some engineers, in estimating the value of gravel recovered from drill holes, use a factor which they claim experience has demonstrated closely represents recovery. The use of this factor practically discounts the prospect value which would have been assumed by the use of the ordinary drill factor. Any engineers adopting such practice should, of course, mention same in their report; otherwise the value they claim for a property may be further discounted by those to whom the report is presented, if they are not conversant with the methods employed in computing the value, and an injustice done the property under consideration.

It is difficult to sample the dredge tailing, and any test, to be at all representative, must extend over a considerable period. Tests made on dredge tailing by different companies have indicated an appreciable loss, but the tests did not, so far as I know, determine the percentage of gold recovery with any accuracy. Some ground in the areas first dredged will undoubtedly be redredged at a profit in the future, when lower operating costs are obtained by increasing the dredge capacity, as discussed in my paper, "Present-Day Problems in Dredging," read before the American Institute of Mining Engineers, at the San Francisco meeting.

Some Actual Recoveries

In a most careful test to determine the dredge recovery, 22 holes were sunk on a measured area. Results were from 3 to 52c. per cu.yd. and averaged 19c., the regular drilling factor being used in these calculations. In working, the recovery was, as near as I can remember, 17c. per cu.yd., or about 90%. Those companies in the Oroville field, which get the high percentage of recovery, are those which previously had discounted the prospecting values by 20 or 25%. One company in working an excess of 3,500,000 cu.yd., obtained a recovery that showed 72% of the average value indicated by prospecting. The ground averaged about 16c. per cu.yd.

Natomas Ground Mapped at 85% of Value Shown by Drilling

In this connection it is interesting to note an excerpt from Mr. Roelker's report on Natomas Consolidated: "The writer wishes to emphasize that according to the statement of the general manager, Newton Cleveland, the value of the different bore tests which are marked on the company's map, are the original value calculated reduced by 15 per cent., in order to make them representative of actual extraction." Only when the property is worked out will it be ascertained whether or not this factor is the right one.

While the tests referred to and the percentage of recovery assumed for a dredge have been figured from prospecting done under careful engineers, there are numerous instances, particularly of early-day drilling, when the recovery afterward made by the dredge was only 40% or less of the assumed average gold content of the ground. This was on account of careless or inexperienced work during the examination. A case in point with this is mentioned by J. E. Hodson, in "The Dredging of Gold Placers," referring to the Ashanti Goldfields Auxiliary dredging ground which had been tested with drill holes: "The bore holes had given from 5 to 11 and 13 grains per cu.yd., but the results achieved by the dredge never gave more than 2 grains," and again, "A dredge in New Zealand is reported as having recovered 40% of value indicated by bore holes."

If the work of prospecting has been properly done, an estimation of the gold content of a property can be made with some degree of accuracy, but, if the work has been carelessly done by unreliable or inexperienced engineers, the results obtained would be worthless and any refinement of recovery calculation ridiculous.

---

*Consulting mining engineer, Kohl Bldg., San Francisco, Calif.

Chispas Cyanide Plant, Sonora

By Edward L. Dufourcq*

In this new 70-ton cyanide mill the current and accumulated concentrator tailings are all-slimed, agitated in Pachucas and filtered by a Burt apparatus. Zinc dust is used for precipitation.

The Chispas mine, situated in the Arizpe district of Sonora, Mexico, and owned by the Minas Pedrazzini Gold & Silver Mining Co., was worked from 1891 until 1900 for its production of high-grade shipping ore. The period from 1900 until 1903 was occupied in running a drainage tunnel under the former workings. At the time at which I assumed the management of the property in 1904, the veins had been cut by this tunnel and, in addition to some high-grade ore, considerable amounts of lower-grade ore had been discovered; a five-stamp mill had been erected with one concentrating table and two amalgamating pans.

Old Mill Used Concentration and Pan Amalgamation

This mill was enlarged as more ore was developed, until in 1910 it consisted of 20 stamps, three Wilfley tables, four 5-ft. pans and two settlers. During part of this period a portion of the slimes that did not pass through the pans in the ordinary amalgamation treatment were hoisted from the settling ponds after drying and oxidizing, and were treated in the pans by being mixed with the current coarse tailings from the concentrating tables. This retreatment of slimes was costly on account of the second handling, the extraction was unsatisfactory, and moreover the total current production of slimes could not be treated in the plant. The extraction in the mill averaged 58 to 60% by concentration and the pan amalgamation then extracted from 55 to 60% of the contents of the table tailings, the total extraction therefore, varying from 71 to 84 per cent.

In 1908 and 1909, experiments were made with cyanide and it was decided in 1910 to install this process, both because of the higher extraction possible and because of the much lower cost of treatment than by pan amalgamation. In this paper I shall outline the construction and detail of the cyanide plant.

Some description of the geology of the ore deposits has already been published[1] so that for the purposes of this paper it will be sufficient to mention that the ore consists of a rather clean quartz carrying the silver in the upper levels of the mine as chloride, and in the lower levels as argentite, polybasite and stephanite. The gold is free in the upper levels and throughout almost the whole vein is carried in about the proportion of 1 oz. of gold to 130 oz. of silver. The average of a number of partial analyses of the ore gave the following result: Insoluble, 80.6; iron, 2.4; lime, 1.6; sulphur, 1.6; antimony, 0.3%; zinc, trace; lead and copper, none. The insoluble is nearly all silica; the ore from the upper levels of Chispas vein, however, carries varying amounts, up to 3 or 4% of aluminum silicate, as does the ore from one of the parallel veins.

Good Extraction by Cyaniding

The cyanide experiments with slime from the accumulation in the ponds below the former mill showed an extraction of 93% of the silver and 98% of the gold, on material which had been long exposed to the weather, and an extraction of slightly over 90% both of gold and silver from the coarser sand tailings which had not been so long exposed. The experiments further showed that the cyanide consumption would probably not exceed 3 lb. per ton of tailings and slimes treated, that about 0.2 lb. of lead acetate would be required per ton, slightly under 2 lb. of lime per ton to neutralize acidity, and that 36 hours' agitation by air would be required to effect the solution of gold and silver if the pulp were all slimed to pass at least 150-mesh, to which fineness it was found necessary to grind the tailings in order to reach 90% extraction.

The crushing section of the former mill, consisting of a 7×10 Blake crusher, and 20 stamps of 850 lb. dropping 100 times per minute with a 6½-in. drop, crushed 46 tons per 24 hours through a 20-mesh screen of No. 25 wire (aperture 0.027 in.). As about 26,000 tons had been treated by this mill up to the end of 1910, and of the tailings discharged over 12,000 tons had been saved in slime ponds, besides several thousand tons of lower-grade sand tailings, it was necessary to design a cyanide plant that would be sufficient to treat the current discharge of tailings from the concentrating tables (having decided to discard the amalgamation process) and at the same time to treat the accumulated slimes and tailings of the former mill.

Allowing for ordinary mill stoppages, it was calculated that at least 40 tons per day of current mill tailings would have to be cyanided, and the plant was designed to treat in addition a minimum of 30 tons per day, to be taken from the accumulated slimes and sand tailings.

16-Mesh Battery Screens Used

It will be shown at what estimated capacity each machine in the new plant was taken and what allowances were made for extra work to be thrown upon any part of the plant. Due to the fact that a high extraction by cyanide could be expected, it was thought wise to change the mesh of the battery screen from the 20-mesh above noted, to 16-mesh with No. 22 wire, giving an aperture of 0.033 in., increasing in this way the stamp duty to possibly 3 tons per stamp per 24 hours. The four batteries of the mill have not yet all been equipped with the new screen, to determine whether the expected stamp duty will be attained. It is my opinion that this duty will be exceeded. The coarser feed to the Wilfley tables will of course result in a lower saving by concentration and richer table tailings, but as all the table tailings will be slimed in the tube mill, the ultimate saving will be greater, since the smelter, in buying the concentrates, pays only for 95% of the silver content. It is also expected to give the tables a greater inclination and make a higher-grade concentrate, so as to effect a saving in overland freight to the railroad. The smelter charges for briquetting and smelting concentrates, together with railroad freight and overland freight to the station, amount to $46 per ton whereas the refining charge on silver-gold bars is only 1c. per oz. (payment for full gold and silver contents) and the express charges on bullion are $4.25 per thousand ounces.

One of the accompanying plates gives the ground plan of the cyanide addition to the mill. For purposes of greater clearness, in preparing this plan some of the pipe-lines were omitted and a number of the launders. The positions of the 20 stamps, the concentrating tables and the power plant are only indicated in outline. The cyanide plant consists of the following machines and appliances: One 14-in. belt conveyor, 160 ft. long, running at a belt speed of 105 ft. per min., brings the slime up from the ponds below the old amalgamation plant to a masonry mixing tank, 16 ft. in diameter. The current mill tailings, after leaving the Wilfley tables, are dewatered and also discharge into this mixing tank. A bucket elevator, with 5×8-in. buckets, raises the combined

---

*Consulting mining engineer, Produce Exchange Building, New York

Note—Abstract of an article in the School of Mines Quarterly, November, 1911.

[1] Eng. and Min. Journ., Dec. 3, 1910.

tailings and slime to a Dorr standard simplex classifier.

Below the Dorr classifier is an Abbé tube mill, 4½×20 ft. with trunnion bearings, and furnished with El Oro type of lining. To facilitate transportation by carts, this tube mill was made in two parts, the shell being cut in two and each half having a ring riveted to it, carefully faced, so as to give exact alignment when the two rings were bolted together on the ground. Danish pebbles are used in the tube mill, the initial charge being 16,000 lb., half of which were of the No. 3, or largest size, the remainder being about 5000 lb. of No. 2 and 3000 lb. of No. 1 size; subsequent feed, of course, is all of No. 3 size. Such additional water as is needed in the tube mill, for maintaining the proper consistency for grinding, is added as weak solution; the stamp milling is done in water in order to avoid consumption of cyanide by the metals removed with the concentrates.

At the discharge end of the tube mill is a second Dorr classifier. Above the tube-mill building are two stock solution tanks of steel, 24 ft. diameter and 8 ft. deep, for strong and weak solutions, capacity 27,000 gal. each. Outside of the tube-mill house, and at a slightly lower level, is situated a Dorr thickener in a steel tank 24 ft. in diameter and 8 ft. deep. Beyond this, as there was not enough fall available, it was necessary to put in a short air lift which is easily operated, on the thickest slime handled, by about 4 lb. of air pressure, which raises the thickened slime to the box from which it is distributed to the six agitation tanks.

DETAILS OF AGITATION TANKS

These tanks are of steel 12 ft. in diameter and 36 ft. high, with a conical bottom sloping 60°, having a capacity of 25,000 gal. each. The detail of the construction of these 36-ft. tanks is as follows: The top ring is composed of No. 10 steel, four pieces to the circle, 8 ft. high, single riveted at the top to a 3×3-in. angle iron, single riveted at the lower side to the second ring, which is 6 ft. 6½ in. high and is made of No. 9 steel. Below this follows the third ring 6½ ft. high, made of No. 8 steel. At the bottom of this third ring is a double row of rivets fastening the third ring to the fourth, the fourth ring being of No. 7 steel, six pieces to the ring. This fourth ring is 6 ft. 8 in. high and is fastened by a double row of rivets at the bottom end to a 6×4-in. angle iron. The cone joins at this point, being riveted both to the sheet of the fourth ring and to the angle iron. The cone is made of ¼-in. steel in six pieces. The height of the cone is 9 ft. 8 in. and at the bottom end is riveted by a double row of rivets to a 10-in. standard cast-iron T, on one side of which is a blind flange and on the other side a 10-in. gate valve. The bottom of the T is supported on concrete.

There is no mechanical agitating device in these agitation tanks, but they are provided with the Towne patent air agitator. This consists of a central pipe 10 in. diameter, reaching nearly to the bottom of the cone and perforated by rows of 4 holes, 1½ in. diameter, the rows of holes being 1 ft. apart except at the upper end of the pipe, where, for 2 ft., they are 6 in. apart. Almost at the top level of the tank there are four 2-in. pipes leading outward and spirally curved from the central pipe towards the circumference of the agitation tanks. The central pipe extends 2 ft. above the top of the tank and is open at the top. Air is admitted through a 1½-in. pipe passing through the blind flange in one side of the 10-in. T at the bottom of each cone. The air pipe enters the center of the central pipe and is turned upward inside of it for about 18 in., terminating in a vertical ball check valve. The discharge from each agitation tank is controlled by a gate valve, all tanks connecting into one central pipe leading to the suction of an Aldrich triplex slime pump, of 6×7 in. size.

BURT FILTER AND ZINC DUST USED

On one side, and above the Aldrich slime pump is situated the Burt filter, 42 in. diameter by 20 ft. 8 in. long. The Burt filter is an iron cylinder, inclined 45°, into the lower end of which the slime is forced under a pressure of 40 to 50 lb. per square inch. In the cylinder are suspended the filter mats of cocoa matting covered with canvas, their frames being perforated pipes connected to a common discharge pipe running along the top of the cylinder out of which the filtered solution passes. The pressure being positive and three times the atmospheric pressure being obtainable, this type of filter is preferable for slimes containing high silica and little alumina, and is quicker in operation than the vacuum types.

A masonry tank, 8×8 ft., 4 ft. deep, is provided at one side of the Burt filter to receive the excess slime discharged from the filter after the cake is formed and before the weak solution is forced through the cake for washing. The strong and weak filtered solutions are collected in the respective tanks beyond the Burt filter, these tanks being of steel, 16 ft. in diameter and 8 ft. deep, capacity 12,000 gal. each The solutions are drawn from these tanks for precipitation by zinc dust, which is added by means of two types of zinc feeders, a Colbath and a Creston-Colorada, which are placed inside the zinc room. A filter press of 12 leaves, 24×24 in., made by the Creston-Colorado Company is used for the product. The barren solutions are run to two sump tanks outside the building, these being of steel and of 24 ft. diameter for the weak solution and 16 ft. for the strong, both being 8 ft. deep. A Deane triplex pump is used for pumping the zinc and solution into the product press, and Deane triplex pumps are also used for returning solutions to the stock tanks.

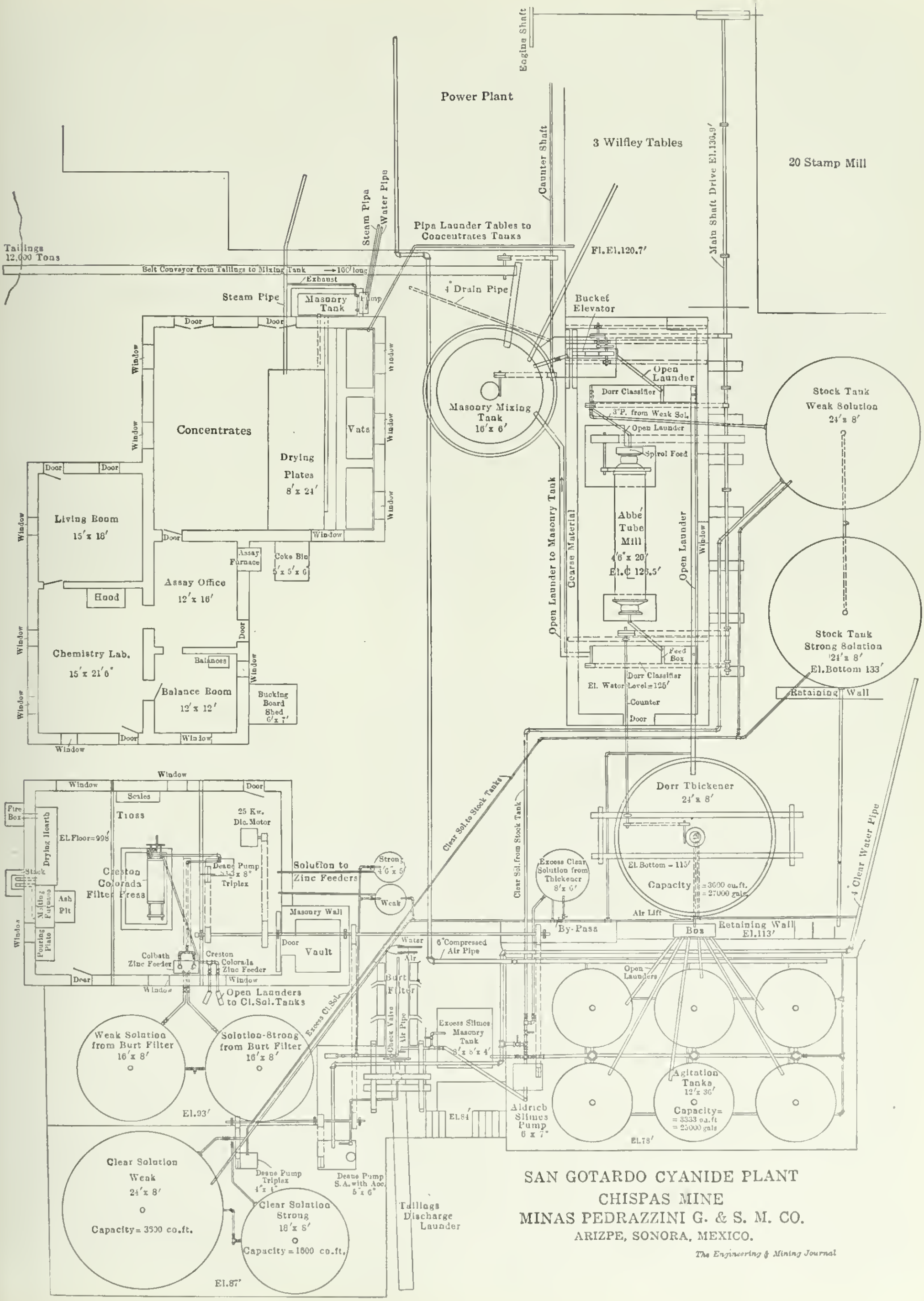
POWER DETAILS

Power for all the triplex pumps and for the feeders is provided by a General Electric type DLC, direct-current, 220-volt motor of 25 kilowatts, situated in the zinc room. All the other power is derived from the main line shaft of the mill, which is driven by a 150-hp. Hamilton-Corliss engine. The generator, which supplies the current for the motor as well as for the lights and for the assay office motor, is situated in the main power plant and consists of a Buffalo Forge Co. engine of 90 hp., direct connected to a General Electric form RB, 6-pole, 250-volt generator of 50 kilowatts.

Compressed air is furnished by two compressors built by the Chicago Pneumatic Tool Co., and about 20 lb. of air pressure is maintained. The normal amount of air furnished is 320 cu.ft. of free air per minute, which however, will probably prove too small if more than four of the agitation tanks are being operated at one time; air is also needed for the Burt filter and for the air lift, the lower pressure therein required being obtained through a reducing pressure valve. It is to be noted that all the valves, cocks and glands or stuffing boxes that are to be in contact with cyanide solution are of iron, no brass being permissible. The masonry tanks are faced with cement, which was then washed with ammonium carbonate solution and then painted with cyanide paint.

In addition to the appliances shown in the plan, there are three tanks, one a steel tank 6×8 ft., situated on the mountain side, 290 ft. above the Burt filter, for accumulating hydraulic pressure to operate the filter door, and the others are masonry tanks situated at about 80 ft. above the mill, for excess solution and for slimes which also are required to be under pressure, as will be shown in describing the operation of the plant.

Due to the situation of the camp, with a 72-mile wagon haul from the railroad at Cananea, all the tanks were shipped knocked-down and the riveting was done on the ground. Ingersoll riveting hammers were used, the compressor for the air agitation furnishing the compressed air. It was somewhat of a risk to use this compressor, which was designed for



SAN GOTARDO CYANIDE PLANT
CHISPAS MINE
MINAS PEDRAZZINI G. & S. M. CO.
ARIZPE, SONORA, MEXICO.

The Engineering & Mining Journal

a maximum of about 50 lb., but had to be run at 80 lb. to furnish effective air pressure for the riveting hammers. The stock and solution tanks are of $\frac{3}{16}$-in. steel, both sides and bottom, and are painted with cyanide paint, two coats inside and one coat outside. They rest on rough rubble masonry foundations, timber being out of the question, as the wagon freight alone on rough pine amounted to 90 pesos per thousand feet.

Unique Support for Pachucas

The ordinary Pachuca type of agitation tank, so far as I had seen it installed in other places, seemed to involve a waste of material in having the cylindrical sides carried to the ground, with the cone at the bottom built inside; such construction also leaves the bottom of the cone, with its valves and connections, rather inaccessible. I therefore decided to support the agitation tanks at the top of the cone, by using a 4×6-in. angle iron, which is riveted to the tank sheets. This angle iron rests on a curved I-beam, 7-in. standard section, made in four pieces, each one-quarter of the circumference of the outside of the tank. This circular I-beam is carried on eight columns, made of 6-in. pipes, with special castings for bases, and capped by castings terminating in a flange conforming to the circle of the I-beam. The pipes are filled with cement concrete and the castings are threaded on, but care was taken to have the ends of the pipe "bottom" into the castings so that the strength of the column would not rely on the strength of the thread. These pipe columns are 12 ft. high and are braced laterally at half their height.

The agitation tanks are set up in three rows of two, and are held together at the top of the cones and at the top of the tanks by steel plates fastened to the angle irons which encircle the tanks. The whole set of tanks is anchored by six horizontal bolts to the retaining wall which sustains the ground forming the bench carrying the Dorr thickener. One Dorr simplex classifier at the head of the tube mill was thought to be sufficient to handle the entire feed that will go to the cyanide plant, on the assumption of 30 tons of the old slimes per day with 40 tons of the current mill table tailings of which over 40% will be slime, but it is probable that the sizing capacity will not be found sufficient when the 20 stamps are all operating on the new 16-mesh screen, and in order to take out all the material of the size to be fed to the tube mill it will probably be necessary to install an additional classifier. On the other hand, the Dorr classifier at the discharge end of the tube mill, which will take out the material which has not been ground to sufficient fineness, will have an exceedingly light load except when the tube mill is crowded by a large proportion of coarse sands coming from the old slime ponds. The thickening process is necessary, as the undersize from the first classifier contains a large amount of water, and the discharge from the tube mill and the second classifier contains too much weak solution to allow the pulp to be passed in this condition to the agitation tanks, since we there require a pulp of of 1:1½ or 1:2, with strong solution.

Estimated Capacity 70 Tons

The capacity of the agitation tanks was figured on a basis of about 35 tons of dry slime to each tank, two tanks being filled in each 24 hours; allowing 36 hours for agitation and 12 hours for settling and decantation, we would always have one pair of tanks emptying and filling, with two pairs of tanks agitating on any given day, thus discharging 70 tons of slime as a minimum to the Burt filter in each 24 hours. It is found that the upper 8 ft. of the contents of a tank will settle in a few hours sufficiently clear to allow decantation, the clear solution not requiring to go to the Burt filter; for that purpose a 4-in. decanting pipe is provided 8 ft. below the top of each agitation tank. The only clarifying that this solution needs before going to the zinc precipitation is provided by sand filters on the false bottoms of the two 16-ft. tanks where the pregnant solutions are held.

The capacity of the Burt filter of the size adopted (42 in.×20 ft. 8 in.) was more problematical, as it depends entirely upon the rapidity with which each operation on the cycle of filtering is conducted. The Aldrich slime pump, if driven so rapidly as to effect a quick filling of the filter, also produces an excessive pressure, and it was decided, at the suggestion of Edwin Burt, to put in one of the masonry tanks on the hill at 80 ft. elevation, which is connected with the discharge of the slime pump so that the pump could run continuously and yet during the time that the filter was filling the excess slime collected in the upper tank would run back quickly to the filter.

The original calculation for the Aldrich pump (6×7-in. triplex) was 100 gal. per minute; taking an agitation tank of 25,000 gal., from which about 6000 gal. had been decanted, there would remain 19,000 gal. which could be taken care of by the Aldrich pump in about 3½ hours, allowing the balance of the time out of each 12 hours for forming the cake, pumping through the wash solution and discharging the washed filter cake. The Burt filter, operated under the original condition, was filled, washed and discharged once in about 50 minutes, but it is hoped to improve this with the use of the high tank for quicker filling with slime, and in this connection the second of the high masonry tanks (80 ft. elevation) is used for weak solution to effect a quick washing of the filter cake (four minutes). The filter should then easily handle over 70 tons, possibly 80 tons, in 24 hours. Increased capacity is also expected by the use of thicker pulp in the agitation tanks; at the present writing, charges of about 38 tons of dry slime per tank are being experimented with, in place of 35 tons.

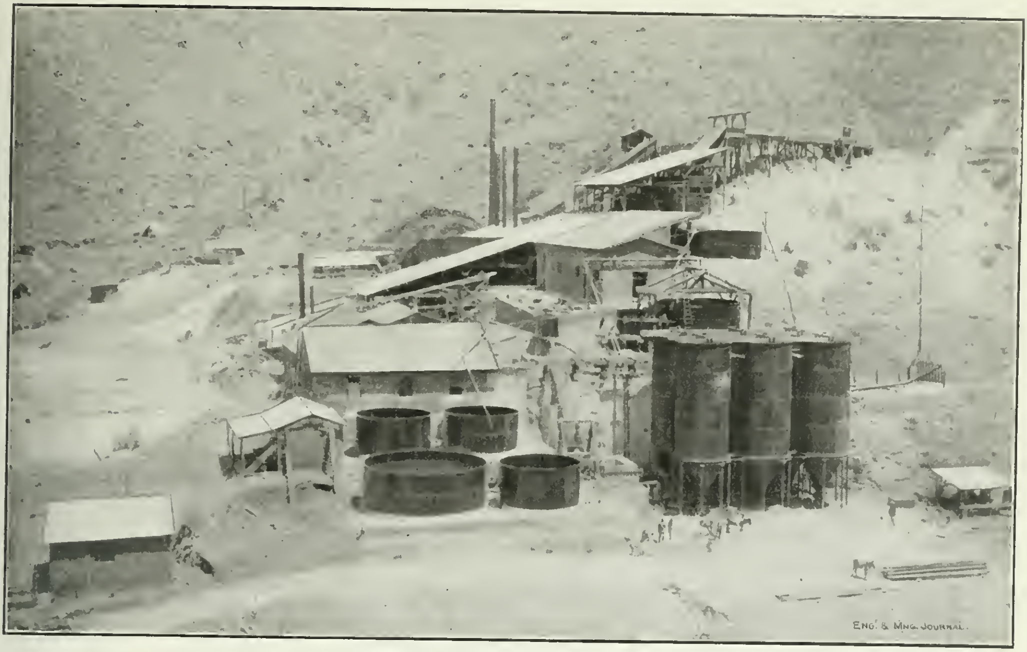
Experimental work is still going on to determine exactly the best method of mixing the zinc dust with the solutions to be precipitated. Two types of feeder are being used, as stated in the outline of the machinery adopted. Variations in the manner of applying the zinc to the solution feed pipes still have to be tried.

The filtered precipitate is dried in pans in a reverberatory hearth, heated by a light fire. After drying, and mixing with fluxes, the melting and refining is done in No. 60 graphite crucibles in two coke furnaces.

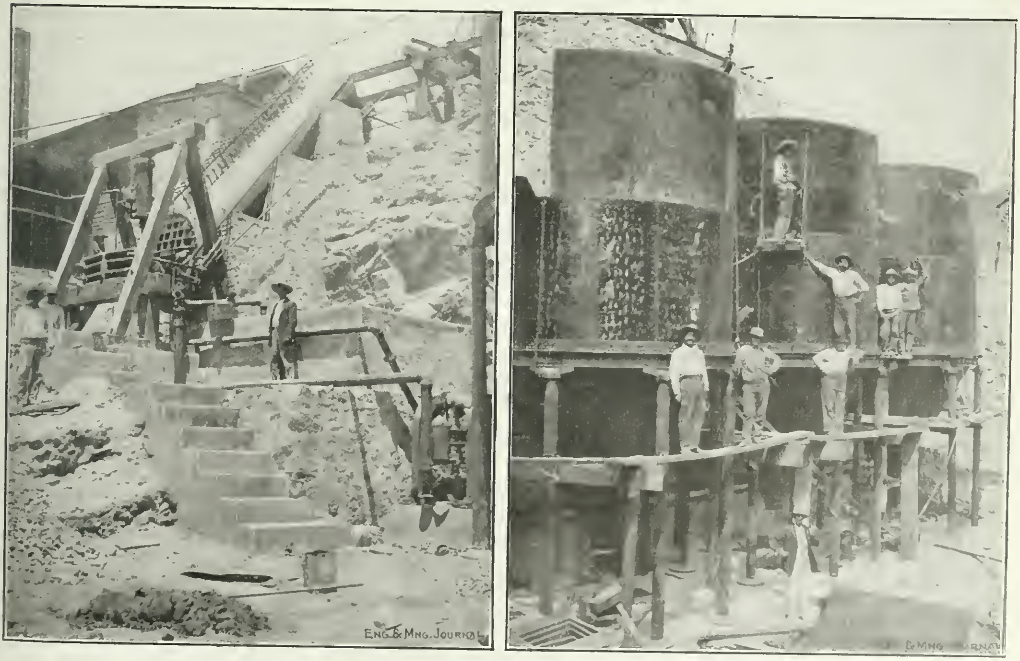
Plant Built in Six Months

The entire plant was constructed without interrupting the operation of the concentrating mill and the old amalgamation process. The construction of the cyanide plant necessitated the building of a new assay and chemical laboratory, to make room for the new concentrate house, this being required as the concentrate was formerly dried, sampled and sacked in the house occupying the space taken for the tube mill. This gave an opportunity for improving the method of handling concentrate. Formerly this was shoveled from boxes at the end of the Wilfley tables and removed in wheel barrows, whereas at present the concentrate drops through a launder and pipe to a lower level and is dewatered in masonry tanks and then shoveled to a steel drying plate 8×24 ft., which is kept hot by the exhaust steam from the compressor.

The time consumed in erecting the plant was much prolonged by the outbreak of the Mexican revolution. Labor conditions were much upset, many of the blacksmiths, riveters, mechanic's helpers and masons leaving their work to join the revolution; the efficiency of those remaining, or of the new men secured, was only about half of the normal. Many shipments of machinery were delayed through suspension of train service at the border, and through the temporary closing of the Mexican Custom Houses. After the machinery reached the end of the railroad, there was great difficulty in securing a sufficient number of freighters to haul to the mines, since at that time the revolution was at its height and raiding parties were daily seizing all available horses and mules.



The Chispas Cyanide Plant at Arizpe. Sonora, Completed May 25, 1911



The Burt Filter and Agitation Tanks of the Chispas Mill

Notwithstanding the delays thus occasioned, the plant was completed in just under six months from the time the excavation was ready for the masons to start. A number of changes in pipe lines, launders and tanks were subsequently made and more will undoubtedly be necessary as experience is gained with the particular type of ore to be treated.

Some Changes Necessary

At present, with only a short experience yet available, I would make the following criticism of the plant as we have erected it: (1) Probably the classification at the feed end of the tube mill is of insufficient capacity. (2) Probably the compressed air supply is too small. (3) Additional capacity to the Burt filter plant may be found necessary. (4) Probably a large product filter press in the zinc room would be found advisable.

These imply changes to the plant which are not necessarily required at once, nor does their lack interfere with successful operation. The ratio of the capacity of each machine to that of the entire plant may vary with conditions that will arise from time to time. For instance, if any of the four batteries of the stamp mill be hung up for repair, the feed can at once be increased on the conveyor bringing up the slime. The conveyor provided for this purpose was of a much larger capacity than needed for elevating only the proportion of old slime which it was aimed to treat under normal conditions. The fact that a large part of the old accumulation of coarse sand tailings can be cyanided at a profit, will result in their being brought up with the slime as circumstances permit, and this too will vary the conditions under which the classifiers will work. The tube mill is of larger capacity than normal running conditions would require, but it was thought well to install it at once of a size that would grind all the mill tailings, if after the accumulated slime shall all have been cyanided, it should be decided to increase the stamping and concentrating section of the mill to a size to supply tailings up to the capacity of the cyanide plant.

Tungsten in Australia

Special Correspondence

In Queensland the mining for tungsten and molybdenite commanded a good deal of attention in 1911 but the output was not so large as in the preceding year. The chief center of operations is Wolfram camp in the Chillagoe mineral district, where wolfram occurs associated with bismuth and molybdenite. In New South Wales the mining for scheelite has been fairly active in the Hillgrove district, while the production of wolfram-bismuth concentrates from the Torrington district has been on an increased scale. Both from Victoria and Tasmania wolfram in small quantity is also obtained.

Suggestions to Mining Students

William R. Cox, who is well known as a successful mining engineer, in an address to the students of the School of Mines and Metallurgy, of the University of Missouri, at Rolla, Mo., on Oct. 24, 1911, under the title of "Some Suggestions to Mining Students," gave the following excellent advice, which the Journal has pleasure in endorsing in all particulars:

The problem confronting every engineer when he finishes the work required by his college may be formulated something like this:

Given my individual talents, such as they may be, and the training which I have received, what must I do to make the most of them in the long run? How may I develop myself, first, most thoroughly; second, most rapidly to the limit of my capabilities, and convert that development into confidence in myself, the respect of professional friends and the practical benefit of a successful career? Many difficulties and some failures will be avoided if every one of you will ponder well this first practical matter, the importance of which will be brought home to you forcibly when I tell you that with all the hundreds of graduates turned out annually by engineering schools, every active operator is put to it continually to supply his need of competent, practical, young engineers. This statement you can verify for yourselves. It means that a large proportion of technical graduates do not develop as they should practically; principally because they do not know how to carry forward their education from the point at which the school drops it.

This scarcity of competent men spells opportunity for those young engineers who have the wisdom and earnestness systematically to prepare themselves practically as well as technically to fill the demand which never fails. Be certain that many operators are searching diligently at all times for the right men, and when someone tells you that your profession is overdone, remind him of Webster's remark about "room at the top." All important progressive operators, individual and corporate, have long since agreed that technical men are the best timber for development into managers and directors of large mining enterprises, and it is your responsibility to fit yourselves for the demand always existing for competent service.

Many graduates make the mistake of seeking at once work of responsibility, calling for experience and expert judgment, which they cannot in the nature of things possess. It is a serious misfortune for the young engineer and for his unwise employer when such a man is called to report upon prospects or mines or to recommend their development, equipment, method of operation, with valuations, estimates of working costs, profits and other data of similar character. The trained engineer with years of practical experience has difficulty in avoiding the mistakes, errors of judgment, and other pitfalls awaiting those who must do this kind of work. Do not court half successes or certain failures in permitting a desire for too rapid advancement to crowd you into undertakings for which you are professionally immature.

Avoid all short cuts which seem to promise success and reputation; set your feet steadfastly in the same logical road which attains the summit of the hill when you have climbed honestly and bravely with no attempt at running around the easy contours.

Now as to hill climbing:

I advise you every one to devote a number of years, more or less according to your aptness and your opportunities, to manual labor in every department of assaying, surveying, drafting, office and accounting, underground work, milling and construction. You will earn at least as much in practical work during this period as you would in minor technical positions, and you will come out with a grasp of your business which no man achieves who lacks the persistent courage to carry him through this invaluable apprenticeship. Much of this work and of the conditions surrounding it will be hard, rough and disagreeable; nearly impossible to men accustomed to luxury and soft living, but we cannot discuss the business of mining from a "pink-tea" viewpoint. With the preparation suggested you will be competent for the management of a modest property or for a position of limited authority and responsibility on a large one, and your steady advancement will depend upon your personal capacity and opportunities. You will know your business, and that is the main point after all.

Be careful and methodical in keeping the notes given you in lectures and classes. This work is entirely neglected by a large percentage of students, with the result that much valuable time is lost when you are put to the practical test of gathering information in the field. My advice is to begin early in your college work a systematic method of compiling useful data. A diary supplemented with kodak pictures of plants, appliances, drawings and constructional work will be of assistance all through your professional life.

The Yellow Jacket Mine, Idaho

By G. L. Sheldon*

Reminiscences of an isolated mine, first opened about 1860: some of the obstacles encountered and the ingenious methods used in surmounting them.

The Yellow Jacket mine is situated in Lemhi County, Idaho. It was formerly reached from Ketchum, Idaho, the terminus of the Shoshone branch of the Oregon Short Line, by a wagon road 80 miles to Challis, and from there 60 miles by trail over three ranges 9000 and 10,000 ft. high; or from Red Rock, Mont., 90 miles by wagon road to Leesburg, by way of Salmon City, and from there 40 miles by trail over one divide to the mine. In recent years the railroad has been extended to Salmon City.

Discovered in 1860

The mine was discovered about 1860. A few years later it was acquired by J. B. Haggin, who, in 1866, put up a 10-stamp amalgamation mill. This was abandoned after operating a few years on the rich surface ores. In the 80's it was taken over by Morrison & Stein Brothers, who operated it intermittently until 1892, on the best ores obtainable by gophering methods. It was sold in 1892 to Colorado people, and I took possession in October of that year. The former owners, after spending two weeks cleaning up, turned it over to us, and we cleaned up $3000 in four days. The former owners were not practical men, the machinery in many places being repaired with baling wire.

The mine is situated on the side of a mountain, 1200 ft. above the mill. As it cost $2.60 per ton to haul the ore from mine to mill, a distance of two miles, it was deemed advisable to put in an aërial tramway. When the apparatus reached Challis, not a packer in the country would contract the delivery. The company therefore purchased a pack train and did the hauling on company account. The cable was coiled in a long, wide coil, several strands on a side, securely tied together, the mules placed in the center, the cable being lashed to each side on the *aparejos*. The double ends were so stiff that the loop extended in place beyond the head of the mule. It required a man to each mule and two for some of them for the first few days. We had a "picnic" with those mules until they became used to the load and conditions.

When a mule passed over a small elevation he had to carry most of the load of the mule ahead and behind; when passing a depression he was sometimes lifted entirely off his feet. About 20 mules were used for each piece. The trail in many places was extremely crooked and since the cable would not bend to these a new trail was cut out and the train sent straight up or down the mountain. At one place a wall-eyed mule had to take too much of the load. He bucked and threw the whole train down the hill 150 ft. into the timber. This so tangled up the cable and mules that it took a day and a half to cut the trees and get the mules and cable out; but no material damage was done. The cost of delivering the ore from mine to mill, when the tram was finally erected, was reduced from $2.50 to 7c. a ton, the difference soon paying for all costs.

One mule packed a new cam shaft to the mine from Challis. A frame was made so that the shaft rested in the center on top and distributed the weight evenly on the *aparejo*. An extra mule packed along two tripods of the same height as the shaft when loaded. Every two or three hours the shaft was shifted back on the tripods and the mule allowed to rest. It cost 10c. per lb. freight from Challis.

Difficult Traveling in Winter

The trip to or from the mine in the winter was not a desirable one. From the top of the hill above Ketchum the stage at that season was a long toboggan, only large enough for the mail sacks, driver and one passenger. Small pine poles 20 to 30 ft. high, every 100 to 200 ft. marked the line of the toboggan road. If the horses were kept in the beaten track, good time was made and it was not a hard trip.

In the spring of the year, when it commenced to thaw, the roadbed being hard and narrow, and 10 to 15 ft. above the surrounding country, traveling was much more difficult. Six or seven miles below Challis the road left the Salmon River, when snowshoes had to be used. The company had four cabins at equal distances apart, with provisions stored in them, and it was necessary to make a cabin each night. The two guides would glide down the hills and mountains and up the other slope on their skis. Afterward we, too, learned to use the skis and found it much easier. By wrapping a burlap sack around the ski and zigzagging up the mountain, one can climb as fast as with snowshoes.

In the following May, before the trails opened up, the camp became short of provisions from the fact that they were bought for 50 men, and many more were worked. Twelve hundred dollars were spent in shoveling out the trail to get supplies, but before the pack train reached the divide, a chinook wind came and melted the snow in two days.

The mill was run by water power from Yellow Jacket Creek, under a 41-ft. head, Leffel turbine wheels being used. An open ditch 1500 ft. long was used, and a great deal of trouble was experienced in the spring from the slush formed by alternate freezing and thawing. It was therefore deemed advisable to put in a tight, covered flume the entire length. The dam at the intake was enlarged and the gate was made to deliver the water to the flume at 10 ft. depth, thus avoiding all anchor ice.

Mill Destroyed by Fire

On the day the flume was to be completed, the mill man was instructed to put new shoes and dies on the stamps. Hardwood wedges were used and the pieces and shavings from these were burned in the heating stove just below the battery floor. A spark from this stove set fire to the roof of the mill which was exceedingly dry, and the mill was entirely destroyed. By turning water into the flume, the penstock and flume were saved.

In August, 1894, a new sawmill was received, and we commenced sawing lumber for the new mill. Logs were obtained from the neighboring mountains 1 to 2½ miles distant and 1000 to 1500 ft. above the mill. In order that the sawmill should be on a level with the upper part of the new mill, so that lumber, lagging, etc., could be delivered on that level to the tramway and thus sent to the mine, the sawmill had to be placed about 100 ft. to one side of the mill, on a side hill, and nearly 100 ft. above the shafting in the penstock, which was in one corner of the new mill site. The main shafting in the sawmill was connected to the shaft in the penstock by ½-in. wire cable, and we were able to cut on an average of 10,000 ft. per day.

The rubber linings used in the sheave wheels carrying the cable wore out during the winter. It would have required 20 days to obtain new ones. As a makeshift manila rope was unraveled, wound in the sheave wheel, and pine pitch, gathered on the mountainside, melted and poured on it. This made a better lining than the rubber and did not slip.

Mill Rebuilt

The plans and specifications for the new 30-stamp mill were received in October, 1894. The excavations for the foundations were largely in dirt and gravel. This material was sent down hill in troughs aided by water from a storage tank formerly used to supply the battery of the old mill. Riffles were placed in the lower boxes, and a substantial saving of placer gold was made. All machinery came from Fraser & Chalmers, Chicago, and every box was found to contain exactly what the bill of lading called for.

---

*Box 135, Ely, Nev.

Three hundred mules were used on the trail packing machinery. The freight was 6½c. per lb. from factory to mill. All shafting was hammered steel, which cost 1c. per lb. more, but resulted in a saving in freight. The mill was double boarded, lined with building paper between and weather strips over the cracks on the outside. It was heated by steam throughout. By working 18 to 20 hr. per day, we were able to drop the stamps within 106 days from the day the specifications were received.

Ore Lost at Shallow Depth

The ore was mostly a fine red, decomposed quartz, together with boulders of white quartz from a few inches to 10 ft. in diameter. On top of the ridge the vein cut off entirely at the 150-ft. depth. Below the ridge the hill dropped off sharply for 100 ft., then flattened out for nearly 1000 ft. The orebody was from 200 to 300 ft. wide and 40 to 80 ft. thick. About 600 to 800 ft. west of the ridge, down the hill, was a large body of white bull quartz left by previous managements 40 to 50 ft. wide, running nearly parallel with the vein, found on the ridge. Some crosscuts were run through this, and it was found to average from $8 to $9. A tunnel 200 ft. vertically lower on a line with the tramway was started into the hill to cut this ore in depth, but the property changed hands before the vein was reached. The new management never found ore on that level.

The new management decided to increase the mill, notwithstanding the fact that the previous consulting engineer and manager advised the development of more ore first. The capacity of the mill was doubled; a new pipeline was put in, in order to get sufficient power; and another tramway installed. The wagon road to the mill had been completed previously. The improvements cost $72,000 and only $68,000 was taken out before the ore was exhausted, and operations ceased.

The country rock is porphyry, probably an andesite, much broken and fractured. The miners call it "block porphyry." It scarcely seems possible that a vein of this size and strength should peter out at such a moderate depth. It is believed that if studied by a competent geologist, it might be found that the vein was faulted, and could be picked up again and worked at a profit.

During the first management of the old mill the average value of ore saved was about $9 per ton; the tailings averaging less than $1 with the old mill, and 50c. with the new. The plate surface was more than double that generally used, and in addition pieces were used the entire length of the launders. Vanners were tried on the tailings in the new mill, but could not make expenses. The bullion was sent out in bars, just under 4 lb., by registered mail, to the New York office, without loss.

Two company boarding houses were run, at which a charge of $1 per day was made. Under the first management the operating cost of this venture was 98c. each per day, but by buying in quantities, this was reduced to 68c. per day. Supplies of all kinds had to be put in for eight months. There was no other settlement within 60 miles, and the manager, besides being a mine and mill man, had also to be something of a doctor and lawyer. One winter there were 24 cases of pneumonia and only one was lost.

[Active operation of the property was resumed by the Yellow Jacket Gold Mining Company under new management, after a careful consideration of reports by E. E. Chase, E. B. Kirby, T. A. Rickard, F. D. Howe and John B. Hastings. We are informed by an officer of the company that at the time these engineers examined the mine, the old workings were either badly caved or were tightly timbered, so detailed study of underground conditions was impossible. The surface of the hill is overlain by a heavy coating of drift, and the difficulty of adequate examination was great. The results of exploration, as reported by the company, are summarized in the following statement: It remained for Mr. Hastings, the present manager, to disclose the actual conditions by proving a north-south fault, which coincides with the lowermost limits of early stoping operations. Mr. Hastings at once bent his efforts toward the location of the vein across this fault and actually entered the vein on a lower level, only to find it again displaced by a diagonal gabbro dike not previously disclosed. All work by the present company has been and still is directed toward opening the vein below the fault and dike. Over the ridge from the mine workings, float from this vein or a similar one is found in quantity, strongly indicating the linear continuity of the ore. Though much might be learned from prospecting in this direction, this course has not been adopted, as the depth of overburden would necessitate tunneling rather than trenching, and, furthermore, expensive equipment would be necessary to bring any ores opened there to the mill. At the main workings, everything is in readiness for production immediately upon the finding of the displaced oreshoot, the 60-stamp mill, ditches, flumes and all machinery having been kept constantly in repair.—Editor.]

Beneficiating Lake Iron Ores

By Dwight E. Woodbridge*

During 1911 some important improvements were made in plants at iron mines in the Lake Superior district.

First in tonnage and results is the great concentrator of the Oliver Iron Mining Co., on the Mesabi range. It is true that this is not essentially a matter of the last year, for experiments looking to the washing of these lean Mesabi ores have been in progress for six years, and two units of the works were operated a short time in 1910. For a period of about 160 days' total working time, in the last year, the work has been in full operation with the five units, with a production of nearly 1,900,000 tons of merchantable concentrates, or 2000 tons above the rated capacity of 10,000 tons per day. This is an admirable result, and one that shows that experiments preliminary to construction must have been most thorough. It is understood that costs of this separation of sand from the west Mesabi ores have been satisfactory, and well within expectations, and there is little doubt that, should an extension of this operation be desirable, the new works would be along somewhat similar lines. This plant has treated ore from a number of mines on the Mesabi, all operated by the Oliver company. It was built primarily for use in connection with the ores of the Canisteo lease, but those from several other mines have been treated the last year, particularly from the Walker, Hill and Holman, two of which are Great Northern leases. In passing, it may be remarked that the capacity of this plant is several times that of any other iron-ore concentrating plant in the world.

The Hawkins mine, belonging to the International Harvester Co., contains a large tonnage of similar sandy ores, and works of the same type are underway there now, to be ready for operation the coming season. This installation differs from the Coleraine plant in but one essential detail, which is that concentration is not to be carried quite so far, for there will be no tables for treating the fines. This new plant will have a 20-hour capacity for 2000 tons of product.

Magnetic Separation

At Moose Mountain, in the Georgian Bay region, are vast deposits of magnetite of from 35 to 40 per cent. iron, with a silica-hornblende-feldspar gangue, and of schistose nature. Here a wet magnetic separator plant of 800 tons daily capacity in concentrates is under construction, using the Grondal patents. This plant is modeled after that at Sydvaranger, Lapland, which has been fully described in the Journal. The works will cost about $250,000 and are expected to produce a brick of 60 per cent. or better, low in phosphorus and of excellent furnace texture. The product to come from this plant the present year will be trifling, as but a part will be ready before late in the season. The Moose Mountain company estimates above 100,000,000 tons of ore upon its property that can be made merchantable. The cost of separation is expected to be under $2 per ton.

---

*Mining engineer, Sellwood Building, Duluth, Minn.

Calcining Siderite Ore

Still more interesting are the works under construction at the Magpie mine, Michipicoten district, by the Lake Superior Corporation. Siderite rocks occur frequently in this region, and the Magpie is a mass of concentrated siderite, carrying, say, 35 to 40 per cent. iron and 18 to 20 per cent. carbon dioxide. The located claims there, of which the Corporation has bought seven for $250,000, contain a tonnage of this rock available for calcination that may amount to 40,000,000 or more tons. Elsewhere in the same region is much more. As the result of experiments in the roasting of this rock to drive off the CO_2 a plant is being erected sufficient to treat 1500 or more tons per day, and it is to be in operation by the opening of navigation the coming spring. The material carries sulphur to excess in the form of pyrite, most of which is driven off at the high temperature maintained in the roasters by means of producer gas. The product is a porous bessemer hematite, running about 57 per cent. iron and basic in nature, and will be made at a cost of about 40c. If this process is a success, and there seems little reason to doubt that, it relieves that company of further anxiety over ore supplies for its works at Sault Ste. Marie.

During the last summer a cave-in above the 700-ft. level of the same company's Helen mine brought down about 350,000 tons of ore. As this mine contains a considerable amount of pyritic sand concentrated in pipes and pockets throughout the deposit, the cave-in resulted disastrously, in that it intimately commingled the ore and pyrite. For this reason a washing plant has been installed at the Helen mine for the purpose of eliminating the sulphur, and ore shipped of late has been passed through this washery. Though this operation is perhaps temporary, it is an installation of ore-treatment works on Lake Superior.

Drying Ore

Experiments in drying ore for the purpose of securing a reduction in freights and a lesser one in furnace treatment, were carried along for some months and have resulted in the erection of a drier plant at the Hollister mine, Crystal Falls district, Michigan. Hollister ore assays about 49% iron, nat., is high silica, low alumina and above the average in hygroscopic moisture, of which it has about 13 to 14 per cent. A drier of the Atlas, horizontal rotating type, with capacity for 300 tons per 20 hours, has been in successful operation there during a part of the last year. The drawbacks to successful operation of such works, some of which readily suggest themselves to the critic, are said to have been met, and are classed as easily surmountable. Indeed, the figures seem to prove them less serious than a casual consideration would indicate. For instance, readmission of moisture into the partially dried ore while *en route*, by rains, from atmospheric absorption and the like, will affect merely the exposed portions of the mass of ore, and then only to the extent of the amount of fall or the percentage of atmospheric saturation limited by the exposed area. In ore in cars or pockets this does not mean much. Hollister ore has been brought down to 6 or 7 per cent. moisture and the guarantees for this ore for 1911 present a marked contrast to those for prior years. It is now proposed to extend this drying process to an ore more difficult of treatment. Works to consist at once of two units, each of 40 tons per hour capacity, are under construction at the Brunt mine, Mesabi range. Brunt ore assays 47 per cent. iron, nat., 5.7 per cent. silica, 5 per cent. alumina and more than 15 per cent. hygroscopic moisture, being, as will be seen, quite clayey and wet. The works under construction will dry 1600 tons per 20 hours. If successful as predicted this capacity will be doubled.

Briquetting Fines

At the mine of the Northwestern Iron company, at Mayville, Wis., a Grondal briquetting plant for fines has been built and is now in operation. The Mayville ores contain a large proportion of fines that have caused much loss in furnaces, and it has been the practice to wet these ores thoroughly before charging them, so that they would stay until thickened or covered. A Grondal plant of four ovens, capacity 400 tons per 24 hours, is now working on these ores. In this plant the kilns consist of long channel furnaces, through which the shaped bricks pass slowly on flat cars. These cars form a continuous, intermittently moving platform dividing each kiln into an upper and a lower compartment. Through the lower one cold air is drawn to protect the trucks from heat; along the upper one and down through the bricks and platforms oil flames pass, agglutinizing the bricks, with an extreme temperature of 2400 deg. F. The bricks are made in a near-by pressing plant.

The plant at Port Arthur, Ont., for the elimination of sulphur from Atikokan ores by roasting with waste furnace gas, has been in operation for a year or two. The ore is crushed coarse and roasted with a heat that drives off most of the sulphur carried in the form of pyrite, etc.

Jones' Step Process Experiments

In addition to all these devices the Jones Step Process Co. has been continuing its experiments in enriching and nodulizing low-grade siliceous ores, at its Iron Mountain headquarters, and will soon open a furnace at the Kloman mine, where there are large quantities of lean, siliceous banded ores.

The significance of all these efforts to enrich otherwise valueless ferruginous material in the Lake Superior region or to improve already merchantable ores so as to effect a material saving in freights and final treatments, should not be minimized. That it has crystallized in a year of low prices and dull business in the ore trade is not so astonishing as it might appear at first glance, and is deeply significant of the attitude of the ore trade toward the future. In time of peace prepare for war, is no less a political than a commercial axiom. This work is doing much to bring into the column of available reserves ores that, up to the immediate present, have been classed as future low-grade reserves or that have not been considered at all.

American Institute of Mining Engineers

Notice is given that the annual meeting of the Institute will be held at the headquarters in New York, Feb. 19, 20 and 21. Local committees have been organized, and a detailed program will be issued later.

At this meeting the important amendments to the constitution, which were proposed at the adjourned annual business meeting in 1911, will be submitted to vote. A summary of these amendments was published in the Journal of Sept. 16, 1911, p. 531, and are embraced under three general heads: (1) Change of name of the Institute; (2) Reclassification of membership; (3) Redistribution of dues. In order that the vote on these amendments may be as full as possible, members who cannot attend the meeting are asked to send their proxies to E. E. Olcott and George W. Maynard, specifying how their votes shall be cast. This meeting will probably have an important bearing on the future of the Institute and it is hoped that there will be a large attendance.

It is the purpose hereafter to make the annual meeting the most important gathering of the year, both professionally and socially.

First Aid to Mining Machinery—VI

By Henry M. Lane*

In making molds for hopper castings, simple patterns cannot be used as the mold would be damaged in drawing the pattern. Skeleton patterns for such work are described; also the making of dry-sand molds.

In many cases a heavy casting may be so broken or of such shape that it cannot be used as a pattern in making a new part, or, when a new casting of fairly intricate form is required, it may be difficult and expensive to make a solid wooden pattern for it. In such cases skeleton patterns may be used to advantage.

PATTERN FOR CIRCULAR HOPPER

In order to illustrate the principle of the use of skeleton patterns, the method of preparing a mold for the casting shown in Fig. 1 will be described. The figure represents one section of a circular hopper, the hopper itself being 5 ft. 6 in. in diameter at the top, and the hopper part having an angle of 45°. It will be noticed that the metal is 1½ in. thick, and that it is supported by a series of ribs, the ribs at the end of each section serving also as bolting flanges.

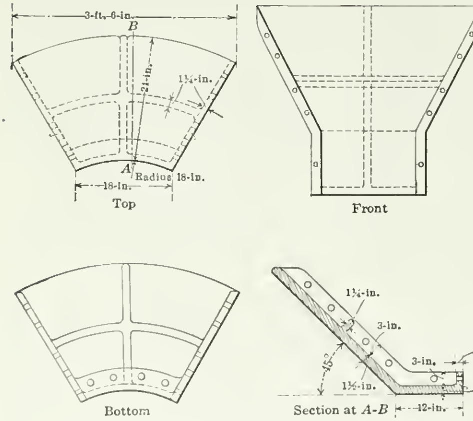


FIG. 1

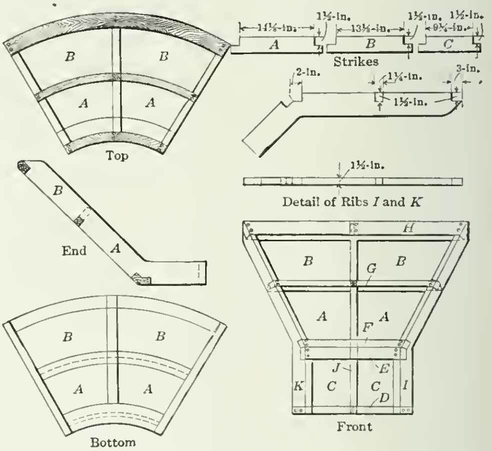


FIG. 2

The Engineering & Mining Journal

CIRCULAR CAST-IRON HOPPER AND PATTERNS FOR MOLDING IT

Four views of the casting are given in Fig. 1. The pattern for making this casting is shown in Fig. 2; it consists simply of the ribs, flanges and a few tie strips.

The opening in the mold which is to be filled by the metal which will form the face of the casting in the areas represented by the openings *A*, *B* and *C*, is formed by striking out the sand with the strikes *A*, *B* and *C*, corresponding to the similarly lettered areas. Three ribs are made, as shown in detail, and these are then connected with circular segments which are worked out to form and attached as shown. The lower flange *D* is, of course, sawed from plank. In like manner the segment *E* is sawed from plank. The segments *F*, *G* and *H* are sawed out to approximate form and then completed with a draw shave or chisels.

MOLDING WITH STRIKES

After the skeleton pattern is placed together, as shown in Fig. 2, molding proceeds as illustrated in Figs. 3 and 5. The drag part of the flask, shown in the illustration, is made of channel irons and is rammed full of sand and the pattern bedded in, as shown in Fig. 3. The sand is filled up even with the top of the pattern, so as to form a parting along the upper face of the pattern. The cope flask is then placed in position, as shown in Fig. 3. This cope flask is constructed as shown in Fig. 4, being made up of channel irons with wooden bars for supporting the sand. These bars may be attached by bolting them to angle irons, as illustrated, or holes may be drilled in the side of the flask and the bars nailed in place.

The angle-iron method makes a stiffer flask, but at the same time one that is considerably more expensive. If much foundry work is being done a flask of this kind is always a good thing to have on hand, as different bars can be introduced to suit different classes of work. The bottom of the bars, of course, will be cut out so as just to clear the pattern and support the sand properly. The bolted bars can be changed more easily than nailed bars, for where nailed bars are taken out they are frequently broken so that they cannot be used again.

MAKING THE MOLD

As already stated, the cope is placed in position and is rammed up in the usual manner. Parting sand has already been placed on the face of the drag so that the cope may be lifted off freely. The cope is then lifted off and set to one side. The drag is finished by taking the strikes shown in Fig. 2 and digging or striking out the sand between the ribs in the spaces *A*, *B* and *C*, Fig. 2, as illustrated in Fig. 5. The ends of the strike ride on the ribs and the lower portion serves to cut out the sand between the ribs. After this has been done the screws holding the segments *D*, *E*, *F*, *G* and *H* are removed, and the segments, with the exception of *D*, lifted out. The flanges *I* and *K* are then drawn from the sand separately. After this the flange *D* is drawn from the sand. This releases the flange *J*, which is drawn last. The flange *D* could not be drawn until *I* and *K* are out of the way, as there would not be clearance for the end of the flange *D*. In like manner flange *J* cannot be drawn until the two portions of *D* have been removed, on account of the fact that *D* passes over the top of *J*. It will readily be seen that

---

*Editor, Castings, Caxton Building, Cleveland, Ohio.

this pattern could not be drawn from the sand in one piece if it were molded with the inside face up.

An Alternate Method of Molding

The pattern can be molded with the inside face down. In this case the striking out of the sand between the ribs is a little more difficult, as the projecting ribs are in the way. If the pattern were molded with the inside face down, the parting would extend from the edge of the flask to the top of the ribs *I* and *K*, and the sand between these ribs and the rib *J* would have to be lifted out with the cope. As it is difficult to lift out such hanging bodies of sand, the method already described would be easier for those not particularly skilled in the art of molding. After the various parts of the pattern have been withdrawn, any broken corners are patched, and if a simple green-sand casting is required the gate is cut, the mold closed and poured.

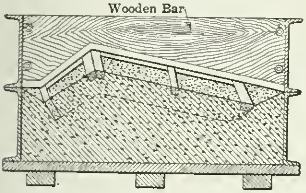


Fig. 3

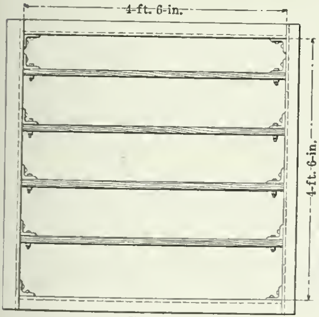


Fig. 4

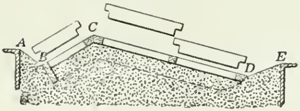


Fig. 5

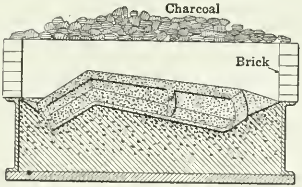


Fig. 6

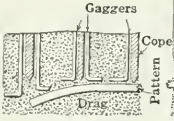


Fig. 7

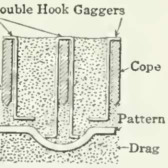


Fig. 8

The Engineering & Mining Journal

Molding with Sweeps, Showing Use of Gaggers

In heavy work the large body of metal retains heat much longer than a thin casting, and hence there is a tendency for the sand on the surface of the casting to be burnt or partly melted, so as to stick to the casting. To reduce this to a minimum, facing or blacking is frequently employed to peel the casting. The regular foundry-supply houses furnish plumbago, coke or soapstone facings for this purpose. In emergency foundries, blacking made from coke fine enough to pass at least a 100-mesh sieve and preferably a 200-mesh sieve, may be used. If a good grade of talc is available, some of this may be ground with the coke. The coke should then be mixed with a little clay wash and glutrin water or molasses water to the consistency of a thin cream. This is placed on the face of the mold by means of a swab or spray. The usual method employed by the foundryman for spraying is to take a large, soft brush with bristles four or five inches long, dip it into the mixture and then, by a quick jerk, throw the liquid on to the face of the mold as a spray of fairly fine drops. Another method is to use a swab made of wicking, which is dipped in the facing and then dragged over the surface of the mold. Care must be taken not to wash away the sharp corners of the work; hence the spraying method is usually better than the swabbing, though in the hands of a skillful man the swab may be used without breaking corners.

Method of Drying the Mold

The corners, if slightly damaged, can be patched with the trowel after the wet facing has been applied. After applying the wet facing the surface of the mold must be skin-dried. This is accomplished in the case of the drag by placing some bricks around the edge of the flask, as shown in Fig. 6, laying some sheets of corrugated iron or ordinary sheet iron across the top of the bricks and building a charcoal fire on top of the sheet iron. The heat from this fire will be radiated down on top of the mold and will dry it. In piling the bricks on top of the flask, a sufficient number of loose joints should be provided to permit the escape of the steam which results from the drying of the wet blacking or facing. The cope is dried by setting it up on four standards, placing some sheets of iron around the outside face and building a charcoal fire under it. It is necessary to dry only the surface for a depth of from 1½ to 2 inches.

Preferably the drying should be done just before pouring the mold. The mold should be closed hot and poured as soon as possible. When making skin-dried molds, a stronger grade of molding sand may be employed than when making green-sand molds, that is, the sand may contain more clay. Frequently in this class of work some very coarse sand or small gravel is worked into the mixture as the foundryman says, to strengthen it, though it probably also acts in opening the vents. For skin-dried molds the sand may be rammed a little harder than for green sand, because the drying removes the moisture from the surface and so gives a freer vent next to the face of the casting.

A Third Method

The casting described in this article could also be made in an all dry-sand mold. If this were the case, however, the wooden bars in the flask shown in Fig. 4 would have to be replaced by cast-iron bars bolted in place. These bars can be made in open sand molds, that is, cast in the floor without any cover over them. Each of the bars, of course, will have to be formed along the lower edge to fit the pattern. Where dry-sand work is to be made, a much heavier or stronger sand is used than for green-sand or skin-dried work. This sand should contain a considerable proportion of clay and should be rammed as hard as the molder can ram it.

Dry-sand molds are more nearly foolproof than green-sand molds. This is because there are not so many difficulties resulting from the venting, since in a dry-sand mold all of the moisture has been removed before the metal is cast. This has a double effect; first, there is no moisture present to be driven out as steam during casting, and, second, what vent there is back of the face of the mold is not clogged by moisture serving as a bonding medium.

Fair dry-sand molds may be made by taking the ordinary green molding sand and wetting it down with glutrin water and clay wash. This can be made by putting one or two shovelfuls of fireclay into a barrel of water, adding from one to two gallons of glutrin, stirring it up thoroughly, and then sprinkling the sand with it. The sand is then cut over several times with the shovel to mix it thoroughly and after this it is rammed into the molds "good and hard." After the molds have been rammed and the pattern drawn they are placed in a core oven and thoroughly dried. This drying should preferably take place at a temperature not exceeding 350° F., and should proceed slowly so that the moisture may pass from the sand without having any tendency to disturb its surface. If the mixture contains sufficient silica, it will not crack seriously during the drying.

Binders Used in Dry-sand Molding

In making dry-sand molds it is always necessary to use a large number of rods or gaggers to tie or bind the sand together, and these are dipped in clay wash and placed next the bars in the cope. The drag, of course, does not need bars, on account of the fact that it is not turned over during any stage of the molding operations. The strongest gaggers are made from twisted bars such as are used for reënforced concrete work. This form of gagger was patented by the Franklin Core Rod & Gagger Co., of Franklin, Penn. For ordinary work, however, round or square wrought-iron rods from one-quarter to half an inch in diameter or cast-iron gaggers a half inch in diameter are used. The method of placing the gaggers next to the bars is shown in Fig. 7. The foundryman calls a piece of iron bent like a letter L a gagger or single-bend gagger. Sometimes the upper end of the gagger is bent back, so that the whole takes the form of the letter Z. These double-bend gaggers are not so handy as the single bend, on account of the fact that the length of the straight portion of the shank is governed by the depth of the bars in the flask. The double-bend gagger, however, can support a much heavier load than the single bend, as the single bend is supported solely by the friction of the sand about the straight portion or shank.

Foundrymen sometimes use what they call soldiers to support the sand in the flask. These are narrow strips of wood from one inch or two inches in width and about an eighth of an inch thick. They are dipped in clay wash and placed in the mold in a manner similar to gaggers, except that the stem of the gagger is always placed next to a bar, while soldiers are frequently placed between bars. Soldiers are particularly advantageous in carrying sand in deep pockets, on account of the fact that they do not weigh as much as gaggers, and hence do not aggravate the trouble they are intended to solve by increasing the weight which must be supported.

Facing and Drying Dry-sand Molds

Dry-sand molds should always be washed or blacked on the face. As the mixture used in dry-sand molds is harder and stiffer than that used in green sand, the wet blacking or facing mixture may be applied to the surface of the mold with a brush or swab. Dry-sand molds cannot be dried satisfactorily by charcoal fire on the floor, as this would serve only to skin-dry them.

Where large work has to be made in the emergency foundry, dry-sand or skin-dried molds should always be used, and if facilities are at hand for drying the mold, the all dry-sand mold is to be preferred. Dry-sand molds are sometimes dried by blocking up the flask on its bottom plate on the floor, building up a loose brick wall about it or a structure made of sheet iron, and then building coke or charcoal fires inside of the structure and maintaining the fire for from 24 to 48 hours. In this case the cope may be placed above the drag, the two being separated by piles of brick at the corners and both are dried at the same time. This is virtually making a temporary core oven on the foundry floor and then drying the molds in it. The surface of the casting made in a dry-sand mold, which has been dried with a proper facing mixture, is generally better than that obtained from a green-sand mold.

The Marysvale Alunite Deposit

A deposit of alunite, recently discovered near Marysvale, Utah, according to the press bulletin of the U. S. Geological Survey, may become of commercial importance for the production of potash to supply Western orchards. A vein of pink spar in the hills southwest of Marysvale had long been known to prospectors, and had repeatedly been located for the sake of small showings of metalliferous minerals in the siliceous wall rocks, but its true character was not recognized until 1910, and on Jan. 1, 1911, the deposit was relocated as potash claims.

The deposit is situated near the head of Cottonwood Cañon, about seven miles southwest of Marysvale, in Piute County. It is found high in the Tushar range, outcropping near the crest of a ridge, which leads from the crest of the main divide at an elevation of approximately 11,000 ft. above sea level, and extends down to about 9900 ft., the lower end being about 4000 ft. above the level of the railroad at Marysvale. So far as is now known, the entire deposit is located.

Alunite is a hydrous sulphate of aluminum and potash containing 11% of K_2O. It is generally white in color, though sometimes grayish or reddish. In the United States, alunite occurs at several places in Colorado: in the Rosita Hills, Custer County; on Calico Peak, near Rico; in the National Belle mine, near Silverton; and at Cripple Creek. It also occurs at Tres Cerritos, Mariposa County, Calif.; associated with the gold ores at Goldfield, Nev.; in the Cactus Range, east of Goldfield; at the Rabbit Hole sulphur mines, near Humboldt House, Nev.; at Alunite, near Las Vegas, N. M.; in the Morenci and Bisbee districts, Arizona; and in the Frisco district, Beaver County, Utah.

In some of these places it is supposed to have been produced by the alteration of potash feldspars. If the alterations are the result of descending acid solutions derived from oxidation of pyrite, the resulting deposit will not presumably extend below the surficial zone of oxidation, but if they are due to ascending acid solutions of volcanic or other origin, they may be expected to extend to greater depths.

The deposit at Marysvale appears to be a large regular true-fissure vein, the alunite occurring in bodies both of compact earthy or granular texture, and in clear crystalline masses, varying from white to a clear pink color. The vein strikes northwest, has been traced by prospecting about 3500 ft. along the outcrop and is known to outcrop for about half a mile more. There is in one place at least 20 ft. of solid alunite in one vein and about 6 ft. more in a parallel vein about 25 ft. away.

If the width of the principal vein be taken at 10 ft. and the proved length of the deposit at 3500 ft., then the area of the deposit will be 35,000 sq.ft. Then for each 100 ft. of depth, at 175 lb. per cu.ft. of rock, the deposit would yield 300,000 tons of rock, or about 30,000 tons of potash, or about one-sixth of our annual imports.

Uranium in 1911

An active demand for uranium ores, particularly from European sources, characterized the uranium situation in 1911. At first it was thought that some new and important use for the metal as an alloy or in the chemical industries had been discovered, but later it was practically admitted by the buyers that the ore was wanted for the purpose of the extraction of radium and radio-active salts.

Interest in the carnotite deposits of Colorado and Utah was revived and great activity in shipping and in exploration in this locality resulted during the summer and autumn. It is probable that these deposits will be still more extensively exploited during 1912. The ore contains both uranium and vanadium. About 30 cars of carnotite were shipped, most of it to England but some of it to Pittsburgh.

A small output of pitchblende was made from mines in Gilpin County, Colorado, and discoveries were reported from Chihuahua, Mexico. The chief output of pitchblende continues to be from Germany and Cornwall, England. Reported deposits of complex uranium ore in Guerrero, Mexico, were examined by the Mexican Geological Institute and were reported as not important.

A large deposit of radio-active uranium ore was reported by Douglas Mawson, in Australia, and its development and exploitation were actively begun with some financial pyrotechnics.

Concentration of Molybdenite Ores

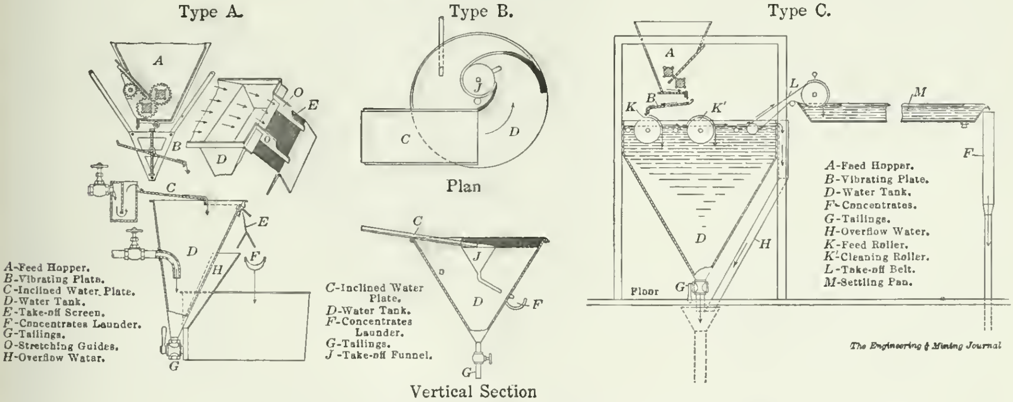
By Henry E. Wood*

In the concentration of molybdenite ores flotation methods are used. When the gangue contains other sulphides preliminary or subsequent treatment is necessary. Three types of concentrating machines are described.

Such a vast amount of information on the general subject of flotation has been published that I will eliminate the theoretical side and give, as briefly as possible, an outline of my device for the concentration of molybdenite. Whatever is said about molybdenite applies, in nearly all cases, equally well to the other sulphides, most of which have a strong flotation tendency. I have developed three flotation machines, two of which are already patented both locally and abroad, and patents are pending for the other.

CONCENTRATION BY FLOTATION

For type A the molybdenite ore is ground dry to 20 mesh or finer, fed automatically from a vibrating plate, which delivers the ore upon a rapidly moving inclined sheet of water. The molybdenite (MoS$_2$) floats and quietly passes over the surface of the tank. In falling from the tank the loaded film is split off by means of a nearly vertical screen, as shown by the accompanying cut, and collected by the usual means.



DIAGRAMMATIC SECTIONS OF THREE MOLYBDENITE CONCENTRATORS

In type B the same method of feed is employed, but the inclined plane of water discharges into a conical tank. In this a vertical movement of the water is obtained by a water jet against the sides. The loaded film is diverted by guiding screens to a funnel, the outlet of which passes through the sides of the tank to a collection launder. This plan collects all of the floating molybdenite, but as it requires some water to carry the film into the funnel, that water contains more or less silica in suspension. The saving in either of these types is good, but the product is more or less contaminated. It was to avoid this feature and meet market requirements that the third machine, known as type C, was designed.

If preliminary tests show that the molybdenite is detached from its gangue at 20, 30 or 40 mesh, it is fed from the hopper to the vibrating plate. From the latter it drops upon a revolving corrugated rubber cylinder. This elevates enough water to saturate the gangue, while the molybdenite floats from the cylinder across the tank to a canvas belt, or series of belts, which emerge from the tank. Before it reaches the take-off belt, water jets just below the surface gently force the film upon the belt. The curve of the belt upon the roller meets the film at a point when the water, with its gangue in suspension, is drained off. The take-off belt is so arranged that the concentrates are deposited in a shallow compartment, from which they float off to settling tanks or to tanks where they are dewatered by filtration. During its passage across the surface of the tank the film passes over one or more partly submerged canvas or screen-covered cylinders, which are revolving at the same speed as the main take-off belt. These cylinders serve the purpose of saturating any gangue that may not have become wetted previously.

The entire operation is so gently performed that but little of the film is accidentally wetted and sinks. The gangue passes out at the bottom of the tank and is subject to table concentration if it should contain other minerals of value that have not floated. For treating ore coarser than 20 mesh the feed cylinder is removed and an impetus given to the surface of the tank by means of water jets in front of the vibrating plate.

REMOVAL OF OTHER FLOATING MINERALS

So far as the concentration of molybdenite that has a simple gangue is concerned, by the use of type C it is completed at one operation. If copper or iron pyrites and other sulphides are present, as is frequently the case, they float with the molybdenite. I employ one of two methods for their separation: The flotation concentrate is given a light roast and the iron and copper removed by magnetic separation. The simpler plan is to pass the wet flotation concentrate over a Wilfley table, making an iron and copper concentrate, as the molybdenite is readily collected by itself in the tailings.

Where mica is present a small proportion of it also floats. As some of the associated micas are magnetic they are taken out by magnetic separation, leaving the nonmagnetic tailings as a high-grade molybdenite concentrate. I have made many tests on molybdenite ores running from 1% up to 8% or more; and where it is contained in a clean quartz gangue there has been no difficulty in obtaining an 80 to 90% MoS$_2$ product with a recovery of 80 to 90%. This method is adaptable to either of the two forms of MoS$_2$.

These concentrators require less than ¼ hp. to operate them, merely enough for feeding purposes. With a clean

---

*President, The Henry E. Wood Ore Testing Co., Denver, Colo.

gangue it is quickly saturated and the concentration completed at one operation. The amount of water required is just enough to carry off the tailings and also what clean water is used in washing the take-off belt. This system of flotation is feasible on account of its simplicity as compared with the various complicated oil and acid flotation processes more widely known, while its operation costs are consequently considerably less.

The present standard machine has a 3-ft. feed with four feet of take-off belt surface. The capacity varies as it is dependent upon several conditions, such as the character of the gangue, the size of the ore treated and the ratio of concentration, the latter feature being affected greatly by the expansion properties of the loaded film. This is extremely elastic, and while it will stand a large amount of compression, care must be exercised to prevent its being overloaded as it is liable to sink from its weight.

The dimensions of the machine can be made to meet almost any practical requirement. The present machine with a 3-ft. feed occupies a floor space of 4x5 ft. and is 6 ft. high. When crated for mule-back transportation its weight is 1300 lb. The net weight is 1000 lb. At present it is manufactured by the Denver Engineering Works and sells f.o.b. Denver for $500 to $600. It is sold without royalty.

Methods of Drying Concentrates

I am frequently asked about the drying of the fine flotation concentrates. It is a mistake in the first place to consider them as being all finely divided sulphides. It is true that nearly all of the fine sulphides are recovered, but along with them a large proportion of the sulphides coarser than 16 mesh will also float, so that the final drying of such concentrates does not differ much from the drying of other concentrates.

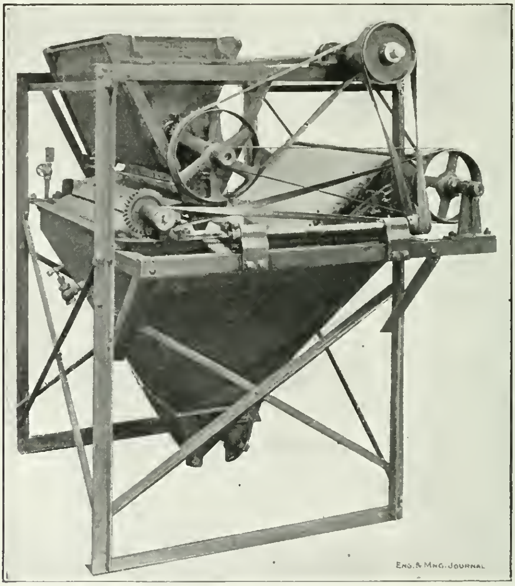
Flotation concentrates may be collected by a series of overflow settling tanks, as the concentrates are wetted in collecting them and sink quickly in the clean wash water, practically no gangue in suspension going with them. In continuous operation I use vacuum or pressure filters to dewater them, after which they are dried by the usual means.

As a matter of interest in connection with the concentration of molybdenite ores, I note that there has been little development of the mines. As a consequence the surface or partly oxidized ores will not do as well as the unoxidized ores. This state of affairs may be largely due to the want of a simple method of concentration, such as this new device is able to supply. I also find that in nearly every sample of molybdenite submitted to me considerable molybdic oxide is present. As practically all the oxides are quickly wetted and sink, one can recover only such of the oxidized particles as chance to land on top of the film of the sulphides.

Ore Must Be Crushed Dry

To procure the advantages of surface-tension principles it seems to me that the ore must be crushed dry. My experience has shown that some of the various types of ball mills (for instance, the Krupp) will not only liberate the sulphides in better shape for flotation, but produce at the same time a minimum amount of fines. If the ore is ground finer than necessary it will also float to a certain extent, a condition to be avoided as far as possible.

It happens occasionally that even in the wet crushing of ores there is a large loss of floating sulphides. I have a simple device for the complete recovery of such floating slimes than can be placed in the discharge launder of any mill.



Wood Type C Concentrator

Another interesting fact has been forcibly impressed upon me in conducting over 800 flotation tests. I refer to the rapidity of the oxidation of the sulphides after they have been ground. An ore like chalcopyrite, for instance, which will float to 80 or 90% of its copper contents, if treated reasonably soon after grinding, will not yield half that amount if allowed to stand a week or two after grinding. If ore that has been ground dry and subsequently wetted and dried again be treated by flotation, practically all that had previously floated will sink.

Oxidizing effects that are invisible to the eye have an important bearing on flotation work. I noticed this feature when concentrating a low-grade chalcopyrite associated with a heavy pyrrhotite. When treated by flotation most of the former material will float, while the latter with some copper will sink. If subsequently this latter mixture is dried and treated magnetically, the pyrrhotite is easily lifted, leaving the chalcopyrite as nonmagnetic tailing to be added to the flotation concentrate, and the two together insure a high total recovery. If the chalcopyrite and pyrrhotite concentrate made after flotation is dried and treated by flotation, the copper will also sink. I have also observed that magnetic minerals will sink to a decided extent—such as magnetite, pyrrhotite, magnetic blende, etc., while the yellow blende will float readily under certain conditions. Apparently the flotation conditions for each ore will require investigation to determine just how it should be treated to insure the best results.

Parting Platinum Silver Alloys

The use of sulphuric instead of nitric acid for parting platinum-silver alloys has long been recommended. A. Steinmann, in *Chemisches Centralblatt*, says the use of concentrated sulphuric acid is likewise inaccurate, and recommends the use of slightly diluted acid, the procedure being as follows:

About 250 mg. of the platinum alloy are mixed with silver (at least 5 times the quantity of platinum present), copper and lead, the quantity of copper to equal that of the platinum. The whole is then cupelled at as high a temperature as possible and the button obtained fused from 5 to 10 min. The resulting button is then rolled to a thickness of 0.2 mm. and heated for 15 min. with dilute sulphuric acid (100 volumes of concentrated acid to 22 volumes of water) at a temperature not exceeding 240° C. The treatment with acid is repeated twice, and residual platinum is washed, dried and weighed.

Wrought Iron Production

By Bradley Stoughton*

The oft-quoted statement that the invention of the Bessemer and openhearth processes would drive the wrought iron industry out of existence has long since ceased to worry the iron manufacturer; nevertheless, the sphere of rolled iron has constantly narrowed, and the actual production in America has been on the decrease since about 20 years ago. The following statistics of the number of puddling furnaces are compiled from data published by the American Iron and Steel Assocation:

Nov., 1887....	4882	April, 1898....	3889
Nov., 1889....	4914	Nov., 1901....	3251
Jan., 1892....	5120	June, 1904....	3161
Jan., 1894....	4715	Nov., 1907....	2635
Jan., 1896....	4408		

The following figures of production of wrought iron are from the same sources.

PRODUCTION OF ROLLED IRON

	Rolled iron, gross tons.	Percentage of total rolled iron and steel.
1888	2,153,263	46.5
1889	2,309,272	44.1
1890	2,518,194	42.8
1904	1,760,084	14.7
1905	2,059,990	12.2
1906	2,186,557	11.2
1907	2,200,086	11.1
1908	1,238,449	10.5
1909	1,709,431	8.7
1910	1,740,156	8.1

It is to be observed that a large proportion—probably from one-half to three-quarters—of this tonnage is made by the busheling and rerolling of wrought iron scrap, and is not the new product of the puddling furnace. This circumstance is especially important because it means the abundant use of an inferior product through a misconception. Busheled scrap almost inevitably contains masses of intermixed steel scrap, which renders the product less able to resist rusting than either wrought iron or steel alone; and yet it is the belief in the superiority of iron to resist rusting that is the chief factor in keeping alive its manufacture today, as evidenced by the circumstance that the field of wrought iron has narrowed more and more to the production of forms that are to be subjected to corrosive influences; namely, roofing sheets, boiler plates and pipes. Whatever one may think of the quality of newly puddled iron in this respect, we believe the unreliability of busheled scrap will not be questioned.

---

*Consulting engineer, 165 Broadway, New York.

The London Silver Market

Messrs. Pixley & Abell's annual circular says that in 1911 fluctuations in quotations of spot silver were rather smaller than in 1910. The highest quotation of the year was $26\frac{1}{8}$d., on Nov. 23, and the lowest $23\frac{11}{16}$d. on Feb. 9, a range of $2\frac{7}{16}$d. against $3\frac{1}{16}$d. in 1910, $1\frac{13}{16}$d. in 1909, 5d. in 1908, and $8\frac{1}{4}$d. in 1907. The average price of spot silver for 1911 is $24\frac{19}{32}$d., against $24\frac{11}{16}$d. in 1910, $23\frac{11}{16}$d. (the lowest on record) in 1909, $24\frac{13}{32}$d. in 1908, and $30\frac{3}{16}$d. in 1907. On Jan. 1 the quotation was $25\frac{1}{4}$d.; that of Dec. 30, $25\frac{1}{16}$d. per ounce.

Speculation in Silver

The very large amount of silver under the control of the Indian group of speculators was again a dominating influence on the market throughout the year, which opened with a steady tone. Prices were maintained at about $25\frac{1}{4}$d., China giving some support to the market until about the middle of January, when an outbreak of plague in Manchuria and Northern China interfered with the export of soya beans and other produce, while at the same time there was a brisk business doing in imports in Shanghai and other China ports. China became a seller on this market, which at once assumed a weak tone, and quotations declined steadily until Feb. 9, when $23\frac{11}{16}$d., the lowest price of the year, was quoted. The Indian bazaars, which had been buying moderately, now began to support the market, there being in some quarters an unfounded apprehension lest the import duty on silver into India should again be increased.

At the same time the plague in Manchuria showed signs of abating, so that the export of beans was resumed on a normal scale. China also became a buyer, and quotations steadily improved to about $24\frac{1}{4}$d. early in March. From this point until the middle of July fluctuations were small, quotations being steady in the neighborhood of $24\frac{1}{2}$d. with a short-lived upward movement during the latter part of April, which carried the price up to $24\frac{15}{16}$d. At this time it was anticipated that the crops in India would be satisfactory, as the monsoon at the opening had been favorable, but during July a spell of dry weather, which lasted for some weeks, set in, and as the prospect of India securing good average crops became improbable, Indian and other speculators began to sell silver, and the market sagged until $23\frac{15}{16}$d. was touched. From this point it recovered slightly, and remained between 24d. and $24\frac{5}{16}$d. until the outbreak of the rebellion in China in October. A demand for dollars in the interior of China caused large purchases of silver to be made in London and India, which, after being coined into British dollars in the Bombay mint, were sent on to Hong Kong. At about the same time there were satisfactory late rains in India, which greatly improved the prospects of the crops and removed all fear of a famine. This, with the demand from China, lifted the price of spot silver to 25d., at about which figure it remained until early in November.

Finding China a good buyer of spot silver, the Indian speculators, who have been large holders of silver throughout the year, then began to take delivery of their contracts as they came due, and the grip which they had on the market was sharply felt. Those who had sold short found great difficulty in securing the silver necessary to cover their contracts, and as the bear account open in London was undoubtedly very large, there was a further sharp rise, and as high as $26\frac{1}{8}$d. was quoted for spot silver, the forward quotation at one time being as much as $\frac{3}{4}$d. below that of spot. This tempting premium caused some shipments from China to be made to this market, while America sent increased supplies, silver, which in normal times finds its way from San Francisco to China, being diverted to this country. These larger supplies, while consumers as far as possible delayed their purchases, served to relieve the strain, and the premium on spot gradually decreased until the middle of December, when the spot quotation declined to about $25\frac{1}{2}$d., while forward was $\frac{1}{8}$d. to $\frac{3}{16}$d. lower. During these weeks China had been a moderate buyer of forward silver, but its purchases were never very large. During the third week of December the market sagged further, while at the same time the Indian speculators stopped taking delivery of their contracts with the result that the premium on spot silver rapidly disappeared, and on Dec. 20 was again quoted below forward, as it had been throughout the year, until the squeeze began in November. At this date the quotation had fallen to $25\frac{1}{8}$d., supplies of spot silver being more than ample, and the market remained at about this figure to the end of the year, China continuing to buy steadily, though India was selling.

Silver in India

The popularity of silver as an investment in India seems to be waning, as the following figures, published by the Commercial Intelligence Department of the Government of India, indicate. After deducting the amounts reëxported from the amounts imported, it appears that India has retained for home consumption during the year ended Oct. 31 last, 44,000,000 oz., against 56,400,000 oz. during 1910, and 60,843,000 oz. during the year 1909. How far these decreases are to be attributed to the increase in the import duty, which was made last year, and how much to larger investments in gold, is difficult to determine. The poorer classes probably find it impossible to invest their small savings in anything but silver, but the wealthier classes are possibly finding gold a more convenient and steadier holding than silver. The stock in Bombay, which amounted to 20,000 bars on Jan. 1, 1911, was reduced to 13,400 bars on Oct. 31, and now amounts to 13,200 bars. The prolonged period of dry weather during the summer did great damage to the crops, but fortunately the autumn rains were good and prevented the disaster of a famine. The demand for silver rupees was smaller than in 1910, and the Indian government again made no purchases of silver, while it seems probable that it will not be obliged to buy for coinage this season, though the Burma rice crop has yet to be dealt with. The total holdings of silver rupees in the treasury is now 25¾ crores (at the exchange of 16d. to the rupee equaling £17,166,009), against 32 crores (£21,400,000) at the end of 1910, and 38½ crores (£25,833,000) at the end of 1909. The holdings of silver in the gold standard reserve, which, at the end of 1910, amounted to 3¾ crores, now amount to 3 crores.

Silver in China

The year 1911 was one of disaster and disturbance for China. The plague in Manchuria and North China, the floods in the Yangtse Valley and in Manchuria, which have caused severe damage to the bean crop, and during the closing months of the year the rebellion, which spread over the whole of the Empire, have all been heavy blows to the immediate prosperity of this country. Still China has withstood these buffets of fate better than could have been expected, and has again been an important buyer, while if the negotiations now in progress for the political settlement of the country result in a stable form of government resting on a popular basis, it is very probable that the material prospects of the Empire will steadily improve, and that the awakening of China will be more rapid than could have been deemed possible a few weeks since. A larger field for the use of silver should be opened up, especially if the reform of the currency, which had been commenced, but which has been in abeyance during the rebellion, should be energetically taken in hand by the new government, as is very probable. A large sum of money will be required to carry through this reform of the currency and for this and other purposes a loan of £10,000,000, of which £6,000,000 was to be devoted to currency reform in China, and £2,000,000 to that of Manchuria, had been arranged for with a group of British, French, German and American banks. The negotiations for this loan will, in all probability, be renewed with the new government, as soon as it is firmly established. The Peking government had during the year secured a stock of silver from various sources, which had been coined into dollars as a commencement of the reform, as arranged with the above mentioned foreign powers. These dollars, which are to be the basis of the new currency system of the Empire, are to weigh 414½ grains with a fineness of 0.900. We understand that it had not been intended to issue these new dollars, of which a few specimens have been received here, until a much larger stock had been acquired, and also until all the arrangements for the change had been completed, but the scarcity of currency, owing to the rebellion, forced the government to issue them recently.

Heavy Shipments to India and China

Shipments of silver bars to India and China have amounted to £9,835,000 in value, being an increase of £1,165,000 over the amount shipped last year. No figures are yet available to show how this amount was divided between the two countries. China also received £1,900,000 from San Francisco, against £1,400,000 in 1910, while in March $10,000,000 from Indo-China were sent to Shanghai.

During this year the Bombay mint coined a considerable quantity of British dollars for use in Hong Kong, but no official statement of the amount has as yet been published. Stocks of bar silver and sycee in Shanghai show a remarkable increase during 1911, as, according to the latest figures available, there are now in Shanghai 243 lacs of taels in sycee and 1590 bars with a sterling value of about £3,300,000. There is also a stock of nearly 9,000,000 Mexican dollars. At the beginning of the year the holdings were 123 lacs of taels in sycee and 6370 bars with a value of £2,302,000 in all.

Other Sales

Purchases by Russia and Germany were again important, the former country taking £1,752,647 from London and the latter £1,725,335, against £1,110,000 and £1,257,780, respectively, in 1910. Shipments to France were £940,283, and to Brazil £216,136, against £533,740 and £53,000 in 1910. British silver coin to the value of £1,751,896, of which £1,069,652 has gone to West Africa, has been exported, against £1,406,500 in the preceding year. The world's production of silver seems to be maintained.

The total value of the imports of silver bars into Great Britain during 1910 amounts to £13,948,960, against £12,660,000 in 1910. In addition, silver ores valued at £1,700,000 were imported, while in 1910 the value of these was £1,862,333 in all.

At the close of 1911 the stock of silver in London is estimated to amount to £1,900,000, while at the beginning of the year it was about £2,000,000, which was probably considerably underestimated.

Famatina Development Corporation

The report of the Famatina Development Corporation, Ltd., for the year ended Dec. 31, 1910, was recently issued. The ores reserves at its mines in Argentine, South America, on Dec. 31, 1910, are reported as 188,570 metric tons. In 1910, 1467 ft. of development work were done, which is comparatively small. About 13,267 metric tons of ore were mined; 11,237 metric tons were smelted from which 392,434 kg. of copper, 3976 oz. of gold, and 72,221 oz. of silver were obtained.

In February, the government aërial tramway by which the ore is transported from mine to smeltery broke, and was not repaired until September. This long interval interfered seriously with the operation of the smeltery. The enforced stoppage was utilized in the installation of a Brown mechanical roasting furnace and a Yeagon briquetting plant. A steam plant of 350 hp. was also purchased and put into operation in January, 1911. This is a necessary addition owing to the fact that the floods of the summer season bring down so much sand and gravel as to interfere seriously with the water power plant, and also with the supply of water clean enough to use in the water jackets and in the boilers.

At Durazno heap roasting is to be employed, as the Brown roaster alone is not capable of treating sufficient ore to supply two furnaces with roasted material. At the roast heaps, pits have been made so that the copper sulphate leached out by heavy rains can be precipitated by scrap iron.

The fine flue dust and the roasted ore from the Brown furance are briquetted with lime as a binder. A proper means of drying briquets is necessary because, undried, they are too friable to withstand direct charging. Thirty cars on which the briquets can be piled as they leave the machine are ordered, and will be of much assistance; if these are satisfactory, additional cars will be ordered. In November, 1911, a contract was concluded with the Argentine government, which should effect a saving to the company of £23,800 per year in the matter of transportation.

The Tasmanian Metal Extraction Company was to have commenced (*Min. Journ.*, Oct. 28, 1911) operation of its bi-sulphite plant late in 1911. The Tasmanian Copper Company has contracted to dispose of all its ore, composed of sulphides of auriferous and argentiferous lead, zinc and copper, to this company. With the bi-sulphite process it is hoped to save the zinc formerly lost, as well as the other metals in the ore.

Mining and Metallurgical Patents

A Classified List of New Inventions

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by The Engineering and Mining Journal upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COPPER

LEACHING—Obtaining Zinc and/or Copper from Complex Ores or the Like. John R. Williams, Henry W. Bradley and Benjamin Bradley, Sheffield, Eng. (U. S. No. 1,006,330; Oct. 17, 1911.)

ORE TREATMENT—Process of Recovering Copper from Its Ores. Henry K. Hess, Philadelphia, Penn., assignor to American Copper Extracting & Refining Co. (U. S. No. 1,014,061; Jan. 9, 1912.)

GOLD AND SILVER

CYANIDING — Decanting Apparatus. M. R. Lamb, Milwaukee, Wis., assignor to Allis-Chalmers Co. (U. S. No. 1,007,954; Nov. 7, 1911.)

DREDGING—Apparatus for Discharging Dredge-hoppers and the Like. Otto Frühling, Brunswick, Germany. (U. S. No. 1,012,196; Dec. 19, 1911.)

HYDRAULIC MINING—Rotatable Hydraulic Nozzle. Alexander McCombie, Grass Valley, Calif. (U. S. No. 1,012,398; Dec. 19, 1911.)

REDUCTION OF SILVER ORES. Colin G. Fink, Schenectady, N. Y., assignor to General Electric Co. (U. S. No. 1,013,931; Jan. 9, 1912.)

STAMP-ACTUATING MEANS. Hans Charles Behr, Johannesburg, Transvaal. (U. S. No. 1,012,187; Dec. 19, 1911.)

STAMP MILLS — Improvements in Stamp Mills for Crushing Ore and the Like. N. Leslie, Blackhall, Scotland. (Brit. No. 19,721 of 1911.)

TUBE-MILL LINING—Improvements in the Lining of Tube Mills. J. S. Rigby and D. Birrell, Liverpool, Eng. (Brit. No. 7801 of 1911.)

IRON AND STEEL

BLAST FURNACE—Safety Device for Blast Furnaces. Samuel B. Shutts and William McHugh, Joliet, Ill. (U. S. No. 1,013,961; Jan. 9, 1912.)

COPPERIZING—Method of Copperizing Iron. William George Clark, Geelong, Victoria, Australia. (U. S. No. 1,014,454; Jan. 9, 1912.)

FURNACE-CHARGING APPARATUS. Carl E. Bedell, Warwood, W. Va., assignor of one-half to Wheeling Steel & Iron Co. (U. S. No. 1,012,235; Dec. 19, 1911.)

MANUFACTURE — Improvements in the Manufacture of Steel. T. D. Mackie, London, Eng., and G. F. Forwood, Surrey, Eng. (Brit. No. 22,569 of 1910.)

MANUFACTURE OF IRON AND STEEL. Frank A. Wilmot, Bridgeport, Conn. (U. S. No. 1,012,310; Dec. 19, 1911.)

REGENERATIVE FURNACE. Thomas S. Blair, Jr., Elmhurst, Ill., assignor to Blair Engineering Co., New York, N. Y. (U. S. No. 1,012,236; Dec. 19, 1911.)

REGENERATIVE FURNACES — Improvements in Regenerative Furnaces. F. Bernhardt, Königshütte, Upper Silesia, Germany. (Brit. No. 28,982 of 1910.)

LEAD, ZINC AND OTHER METALS

ALUMINUM—Process for Pickling Aluminum and Its Alloys Prior to Galvanizing or Coating the Same with Other Metals. Stephan Jahn, Charlottenburg, Germany, assignor to Aktiengesellschaft Mix & Genest, Telephon- und Telegraphen Werke, Berlin, Germany. (U. S. No. 1,011,203; Dec. 12, 1911.)

TIN—Method of Detinning. Heinrich Brandenburg, Kempen-on-the-Rhine, Germany. (U. S. No. 1,012,511; Dec. 19, 1911.)

ZINC—Machine for Cleaning Muffles of Zinc Furnaces. Otto Saeger, Breslau, Germany. (U. S. No. 1,014,333; Jan. 9, 1912.)

ZINC—Method of Producing Zinc Oxide. Harry H. Hughes, St. Louis, Mo. (U. S. No. 1,014,062; Jan. 9, 1912.)

ZINC—Treatment of Complex Ores. Edgar Arthur Ashcroft, Sogn, Norway. (U. S. No. 1,011,897; Dec. 19, 1911.)

ZINC-LEAD ORES—Treatment of Refractory Zinc-lead Ores. Percy C. C. Isherwood, Leytonstone, England. (U. S. No. 1,011,962; Dec. 19, 1911.)

ZINC-LEAD ORES—Metallurgy of Metal Sulphides. Edgar Arthur Ashcroft, Sogn, Norway. (U. S. No. 1,011,899; Dec. 19, 1911.)

ZINC-LEAD ORES — Metallurgy of Zinc-bearing Lead Sulphides With or Without Small Admixtures of Other Metals. Edgar Arthur Ashcroft, Sogn, Norway. (U. S. No. 1,011,898; Dec. 19, 1911.)

MINING—GENERAL

BELT CONVEYOR. Jere L. Wentz, Passaic, N. J., assignor to Robins Conveying Belt Co. (U. S. No. 1,014,106; Jan. 9, 1912.)

CHANNELING MACHINE. Henry H. Mercer, Claremont, N. H., assignor to Sullivan Machinery Co., Claremont, N. H. (U. S. No. 1,011,221; Dec. 12, 1911.)

CLUTCH MECHANISM FOR WINDING OR HAULING ENGINES. Hans Charles Behr, Johannesburg, Transvaal. (U. S. No. 1,012,188; Dec. 19, 1911.)

CONVEYER BELT. Walter W. Spadone, New York, N. Y., assignor to Gutta Percha & Rubber Manufacturing Co., New York, N. Y. (U. S. No. 1,009,264; Nov. 21, 1911.)

DRILL—Portable Electric Rock Drill. John Albert Pierson, Pigeon Cove, Mass. (U. S. No. 1,011,841; Dec. 12, 1911.)

DRILLS — Improvements in Rock Drills. N. Staub, Schiffweiler, Germany. (Brit. No. 11,782 of 1911.)

DRILLS — Improvements in Rock Drills. Pedro Campo, Santiago, Chile, and F. H. Rapley, London, Eng. (Brit. No. 9215 of 1911.)

EXCAVATORS—Tooth for Excavators or the Like. Michel J. Woznack, Seattle, Wash. (U. S. No. 1,011,547; Dec. 12, 1911.)

FLUME. George L. Hess, La Junta, Colo. (U. S. No. 1,008,466; Nov. 14, 1911.)

FLUME OR CULVERT. Arvid Reuterdahl, Boise, Idaho. (U. S. No. 1,010,074; Nov. 28, 1911.)

LAMP—Acetylene Lamp. Martin William Moore, Springfield, Ill., assignor of one-third to George Conlisk and one-third to Joseph Lopez, Springfield, Ill. (U. S. No. 1,008,923; Nov. 14, 1911.)

MINE JACK. Charles A. Miller, Connellsville, Penn., assignor of one-half to John J. Malloy, Connellsville, Penn. (U. S. No. 1,009,545; Nov. 21, 1911.)

MINER'S LAMP HOLDER. Walker S. Adams, Parkersburg, W. Va., assignor of one-half to Perry D. Dye, Parkersburg, W. Va. (U. S. No. 1,011,003; Dec. 5, 1911.)

MINERS' LAMPS—Clip for Miners' Lamps. Grant I. Rawson and Llewellyn B. Shultz, St. Louis, Mo., assignor to Pilley Packing & Flue Brush Manufacturing Co., St. Louis, Mo. (U. S. No. 1,014,025; Jan. 9, 1912.)

MINER'S PICK. Frank E. Derschmidt, Ankeny, Iowa. (U. S. No. 1,014,575; Jan. 9, 1912.)

SHAFT LINING — Lining Wall for Shafts. George W. Jackson, Chicago, Ill. (U. S. No. 1,009,312; Nov. 21, 1911.)

ORE DRESSING—GENERAL

CONCENTRATION — Improvements in or Relating to Method and Apparatus for Ore Concentration. E. H. Nutter and Minerals Separation, Ltd., London, Eng. (Brit. No. 23,949 of 1910.)

CONCENTRATOR. Benjamin Franklin Cobb, Denver, Colo. (U. S. No. 1,010,348; Nov. 28, 1911.)

CRUSHER—Rock and Ore Crusher. Howard Roy Stacks, Glenside, Penn., assignor of one-half to Richard O. Kohler, Catasauqua, Penn. (U. S. No. 1,014,532; Jan. 9, 1912.)

CRUSHING MACHINES — Improvements in Crushing Machines. E. B. Symons, Milwaukee, Wis. (Brit. No. 11,223 of 1911.)

CRUSHING ROLLS. Jeremiah S. Frazee, New York, N. Y. (U. S. No. 1,014,383; Jan. 9, 1912.)

PULVERIZER. Arthur F. Williams, St Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,014,191; Jan. 9, 1912.)

PULVERIZERS—Screen for Pulverizers. Edward H. Frickey, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,014,384; Jan. 9, 1912.)

PULVERIZING — Dust Deflector for Pulverizer Machines. Milton F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,014,193; Jan. 9, 1912.)

QUARTZ MILL. Charles Wallace, Denver, Colo., assignor to Wallace-Owings Machinery & Supply Co. (U. S. No. 1,014,273; Jan. 9, 1912.)

SEPARATION—Hydraulic System of Ore Separation. William Polglase and Frank Bates, Great Falls, Mont. (U. S. No. 1,012,151; Dec. 19, 1911.)

SEPARATOR—Centrifugal Ore Separator. Philip F. Peck, Chicago, Ill. (U. S. No. 1,012,097; Dec. 19, 1911.)

METALLURGY—GENERAL

CRUCIBLE FURNACES — Improvements in or Relating to Crucible Furnaces. L. Rosseau, Argenteuil, France. (Brit. No. 4171 of 1911.)

CUPOLA FURNACES — Improvements in Cupola Furnaces. P. Anderson, Arvika, Sweden. (Brit. No. 18,414 of 1911.)

ELECTRIC FURNACE. William C. Arsem, Schenectady, N. Y., assignor to General Electric Co. (U. S. No. 1,009,625; Nov. 21, 1911.)

ELECTRIC FURNACES — Improvements in Electric Furnaces. J. E. Florence, New York, N. Y. (Brit. No. 8998 of 1911.)

EXTRACTION—Improvements in and Relating to the Extraction of Metals from Ores. B. Bradley, Manchester, Eng. (Brit. No. 28,274 of 1910.)

FURNACE GASES—Apparatus for Purifying Furnace Gases. Utley Wedge, Ardmore, Penn. (U. S. No. 1,012,488; Dec. 19, 1911.)

LIME BURNING—Process of Burning Lime. John G. Jones, Carthage, N. Y. (U. S. No. 1,011,804; Dec. 12, 1911.)

OIL-BURNING PLANTS—System of Regulation for Oil-Burning Plants. Jas. R. Atchison, San Francisco, and Clarence R. Weymouth, Berkeley, Calif., assignors to Chas. C. Moore & Co., Engineers, Inc. (U. S. No. 13,337; Dec. 12, 1911.)

REDUCTION—Improved Process for the Reduction of Metals from Their Ores. A. Berglof, Chicago, Ill. (Brit. No. 20,115 of 1910.)

REFRACTORY BODY and Process of Making the Same. Edward Goodrich Acheson, Stamford Township, Welland County, Ontario. (U. S. No. 1,014,199; Jan. 9, 1912.)

ROASTING — Improved Process and Apparatus for Roasting Fine Ores. W. Buddeus, Wiesbaden, Germany. (Brit. No. 1131 of 1911.)

SMELTING FURNACE with Electric Refining Hearths Connected Thereto. A. Helfenstein, Vienna, Austria. (Brit. No. 5140 of 1911.)

Personal

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

H. H. Knox is examining mines in Bulgaria.

W. Rowland Cox, of New York, has opened an office at Los Angeles.

W. J. Elmendorf, of Spokane, Wash., general manager of the Portland Canal Mining Co., is in Toronto, Ont.

T. N. McCauley, general manager of the Mascot Copper Mining Co., Bisbee, Ariz., has been in San Francisco.

John Kiddie has been given charge of the Arizona Copper Co.'s engineering department, at Morenci, Arizona.

Ernest Levy, manager of the Le Roi No. 2, Ltd., at Rossland, and the Van-Roi Mining Co., Slocan Lake, has gone to London.

Ernest Williams, who has been in charge of operations at the Bewick-Moreing properties in Porcupine, Ont., will return to England soon.

J. M. Ruffner, manager of the North Columbia Gold Mining Co., operating hydraulic mines in Atlin, B. C., has gone to Cincinnati for the winter.

George H. Garrey, who recently accepted the position of mining geologist for the American Smelting & Refining Co., and allied Guggenheim companies, is in New York.

Herman L. Schneider, for over six years with the Rio Tinto Copper Co., at Terrazas, Mexico, has resigned his position as manager and will be for the present at El Paso, Texas.

George M. Richards, of New York, has gone to London on professional business, and expects to remain there several months. His address will be in care of the Union of London & Smith's Bank, London, England.

Henry Hanson, who is superintending the construction of the mill for the Merrill Metallurgical Co., of San Francisco, at Porcupine, Ont., will join the staff of the Dome mine as mill superintendent when construction is completed.

W. H. Yeandle has been transferred from the position of assistant general superintendent of the mining department of the Cia. Real del Monte y Pachuca and is now connected with the Exploration Department of the United States Smelting, Refining & Mining Co., Mutual Life Building, Mexico City.

H. A. Barren has been appointed general superintendent of the blast furnaces and steel works of the American Steel & Wire Co. in the Cleveland and Pittsburg districts, succeeding J. W. Carpenter, resigned. B. D. Quarrie has been appointed general superintendent of the Newburg steel works and blast furnaces of this company at Newburg, Ohio, succeeding H. A. Barren, promoted.

Obituary

Clark T. Shaw died at Manhattan, Nev., Jan. 12, aged 54 years. His death was due to poisoning by cyanide of potassium. He was from Massachusetts and had been in Nevada for some time, and was known as a competent mill manager. He has been in charge of the War Eagle mill, at Manhattan, and was about to take charge of the Lemon mill.

Thomas H. Rooney died at San Francisco, Jan. 9, aged 66 years. Mr. Rooney was born in New York City and went across the plains to California in 1850 with his mother, the father having gone the previous year around the Horn. He was a brother-in-law of James Fair, and uncle of Mrs. William K. Vanderbilt and Mrs. Herman Oelrichs. He had charge of the sinking of the Union shaft on the Comstock in the '60s; was afterward superintendent of the Sierra Nevada, and was for a long time associated with Fair, Mackay and Flood in their Virginia City operations.

Thomas S. Kilgallan died at Wallace, Idaho, Jan. 14, aged 59 years. He was born in New York, and at an early age began work in the anthracite mines of Pennsylvania. In 1879 he went to Butte and was a resident of the city up to the time of his death. He was employed at a number of mines and worked his way up to be superintendent of the Colusa-Parrot and later of the Stewart and the Original. He retired about 10 years ago, but was interested in mines in Montana and Idaho. Mr. Killgallan was active in politics and served several terms in the Montana legislature. He leaves a widow, one son and five daughters.

Archibald G. Brownlee died at the Stanley mine, near Idaho Springs, Colo., Jan. 16, aged 55 years. He was born at Ottawa, Canada, and came to this country when a boy. He served several years in the U. S. Army and was for some time Indian agent in North Dakota. About 1890 he became engaged in mining in British Columbia and then in Alaska. He went to Colorado about 1901, and was concerned with several mines. Among them are the Japan-Flora group, near Telluride, and the Stanley mines in Clear Creek County, both of which he developed to a great extent. He was the principal organizer of the Western Metals Co., which built a mill at the East Griffith mine, in the Georgetown district. He was a member of the Colorado Scientific Society.

John W. Young died, Jan. 14, at his home at Evanston, Ill., aged 58 years. He was born in Brooklyn, N. Y., and took a degree as mining engineer at Columbia in 1879. He at once began active life in his profession. He later became a dealer in mining machinery and went to Chicago as the representative of a New York firm. In 1890 he was made vice-president of the Fraser & Chalmers Co., which office he held until 1898, when he became European representative of the Allis-Chalmers Co. In 1907, on the organization of the Chalmers-Williams Co., Mr. Young was made vice-president and a director of the company. Mr. Young was a member of the Chicago Club, the American Institute of Mining Engineers, Montana Society of Engineers, the Engineers' Club of New York, the Midwood Club of Brooklyn, and the Alta Club of Salt Lake City. He leaves a widow and a son.

John B. Hobson died at Victoria, B. C., Jan. 10, aged 67 years. He was born in Ireland and came to this country with his father when a child, settling in California in 1849. He had some preliminary training as an engineer in San Francisco, and after working as a contractor for a time, he became interested in hydraulic mining in Placer County. From 1871 to 1891 he was in charge of several mines at Iowa Hill, which included some of the largest operations of that kind in the state. Together with the late Jacob H. Neff he was instrumental in organizing the State Miners' Association, and in its interest went to Washington with the late Judge Niles Searls and former congressman J. K. Luttrell to secure legislation to rehabilitate hydraulic mining. The result of these efforts was the so called Caminetti bill, which now regulates that industry in this state. From 1889 to 1890, Hobson was an assistant to State Mineralogist William Irelan, Jr. In 1892 he went to British Columbia, where he opened up the Cariboo and Horsefly hydraulic mines in the Cariboo district for Sir William Van Horn and other large owners of the Canadian Pacific railway. When a few years later these properties were taken over by the Guggenheims, Hobson remained as their manager. Recently he engaged in the work of developing hydraulic mines of his own in that territory. He was for the past 20 years a prominent figure in British Columbia mining. In California he is remembered as the associate of Jacob H. Neff and the Colemans in bringing hydraulic mining to its greatest prosperity.

Societies and Technical Schools

Northwest Mining Convention—The Mining Men's Club, of Spokane, is actively engaged in preparations for the proposed convention, at Spokane, Wash., Feb. 15-17. Invitations have been sent to the mining men of the Northwest, including Alberta and British Columbia. Among the subjects proposed for discussion are mining laws; water-power development and metallurgical economics; prospecting and mine promotion; mine development and management; and safeguards of mining investment.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Jan. 1[illegible]—It is claimed by a special agent of the State Conservation Commission, acting also for the board of control under the law regulating appropriation of water, that 95% of the water-power locations in California are made not in good faith but for speculation purposes; that valuable water-power sites are being held by a man and a wheelbarrow, by the building of cabins and blazing of trails and by making surveys. The plan of the speculator, according to the special agent, is to stay on the ground until it is ascertained whether or nor any large company or interest is likely to purchase the right. If this is the condition the board of control must have been more mindful of the application fee of $10 than of the character of the applicant and the purpose of the appropriation. The law, approved Apr. 8, 1911, plainly provides that "the applicant shall set forth the nature and amount of the proposed use, the head and amount of the water to be utilized, the uses to which the water and electricity, or electrical or other power are to be applied, the location, character, estimated capacity, and estimated cost of the works," and other like provisions that a mere speculator would find difficulty in complying with if the board of control enforces them.

The law further provides that actual construction work shall begin within six months from approval of the application, and that the board of control has six months for consideration and rejection of the application. The facts that the applicant is not required to do anything in the first six months, and that the board of control mav within that period reject his application, make it wholly unnecessary for the applicant to even buy a wheelbarrow; if at the end of the six months there is no better evidence of good faith than the class of labor referred to it would be the duty of the board of control to put the speculator off the ground and revoke his license for failure to comply with the requirement respecting the commencement of actual construction. The law is simple, plain and sufficient, and six months is a liberal allowance for a *bona fide* applicant to begin work. If the condition reported by the special agent is the result of careless conduct of the board of control, as appears to be the case, the remedy should be provided by the board without recourse to the courts. It would be manifestly unfair to the *bona fide* applicant for the use of water to develop electricity or electrical or other power, to compel him to pay the speculator a bonus for a pretended water right to which he is not legally entitled, or to take the matter into the courts. If the law is not sufficient protection against irresponsible locators, it can be repealed.

Denver

Jan. 18—The below-zero weather at Cripple Creek and the fact that one of the large mines which discharged into Wilsac Creek, had temporarily ceased pumping, shortened the water supply so that the mill of Strattons' Independence was compelled for a few days to close down, but warm weather and the resumption of pumping operations have ended the water famine and the mill is running again as usual.

The El Paso, which is one of the representative and successful mines of Cripple Creek, now has about $120,000 cash in the treasury and 133,333 shares of the Cripple Creek Drainage Co., which the mining company subscribed for at $1 per share. This company has a clean and efficient management under Allan Burris, its president. He worked for wages in the mine for years, under former superintendents, knows every foot of the property and is the only president of any mine in Cripple Creek who spends most of his time underground.

Driving tunnels to develop at depth veins which in early days produced largely from the surface and since were abandoned for various reasons, is now the order of the day in nearly all Colorado mining districts and in the Georgetown district they are particularly active. On Saxon Mountain the Culley tunnel, now in 910 ft., is to be driven some distance further to the intersection of several known veins, chief of which is the Anamora, credited with a former production of $500,000. The tunnel of the Golden Glory Mining Co., now in 800 ft., will be driven steadily through the year to the intersection of several veins. This enterprise is financed by cattlemen of Fort Worth, Texas. The Eureka adit on Griffith Mountain is to be driven steadily ahead for a similar purpose and a contract to drive the Prudential tunnel, now in 900 ft., has been awarded to R. A. Patterson, the object being to cut the Magenta vein which is 75 ft. wide on the surface with good indications.

The production of San Juan County was slightly less in 1911 than during the preceding year, this being due chiefly to the traffic blockades, caused by floods in the Animas River and tributary streams. This blockade lasted from Oct. 4 to Dec. 10. Since the opening of their lines the railroads have enjoyed splendid business and much accumulated ore and concentrates are being moved. The outlook for the coming season in this county is cheerful. The year will probably be marked by greatly increased activity in the South Mineral Creek area and on the Eastern or Gold range, where is the Buffalo Boy mine, which created some excitement by reason of rich ore finds.

Butte

Jan. 17—B. B. Thayer, president of the Anaconda Copper Mining Co., is in Butte making his semiannual inspection of the companys' properties. Mr. Thayer is well pleased with the prosperous condition of the camp and with the appearance of the mines, which he believes to be in better condition and in a more advanced stage of development than ever before. By reason of the cheap electric power which can be furnished in large quantities to the mines of Butte, and, in fact, all over the state, from the immense hydro-electric power plants at Great Falls and along the Missouri River, he believes that mining will in the future be conducted on a much cheaper basis than formerly, and that copper in particular will be mined at a considerably lower cost after the hoists of the Anaconda company are all operated by compressed air generated by electricity, and ore-hauling in the principal mines is done with electric motors in place of horses.

In the country adjacent to Maiden, in Fergus County, considerable capital has been interested in the last year and a number of properties are being developed. Extensive work has been done at the Cumberland mine, several bodies of gold ore having been opened preparatory to mining operations. Several other properties which have been developed in a small way, are now being financed, and it is expected that cyanide plants and concentrators will be built at a number of them soon, for the treatment of the lower-grade ores. Fergus County has become famous for its sapphires, some of the finest ones in the world having been found there; the sapphire mines in the Yogo district were operated during 1911 successfully, and some new territory was explored. The London &

American Sapphire Co., which has developed a number of producing mines, owns the majority of the producing properties in that district.

Salt Lake City

Jan. 18—The Utah Apex Mining Co., at Bingham, is adding to its output and increasing earnings. During November, receipts from ore shipments amounted to $38,306, while other receipts brought $1470. The operating expenses were $21,184, including construction and equipment charges, amounting to 43c. per ton of ore mined. This left a net profit for the month of $18,592. Aside from the new equipment and construction, on a mining-cost basis the profits amounted to $20,577. There was shipped 1765 tons, net weight, of first-class ore, and 4524 tons of ore were sent through the mill, making a total of 6289 tons mined. The concentrates produced amounted to 1991 tons.

Good progress is being made by the International Smelting & Refining Co. in the erection of the lead smeltery at Tooele. Material used in construction has been arriving promptly. The flues, baghouse and stack are finished, and the ore bins are nearly completed. The blast-furnace building has been erected, and the foundations for the sintering plant completed. It is expected that the lead plant will be put in commission by Feb. 15, when the two furnaces of 250 tons capacity each will be blown in. The plant should be in full blast by Mar. 1. The supply of lead ores is coming chiefly from the Cœur d'Alene, Idaho, and from Park City and Tintic. Ore is also being received from Lemhi County, Idaho, and more is expected from that region. Some lead ore is also being received from Montana. The iron ore for fluxing will come from Pioche under a contract with the Prince mine for 200 tons per day. Shipments of tailings from the old pan-amalgamation mills at Bullionville owned by the Prince, are now being received, and shipments of iron-manganese fluxing ores, carrying some silver and lead, will be started from the Prince mine proper when the new 8-mile railroad spur has been built from Pioche to the mine. Surveys for this spur are being made, and grading and construction will be started soon. In addition to the iron-manganese fluxing ores the Prince mine will also ship a higher-grade silver-lead ore. The three reverberatory furnaces are smelting copper ores and are treating about 600 tons per day.

The following is an estimate of the production of Utah smelting plants during 1911: Gold, 240,039 oz. @ $20.67 per oz., $4,961,606; silver, 12,573,931 oz. @ 53.27c. per oz., $6,698,233; lead, 117,593,855 lb. @ 4.12c. per lb., $5,197,648; copper, 131,782,916 lb. @ 12.27c. per lb., $16,169,764; zinc, 10,541,198 lb. @ $5.71 per 100 lb., $601,902; $33,629,153, total value.

Negaunee, Mich.

Jan. 19—In accordance with the policy adopted nine years ago, the United States Steel Corporation has again offered employees an opportunity to invest a part of their earnings in the company's stock under favorable conditions. The subscription price for the preferred stock that the company is to issue at this time is $116, and $65 is to be the price for the common stock. Under the plan adopted by the corporation when the first stock was issued to employees, those earning $1100 or less per year may not subscribe for more than one share of the preferred stock, while those receiving between $2000 and $3000 annually may subscribe for as many as 15 shares. Of the common stock, employees earning under $500 per year are limited to one share, with a maximum of 25 shares for the highest-salaried employees or officials. Payment of the subscriptions is to be made in monthly installments, to be deducted from salaries or wages. There is a number of the Corporation's employees in the iron-ore mines holding stock, some of them having bought when the offer was first made.

Deadwood

Jan. 19—A good January thaw has set in, and work is progressing much more smoothly at the mines in this district. The Wasp No. 2 found it necessary to suspend operations, as the deep snow and cold weather interfered with operations. Construction work at several properties, which was seriously hampered, has been resumed. At Galena the Black Hills smeltery is rapidly nearing completion, and a continuation of the pleasant weather should see it finished on contract time, Feb. 1. Owing to a combination of deep snow and a landslide, which took out a section of the track, the spur to the Victoria mill, in Spearfish Cañon, will not be in shape for the delivery of coal when work is resumed at an early date, and for that reason no attempt will be made to operate the air compressor, and mining will be done by hand methods. The large amount of snow which has fallen assures a good supply of water for mining purposes during the coming summer, and operations will be stimulated.

Wallace, Ida.

Jan. 17—The snowslides of the last few days which were common in the outlying cañons proved disastrous in several places and caused a total of five deaths. Two men were killed on Big Creek, two at Sunset and one at Mace. In many other places the slides carried away cabins and other property which happened to be in their paths. A slide occurred at Mace over the same path taken by the disastrous slide of February, 1910, when a dozen persons were killed. This one, however, moved slowly and started lower down the mountain.

Porcupine

Jan. 18—The closing down of the Foley-O'Brian mine probably marks the end of what once was one of the best known and best thought of Porcupine properties. The stock of this company has shown an almost continuous decline since it was first issued. Various theories are put forward as the reason for the shutdown, but underground development has been disappointing, and it is probable that this is the cause.

For some time past, those interested in mining in northern Ontario, have been endeavoring to have several changes effected in the Mining Act, and announcements of some of these were made a few days ago. Permits for prospecting in the Forest Reserve can now be obtained in the local recording office, instead of having to send to Toronto, as was formerly the case. Reductions have also been made in the fees for transferring interests in a mining claim. The Department also has under consideration the withdrawal of the townships of Ogden and Deloro, from the Forest Reserve, but this is a matter that will require special legislation. It is believed that these changes mark the commencement of a general reduction in all fees to the Recording Office.

Mexico

Jan. 15—In a recent interview with the *Mining Gazette,* at Houghton, Mich., U. S. A., Julio Madero, brother of President Madero, made some interesting statements. Regarding foreign investments in the Republic, he said: "American capital in Mexico is in a better position than ever. The government will offer every inducement and guaranty to foreign capital as we need it to develop the country."

Concerning the political situation he said: "The situation in Mexico is not nearly so complicated nor so serious as some of the press reports have seemed to indicate. Normal conditions, toward which the country made rapid strides after the revolution, have not been affected by the unsuccessful attempts to consolidate the several local disturbances into a revolution. My brother has been in office less than two months; at the end of three you will see the country completely pacified and started upon a new period of prosperity and development.

"If you Americans will only look back to your reconstruction days, and then consider how much more complete is the overturning of the local governments in Mexico, you will cease to wonder at the existence of petty disturbances now in Mexico. But the army, including all the men who fought perfunctorily to sustain President Diaz, are loyal to the present government and will sustain it to the end."

The Mining News

The Current History of Mining

Alaska

The following gold shipments were received at the U. S. assay office in Seattle, during 1911: Circle, $38,083; Cook Inlet, $139,388; Copper River, $216,477; Eagle, $49,979; Iditarod, $1,116,016; Koyukuk, $135,852; Nome, $1,862,317; southeastern Alaska, $169,497; Tanana, $1,089,368; total, $4,816,981.

Jesson Brothers will work their property, at the head of Chatham Creek, in the spring. A tunnel is now in 150 ft., and this will be extended.

Carlisle Fraction—This property has been leased by A. Littlewood, Fairbanks, who will develop it as soon as the weather permits.

Arizona

GILA COUNTY

Southwestern Miami—Hole No. 2 is 330 ft. deep and is being continued. At the annual meeting of stockholders to be held in Globe on Feb. 12, it is proposed to increase the capitalization from 50,000 shares to 100,000 shares, $5 par value.

Old Dominion—The preliminary work in the concreting of the Kingdon shaft to 1000 ft. depth has begun, under the direction of Contractor Paul Michaelson and C. H. Weideman, construction engineer.

Arizona Commercial—Charles S. Smith, president of the company, is visiting the mines and states that work will not be begun by the new company until the bonds of the old company have been foreclosed and the new company takes possession of the property, which will probably be some time in June or July. It is proposed to confine the work to the old Copper Hill shaft, near the United Globe ground, and to make some arrangement with the Superior & Boston whereby the latter company will develop the ground tributary to the Eureka shaft.

Magma—James Neary, superintendent of this copper mine, at Superior, 30 miles west of Globe, was in Globe recently and purchased three teams from the Superior & Globe mining company to be used in hauling ore from the mine to Florence, whence it is shipped by rail to the El Paso smeltery. Mr. Neary states that 300 ft. of drifting have been done on the eighth level, opening a vein of copper ore 15 ft. wide in places, the shipments averaging 26% copper. The ore on this level consists mostly of the rich sulphides, bornite and covellite. About 60 men are employed and 150 tons per month are being shipped. The mine was formerly known as the Silver Queen and is now owned by the Gunn-Thompson Company.

Miami—It is proposed to resume churn drilling soon, but this work has not yet been started as reported in some Eastern papers. The ground to be drilled lies a few hundred feet northeast of the present developed orebody and the surface indications are believed to be favorable to the existence of another body of ore.

Live Oak—Three drifts have been started from the station on the 800-ft. level in No. 2 shaft and all are breasted in ore. Drifts and raises are being driven in ore at the east end of the orebody on the fourth level.

Inspiration—The temporary warehouse is finished. Underground work has not yet been resumed and construction of the dam across Pinal Creek is progressing satisfactorily. About 120 men are employed. The telephone line from the dam site to the mine is nearly completed. The Arizona Eastern R.R. Co. has instituted condemnation procedings in the district court to obtain a right-of-way for the extension of its line from the present terminus at Miami to the portal of the main tunnel of the mine, a distance of less than one mile. It appears that J. P. Morgan & Co. is the dominant banking interest in the underwriting of the stock and bond issues of the Consolidated company.

Duquesne—Ore is being hauled from this group, 15 miles west of Globe, and loaded on the car at Miami, preparatory to shipping to the smeltery at El Paso. The ore is reported to run well in gold, silver and lead.

SANTA CRUZ COUNTY

Arizona-Pittsburgh—Work has been resumed on this copper mine, under the charge of Frank Siebold.

Black Hill—J. F. Orosco, owner of this group, has made a good strike of shipping copper ore. The ore is wide and contains both copper and silver.

Glove—Sheehy Brothers are getting out a new shipment of five or six cars of carbonate ore. They have about decided to sink a deep shaft and will be in the market for machinery.

Marsteller—This group of claims, near Nogales, has been bonded to Col. O. P. Posey, who is doing work on them. The vein is from 18 to 25 ft. wide and shows high-grade gold ore on the surface.

California

AMADOR COUNTY

Kennedy—The board of directors and Superintendent Smith were reëlected at the annual meeting held at San Francisco in December.

South Amador Mining Co.—This company is reported to have made a payment under contract of purchase of the group of properties composed of Amador Queen No. 2, Schoolhouse, Aetna and the McKay ranch. The properties are held by C. D. Porter under bond from W. J. McGee, of San Francisco. An electric hoist has been installed on the Queen. J. McCorsley is manager.

Penn Mining Co.—Representatives of the boards of supervisors of Amador, Calaveras and San Joaquin Counties visited the copper mine and smeltery at Campo Seco, Jan. 4, to investigate the conditions that have caused complaints by the farmers regarding the smoke fumes. The company has made efforts to neutralize the smoke and has agreed to try further to satisfy the farmers.

BUTTE COUNTY

Drobnier Dredging Co.—This company has been incorporated with head office at Chico, to operate on lands south of Oroville. The directors are D. Breslauer, E. F. Coutolenc, O. A. Shaw, C. C. Jends, B. F. Hudspeth and H. H. Shaw, of Chico, and L. F. Riley, of Oroville. Capital stock is $250,000.

CALAVERAS COUNTY

Lightner—This property at Angels has been purchased at sheriff's sale by W. J McGee, of San Francisco. The price paid was $85,000 in satisfaction of judgment held by James V. Coleman, owner of the Angels mine, adjoining.

FRESNO COUNTY

Recent development of mining claims in the vicinity of Dunlap has induced the establishment of a post office. The camp is situated about 40 miles east of Fresno and is reached by stage 28 miles northeast from Sanger. It has attracted a good deal of attention during the last year.

HUMBOLDT COUNTY

California Mining & Dredging Co.—This syndicate has made an agreement of sale of its properties to Wilson Foster, at a price said to be more than $300,000. Other properties in the vicinity of Orleans will be included in future negotiations.

Inyo County

Woodin-Grant—Ore from these claims at the summit of the White Mountains is being milled at the Bradford mill near Aberdeen station. I. J. Woodin and W. T. Grant are the owners.

Kern County

Santa Ana—Fifteen tons of ore averaging $20 per ton are reported as the daily output. The Four Ace Mining Co. is the owner.

Grand Tank—William Bouchard has sold this group of claims to T. B. Peterson and A. F. Dejdrick. The purchasers are owners of the Brymer group, from which they extracted 10 tons in December, which were treated at the Red Dog mill, returning $160 per ton.

Mariposa County

Crown Lead—The 20-stamp mill is running one shift and a large amount of development is being done. Thirty men are employed. G. S. Ireland, Coulterville, is superintendent.

Oro Rico—The 20-stamp mill is rereported to be running on good ore. Thomas Mutton, Coulterville, is superintendent.

Bondurant—This property is still inactive owing to the failure of adjustment of the bond, though it is reported that there is prospect that matters will be settled and operations resumed soon.

Monterey County

Buclimo—Active preparations are in progress for driving a new tunnel and the installation of assay and cyanide plants. James White, Watsonville, is superintendent.

Nevada County

The flumes along the San Juan ridge and at Graniteville, that were destroyed by the heavy snows of last winter, have been repaired and the prospects are good for a better season of mining this year than last. The snow of the present winter fell on dry ground and the freeze that followed was discouraging, but the recent moisture in the precipitation should insure abundant water.

Prudential—There is prospect that this mine will resume operation. George A. Aldrich still holds the bond, but has done no active work for several weeks. W. R. Burch, and others of San Francisco, are said to be interested in the property.

Le Duc Gold Mining Co.—The following officers have been elected: John P. Jones, president; B. A. Penhall, vice-president and general manager; Dr. W. G. Thomas, secretary; Frederick Allen and James Sampson, directors.

Murchie—The property of the Murchie Gold Mines Consolidated and the Murchie Extension has been sold to the Pacific Gas & Electric Co., to satisfy judgments awarded the South Yuba Water Co., amounting to $9800. The Murchie companies have one year in which to redeem. The mine is considered a good one, but has been tied up financially and has not produced for several years.

Colorado

Clear Creek and Gilpin Counties

Smuggler—Franchini & Co., lessees in this mine, on Brown Mountain, have opened gray copper ore on the fourth level, the shoot being 100 ft. long.

Chicago Mountain M. & T. Co.—The six mining claims owned by this company, on Chicago Creek, near Idaho Springs, have been taken over by R. R. Graham and H. B. Baker on a 5-year lease and bond, and will be developed as rapidly as possible.

Wyoming Mining & Tunnel Co.—A syndicate of Pennsylvania men is said to be backing this company, which has commenced driving the tunnel to cut the Silver Age, French Flag and other veins on its course.

Cripple Creek District

Isabella—Davis & Hughes, lessees in Emma No. 1 shaft, have reported a discovery of 5 ft. of ore, 50 ft. long and assaying $60 per ton. The values are in sylvanite and free gold.

Strattons' Estate—J. B. Polly and F. S. Chilson report that under their lease on the Six Points, on Bull Hill, they have opened an oreshoot of extraordinary richness, and that they have opened it at a greater depth by a crosscut from the Los Angeles mine, on which they obtained a lease for that purpose. The sampler controls show that the ore in carload lots yielded 6 to 8 oz. in gold per ton. Five cars have already been sent out.

American Eagles—At this mine of the Strattons' Estate, leased by the Colorado Mines Investment Co., of Denver, rich ore has recently been opened at the 1100 level. Three carloads of 2-oz. gold ore per week are being shipped. The width of the orebody is about three feet.

Lake County—Leadville

Helena—Twenty-four men are now employed at this Iowa Gulch mine, and the vein is getting wider with an increased grade of ore.

Sugar Loaf Consolidated—This mining and tunnel company is shipping a good grade of ore regularly from the old Sherrill workings and the main tunnel is being driven ahead.

Chip—In a drift from the bottom of the shaft, a vein of high-grade silver-copper ore 1 ft. wide has been opened. It is supposed to be an extension of the vein that was found in the Elk shaft at the head of East 5th St., 25 years ago.

Dome—Sixty tons per week of carbonate-of-zinc ore are being shipped by the lessees.

King Solomon—This company, operating at Frisco, Kokomo and Alice, is stated to have had a successful year at the King Solomon tunnel, Frisco, on No. 11 vein; a block of lead-silver-gold ore has been developed for stoping, 100 ft. long, 100 ft. in depth and 3 ft. wide. Late last autumn the company unwatered the Wilson mine at Kokomo and is now shipping ore to the mill regularly.

Ouray County

Revenue—The important announcement is made that A. E. Reynolds has retired from the management of this company, his entire holdings going into the hands of a Kansas City corporation, with Edwin H. Platt as manager at the mine. The Revenue mill is to be reconstructed and extensive development done on the Cumberland vein.

Bard Creek Co.—This company has done nearly 2000 ft. of work on its Lincoln Mountain group, and has opened some gold and silver ore for 80 feet.

National—A strike of high-grade galena is reported in this mine, in the West Argentine district.

San Juan District

Gold King—This mine, opened in a judicious manner by Mears & Slattery, is assuming proportions of a larger mine, and is being credited with the production of much rich ore. It is being operated partly under a subleasing system. The mine is under the personal supervision of J. H. Slattery.

Silver Ledge—W. Z. Kinney has resigned the management of this mine, Leo F. Arnold succeeding. Jig practice has been temporarily suspended in the mill, which continues to produce zinc and lead concentrates. It is reported that another shoot of ore was recently encountered on three levels, while excavating wall rock for waste.

Sunnyside—The mine continues steady production. By taking over the property of the Quartz Mining & Milling Co., which included the Washington, Oregon, Mother Goose and Grand View mines, well known properties worked in the early days, it has materially increased its holdings. With the Terry tunnel, driven under the management of J. T. Terry, one of the present owners, the property is in an improved condition. At the mill, the American Zinc Ore Separating Co. is installing its initial Colorado plant, using the Huff electrostatic machines for the treatment of zinc ores. The buildings, foundations, etc., constructed under the direction of William T. Terry, metallurgist for the property and a coöwner, are completed and the machinery is on the ground ready for installation. The outcome of these operations is being earnestly watched, as its success may mean a larger production of zinc-bearing ore in this section.

Idaho

Coeur d'Alene District

Stewart—The new tunnel at the mine struck an unexpected orebody recently. The discovery was made just after the tunnel passed the Osburn fault and is nearly 2000 ft. from where the main orebody should be encountered. The extent of this apparently new vein is not yet known. The tunnel has been constructed with record-breaking rapidity. Little trouble has been encountered in passing through the fault zone, practically no water coming from there. It is now thought that the large volume of water which had to be contended with in the Calodonia tunnel in cutting the fault, has practically drained it above that level. Preparations are being made to construct the portal buildings so that they will be ready for use should the orebody encountered prove to be the main one.

Black Horse—This company has just completed the installation of a 10-drill Ingersoll-Rand compressor. The company now has a 100-hp. gasoline engine in working condition and will start the compressor soon. The use of machine drills will greatly aid in development. The property is situated in the Murray district.

Michigan

Copper

New Baltic—Development work has reached the west vein of the lode at the 500-ft. level, showing an encouraging amount of copper. Some drifting has been done on the main lode at this level, which was encountered about a month ago, and the showing is an improvement on the character of the ground exposed at the 360-ft. level.

Franklin—The new hoisting engine at No. 1 Pewabic shaft is being tested out and after necessary adjustments will go into commission. Everything is in readiness at the mine and mill to begin production on an increased scale.

Mayflower—Owing to the extremely severe weather that has prevailed throughout the district for the last three weeks, progress on No. 17 drill hole has been necessarily slow. This hole is going down to secure additional data on the formation that revealed such a rich core in No. 16 hole.

Hancock—No. 2 shaft has penetrated the lode, designated as No. 6, for a distance of about 20 ft., and has not as yet reached the foot wall; the lode is well mineralized in shot and fine copper. Shaft-sinking is going forward with all possible speed and it is estimated that another lode or branch of the Pewabic main lode will be reached a short distance below the present one, and that the Pewabic lode, the objective point, will be reached about Mar. 1. The disclosure of copper in such quantities in the various lodes affiliated with the Pewabic is most gratifying and strengthens the belief that the main lode when encountered will be heavily mineralized.

Centennial—The north drift from the 27th level has been connected through with the No. 1 shaft of the South Kearsarge, affording better ventilating facilities for both shafts. The extension of lateral openings north from No. 2 shaft is approaching the mineralized zone of the Kearsarge and Wolverine properties, and it is stated that an improvement is being noted in the quality of the rock in some portions of the openings.

Wolverine—The company has extended the exploratory crosscut from the 28th level drift, eastward about 1400 ft., and there is about 1200 ft. more to go before reaching the boundary. Results will be watched with interest, as this section is attracting a good deal of attention.

Mohawk—No. 6 shaft has reached the lode at the ninth level. Drifts north and south from the levels above are opening ground that is much improved over that of the northern workings. The remaining five shafts are all sinking, and the rock going to the mill from the various openings is about the average grade.

Iron

Lake Superior Iron & Chemical Co.—At a recent meeting of directors in New York, Frank W. Hutchins, of Detroit, was elected treasurer, to fill the vacancy caused by the resignation of A. Van Oss. The company owns and operates six charcoal pig-iron furnaces, with charcoal and chemical plants at Ashland, Wis., and Manistique, Newberry, Boyne City, Elk Rapids and Chocolay, Mich. It also leases and operates the Yale iron mine, at Bessemer, Mich., and owns over 100,000 acres of hardwood timber land and 47 miles of railroad. The general offices are in the Penobscot Building, Detroit, Michigan.

American Mine—This hard-ore mine of the M. A. Hanna interests, situated 10 miles west of Ishpeming, has a contract to ship 60,000 tons of ore to the Algoma steel mills at the Canadian Soo and about 500 tons per day are being forwarded.

Winton-Vermillion Iron Co.—This company's lands, two miles east of Negaunee and near Eagle Mills, are being drilled by W. T. McCarthy, diamond-drill contractor of Negaunee. The company has 680 acres in Sec. 34—T. 48 N.—R. 26 W. It seems rather too far to the east to expect iron ore, as the formation in the vicinity is generally believed to be Siamo slate. The same interests control the Flynn property in Minnesota and are also opening a shaft near the Canadian Soo. Albert Salzer, of Minneapolis, is president of the company and George I. Gorham is secretary and treasurer.

Oliver Iron Mining Co.—The two diamond drills recently operated in the Cyr swamp, south of Little Lake in the Gwinn district, for which the Duluth Diamond Drill Co. had the contract, were called in several weeks ago by the Oliver company.

Minnesota

Mesabi Range

It is reported that the contract for the work of changing the course of the Embarrass River will be let before the season opens, with the idea that the work, which is a large undertaking, will be finished before the end of 1914, or the expiration of the Oliver Iron Mining Co.'s Hill lease.

Buffalo-Susquehanna—The Winston-Dear Co. has closed down operations at this property at Hibbing for the season. This is the last of the contracting companies to suspend stripping operations on the Mesabi Range.

Grace—This mine, which was recently acquired by the Inland Steel Co., will be one of the producers in the season of 1912. Much of the surface work, which has been done under contract, has been completed. William Wearne, general superintendent for the company on the Cuyuna and Mesabi Ranges, is in charge.

Kellogg—This mine, operated by the New York State Steel Co., at Biwabik, will commence mining operations on Feb. 1. It is one of the large underground properties in the district, and will employ a force of about 300 men when working up to capacity. H. F. Kendall, general superintendent for the company, is in direct charge of operations.

Montana

Butte District

Anaconda—In the suit instituted against the Anaconda company, by Gus J. Kohl, the latter claims that he located the claim in 1890, and that he disposed of a two-thirds interest in it to the men from whom the Anaconda company purchased the property. He asks for an accounting of the ore extracted since then, alleged to be worth $3,000,000, and for one-third of the profits.

Tuolumne—Steam was turned into the new plant, Jan. 15, and it is expected that it will be placed in final commission before Feb. 1. The crosscut on the 1800-ft. level recently cut the north vein, and drifting has developed a good body of ore, the breast at present being in 7 ft. of ore averaging 6% copper, carrying bornite and copper glance; this ore is being shipped to the Washoe smeltery as fast as mined.

Ophir—A contract for the machinery and the building of the new concentrator at this mine of the Butte Central Copper Co., has been awarded to the Colorado Iron Works, the contract stipulating that the work shall be finished by June; the concentrator will have a capacity of 100 tons of ore per day. The company has advertised for bids for the construction of the concrete work. Ore shipments have been resumed at the mine, one car of ore per week being shipped to the Washoe smeltery.

Pilot—At the annual meeting, Jan. 11, the finances of the company were reported in good condition and sufficient to carry the development work now in progress, to what is believed will prove a producing basis. A station will be cut on the 900-ft. level and a crosscut driven to the vein which was cut on the 1300-ft. level.

Deer Lodge County

The preliminary survey of the part of extension of the Butte, Anaconda & Pacific R.R. between Silver Lake and Georgetown, has been completed and men are now engaged in clearing the right-of-way and grading.

Georgetown Gold Mining Co.—At a meeting of the stockholders in Anaconda, Jan. 15, it was voted to resume operations as soon as the snow is gone, and the following officers were elected: H. A. Conyne, president; Garry Nugent, vice-president; James Pringle, secretary and treasurer; Charles Bostrom, general manager, all being Anaconda men. The company owns the Duplex, Standard and Four Aces claims, situated near the Southern Cross and Oro Fino mines. A tunnel has been driven 140 ft. on the vein on the Duplex claim, and tunneling will be continued.

Jefferson County

Boston & Corbin—A vein of ore recently encountered in the 1200-ft. level crosscut, has been drifted on for 40 ft., opening an average of 2 ft. of good copper ore which improves as the drift continues. The management believes it to be the same vein as that opened on the 500- and 700-ft. levels.

Lincoln County

Hazel T.—Work has been resumed at the Shaughnessy Hill property by this company, and two shifts of men are driving the lower tunnel to cut the vein at an estimated depth of 300 ft. A tunnel was originally driven which cut the vein at a depth of 145 ft. and drifting was done both ways on the vein for a considerable distance, indicating that a good quality of silver-lead ore exists.

Sanders County

Montana Gold—At this property, owned by R. Martin and others, of Spokane, a strike of free-milling gold ore has been made. A crosscut tunnel was driven 275 ft. to the vein and a drift started at 130 ft.; the latter opened the oreshoot, which extends across the face of the drift.

Nevada

Comstock Lode

Union Consolidated—The new station at the 2500-ft. level of the joint Sierra Nevada winze has been completed, and recently a west crosscut was started, the object being to make connection on this level with the north drift from the Mexican workings, the latter being advanced along the course of the vein. The crosscut will be extended about 700 ft. before reaching the point of connection with the north drift, and will be farther east by several hundred feet than any Comstock workings in the deep levels. The progress downward of the winze has disclosed the fact that the country is well mineralized. When the connection is made all work in the Union will be accomplished through the winze, instead of through the Mexican.

Ophir—A southwest crosscut has been started from the end of the south drift from the west crosscut, and is being advanced through porphyry and quartz in a strong vein formation. This crosscut will open a large unexplored territory in the main Comstock vein. The ore recovery from the mine last week was about 400 tons, giving $14,000 gross assay value.

Ward—Blowers and air pipe are being installed on the 2000-ft. level at the Ward raise, where the old workings from the Bullion incline were broken into recently. Air will be forced ahead and the bulkhead holding the water in the Gold Hill mines tapped as soon as possible. The territory between the first and second bulkheads has already been drained.

Mexican—The mill is now running at one-half capacity on second-class ore, but the production will be increased as soon as a new classifier has been installed, the first one being insufficient to handle the pulp properly.

Con. Virginia—The southwest drift in the vein on the 2550-ft. level is in a mixture of clay and quartz stringers carrying low-grade ore. The vein is now much wider than the drift.

Savage—The stockholders' annual meeting at San Francisco on Jan. 8 elected H. L. Slosson, Jr., W. C. Ralston, C. B. Sessions, and reëlected A. F. Coffin and W. B. Bannon as directors. The directors elected Mr. Slosson, president; Mr. Ralston, vice-president; Whitman Symmes, superintendent, and Miss O'Neil, secretary. This places the Savage under the same control as the Mexican.

Nye County

Tonopah—The net profits for December amounted to $160,978 from 15,062 tons of ore milled, of an average value of $20.25 per ton. During the quarter ended Nov. 30, 1911, the gross value of the ore milled was $873,824; mining, milling and general expense, $430,312; net earnings, $443,511; miscellaneous income, $16,524; net income, $460,036; exploration, $12,587; dividend payable Jan. 20, $400,000; leaving $47,448, surplus for the quarter. The cash statement shows cash on hand, Nov. 30, as $705,097, and $1,651,669 as total quick assets.

Tonopah-Belmont—The net profits for December amounted to $151,137. The company milled 7490 tons and shipped 2330 tons to the smelteries. The main working shaft entered the Belmont vein recently at a depth of 1375 ft. and has now penetrated it for 20 ft. without striking the footwall. All of this ore is of shipping grade. A winze is also being sunk on the vein from the 1286-ft. level, 300 ft. east of the shaft, and is also in shipping ore.

MacNamara—The plant of 10 stamps and one tube mill, having a capacity of 50 tons per day, commenced operations last week.

Tonopah Extension—The company has announced that it will commence the payment of regular dividends soon. The mill is treating an average of 4400 tons per month, the net profits ranging from $15,000 to $18,000 per month. Sinking of a new 3-compartment shaft, 1250 ft. west of the present shaft, will soon start.

Mizpah Extension—The company has opened up at a depth of 1000 ft. what is believed to be the eastern extension of the Belmont companys' Little Belle vein. It is low-grade ore, 20 ft. wide, with a 12-in. streak averaging $66.90 per ton.

Big Four—The orebody in this mine at Manhattan is 44 ft. wide on the 400-ft. level, averaging, through the mill, $20.30 per ton. The mill is treating 55 tons per day.

White Caps—John Kirchen, manager of the Tonopah Extension mine, and Tonopah associates have purchased this lease in which a large tonnage of milling and shipping ore is exposed.

New Mexico

Grant County

Men reported to be representing Phelps-Dodge interests, arrived at Silver City recently and went from there to Leopold. It is stated by one of the officials that no immediate resumption of mining operations is contemplated.

Chloride Flat—A body of rich ore has been encountered in a drift from the main shaft.

Sierra County

Vanadium Mines Co.—On Jan. 22, at Pittsburg, Penn., W. A. Bonitz was appointed receiver for this company. The petitioner, Helen F. Bennet, alleged that the company has debts of $203,000. The company's mines are situated in this county, and the plant for the reduction of ferro-vanadium is at Rankin, Pennsylvania.

SOCORRO COUNTY

Ernestine—H. B. Hovland has confirmed the reports as to his option on this property and states that it covers a period of 90 days, about one-third of this having already expired. As yet no action has been taken under this option.

Tri-Bullion—Development work with day and night shift is being done at the Contact shaft, situated west of the Kelly mine, and at the Nit shaft, north of the Graphic mine. Both shafts are following drill holes.

South Dakota

BLACK HILLS DISTRICT

Columbus—Montreal men who have secured an option on this and the Hidden Fortune properties, have started energetically at a thorough examination. A. M. Howatt, of Salt Lake, is in charge of the work with a crew of technical men assisting. The Hidden Fortune shaft has been dewatered, and this and the surface workings are being sampled. The work of removing the water from the Columbus shaft is proceeding, although it is rather slow work on account of the large stopes which are filled with water. This shaft is 500 ft. deep, with most of the stoping on the 200 level and above. H. D. Whitehead, of Los Angeles, is in charge of the assay office.

Wasp No. 2—The management decided to suspend operations on Jan. 7 until weather conditions were more favorable for mining in the opencut. The shutdown is indefinite, but will probably not last longer than Apr. 1. During 1911 this mine produced $286,160 in gold bullion. Dividends to the amount of $60,000 were disbursed during this time, making the total dividends to date $291,965, or nearly 60% of the $500,000 capitalization.

Texas

A New York syndicate, headed by S. M. Swenson & Son, 37 Wall St., has acquired about 10,000 acres at the mouth of the Brazos River, and will develop the sulphur deposit on the Bryan Heights "dome."

Utah

BEAVER COUNTY

Beaver Combination—This property is in the Star district, between the Red Warrior and Moscow. The shaft has just been completed to the 100-ft. level, and a contract has been given to sink to the 300. A vein, 5 ft. thick in places, is being followed. It is proposed to install a new hoisting plant, and to push work as soon as the 200-ft. level is reached.

JUAB COUNTY

Tintic shipments for the week ended Jan. 12 amounted to 153 cars. The output is not yet back to normal, but railroad facilities are improving.

Sioux Consolidated—The financial statement for the last year has been issued. Receipts, including cash on hand, Jan. 1, 1911, were $160,654. Cash on hand, Dec. 31, 1911, amounted to $714. During the year, 7884 tons of ore were marketed, bringing $78,244. Three dividends of 4c. per share each, amounting to $89,446, were paid.

Colorado—Some good silver-lead ore has been found on the 300-ft. level of the No. 2 workings. Four or five feet of ore have been opened.

Beck Tunnel—Drifting has been started north from the 300-ft. level of the No. 2 shaft. This work is being done to prospect at depth below the iron blowout and croppings on the northern end of the property.

PIUTE COUNTY

Bully Boy & Webster—Breaking ground for the new 100-ton mill was started about Dec. 15, and it is planned to have the plant ready for work during the coming spring. The cost will be approximately $35,000. There is estimated to be about 60,000 tons of ore between the No. 1 and lower workings of the No. 2 tunnel, which runs as high as $10 in silver and gold, about $9 being in the latter metal.

SALT LAKE COUNTY

Bingham Mines—During the last fiscal year, this company is reported to have earned $80,000 net, after payment of all expenses, including interest on bonds. The earnings will be used to retire bonds to save interest charges during 1912.

Alta Tunnel & Transportation—This company was recently incorporated with 1,000,000 shares, par value 10c.; J. A. Eakins is president. It is expected that a tunnel will be driven from Silver Fork of Big Cottonwood to crosscut the vein system at Alta. If this is done, the important veins of the camp will be cut at a greater depth than yet reached.

Utah Mines Coalition—The stockholders have approved of turning over the company's assets to the Michigan-Utah company for 250,000 shares of the latter company's stock.

Utah Copper—The company's output for 1911 is estimated at 98,000,000 lb. The production in 1910 was 85,644,511 pounds.

SUMMIT COUNTY

Daly West—The loading station is reported to have been destroyed by fire on Jan. 20, entailing $15,000 loss with no insurance. Operations at the mine have been entirely suspended but the management hopes to resume soon.

UINTAH COUNTY

On Jan. 1 about 200 men made a rush for the Vernal oil fields to relocate claims on which the necessary assessment work had not been done.

Phosphate deposits were discovered about six months ago near the north rim of the Uintah Basin, about 16 miles north of Vernal. The deposits are reported to be about 25 ft. thick. The greater part of the phosphate area, except the southerly outcrop, is within the forest reserve.

Wisconsin

Quinlin—This mine, at Benton, which was profitable about 20 years ago, is being reopened with excellent indications.

Campbell Separating Co.—This company, at Cuba City, is adding five more electric separators to take care of its growing business.

Optimo—This mine, at Linden, will be equipped with a 200-ton electric separator.

Rowley—The new mill at this mine has been completed by the Vinegar Hill company, and mining will be resumed by the new owners, after a 4-year shutdown. The company will place a mill on the old Raisbeck mine, one of the oldest in the district.

Canada

ALBERTA

Canadian Western Natural Gas, Light, Heat & Power Co.—This company has been incorporated in Alberta with a paid-up capital of $8,000,000, par $100. The company has an agreement with the Canadian Pacific Railway Co., giving it the right to drill for natural gas over an area of 2425 square miles in southern Alberta. It already owns eight natural-gas wells, producing 68,000,000 cu.ft. per day, of which aggregate 65,000,000 are stated to be obtained from five wells having an average closed-in or rock pressure of 795 lb. per sq.in. Of the eight wells, one is at Bassano, one at Brooks, one at Dunmore Junction, and five at Bow Island, all being along the lines of the Canadian Pacific Railway.

ONTARIO

Good Luck—This claim, comprising 233 acres in Van Horne Township, Manitou Lake area, has been sold by A. McPhail and D. Hutchison, to a syndicate of London, Eng., represented by C. H. James. The price is said to be $75,000. A force of 20 men under Supt. C. H. Rogers has been put to work.

ONTARIO-COBALT

Ore shipments for the week ended Jan. 19 were as follows: McKinley-Darragh, 142,980 lb.; Coniagas, 109,080; Nipissing, 103,700; Buffalo, 61,360; total 417,120 lb. Bullion shipments were: Crown Reserve, $35,840, and $6500 from the Nova Scotia.

La Rose—A financial statement as of Jan. 2 shows: Cash in bank, ore in transit and at smelteries, $1,542,737; at mine ready for shipment, $108,585, and $1,651,322 total.

Nipissing—The report that the company has acquired an option on the Tommy Burns property at Porcupine is denied by E. P. Earle, president. He states that he, personally, has an arrangement with certain men interested in the Porcupine property, whereby he can, if he so desires, make preliminary investigations and acquire certain stock interests. Snow on the ground prevents anything being done under this option until spring. A financial statement of the Nipissing company as of Jan. 2 shows: Cash, $1,014,309; ore in transit and at smelteries, $128,034; at mine ready for shipment, $291,428, making $1,433,771 total.

Green-Meehan—The purchaser of this mine is an American syndicate of Detroit and Buffalo men. Arrangements are being made for active development work and it is proposed to install a mill. It is stated that there is $75,000 worth of ore on the dump.

ONTARIO-PORCUPINE

Hollinger—A strong syndicate is reported to be negotiating for 200,000 shares of this stock. The long delayed Robbins report is to be issued in a few days.

Swastika—The Armstrong-McGibbon interests are stated to be negotiating for a large block of this stock.

North Dome—The new plant is completed and underground work is being started. President B. E. Cartwright, of the Temiskaming company operating this property, reports that a station is being cut at 50 ft., or 10 ft. above the bottom of the shaft, from which a crosscut will be run to test the vein. The shaft will be put down to the 100-ft. level, where a second station will be cut. The 6-drill compressor is supplying air for two underground drills.

Imperial—Drifting on the vein at the 100-ft. level is giving good results.

Flannigan-McLean—These claims are under option to Philadelphia men.

Amcrican Goldfields—An important new vein, which does not show on the surface, has been struck by the diamond drill on the 150-ft. level.

ONTARIO-SUDBURY

Canadian Copper Co.—The company is actively pushing development work at the Froude mine. The shaft is down over 100 ft. Poles for the power line from Copper Cliff are up, the wire is nearly all strung and the railroad spur is about one-half graded. This spur will cross the main line of the Canadian Pacific R.R. at a point about half-way between Sudbury and the Murry mine. The C. P. R.R. is also constructing a spur from this point to Copper Cliff, thus giving a better opportunity to handle freight from the higher level of its main line. The rock house at the Creighton mine of the company was recently destroyed by an explosion. The cause of the explosion is not known. One man only was in the building at the time and he was blown to atoms. The hospital was recently burned down entailing a $50,000 loss covered by insurance.

Morley-Caswell — This property at West Shining Tree has been taken over by the Duluth West Shining Tree Mining Co., capitalized at $300,000, the first company to enter this field. Ten men are at work and a diamond drill will soon be put in.

Mexico

MEXICO

Esperanza, Ltd.—During December, the mill crushed 21,385 tons of ore. Total receipts were $137,207; expenses, $108,661; profit, $28,456. During the month 1429 ft. of development were done.

SONORA

Greene-Cananea—Accompanying the announcement of the initial dividend of 25c. per share, payable Mar. 1, the estimated results for 1911 were issued as follows: Copper produced, 45,247,218 lb.; cost per lb., 9½c.; construction per lb., ⅝c.: total cost, 10⅛c.; net profit, $1,140,000, after deducting construction expenses. W. E. Corey has been elected a director succeeding James Hoatson.

TEPIC

The Southern Pacific R.R. was expected to be opened to traffic as far as the city of Tepic, on Jan. 15, establishing a direct connection between Los Angeles, Calif., via Nogales, Ariz., and the city of Tepic. This is a trip of about three days, and there is little doubt that this district will receive considerable attention in the future.

Zopilote—A. F. Flynt, an engineer from Minnesota, U. S. A., acquired this property under lease and option last May. The 20-stamp mill and the two ball mills were repaired and put in commission, a concentrator was installed and the old hypo-lixiviation plant was converted into a cyanide plant; milling and treatment commenced in August. Since then the plant has run without interruption, the property employing 200 men. The shipments vary from $10,000 to $15,000 per month, Mexican money. There are large reserves of low-grade ore in the mines, as the old company did not attempt to work any ore assaying less than one kilo of silver per ton. The ores from the Jabalina and Restauradora mines are being worked at present. Some high-grade ore running from 6 to 10 kg. of silver per ton is reported to have been struck in both these mines. There is a good waterpower near the property, which it is planned to take advantage of.

Tenamache—The mine is situated on the edge of the ground belonging to the Zopilote company, and is owned by an American company, controlled by Mr. Ramsdell, of Guadalajara, that has been doing development work for the last three years, opening up old Spanish workings. H. Hale is in charge. The metallic content is silver, and the mine is said to contain some high-grade ore. No mill is at the property, but a shipment is now being made ready, to be sent over the Southern Pacific R.R. to a Northern smeltery.

Purisima—This property is situated 60 km. north of the city of Tepic; it is owned by A. F. Flynt, who has been doing development work during the last five years. A steam hoist and crusher have lately been installed and additional cyanide tanks and a Wilfley concentrator are being erected at the mill, increasing the present capacity to 25 tons per day. No ore has been stoped, all the ore milled originating from the development work, which has paid the expenses of operating the property.

Central America

COSTA RICA

Aguacate—The 50-ton mill ran steadily during December, yielding a fair profit over all expenses. The cyanide plant is now under construction. Recent installations include a Morgan Smith turbine and auxiliary steam plant. A 6-months' supply of ore has been blocked out above the 500 level and development is being pushed. P. G. Spilsbury is general manager and the office of the company is at 55 Liberty St., New York.

South America

PERU

Sulphur of high purity has been found in the southern part of the country. The deposits are near a railroad to the coast, which will soon be extended to pass the place of discovery.

Africa

TRANSVAAL

A new diamond field is reported to have been found in the western part of the Transvaal. There has been a rush to the region.

Asia

CHOSEN

Oriental—During November, 26,654 tons of ore were crushed, yielding $132,100 gross and net $56,002. Operating expenses were $73,786 and $2312 were spent on development and improvements. The Kung San Dong 40-stamp mill and the East Candlestick 10-stamp mill were hung up, the former 16 and the latter 10 days because of labor shortage.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Jan. 24—The coal trade in the West is gradually settling down into shape as the special demand resulting from the extreme cold weather passes over. At the same time working conditions at the mines and on the transportation lines are improving, though there are still complaints of shortage of cars and of delays in railroad deliveries.

Very much the same conditions exist in the East, both in the anthracite and the bituminous trades. Special demand is decreasing, and deliveries are improving, so that trade is again approaching a normal basis.

The Mine Workers' convention at Indianapolis moves slowly. The tendency so far seems to be toward the adoption of a radical policy.

At a meeting held in Chicago, Jan. 16, at which were present representatives of the coal operators of Illinois, Indiana, Michigan, Wyoming, Montana, Iowa, Kansas, Missouri and Oklahoma, an organization known as the American Federation of Coal Operators was effected for the purpose of bringing about a peaceful solution of labor disputes. H. N. Taylor was chosen president; C. S. Keithe vice-president; Charles L. Scroggs secretary and treasurer. It will be noted that Ohio and Pennsylvania were not represented.

Coastwise shipments of coal by water from principal Atlantic ports, 11 months ended Nov. 30, long tons:

	Anthracite	Bituminous	Total
New York	13,182,089	9,725,655	22,907,744
Philadelphia	1,977,886	4,466,196	6,444,082
Baltimore	235,735	3,668,293	3,904,028
Newport News	....	2,440,418	2,440,418
Norfolk	....	4,214,834	4,214,834
Total	15,395,710	24,515,396	39,911,106
Total, 1910	14,519,457	23,725,523	38,244,980

Total increase in 1912 was 1,666,126 tons, or 4.4 per cent. New York includes all the harbor shipping points.

British Coal Exports—Exports of fuel from Great Britain year ended Dec. 31, long tons: Coal, 64,599,266; coke, 1,064,839; briquettes, 1,612,741; coal sent abroad for use of steamships in foreign trade, 19,264,189; total, 86,541,035 tons, an increase of 2,494,980 tons, or 3 per cent., over the previous year.

German Coal—Coal production of German Empire, 11 months ended Nov. 30: Coal, 147,309,185; brown coal, 67,081,079; total, 214,390,264 metric tons, an increase of 12,401,523 tons over last year. Coke made was 23,025,879 tons; coal briquettes, 4,577,103 tons; brown-coal briquettes, 15,492,564 tons.

Exports from Germany, 11 months ended Nov. 30, were 24,806,125 metric tons coal; 52,582 tons brown coal; 4,079,834 tons coke; 2,236,907 tons briquettes. Imports for the 11 months were 9,958,356 tons coal; 6,468,976 tons brown coal; 549,013 tons coke; 195,984 tons briquettes.

Iron Trade Review

New York, Jan. 24—The situation in the iron and steel markets shows no material change. A fair amount of new business is reported, though the buying is still much below the high level of the December spurt. Specifications on contracts are on a fair scale and most mills are in position to utilize a good part of their capacity and have no need to worry about new business for a month or so to come. Prices are gradually firming up and there have been actual advances in several lines. Rail orders are still coming in, though the rail mills are still in a position to take orders for 1912 rolling quite freely. This line is, perhaps, the most backward of all in finished steel.

In pig iron there are many small orders—and a few larger ones—for foundry and basic iron. Furnace activity shows some increase, but more among the steel works stacks than the merchant furnaces. Many of the latter are inclined to hesitate about blowing in, except on a basis of positive contracts.

There is talk about Lake ore prices for the coming season, but nothing positive has yet been done.

The contract for 15,353 tons of armor-plate for the two new battleships has been divided into three nearly equal parts, and awarded to the Midvale, the Carnegie and the Bethlehem steel companies.

Southern producers have organized a movement to secure lower freight rates on pig iron from Alabama and Tennessee to points in the North and Northwest. The matter is to be taken up with the railroads first. Later on application may be made to the Interstate Commerce Commission, if necessary.

Negotiations have been going on among several Mahoning Valley blast-furnace interests with a view of consolidating and building a steel plant, and it seems now that this plan will go through. The Brier Hill Iron & Coal Co., operating Grace furnace, at Youngstown, with a capacity of 140,000 tons of pig iron per year; the Youngstown Steel Co., operating a blast furnace with a capacity of 100,000 tons per year, and the Thomas Steel Co., Niles, Ohio, operating sheet mills, propose to consolidate as the Brier Hill Steel Co., with a capital stock of $15,000,000, and to build an openhearth steel plant adjacent to the blast furnace of the Brier Hill company. It is possible, but not yet settled, that the Empire Iron & Steel Co. and the De Forest Sheet & Tin Plate Co., both operating sheet and tinplate mills at Niles, may be included. The new plant will have a capacity of probably 1000 tons of steel per day, which will be furnished in the form of billets, sheetbars and tinbars to sheet and tinplate mills in the district. The furnace companies mentioned have large ore and coal properties.

Baltimore

Jan. 22—Exports for the week included 112,309 lb. spelter, 88,740 lb. zinc dross and 2,270,900 lb. steel billets to Liverpool; 560,064 lb. pig lead to Hamburg. Imports included 20,835 ingots spelter from Antwerp; 1000 tons spiegeleisen and 500 tons manganese ore from Rotterdam; 4525 tons pyrites from Huelva, Spain; 17,400 tons iron ore from Cuba.

Birmingham, Ala.

Jan. 22—While much is still being said in the South about exports of pig iron and steel rails, there is a little business being transacted in the domestic trade. The iron prices are steadier with $10.25 per ton, No. 2 foundry, as the average quotation. There is very little $10 iron now being sold, as far as can be learned. Sales being made are for delivery during the second quarter of the year. The make is not being improved any nor is there any indication of any increased output this month. Furnace repairing has not been abandoned, but as long as there is a good quantity of iron in furnace and warrant yards and the make is almost equal to the outward movement, there will be no larger production.

Shipments of pig iron to Austria and to Hull, England, are announced in this territory, while a movement of 3300 tons of steel rails from the Tennessee Co.'s steel plant at Ensley, to Kobe, Japan, has been started on, the inspectors from that country being in this district now.

The order is for a new railroad being constructed in Japan and the rails are shipped by Savannah.

There will be a heavier melt at the cast-iron pipe plants in this section after Mar. 1, preparations being made to start up the big Dimmick pipe works, now property of the United States Foundry & Cast Iron Pipe Co. There is a little better condition noted also at the machine shops and foundries. The steel industry is looking up also.

Charcoal iron is still selling slowly, but with no reduction in the price, $22@22.50 per ton.

Chicago

Jan. 23—The iron market is quiet but firm, and there are no indications of weakness in the near future. There is a good demand for most lines of finished products, but pig iron does not strengthen. Southern No. 2 pig holds to $10, Birmingham, or $14.35, Chicago, despite efforts to lift it to at least $10.50; Northern No. 2 stays at $14 minimum, with local furnace men anxious to move it at that price. The temporary strengthening of a brief buying wave soon passes away in this market, for the melters of pig iron are not yet inclined to buy freely for deliveries several months ahead. Most of the orders now being booked are for second-quarter delivery; a few run into third quarter, and occasionally a melter will buy for the last half. The size of orders, however, is small; few are for more than 500 tons each. Lake Superior charcoal pig iron is quiet at $16 minimum.

In the finished-goods market there is a fair run of business in structural material, chiefly for buildings and bridges scattered throughout the western and southwestern territory, with a little business on railroad needs; prices run 1.30@1.35c., Chicago, for beams, etc. Railroad supplies are in increasing demand aside from rails, and some heavy rail requirements are still pending. The bar market shows increasing strength for local mills, as compared with Pittsburg, with very little tendency now to cut under Pittsburg prices, plus freight, and soft-steel bars selling at 1.25@1.33c., Chicago. Iron bars are selling fairly well at 1.15@1.20c. Plates are quiet at 1.30@1.35c., Chicago, and sheets are weak and ragged at 2.03@2.05c. General manufacturing conditions continue depressed, with little prospect of speedy recovery.

Cleveland

Jan. 22—Nothing more has been heard about ore prices for 1912, and there seems to be nothing doing yet.

Pig Iron—Sales continue good and inquiries frequent. Some large orders for basic have been placed. Prices have not advanced, but have a firmer tendency. No. 2 foundry is $13.25 and basic $13.40, Cleveland delivery.

Finished Material—Mills are doing pretty well. Some new orders are coming and specifications on contracts are quite liberal. Prices are generally firmer, except on plates, where there is still some shading.

Philadelphia

Jan. 24—The temporary activity in the pig-iron market, which raised expectations so high, has subsided and business for the past few days has been unimportant, excepting in a few cases where negotiations that have been pending for some time were brought to a close. The hardness of prices is being and probably will be maintained. The only interesting thing of the week was the slipping of some business to Virginia furnaces which was heading this way, but which was attracted southward by more favorable quotations. Some makers claim that as comparatively few buyers have covered their wants beyond 30 days, the present firmness will not only continue but that an advance of 25 cents can be safely expected. Actual consumptive requirements are on the increase. The better grades of No. 2 X foundry are approaching scarcity as to early deliveries. The quotations for second quarter are too high to induce foundrymen to order. Today's quotations are $15@15.25 for No. 2 X; $14@14.50 for forge; basic $14.25 nominally.

Steel Billets—Openhearth billets are not inquired for and no sales are heard of, but quotations are strong. Forging billets are held strongly at the advance with more liberal orders than usual.

Bars—The only change in the situation is that mill men are now soliciting business for any sort of forward delivery on the basis of present prices. Jobbers have placed liberal orders for probable requirements for the next two months.

Sheets—The strong tone of the sheet market is stimulating a good many buyers to extend their orders and the inquiries this week from a few large users of sheets point to an unusually large business this month.

Pipes and Tubes—A strong tone in the tube market is due to the contracting ahead of some large buyers.

Plates—The plate mills have more business on hand than for a long time. The smaller boiler shops throughout the East are picking up business.

Structural Material—There is enough pending business to give a strong tone to the market but just at present the orders are rather light. Large buyers are disposed to higgle over asking prices on business which can be safely postponed a few weeks.

Scrap—Dealers in scrap are making no effort to unload their large stocks and consumers are showing no disposition to purchase beyond immediate necessities.

Pittsburg

Jan. 23—The steel market continues quiet all along the line, no improvement having occurred in the past week. There is a fair volume of specifications against contracts for bars, plates, shapes, etc., in some cases close to the output, but usually falling below the output. The mills entered the year with a good aggregation of specifications, however, and continue to be in comfortable position.

The indifferent tone of the market in general has not had any material influence upon prices, which are quite well maintained. There is a little weakness in sheets at points, but on the other hand wire products have been advanced $1 a ton. It appears that the American Steel & Wire Co., the leading interest, contemplated making an advance, but that the Pittsburg Steel Co., one of the prominent independents, anticipated its action by a day, sending out notices Saturday night, while the leading interest sent out its notices Monday night. Superficially, the various independents immediately fall in line and advance their prices, but as a matter of fact it is understood that a number of them quietly make contracts at the old price with some of their favorite customers, not getting up to an advanced price absolutely until several days have elapsed. It is understood that some business of this sort is being done at this time, but for practical purposes the market may be quoted at the $1 a ton advance, as follows: Plain wire, 1.40c., base; wire nails, $1.60, base; painted barb wire, 1.60c.; galvanized barb wire, 1.90c. The previous advance, of $1 a ton, was made Dec. 11 last. The year 1911 opened with nails at $1.70, there being two advances early in the year to $1.80, after which the market declined a total of $6 a ton to $1.50, late in November. Barring the low prices late last year, the new $1.60 price is as low as any made since 1899, though it was touched twice, in 1904 and in 1909.

Pig Iron—The foundry-iron market is stiffer, a number of small lots having gone at $13.25, Valley, while formerly $13 could be done on both small and large lots. The Standard Sanitary Manufacturing Co. has purchased about 3000 tons of Northern iron for first-quarter delivery to its New Brighton and Allegheny plants, at $13, Valley, and has also bought about 2000 tons of Southern iron for its Louisville plant, at $10, Birmingham. Small lots of malleable iron have been sold at $13.10 and $13.25, Valley, marking a definite advance in this market, considering that the 1000-ton lot mentioned last week brought $13, Valley, when the market formerly was about $12.75. It is understood that the Pittsburg Steel Co. has bought between 10,000 and 15,000 tons of basic iron for February delivery, from the same interest from which it purchased a similar tonnage for

January. The price of $14.25, Valley, on bessemer iron has been cut lately by brokers, one selling 1000 tons to a foundry interest in this district at the reported price of $14.10, while 3000 tons was similarly sold to a steel casting interest at $14.20 or less. The furnaces continue to quote $14.25, and a sale of two carloads was made yesterday at this figure. We quote: No. 2 foundry, $13@13.25; malleable, $13@13.25; forge, $12.50@12.75; basic, $12.35@12.50; bessemer, $14.25, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—Sales are relatively light, but the market is well held at $41, Baltimore, for prompt or forward delivery.

Steel—Competition by mills west of Pittsburg has resulted in a slightly lower level for billets and sheet bars. It appears that the marking up process proceeded too rapidly, and prices today are about $1 a ton at Youngstown below the quotations of a week or two ago, although about $1 a ton higher than the lowest prices made recently. We quote bessemer billets at $19 and bessemer sheet bars at $20, f.o.b. Youngstown; bessemer and openhearth billets at $19.50@20; bessemer and openhearth sheet bars at $20.50@21 Pittsburg. The advance in wire products ostensibly carries with it an advance of $1 a ton in rods, making the nominal quotation $26, Pittsburg, but it is doubtful whether all producers will insist upon the $26 price on attractive orders, and we now quote the market at $25@26, Pittsburg.

Sheets—Specifications are coming in at a fair gait, but are hardly equal to current shipments, and there is very little new inquiry. Occasional reports are heard of shading, but in general prices are well maintained. The leading interest is quoting a higher level on corrugated roofing than some of the independents, based on a new list it issued about three weeks ago, showing a new arrangement of differentials between gages. Its prices on 28 gage corrugated are $1.35 for painted and $2.50 for galvanized. We quote: Blue annealed, 10 gage, 1.40c.; black, 28 gage, 1.90c.; galvanized, 2.90c.; painted corrugated, $1.30@1.35; galvanized corrugated, $2.47@2.50 per square.

St. Louis

Jan. 22—The market is just a little brighter on pig iron. A few more inquiries have been received and the volume of business contracted for this week has been a little larger. There is no doubt that the demand will increase considerably in the course of a few weeks, as weather conditions have been such since the holidays as to discourage buying. It is thought that in the next two months foundries will be buying quite freely for present needs and will also be inclined to put in a fair stock of iron to meet future requirements. The demand for cars and railroad supplies in general, as well as for other finished products, is quite encouraging. The price of $10.50 per ton, Birmingham, or $14.25, St. Louis, for No. 2 foundry is both the current and future quotation. There has been some business done in Northern iron, though the volume is not as great nor the price as strong as on Southern iron. Northern No. 2 is quoted at $14.50@15 per ton, St. Louis.

METAL MARKETS

New York, Jan. 24—The metal markets are again inclined to be more quiet, though actual demand continues good and the tendency is to improvement.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Dec, 1911..	$ 994,677	$ 4,707,330	Exp. $ 3,712,653
1910..	1,330,400	4,976,632	Imp. 3,646,232
Year 1911..	37 183,074	57,445,184	Imp. 20,262,110
" 1910..	58,774,822	59,222,518	Imp. 447,696
Silver:			
Dec. 1911..	5,997,360	3,306,727	Exp. 2,690,633
" 1910..	6,061,060	4,398,450	Exp. 1,662,610
Year 1911..	65,664,646	43,746,571	Exp. 21,918,075
" 1910..	57,360,973	45,878,168	Exp. 11,482,805

Exports from the port of New York, week ended Jan. 20: Gold, $1076; silver, $1,236,000, chiefly to London. Imports: Gold, $151,315; silver, $95,562, from Mexico, Central and South America.

Gold—Prices on the open market in London were at the usual level, 77s. 9d. per oz. for bars, and 76s. 4d. per oz. for American coin. There was no special demand except a moderate one for India, and some shipments to South America.

Iridium—The market is steady and the price continues $64 per oz. for pure metal.

Platinum—Trade is rather quiet and prices are reported unchanged. Dealers ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal.

Our Russian correspondent writes, under date of Jan. 10, that the market is dull and inactive. The position is a hesitating one, and dealers are quite uncertain as to which way it will turn; whether prices will advance or recede. Quotations are nominally unchanged, 10 rubles per zolotnik—$37.60 per oz.—being asked at Ekaterinburg for crude metal, 83 per cent. platinum; 38,500 rubles per pood—$37.73 per oz.—at St. Petersburg for the same grade.

SILVER AND STERLING EXCHANGE

Jan.	18	19	20	22	23	24
New York ..	56⅝	56⅞	57¼	57⅜	57¼	57⅜
London .	26	26¹⁄₁₆	26⅛	26⅜	26¼	26⅜
Sterling Ex	4.8675	4.8695	4.8705	4.8710	4.8725	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—Silver has advanced on speculative buying, based on reports that there has been a further reduction in the Indian currency reserve. No definite information on this point has reached this market. Meantime silver looks steady.

Exports of silver from London to the East, Jan. 1 to Jan. 11, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India....	£ 163,500	£193,300	I. £ 29,800
China......	86,000	80,000	D. 6,000
Total	£ 249,500	£273,300	I. £ 23,800

India Council bills in London averaged 16.09d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

Jan.	Copper: Lake, Cts per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
18	14.30 @14.50	14.10 @14.15	43	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
19	14.30 @14.50	14.10 @14.15	42½	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
20	14.30 @14.50	14.10 @14.15	42½	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
22	14.30 @14.50	14.10 @14.15	42	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
23	14.30 @14.50	14.10 @14.15	42	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
24	14.30 @14.50	14.10 @14.15	43	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Jan.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
18	63	63¾	67¼	192	188¾	15[illegible]	26¾
19	62¹¹⁄₁₆	63⁷⁄₁₆	67¼	190¼	187¼	15[illegible]	26¾
20	......	......	......	......	......	...	...
22	62¾	63⁹⁄₁₆	67¼	189	187	15¾	26¼
23	62⅜	63⅛	67	189¼	188	15¾	26¾
24	62⁷⁄₁₆	63³⁄₁₆	66¾	192	190½	15¹¹⁄₁₆	26½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—During the week of Jan. 18-24 the market has been extraordinarily dull, the same general conditions prevailing as during the previous week. While some of the agencies continue to quote 14½c., delivered, usual terms, as their price asked for electrolytic, others have offered freely at 14⅜c., delivered, etc., and trade when any interest is manifested. The sales of the week have been light, the few reported having been at about 14.30, delivered, usual terms, corresponding to about 14.10@14.15, cash, New York, but sales by second hands are reported to have been made at lower figures. The market for Lake copper has been equally dull and nominal. One or two lots sold at 14.40. The situation is simply that consumers have well covered their immediate wants and at present are indisposed to anticipate their requirements at the present level of prices. Producers on the other hand are so well supplied with orders that they are not pressing their metal for sale. The market is quoted nominally at 14.30@14.50c. for Lake copper and 14.10@14.15c. for electrolytic in cakes, wirebars and ingots. Casting copper is quoted nominally at 13⅞@14 cents.

The standard market has been subject to constant selling pressure, in consequence of which the tendency is distinctly downward. The close is barely steady at £62 8s. 6d. for spot, and £63 3s. 9d. for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 15¾c. base, carload lots at mill.

Copper exports from New York for the week were 7915 long tons. Our special correspondent gives the exports from Baltimore at 1390.

Brass Prices—The American Brass Co. announces the following new prices, taking effect Jan. 11: Sheets, high brass, 16c. net per lb.; low brass, 17⅝c. Wire, high brass, 15¾c.; low brass, 17⅝c. Rods, high brass, 15¾c.; low brass, 18⅜c. Brass tubing, brazed, 20¾c.; open-seam, 19⅜c. Brass angles and channels, 19½c. Scrap allowances are 10½c. net per lb. for high brass and 11⅝c. for low brass.

Tin—The London market did not develop any definite trend during the past week, being firm one day and weak the next. The bulk of the transactions took place in three-months tin, which was rather firmer in tone than spot material. The East does not seem to be an anxious seller at this time, as hardly any offers are forthcoming from there. The close is strong at £192 for spot, and £190 10s. for three months.

Inquiries in the domestic market were plentiful, but very little business took place. Spot tin is still scarce, but the premium which had risen to almost 1c. per lb. seems to be getting smaller. The quotation for January tin is about 43 cents.

The Netherlands Trading Society announces that the quantity of Banka tin to be sold in 1912 will be increased from 235,000 to 265,000 pikuls. The production of Billiton tin in 1911 was 73,538 pikuls, an increase of 4038 pikuls over the previous year.

Messrs. Robertson & Bense report the arrivals of tin ore at Hamburg, Germany, in December, at 1216 tons.

Tin output of Federated Malay States year ended Dec. 31 was 43,863 long tons in 1910, and 43,610 in 1911; decrease, 253 tons.

Receipts of Bolivian tin in Great Britain in 1911, as reported by Messrs. H. A. Watson & Co., Liverpool, included 29,676 tons of ore and concentrates and 464 tons bars; the whole equivalent to 18,269 tons metallic tin. Receipts in Europe for three years past, reduced to terms of fine tin, were, in long tons:

	1909	1910	1911
British ports	14,550	15,727	18,269
Havre	1,216	808	1,155
Hamburg	2,275	1,690	3,170
Total	18,041	18,225	22,594

The receipts in 1911 exceeded those of 1910 by 4369 tons, and those of 1909 by 4553 tons.

Lead—The market is unchanged at 4.45c., New York, and 4.32½@4.37½c., St. Louis.

The London market is easier and closes at £15 13s. 9d. for Spanish lead, and £15 16s. 3d. for English.

Spelter—The increase in activity that was noted last week has been well maintained and this week the transactions have amounted to a rather large tonnage, including February, March and April contracts. Occasional carloads of prompt metal have fetched a premium, but that is dwindling. The demand from consumers has been freely met by smelters. The market closes steady at 6.25@6.35c., St. Louis, and 6.40@6.50c., New York.

The London market is lower at £26 10s. for good ordinaries, and £26 15s. for specials.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business continues steady and quotations hold at 19@19½c. per lb. for No. 1 ingots, New York. The foreign market is reported firm at about 12c. for ingots.

Antimony—Business has been rather quiet. Cookson's is again a shade lower, at 7¾@7½c. per lb.; Hallett's is quoted the same, 7¾@7½c. For Hungarian, Chinese and other outside brands, 6¾@7c. per lb. is named.

Quicksilver—Business continues on a fair scale. The New York quotation is $43 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $42.50 per flask for domestic business and $40 for export. London price is £8 per flask with £7 17s. 6d. quoted from second hands.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 20—The high price for zinc sulphide ore is $50 per ton, the base per ton of 60 per cent. zinc at $45@47 per ton. Zinc silicate sold at $24@27 per ton of 40 per cent. zinc. The average price, all grades of zinc, is $45.40. The high price for lead ore is placed by one purchasing agency at $60 and by another at $62.50 per ton. The average price, all grades of lead, is $59.58 per ton.

SHIPMENTS, WEEK ENDED JAN. 20

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,676,860	......	758,120	$105,471
Joplin	1,608,530	......	77,930	39,330
Galena	491,820	......	183,580	16,570
Alba-Neck	658,360	......	......	15,471
Carl Junction	562,490	......	......	14,060
Oronogo	383,480	......	70,860	11,948
Duenweg	462,630	......	49,750	11,901
Carthage	388,160	......	......	8,733
Granby	337,280	......	10,780	5,450
Springfield	199,930	......	......	4,750
Stott City	203,000	......	......	4,466
Wentworth	124,890	......	......	2,746
Spurgeon	87,630	......	30,040	2,535
Saginaw	....	88,890	11,610	1,675
Lawton	65,620	......	......	1,510
Quapaw	60,690	...	......	1,335
Jackson	48,680	......	......	1,070
Badger	35,830	......	4,680	915
Totals	9,394,880	88,890	1,197,350	$251,036
3 weeks	24,391,200	517,180	3,327,960	$649,857

Blende val., the week, $214,032; 3 weeks, $540,200

Calamine, the week, 1,333; 3 weeks, 7,515

Lead value, the week, 35,571; 3 weeks, 99,142

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85		$40.55		$55.68	
February	40.21		39.16		54.46	
March	39.85		38.45		54.57	
April	38.88		37.47		56.37	
May	38.25		36.79		55.21	
June	40.50		38.18		56.49	
July	40.75		38.36		58.81	
August	42.50		41.28		60.74	
September	42.63		41.29		59.33	
October	42.38		40.89		54.72	
November	45.40		43.25		57.19	
December	44.13		40.76		62.03	
Year	$41.45		$39.90		$56.76	

Note—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

With practically all competition wiped out among the various local lead smelteries, through some purchase or agreement, it is the local smelters against the St. Louis Smelting & Refining Co. While the Webb City smelter is ostensibly owned by the American Metal Co. and the Galena smelter by the Hammer Paint Co., there are those here who profess to believe that the Picher Lead Co. has enough stock in each to have a voice in its business policy.

Other Ore Markets

Tungsten Ore—Ferberite, wolframite and huebnerite ores, $6.50@7 per unit per ton of 2000 lb. of ore containing 60 per cent. of tungsten trioxide. For scheelite ore, 50c.@$1.50 per unit less.

Zinc Ores—For Rocky Mountain blende of good quality, especially as to iron and lead contents, the current price is for the zinc contents, less eight units at the St. Louis price for spelter; with a deduction of $16 to $18 per 2000 lb. of ore; sellers to deliver ore at smeltery. Penalties may be charged for detrimental impurities. Blende is readily obtainable at Joplin on the basis of 87 per cent. of the zinc content at St. Louis quotation, less $16 for treatment, and less penalties for iron and lime.

Chemicals

New York, Jan. 24—The general trade is still rather quiet, but is feeling the effects of the contract season.

Copper Sulphate—A stronger demand is reported and a good business is doing. Quotations are unchanged at $4.90 per 100 lb. for carload lots, and $5.15 per 100 lb. for smaller parcels.

Arsenic—The market is stronger and prices are firmer, $2.50@2.62½ per 100 lb. being asked for white arsenic.

Sulphur—Reports from Texas are that a syndicate has acquired 10,000 acres of land on the Brazos River near its mouth, on which sulphur deposits are known to exist. The plans include active working of the deposits, the construction of a town and a shipping port. M. Swenson & Sons, of New York, represent the syndicate; among its members are John Hays Hammond and A. Chester Beattie.

Nitrate of Soda—Business is still inclined to be quiet. Spot nitrate is still 2.20c. per lb.; while 2.20c. is asked for futures up to July 1, and 2.17½c. for deliveries after that date.

Petroleum

The summary prepared by the *Oil City Derrick* gives the number of new wells completed in 1911 as follows: New York and Pennsylvania, 2008; West Virginia, 1192; Southeastern Ohio, 1197; Lima field, 527; Indiana, 117; Kentucky and Tennessee, 1365; Kansas, 417; Oklahoma, 4032; Louisiana and Texas, 327; total, 11,869, or 1714 less than in 1910. Besides the oil producers, there were 1116 new gas wells, and 1192 dry holes.

MINING STOCKS

New York, Jan. 24—On Jan. 18 the Stock Exchange was decidedly dull and uninteresting. On the Curb there were large dealings in Inspiration Copper at a slight advance. Butte Coalition was active at a decline. Porcupine shares were in fair demand.

On Jan. 19 trading on the Exchange was more active and prices showed some tendency upward. Amalgamated Copper and Steel common both made advances. On the Curb there was some activity in coppers, notably Inspiration and Greene-Cananea. Other mining stocks were quiet.

On Jan. 20 there were sharp advances on the Exchange, nearly all of the prominent stocks gaining on an active market. Mining stocks on the Curb were more active and stronger, though the Curb did not fully come up to the Exchange rises.

On Jan. 22 the Exchange continued strong and active. United States Steel common held its own well, notwithstanding the proposed tariff reductions. There was one sale of Homestake at $89.50 per share. On the Curb the copper stocks were active, Inspiration, Greene-Cananea and Giroux selling freely at only fractional changes.

On Jan. 23 the Exchange was quiet and rather dull, on light business, though prices were well maintained. The Curb dealt rather freely in copper shares at small advances. Cobalt and Porcupine stocks were in favor and held their own in price.

Today conditions on the Exchange are about the same; quiet but rather firm. The Curb is still buying copper shares at slowly advancing prices. Only moderate trading in other mining stocks.

Boston, Jan. 23—This week interest has centered in the Lake Superior issues, notably Old Colony and Mayflower, through the recent rich drill strike in the latter mine. Both of the above mentioned stocks are at a slightly higher level than a week ago. Further favorable developments are expected from these properties, which tends to keep the stocks in the limelight. As a matter of fact, most of the activity has been in the lesser mining securities, which does not tend to give the market as healthy an appearance as is desired.

Greene Cananea has shown renewed activity on the resumption of dividends, and is up to $9 per share. The last 25c. dividend is made possible by the resumption of dividends by its subsidiary companies. The advent of former President Corey, of the Steel Corporation, into the Greene Cananea directory is also reckoned as a favorable factor.

Chino and Hancock have also been in the foreground in this market, both showing advances. Inspiration is also looked upon favorably. These convertible bonds are quoted 109@112, and the rights to subscribe to these bonds are 75c. bid.

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	October	Nov.	Dec.
Alaska shipments.	2,704,802	1,274,655	4,995,008
Anaconda....	21,400,000	20,850,000	....
Arizona, Ltd..	2,720,000	2,960,000	3,100,000
Balaklala	....	....	.. ..
Copper Queen......	7,786,218	6,946,775	....
Calumet & Ariz....	4,784,000	4,390,000	4,486,000
Detroit...	2,086,624	1,941,498	... .
East Butte.	920,000	983,405	....
Mammoth..........	1,865,846	1,793,181	1,721,404
Miami	....	....	2,500,000
Nevada Con........	5,547,931	5,207,983	4,679,674
Old Dominion......	2,050,000	2,082,000	2,610,000
Ray..................	2,069,287	2,517,000	2,660,000
Shannon......	1,124,000	1,256,000	....
South Utah...	326,578	361,681	267,614
United Verde*.....	2,750,000	2,600,000	2,000,000
Utah Copper Co....	8,660,729	9,117,961	9,039,557
Lake Superior*....	18,440,000	18,600,000	17,600,000
Non-rep. mines*	13,564,713	11,483,000	....
Total production.	98,800,728	94,265,139	....
Imports, bars, etc..	22,960,027	17,224,725	....
Total blister.....	121,760,755	111,489,864	....
Imp. in ore & matte	4,137,431	4,767,217	....
Total....	125,898,186	116,257,081	....
Brit. Col. Cos.:			
British Col. Copper	778,586	....	....
Granby	... .	....	....
Mexican Cos.:			
Boleo....... . ..	1,245,440	....	2,645,640
Cananea	5,804,000	....	3,706,000
Moctezuma	1,719,643	1,682,768	... .
Other Foreign:			
Cape Cop., S. Africa	....	857,920	....
Spassky, Russia....	672,000	685,440	....
Famatina, Argen..	....	174,720	... .
Exports from:			
Chile...............	4,816,000	4,704,000	6,824,000
Australia	7,056,000	7,168,000	11,200,000

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
Year 1910....	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,657	53,208,739
II....	109,828,297	50,518,998	45,111,019
III.....	130,532,080	66,080,789	59,081,127
IV.............	118,085,223	52,407,650	62,129,599
V...	126,962,544	64,543,963	61,978,567
VI	124,554,312	61,655,561	71,460,619
VII.	112,167,934	56,982,582	74,880,658
VIII	125,493,667	69,935,364	69,855,660
IX.	115,588,950	67,311,584	50,824,011
X...	118,255,442	64,068,307	60,084,349
XI....... . ..	111,876,601	68,039,776	67,049,279
XII............	122,896,697	65,988,474	79,238,716
Year, 1911...	1,431,938,338	709,611,605	754,902,233

	VISIBLE STOCKS		
	United States	Europe	Total
I, 1911.........	122,030,195	236,629,120	358,649,378
II.............	142,439,490	236,992,000	379,431,134
III.......	156,637,770	233,385,600	390,023,009
IV....	162,007,934	223,014,400	385,022,434
V..............	165,565,908	212,284,800	377,840,708
VI.............	165,995,932	202,540,800	368,536,732
VII..	167,434,164	195,932,800	363,366,964
VIII.	137,738,858	191,891,840	329,630,698
IX.............	133,441,501	191,228,800	324,670,301
X..............	140,894,856	191,945,600	332,840,456
XI......	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912.	89,454,695	158,323,200	247,777,896

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Curb trading has been of fair proportions, with especial activity and strength in First National and a few others. Ohio Copper, Rhode Island Coal and United Verde Extension developed pronounced weakness.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan 22	....	$1 00
Alta, Nev	Jan. 26	Feb. 16	0.05
Andes, Nev	Feb. 7	Feb. 28	0.05
Black Jack, Utah	Feb 6	......	0.01
Boston Ely, Nev	Jan. 18	......	0.50
Bruns. C. V. M., Nev	Jan. 12	Feb. 2	0 02
Bullion, Nev	Jan. 12	Jan. 29	0.05
Chollar, Nev	Jau. 3	Jan. 26	0.10
Confidence, Nev	Jan. 16	Feb. 6	0 20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev	Feb. 14	Mar. 6	0.05
Federal Ely, Nev	Jan. 5	Jan. 27	0.01
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0 05
Hancock Con., Mich	Jan. 10	....	1.00
King David, Utah	Feb. 13	Mar. 6	0.005
Ojibway, Mich	Jan. 10	....	1 00
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0 10
Seven Troughs Mon., Nev	Jan. 10	Jan. 31	0.002½
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz	Jan. 15	....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea Con., Utah	Jan. 17	Feb. 8	0.015
Tintic Standard, Utah	Jan. 8	Feb. 5	0.00
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	......	24.154	24.865	......
February	51.534	52.222	......	23 794	24.081	......
March	51.454	52.745	......	23.690	24.324	......
April	53.221	53.325	......	24 483	24.595	......
May	53.870	53.308	......	24 797	24.783	......
June	53.462	53.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52 171	......	24 428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25 680	25.649	..
December	54.428	54 905	......	25.160	25.349	...
Year	53.486	53.304	......	24 670	24 592	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	......	12 680	......	55.600	...
February	12 256	......	12.611	.....	54 974	....
March	12 139	.....	12 447	......	54.704	....
April	12 019	.....	12 275	......	54 034	....
May	11 989	....	12.214	....	54 313	....
June	12 385	.....	12 611	.	56 365	..
July	12 463	......	12 720	....	56 673	..
August	12 405	.....	12 634	.	56 266	
September	12 201	.....	12.508		55.253	....
October	12 189	.....	12 370	.	55.170	.
November	12 616	....	12 769		57.253	.
December	13 552	..	13 768	.	62 068	
Year	12 376	...	12.634	...	55.973	.

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	.....	July	42 400	.
February	41 614	......	August	43 319	
March	40 157	..	September	39 755	
April	42 185	....	October	41 185	.
May	43 115	. .	November	43 125	. .
June	44 606	.....	December	44 655	.
			Av. Year	42 281	..

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	......	4 334	.....	13 009	......
February	4 440	....	4 266	......	13 043	......
March	4 394	...	4 238	......	13 122	...
April	4 412	..	4 262	....	12.889	.....
May	4 373	..	4 223	......	12 984	......
June	4 435	....	4 292	....	13.260	..
July	4 499	....	4 397	......	13 530	....
August	4 500	......	4 406	......	14.260	....
September	4 485	.....	4 356	......	14 744	......
October	4 265	....	4 139	......	15.332	......
November	4 298	......	4.181	.....	15.821	.....
December	4 450	....	4 332	......	15.648	....
Year	4 420	......	4 286	......	13.970	....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	......	5 302	......	23.887	......
February	5 518	......	5 368	......	23 276	......
March	5.563	......	5 413	......	23 016	.....
April	5 399	......	5.249	......	23 743	......
May	5.348	......	5.198	......	24.375	.....
June	5 520	......	5 370	.....	24 612	.....
July	5 695	......	5 545	......	25 006	.....
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	.....	27 750	......
October	6.102	......	6.951	......	27 256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	.....	26 849	......
Year	5.758	.....	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	......	$14 40	......	$14 75	......
February	15 90	......	14 50	......	14 81	......
March	15.90	.....	14 65	......	14.96	......
April	15 90	......	14 65	......	15 00	.....
May	15.90	......	14 30	......	14 72	......
June	15 90	......	14 06	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	.....	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	.....	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Jan. 23

Name of Comp.	Bid.
Acacia	04¾
Cripple Cr'k Con.	02⅛
C K & N	14
Doctor Jack Pot	.06¼
Elkton Con	.64¾
El Paso	.75
Findlay	05
Gold Dollar	.17
Gold Sovereign	.02¼
Isabella	.15⅜
Jack Pot	.05¼
Jennie Sample	.06
Lexington	01
Moon Anchor	01¾
Old Gold	02¼
Mary McKinney	.46
Pharmacist	.02¼
Portland	93
Vindicator	68
Work	.02¼

SALT LAKE Jan. 23

Name of Comp.	Bid.
Beck Tunnel	.13
Black Jack	10½
Carisa	‡ 17
Cedar Talisman	02¼
Colorado Mining	31
Columbus Con	20
Daly-Judge	‡5 20
Grand Central	70
Iron Blossom	1 00
Little Bell	40
Lower Mammoth	02½
Mason Valley	11 25
May Day	15½
Nevada Hills	2 15
New York	‡ 07
Prince Con	80
Silver King Coal'n	1 65
Sioux Con	11½
Uncle Sam	25
Yankee	‡.24

TORONTO Jan. 23

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6 75	Pearl Lake	10
Hudson Bay	75 00	Porcu. Gold	45
Temiskaming	34	Porcu. Tisdale	03
Wettlaufer-Lor	80	Preston E. D.	06
Apex	06	West Dome	37
Central	3 62½	Standard	.08
Doble	62	Foley O'Brien	25
Dome Exten	32	Rea	1 30
Hollinger	13 00	Crown Chartered	14
Imperial	05	Swastika	10

SAN FRANCISCO Jan. 23

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.01	Belmont	8 30
Belcher	48	Jim Butler	36
Best & Belcher	.13	MacNamara	26
Caledonia	1.40	Midway	.26
Challenge Con	.13	Mont.-Tonopah	1 02½
Chollar	16	North Star	.29
Confidence	.65	West End Con	.82
Con. Virginia	.76	Atlanta	.17
Crown Point	.48	Booth	.06
Gould & Curry	08	C.O.D. Con	.14
Hale & Norcross	.17	Comb. Frac	.13
Mexican	4.50	Jumbo Extension	21
Occidental	50	Pitts.-Silver Peak	1 31¼
Ophir	1.45	Silver Pick	.06
Overman	1.25	St. Ives	.30
Potosi	08	Trampa Con	02
Savage	.13	Argonaut	2.50
Sierra Nevada	.37	Bunker Hill	‡3 00
Union Con	1.22½	Cent. Eureka	36
Yellow Jacket	40	So. Eureka	‡6 00

N. Y. EXCH. Jan. 23

Name of Comp.	Clg.
Amalgamated	64¾
Am. Agri. Chem	61½
Am.Sm.&Ref.,com	72⅛
Am. Sm.& Ref., pf.	103½
Am. Sm. Sec., pf. B	87
Anaconda	35⅝
Batopilas Min	1½
BethlehemSteelpf	61½
Chino	26¾
Federal M.& S., pf.	37⅛
Goldfield Con	4½
Great Nor., ore ctf.	41¾
Homestake	88
Miami Copper	24½
Nat'nalLead,com.	54
National Lead, pf.	106⅞
Nev. Consol	19¼
Pittsburg Coal, pf.	80½
Ray Con	17⅞
RepublicI&S,com.	26¼
Republic I & S, pf.	85½
SlossSheffi'd,com.	41
Sloss Sheffield, pf.	108¼
Tennessee Copper	37½
Utah Copper	55⅞
U. S. Steel, com	66⅜
U. S. Steel, pf	111⅛
Va. Car. Chem	55½

N. Y. CURB Jan. 23

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	42
Braden Copper	5⅝
B. C. Copper	4⅜
Buffalo Mines	1¼
Butte & Vipond	53
Butte Coalition	22½
Cobalt Central	‡.01
Con. Ariz Sm	½
Davis-Daly	⅞
Diam'field-Daisy	13
Ely Con	½
Florence	60
Giroux	4⅝
Gold Hill Con	
Greene Cananea	9
Greenwater	06
Guggen. Exp	‡180
Inspiration	10⅝
Internat. S. & R	‡124
Kerr Lake	2 13/16
La Rose	3¾
McKinley-Dar-Sa.	1⅝
Min. Co. of A. new	4
Nev Utah M. & S.	1/16
Nipissing Mines	6⅞
Ohio Copper	⅞
Pacific Sm. & M	⅜
Porcupine T'nsite	03½
Precious Metals	‡1⅜
Ray Central	1¾
Red Warrior	‡1½
South Utah M.& S.	‡⅜
Standard Oil (Old)	625
Stand'd Oil of N.J.	369
Stand'd Oil Subs.	325
Stewart	1
Tonopah	7 5/16
Tonopah Ex	1⅛
Tri-Bullion	⅛
Tularosa	⅛
Yukon Gold	3 1/16

LONDON Jan. 24

Name of Com.	Clg.
Camp Bird	£1 12s 9d
Dolores	1 10 0
El Oro	0 16 9
Esperanza	2 12 6
Mexico Mines	7 5 0
Oroville	0 5 3
Stratton's Ind.	0 3 1½
Tomboy	1 2 6

BOSTON EXCH. Jan. 23

Name of Comp.	Clg.
Adventure	6
Algomah	6 7/16
Allouez	42½
Am. Zinc	25½
Ariz. Com., ctfs	3½
Bonanza	45
Boston & Corbin	8½
Butte & Balak	3¾
Calumet & Ariz	61
Calumet & Hecla	430
Centennial	20½
Con. Mercur	05
Copper Range	53½
Daly West	5
East Butte	13
Franklin	11¾
Granby	37
Hancock	34½
Hedley Gold	15½
Helvetia	1¼
Indiana	13
Island Cr'k, com	41½
Isle Royale	21½
Keweenaw	1⅜
Lake	36
La Salle	5⅛
Live Oak	42¼
Mass	8
Michigan	3½
Mohawk	55
New Arcadian	4
New Idria Quick	7⅝
North Butte	25½
North Lake	5¾
Ojibway	6
Old Dominion	46½
Osceola	108
Parrot	‡13¼
Quincy	76½
Shannon	10¼
Shattuck-Ariz	18
Superior	27
Superior & Bost	4⅛
Tamarack	31
Trinity	6¼
Tuolumne	3½
U. S. Smelting	35
U. S. Smelt'g, pf	47¾
Utah Apex	3
Utah Con	16⅛
Victoria	5
Winona	5¾
Wolverine	97½
Wyandot	2¼

BOSTON CURB Jan. 23

Name of Comp.	Last
Ahmeek	240
Bingham Mines	2
Boston Ely	1 5/16
Boswyocolo	10
Cactus	16
Calaveras	2
Chief Cons	85
Corbin	3
Cortez	1
Crown Reserve	2
First Nat. Cop	2
Majestic	44
Mazatan	1
Moneta Porc	14
Nevada-Douglas	2
New Baltic	4
Oneco	2
Raven Copper	.24
Rhode Island Coal	34
San Antonio	‡3
South Lake	6
Trethewey	‡ 55
Union Mines	‡
United Verde Ext.	.65
Vulture	‡5

‡Last quotation

The Engineering and Mining Journal

Vol. 93. FEBRUARY 4, 1912. No. 5.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 10,000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Editorials:

The Basis of Calculating Tonnage Costs ... 247
Explosives ... 248
The Paralysis of Mining Districts ... 248
Southern Iron Rates ... 248
The Steel Corporation in 1911 ... 248
Metallics—By the Way ... 249

Correspondence and Discussion:

The Basis of Calculating Tonnage Costs....Electric Railroads in California....College Men Underground....Tantalum in the United States ... 250
Dome Mines Co., Ltd ... 251
Hollinger Gold Mines, Ltd ... 251
The Porcupine Outlook ... 252
Old Freibergers ... 252
Canadian Mining Institute ... 252

Details of Practical Mining:

The Disinfection of Swimming Pools....*Air Cylinders for Changing Cages....Uses for Old Hoisting Cable....*Gate for Skip Loading Bins....*Idler for Hoisting Rope in Inclines....*Battery Method of Stull Timbering....*Gate for Vertical Ore Chutes....“Don'ts” in Using Explosives....*Landing Chair for Cages....Safeguarding Ore Chutes ... 253
December Operations at Goldfield Consolidated ... 258
California Oil in December ... 258
Mining News via the Daily Papers ... 258
Danger in the Use of Sodium Peroxide ... 258
The Slow Speed Chilean Mill. J. B. Empson 259
E. R. Buckley ... 262
Nevada Consolidated ... 262
Last Word on Potash ... 262
Wet Assay of Copper Mattes. Donald M. Liddell 262
Farrell on Steel Prices ... 262
The Geology and Mining of Clay. Edgar K. Soper 263
*Utilization of the Waste Heat in Slag ... 267
Binder for Copper Chips ... 267
*Diamonds in the Belgian Congo. Sydney H. Ball 268
Recent Developments in Explosives. A. E. Anderson 270
*Power System Cleveland Cliffs Iron Co. ... C. A. Tupper 274
The Barker District, Montana. J. R. Villars 275
Serpek Process of Nitrogen Fixation. 275
Mining Index ... 276
Personal, Obituary and Societies ... 280
Editorial Correspondence ... 281
Mining News ... 283
Markets ... 289

*Illustrated.

The Basis of Calculating Mining Tonnage Costs

The communication from Mr. William Hague under the above caption, printed elsewhere in this issue, reopens an old subject of discussion, viz., What is the basis upon which mining costs should be computed? Unless there be some understanding about this, or a specific explanation in connection with every presentation of figures, there is likely to be confusion and the making of improper comparisons, just as Mr. Hague has pointed out. It will be useful to review some of the fundamental conditions that obtain in mining.

Mines possess widely different characteristics. Some are opened in large, sharply defined orebodies, which can be cleanly extracted without taking any of the country rock, whereof the entire product may be sent to the mill. Another class is opened in thin orebodies, wherein it is necessary to take out a more or less width of barren rock, although the ore itself may be sharply defined, in order to make room in which to work to get the ore. Another class of mines is opened in orebodies that fade out gradually, the limit of extraction being determined by the profit realizable, which is generally a fluctuating factor. Finally, there is the class of mines that is unquestionably of the most importance, wherein the ore is more or less mixed with worthless material that must be extracted in order to get the ore.

In the last class of mines always, and in our second class to a certain extent, the entire process from the mining to the delivery of the product from the mill is one of concentration. This begins underground in the effort to break the least possible amount of worthless rock. It continues through the processes of hand-sorting underground, hand-sorting in the rock-house, hand-sorting in the mill, and finally (in the case of dressing works) mechanical sorting. In mines where the practice is necessarily of this nature, and their name is legion, the question is what should be the basis for determining the cost of mining per ton of ore?

Theoretically, the true basis for comparison is, we think, the number of cubic feet of ground stoped, which takes into account the specific gravity of the ore, a factor of consequence that is generally disregarded. This system of measurement finds a practical expression in the fathom basis, sometimes employed in connection with underground contract work in the copper mines of Lake Superior. Several years ago Mr. Hugh F. Marriott undertook to introduce in certain mines of the Witwatersrand the unit of square fathom of vein area stoped. If veins were of a uniform thickness, which they are not, this would be equivalent to a volume basis. However, Mr. Marriott's proposal did not meet with favor, and for our own part we grant freely that, although a volume basis may be theoretically ideal, practically it is out of the consideration.

The question consequently resolves itself substantially into the two alternatives: Shall the cost of mining be referred to the tonnage of ore raised, or to the tonnage milled? The answer is not quite simple. A figure referred to the tonnage raised may fail to be a true index, because a large quantity of rock or low-grade ore may have been separated underground and filled into old stopes. On the other hand, two mines of the same kind and the same district may exhibit a difference in practice after the ore has been hoisted. One may sort out a good deal of waste at the shaft and forward to the mill what is already a partially concentrated product; while the other may send the entire product to the mill and there perform the same kind of preliminary sorting, which then becomes distinctly a part of the milling process.

It would be desirable if we could have some standardization respecting this question in accounting, but we fear that the difficulties are prohibitory. Anyway we hope that Mr. Hague's communication will lead to some further discussion of this subject, which is of perennial interest.

Explosives

The article on "Recent Developments in Explosives," by A. E. Anderson, presented elsewhere in this issue of the JOURNAL, will bear careful reading. To those familiar with the chemistry of explosives, there will probably appear little that is new. The article contains much, however, that is not only interesting, but important that those engaged in mining, in the actual breaking of ground, should know. The original of this article was presented recently as a lecture to the mining men of Telluride, Colo., with special reference to Western practice.

The developments in the manufacture of this essential to the miner, that have been made during the last 100 years, have followed careful experimentation and have kept pace with the demands made by the constantly increasing scope of the mining industry, and the requirements of efficient work. They have resulted in the evolution from a single product, black blasting powder, of a great variety of low- and high-power explosives; with these, also, have been evolved the necessary devices, known as detonators, to explode properly the charge itself. It is now possible to prepare a charge with such a combination of powders or gelatins, that, with the proper detonator, much more effective results can be obtained and at no greater cost than heretofore.

Of not the least importance is the proper handling of explosives in general, but of these new high explosives in particular. Many of the precautions advocated by Mr. Anderson are so obvious as to make the emphasizing of them seem almost unnecessary. However, to those in possession of any list of mining accidents over a period of the last few years, the number of such due directly to explosives will at once be recalled. If the precautions suggested in this article were universally and faithfully observed, there would be little question that accidents due to the mishandling of explosives would nearly or entirely cease. Such a happy result is, of course, not to be expected; but it is the ideal condition, and as such should be striven for.

The Paralysis of Mining Districts

The Director of the U. S. Geological Survey has made a name for himself as the giver of excellent advice respecting needed amendments of the mining laws of this land. It is a pity that the gentlemen who represent the people in the halls of Congress will not, anyway do not, heed his words. In his last annual report he makes a commendable suggestion, as follows:

> In the case of unpatented claims a remedy should be sought for what has been termed "the paralysis of mining districts," and the rigid requirement of annual assessment work should be made actual and effective by inspection and supervision, in order to put an end to the present procedure of allowing a claim to lie idle for practically two years after its location, not to mention the many localities where claims are held year after year with only perfunctory compliance, or even without any performance of assessment work—a type of local disregard for law that is in striking contrast to the observation accorded to the district customs and regulations of earlier days, whereby the right of possession was made absolutely dependent upon continuous operation.

In the midst of the play of boundless ambition in Washington for new bureaus to be organized, new jobs to be created and new literature to be disseminated, Uncle Sam does not seem able to manage his own property. The director of the Survey has pointed to this case of the unpatented mineral claims, the property of the Government but held by locators under conditions, the evasion of which has long been a joke.

Let the Government attend to its own. Let the Bureau of Mines organize a corps of inspectors and bring triflers to book, incidentally providing a fine array of new jobs in the bureau. This would be a field of usefulness more worth while than the operation of "experiment stations."

As for the unworked patented claims, held for the unearned increment, let the States attend to them by a suitably adjusted system of taxation.

Southern Iron Rates

Alabama iron makers are protesting against the railroad rates from their furnaces to Western points. The present rate from Birmingham to St. Louis is $3.75, and to Chicago, $4.35; which work out to 0.85 and 0.67c. per ton-mile, respectively. These seem rather high rates for freight like pig iron, which is moved in carload lots at the least, requires no special care and is not subject to damage —in a word, is low-class freight, and should get the lowest rates. The Southern ironmasters, however, do not base their complaint so much on the ton-mile charge as on the fact that rates are the same now, when pig iron is selling around $10 at furnace, as they were when it was bringing $2 or $3 more. They are willing that the railroads should take their share, but think that the carrier should be ready to divide the burden of lower prices with the producer. Another article of their complaint is that the high freights put them at a disadvantage in the Western markets in the competition with Northern furnaces.

As the large majority of the Southern furnaces are merchant furnaces and sellers of foundry iron chiefly, this question is an important one to them. But if they undertake to put the question of rates, not on the basis of the service actually rendered by the carrier, but on that of a division of profits, they complicate the matter and raise questions which will make the already difficult matter of rates even harder to settle than it is already—and that is saying much.

Steel Corporation Earnings in 1911

The reports of fourth-quarter earnings of the United States Steel Corporation, showing $23,105,115, against $29,600,000 in the third quarter, is somewhat better than was expected. It is doubtful, however, whether the unseen charges for depreciation, etc., were as liberal in the fourth as in the two preceding quarters. Realized prices in the fourth quarter were materially below those in the preceding quarter, and the tonnage was not greatly increased. In the present quarter realized prices will be no higher than in the fourth quarter, if as high, but the tonnage will be greater, pointing to earnings for this quarter of about $25,000,000. Quoted prices are, of course, higher, but the selling for this quarter was done when prices were at their lowest.

The fourth quarter's earnings bring the total for the year up to $104,355,463, which is below that for 1910 by $38,788,378; and is the smallest total since 1908, showing a gain of $12,507,853 over that year of extreme depression.

Metallics

Ore can be transported by burro from mine to mill or railroad in the Parral, Mexico, camp for from one to 1.50 pesos per metric ton for distances upward of two miles.

The Murex process of magnetic separation is in use by the Cordova Copper Co., and also at a plant at Malines, France. It is reported that other installations are being made.

At Stratton's Independence mill, in the last fiscal year, the wear and loss of steel in the chilean mill rolled-steel tires was 0.43 lb., and in the dies 0.19 lb. per ton of ore crushed.

In the Aurora mine in eastern Chihuahua, owned by the Madero family, both wulfenite and vanadinite are found, associated with galena carrying low silver content. Some of the vanadinite as concentrates running 18% V_2O_5 has been shipped to England.

Unless solutions entering zinc boxes are fairly strong in free cyanide, it is advisable to allow strong cyanide solution to drip into the first compartment. Better precipitation is obtained thereby, and the formation of the troublesome "white precipitate" is largely avoided.

A boiler of commercial size has been built for testing the practical results in the flameless combustion of gas as developed by Prof. William A. Bone. This boiler, which has constructed for the Skinningrove Iron Co., of Yorkshire, is to be capable of evaporating 5500 lb. of water per hour; it is 4 ft. long, 10 ft. in diameter, and contains 110 three-inch tubes. It is to be fired with byproduct coke-oven gas.

According to the building laws of the city of New York, reinforced-concrete structures shall be so designed that the stresses in the concrete and steel shall not exceed the following limits: Extreme fiber stress in compression, 650 lb. per sq.in.; in direct compression, 500 lb.; in shearing, when all diagonal tension is resisted by steel, 150 lb., and 40 lb. in shearing when diagonal stresses are not so resisted.

At some mines on the Rand the mining system now in favor is a combination of old Rand methods and colliery practice. The circular shaft at the New Modderfontein will be provided with mechanical ventilators and large blocks of ore will be mined on a modified longwall system. At the Modderfontein B, these blocks measure 1000 ft. on the dip and are 750 ft. long. On the 2200-ft. level of the Crown mine, the two shafts are to be connected by a main haulage level 14½ ft. wide that will be three miles long, passing from one end of the property to the other. Electric traction will be used.

By The Way

Some recent company meetings have shown that all the insurgents are not in the Republican party.

An entirely accurate method of measuring the height of a cliff with an aneroid barometer is given in the *Pahaspa Quarterly*. Lower the barometer by a string and measure the string.

A convention of mining men is to be held at Spokane during February. The announcement that certain gentlemen will present a resolution in favor of an "increased coinage of silver dollars at a mint to be located in the Northwest" sounds like a voice from the grave.

A review of the year 1911 was published recently by a local paper, at Grants Pass, Ore. It is a model of terseness and brevity, as can be readily seen from the following reference to mining in that district: "Mining interests have been somewhat up and down during the year. The most exciting was the Higging strike in the Kerby district." By the substitution of other names in the last sentence, this résumé of the year could be aptly applied to many other camps.

One of the mysteries is who buys defunct mining stocks. Prices paid are generally low, indeed, but even at that, where do the buyers look for any profit? Now and then the securities of an estate are closed out at auction, and in the reports we are sure to find some item like this: "1000 shares of Garfunkel Mining Co.; $10,000 first-mortgage bonds same company, coupons from July, 1882 attached; $10 for the lot." But why the $10? Is the buyer accumulating a museum for posterity?

The following from the *White Pine News* emphasizes the need of knowledge concerning explosives, and of occasional review of precautions in their use, such as presented elsewhere in this issue: "While kneeling over a small fire, thawing out several sticks of frozen powder, W. R. Bauer was blown up and instantly killed by an explosion on the properties of the Ely Verde Copper Co., south of the steam-shovel pit of the Nevada Consolidated, where he was engaged in doing the annual assessment work."

There is a new patented device, known as a metalometer (U. S. pat. 1,009,660), which is intended "to easily and quickly determine" (poor infinitive) "approximately the value of an ore by a prospector or person without knowledge of chemistry, metallurgy, or electricity." However, "it is not intended to make quantitative determination by the invention herein described." The invention is portable and consists of a galvanometer, and an electric battery, one pole of which is formed by a powdered sample of the ore to be examined. The voltage of the current produced is expected to indicate the sort of ore one is dealing with. We have heard of complex ores that—but why be captious.

Who will care to go to the docks to see the "Olympic" or the "Lusitania" now? *Financial America* states that the Steel Corporation has placed an order with the American Shipbuilding Co. for two ore vessels of the Isherwood type, 600 ft. long, with a carrying capacity of 225,000 tons each. Sounds as if they were going to pick up a mine and carry it away in these ships. We shall expect to hear of a contract being awarded to Vulcan for a loading crane, unless someone kindly comes forward and chops a few ciphers off that carrying capacity.

Approximately four-fifths of the excavation required for the Panama Canal was completed on Jan. 1, 1912. According to the *Canal Record*, American engineers since May, 1904, have taken 158,010,963 cu.yd. of dirt and stone out of the canal bed. French engineers, who preceded them, had removed 78,146,960 yd., but only 29,908,000 yd. of this work was of value to the canal as rerouted. On Jan. 1 there remained to be excavated 37,230,439 cu.yd. The vast concrete construction is going on rapidly, and at the beginning of the year 75 per cent. of concrete for canal locks was in place. At Gatun locks, where work is farthest advanced, some employees have been notified that their services will soon no longer be required, though they may still find employment on other sections.

Now that the topography of the Porcupine boom resembles a pancake, the stable door is going to be locked by *Everybody's Magazine*. In the advertisement for the February number the announcement is made "You have been told often enough how you lost your money after you had lost it. * * * * Here you get a chance to look over the trap and size up the bait before you walk into it. * * * * In the February number, *Everybody's Magazine* tells the clear cold-cut truth about Porcupine. * * * * Trailing behind the few real mines in varying stages of development are an infinity of near-mines, prospect mines and mining companies, and these, baited with the lure of real gold in the others, are being foisted on the public by all the old tricks of shady promotion—and some new ones * * * You'd better know the truth about the camp and its promotion before the harm is done instead of afterward." This was all true enough a year ago, and we presume it is interesting to review history. It is grievous, however, to see this usually uptodate magazine bringing up the rear of the procession and so busy in trying to lock the stable door now.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Basis of Calculating Tonnage Costs

Should tons milled or tons hoisted be the basis for calculating the yield and the cost per ton for mining operations?

Many mining companies in their annual report state the cost for mining and beneficiating on the basis of tons milled rather than on that of tons hoisted, and in the article, "Data on the World's Principal Mines," in the JOURNAL of Jan. 13, 1912, S. F. Shaw says: "Tonnage produced refers to the tons of ore actually shipped to the smeltery or treated locally, and does not include waste which was sorted out of the ore." He compiles the cost per ton for various mines from their annual reports, and for those where surface sorting is employed, this figure is, therefore, presumably per ton of ore milled. The point of basing output and cost per ton upon tons of ore milled rather than upon tons of ore hoisted seems open to discussion. For instance, at the North Star mine, in California, much waste is unavoidably mixed with the quartz in the process of breaking, and owing to the impossibility of entirely removing it, this waste must be considered as a constituent of the ore. Formerly all ore hoisted was sent to the mill. During the last year, however, from 5 to 10% of the material delivered to the mill has been removed at the crusher as waste. The question naturally arose whether to base the yield and the cost on tons of ore milled or on tons of ore hoisted. It was finally decided that the latter was the logical basis, for the reason that sorting was a form of concentration, rough to be sure, but effective, as it removed a portion of the worthless material early in the process of beneficiation.

In the recent report of the Cananea Consolidated Copper Co., published in the JOURNAL of June 24, 1911, Doctor Ricketts gives the cost for mining and beneficiating per ton of ore, including the cost of selling the refined product. A large part, however, of every ton of ore the mine produces is discarded in the concentrator, and receives no further treatment, although the beneficiating process is by no means completed at this point. Arguing from analogy, if it is correct for a mine where surface sorting is employed, to give the yield and the costs per ton milled, it would be correct for the Cananea Consolidated to state the mining and beneficiating costs per ton of concentrate produced. This figure, however, would not be practically useful, either for comparison with former years or with other properties, especially as applied to the cost of mining. Why, then, should a mine, where a certain amount of worthless material is discarded at some point in the metallurgical process, give costs on the basis of the concentrated product rather than on the basis of the ore hoisted?

Of course, in a statement of the milling operation, it should be made clear that so many tons of waste were removed before stamping, so that those interested would not be misled into supposing that the stamp duty had been miraculously increased.

WILLIAM HAGUE.

Grass Valley, Calif., Jan. 20, 1912.

Electric Railroads in California

The interurban electric railroads in California have an aggregate trackage of 1086 miles, projected and operated chiefly for the development of agricultural and horticultural fields and the improvement of real estate. Considering the area of the state and the opportunities for the development of the mining as well as the agricultural districts, this trackage is insignificant. Only a small proportion of the electric lines enter the mining districts, being confined chiefly to the dredging fields of the American, Yuba and Feather Rivers. Natoma and Folsom, in the American River districts, are connected directly with Sacramento by electric railroad. A direct electric line also connects Sacramento with Marysville, in the Yuba district, and Oroville and Chico, in the Feather River district. All these towns are also served by steam railroads, but the electric roads have had a large share in the advancement of the dredging industry commercially, and should add to the development of the quartz- and drift-mining districts by extensions into Nevada and Sierra Counties, not only directly, but by compelling extensions of steam railroads.

Nevada City and Grass Valley, two of the most important mining towns in the state, are dependent on a narrow-gage steam railroad, connecting with the Southern Pacific R.R., at Colfax, and necessitating the transfer of all freight. The development of other districts in Nevada, Yuba and Sierra Counties, commercially related to these towns, has been retarded by lack of rail transportation. Most of the camps open to profitable development are so situated as to be easy of access by rail, and especially by electric lines. The recent developments in the Alleghany and Downieville districts invite the advent of electric lines into Sierra County. One line could be economically constructed from Oroville to Downieville. An electric line from Marysville *via* Auburn, Placer County, to Nevada City, and thence to Alleghany, would give direct connection between southern Sierra County, northern Nevada County and the city of Sacramento, and would cover a large mining territory awaiting transportation facilities necessary to thorough development. Such electric extensions have been projected and talked about for several years. Until they are built and operated the mineral wealth in many of these districts will remain undeveloped. Neither the lack of mineral deposits nor the lack of water power for the generation of electricity can be offered as a reason for the failure to provide these districts with rapid transportation.

CALIFORNIAN.

San Francisco, Calif., Jan. 22, 1912.

College Men Underground

I wish to tender somewhat tardy thanks for the editorial in the JOURNAL of Dec. 30, 1911, entitled "College Men Underground." That it struck a responsive chord is indicated by the fact that practically every producing mine in the district is now following the plan outlined. In this district alone, seven college graduates whom I know personally started work along that line within the last two weeks. One of the largest iron companies has started two men within the last week, and, if successful, I am told that it will start a department for this work. Some companies are confining their attention to the breaking of ground, while others are studying all branches of underground work.

SUPERINTENDENT.

Houghton, Mich., Jan. 20, 1912.

Tantalum in the United States

In the JOURNAL of Jan. 27, 1912, there was an inquiry from "Engineer" as to where tantalum is found in the United States. In reply thereto I suggest that he communicate with Emil Hesnard, Keystone, S. D., or to E. E. Smith, Cañon City, Colo.

C. B.

New York, Jan. 27, 1912.

Dome Mines Co., Ltd.

The first report of the Dome Mines Co., Ltd., has recently been issued and contains a number of interesting features, showing the cost of opening a mine in the Porcupine district and the amount that has been spent by the company on such work up to Nov. 30, 1911. The company is organized under the laws of the Province of Ontario, and owns 240 acres of patented lands in Tisdale Township, Ont., Can., in the Porcupine mining district. This property was acquired by the issue of $2,500,000 worth of the company's capital stock at par, which was subject to a charge of $450,000, for which amount bonds of the company were issued. It is stated that under the same agreement the Monell Syndicate expended for development work, plant and betterment, the further sum of $375,000, without charge to the company. On Aug. 29, 1911, the capital stock of the company was increased by the issue of $1,000,000 worth of stock, which was offered to the shareholders of record, and was subscribed and paid for at par; the proceeds of this sale of stock went into the treasury, out of which the above mentioned bonds were retired.

STATEMENT OF OPERATIONS, DOME MINES, TO NOV. 30, 1911

Receipts	
Proceeds of sale of 99,997 shares of capital stock at par	$999,970.00
Insurance recoveries	309,236.35
Gold sales	4,276.61
Total	$1,313,482.96
Expenditures	
Plant and equipment	$672,060.28
General development	69,012.12
General charges, not allocated	57,792.82
Less accounts payable	151,120.16
Redemption of bonds	450,000.00
Total expenditures	$1,097,745.06
Balance	$215,737.90
Cash on hand Nov. 30, 1911	$202,192.63
Accounts receivable	13,545.27
	$215,737.90

Property Equipment

In July, 1911, the plant was destroyed by fire and the approximate amount of the loss, after deducting salvage, was collected as insurance and amounted to $309,236.35. The plant under construction at present, so it is stated, consists of 40 stamps with the necessary tube-mill and cyanide equipment, and is estimated will be able to handle between 350 and 400 tons of ore per day. The power house is designed with sufficient excess power to operate a mill of double this capacity. The mill, rockhouse and power house are all of steel and concrete construction and are absolutely fireproof; the storehouse and laboratory are made of steel and brick and are also fireproof. The houses of the various superintendents, foremen and miners are of brick, with galvanized-iron roofs, as are also the hospital, clubhouse and eating camp. The construction of the company's own railroad, approximately two miles long, from the Temiskaming & Northern Ontario Ry. to the mill site, has been completed. It is stated that from present indications the mill is expected to be in operation in the latter part of February.

Underground Development

Diamond drilling is said to have indicated a large body of ore of good milling grade, and this ore has been cut at various depths up to 1000 ft. W. F. Edwards, president, states that it will be necessary to do a large amount of sinking and drifting on this orebody before it will be possible to state intelligently the size of it, and what will be the average grade of the ore to be milled. It is further stated, however, that sufficient work has been done to justify the management in equipping the property with the most permanent type of buildings and machinery, with the view of extending the plant as the further development of the mine may warrant. The eight shafts in process of sinking have reached the following depths: No. 1, 72 ft.; No. 2, 45 ft.; No. 3, 50 ft.; No. 4, 35 ft.; No. 5, 175 ft.; No. 6, 145 ft.; No. 7, 200 ft., and No. 8, 102 ft. About 1310 ft. of drifting and crosscutting have been done at the 50-ft. level, and diamond drill holes have been put down aggregating a total depth of 9046 feet.

DOME BALANCE SHEET, NOV. 30, 1911

Assets	
Cost of properties	$2,575,000.00
Plant and Equipment:	
By syndicate	250,000.00
By company	672,060.28
General Development:	
By syndicate	125,000.00
By company	69,012.12
General charges	57,792.82
Less—gold sales	4,276.61
Less insurance recoveries	309,236.35
Accounts receivable	13,545.27
Cash	202,192.63
Total	$3,651,090.16
Liabilities	
Capital Stock:	
350,000 shares, par $10	$3,500,000.00
Less in treasury	30.00
Accounts payable	151,120.16
Total	$3,651,090.16

As shown by the accompanying balance sheet, the cost of the plant, equipment and development of the property since the beginning of operations, is $860,352, after deducting $309,236, which was collected as insurance. This cost includes the $375,000 that were expended by the Monell Syndicate prior to Apr. 22, 1911, but not charged against the company. The company has obtained the services of W. W. Mein, as consulting engineer, and of Henry Hanson, associated for a number of years with the Merrill Metallurgical Co., of San Francisco, as mill superintendent.

The report shows the following men as the executive officers of the company: Ambrose Monell, president; W. S. Edwards, first vice-president; E. F. Wood, second vice-president; W. A. Bostwick, third vice-president; James L. Ashley, treasurer and assistant secretary; Alexander Fasken, secretary; F. S. Jordan, assistant treasurer, and James W. Beard, auditor. The directors are as follows: E. C. Converse, J. R. De Lamar, C. L. Denison, W. S. Edwards, Alexander Fasken, Ambrose Monell and J. S. Wilson. The head office of the company is situated at 58 Wellington St., E., Toronto, Ont., and the executive and financial departments are at 43 Exchange Place, New York.

Hollinger Gold Mines, Ltd.

After a wait of many months, the long-looked-for and first official report of the Hollinger Gold Mines, Ltd., was issued in Montreal, Que., on Saturday, Jan. 27. The pamphlet report itself is not yet available, and the following figures are those published in Montreal on that date. The report gives 462,000 tons of ore as fully and partially developed, with $10,230,000 as the total gross estimated value. Approximately 3000 samples are said to have been taken, which required the making of 8400 ft. of sample trenches. It is stated that a minimum stoping width of 3 ft. has been taken and $4 ore is considered the minimum payable grade. Conservative allowance is said to have been made for the persistance of ore beyond present workings and the estimates do not take into account a depth greater than 300 feet.

Sampling Returns

The sampling returns for Nos. 1, 2, 3, 4 and 8 veins are given as follows:

No. 1 vein, surface exposure, 950 ft.; average width, 9½ ft.; average assay value, $32.96 per ton gold. On the 100-ft. level, there is 1000 ft. of drifting in payable ore; average width, 8 ft.; average gold value, $31.54 per ton. The 200-ft. level shows 350 ft. of drifting; average width, 9⅓ ft.; average gold content, $49.30 per ton. Every additional 100 ft. of depth on No. 1 vein below 300 ft. is expected to add $2,100,000 to the profits and the continuance of other veins beyond the arbitrary depths allowed may also considerably increase the returns. No. 2 vein, exposed on surface for 300 ft., gives an average width of 7 ft.; average gold content, $7 per ton. It is stated that on this vein, crosscuts at three points on the 100-ft. level opened an additional length of 450 ft. There is a crosscut also at one point on the 200-ft. level, and 25 ft. of drifting on the 100-ft. level. This drift is said to average $20 ore over its width for the distance of 25 ft. The crosscuts are said to have shown the following grades of ore at the points cut; $7.20 over a width of 13 ft. and $16 over a width of 8 feet.

No. 3 vein, exposed for 350 ft. on surface shows an average gold content of $9.30 per ton over an average width of 5½ ft.; 35 ft. of drifting on the 100-ft. level gave $4.50 per ton over an average width of 5.2 ft. No. 4 vein, exposed for 375 ft. on surface is claimed to have given an average gold content of $11.60 per ton over an average width of 8 ft. A crosscut at the 100-ft. level of this vein showed an average width of 22 ft. and average gold content of $16 per ton over the full width. Fifty feet of drifting on this level gave $32.40 per ton across the width of the drift. On No. 8 vein an average width of 7 ft. gave $13.92 per ton over a length of 86 ft. exposed on surface. A crosscut on the 100-ft. level exposed a width of 25 ft., and a gold content of $7 per ton.

It is stated that in addition to these five veins, there are 31 veins upon which no development work has been done; that these have been exposed at intervals on the surface and thoroughly sampled.

ESTIMATED TONNAGE AND CONTENTS

Vein No.	Deepest Workings, Ft.	Estimated Tonnage	Depth Allowed, Ft.	Gross Gold Contents
1	200	210,000	300	$7,560,000
2	200	110,000	200	1,200,000
3	100	20,000	100	150,000
4	100	35,000	200	450,000
8	100	10,000	200	140,000
Miscellaneous . . .	. . .	77,000	. . .	730,000
Totals.		462,000		$10,230,000

The report further states that in the aggregate, the orebodies so far discovered will yield for each 100 ft. of depth, approximately 225,000 tons, containing a gross gold content of $4,000,000, from which a net profit of $2,500,000 may be expected from each 100 ft. of depth. It is also claimed that profits during the next four or five years should amount to $7,500,000 and should continue after that period. It is unofficially announced that the directors are providing for the amalgamation of the Hollinger, Miller-Middleton and Dixon-Gillies claims, numbering 15 in all; that details are being worked out and that Hollinger shareholders will participate in the new share issue.

Property Equipment

Comprehensive tests made upon the ore are said to have shown that by means of the cyanide process, a satisfactory extraction of the gold may be obtained. A 4-compartment shaft is being sunk and will be continued to the 400-ft. level. A winze is about to be started from the 200-ft. level, which will be driven to the 400-ft. level on the main vein. The total underground work accomplished amounts to 3717 ft. divided as follows: Shafts, 366 ft.; winzes, 127 ft.; raises, 82 ft.; drifting, 100-ft. level, 1289 ft.; 300-ft. level, 370 ft.; crosscutting, 100-ft. level, 1233 ft.; 200-ft. level, 250 ft. The cost of the mill, which will have a crushing capacity of about 300 tons per day, when completed, will be about $275,000 and it is expected to be in operation some time in April. The cyanide plant is being constructed with a capacity of 500 tons per day, to avoid the cost of making extensions later. The only current liabilities are accounts payable amounting to $150,403, most of which is due to the original syndicates, members of which have made the necessary financial arrangements to carry the work in hand to completion. Manager Robbins concludes his report by saying that the future of the company is positively assured.

The Porcupine Outlook

Porcupine Correspondence

The present year will probably see many changes in the Porcupine district, some of them of an encouraging nature; the majority, it is to be feared, however, will bring only disappointment. A large number of the wildcats will retire to their native solitudes, while others of the more honestly managed companies will be forced to suspend work because of a lack of funds, and inability to develop orebodies of sufficient size and richness to justify further development. It is commencing to be realized that the development of a gold mine is a matter requiring a large amount of capital, combined with careful and efficient management; since the collapse of the Porcupine boom, any attempt to harvest further the usual crop of gullible investors is likely to prove a failure.

To return to the more encouraging features, it seems certain that during the present year, at least four mills will be in operation: The Dome, Hollinger, Vipond (Porcupine Gold) and McIntyre, and already one of these companies is considering an enlargement of the present estimated capacity. While predictions at this time are necessarily vague, it is quite safe to state that the output of gold for the year will be considerably in excess of $1,000,000.

As a whole throughout the camp, good progress is being made along conservative lines, and the reports on developments at the more important properties are distinctly encouraging. While mining has not been carried to any great depth, diamond drilling on several properties has disclosed the presence of orebodies at about 1200 ft. With Porcupine veins, however, the assays obtained from the cores can be considered only as indicative, and no real idea as to the value of the ore at that depth can be gained, until development work has been carried much below the present levels. An interesting feature of the Porcupine district lies in the fact that the boundaries of the ore-bearing area have not been increased to any appreciable extent, since the original staking took place. The present area is, however, large, and its possibilities are great; adequate investigation of the known properties will occupy the attention of operators for several years to come.

Old Freibergers

At a dinner of old Freiberg students held in London on June 30, 1911, it was decided to found a society to be called the "Old Freibergers," and an executive committee was elected. Since that date the rules of the society have been framed. Its object is for social intercourse and to keep the reminiscences of the old Bergakademie alive among its former students. While London is the home of the society, its members are desirous that the roll shall bear the names of many former Freiberg students not resident in Great Britain; they will welcome foreign accessions to their number, and will be especially pleased if such members can be present in London at the time of the half-yearly gatherings.

Mining engineers and metallurgists are very much "birds of passage," but London can claim to be a center through which most of them will almost certainly pass at some time in their lives *en route* to foreign fields. The committee suggests that the association in London may well be regarded, if only on account of its geographical position, as a central society to which old students of the Academy, wherever they may be, would feel it a pleasure to belong. The rules of the society provide for two dinners in London each year. It is hoped that the first will be held in March next, though the date has not yet been fixed. The object is to have it as near as possible to the anniversary of the foundation of the Freiberg School, on March 25, 1765.

The president of the association is Edward Hooper; the secretary is A. H. Curtis, whose address is 3 London Wall Buildings, London, E. C., England.

Canadian Mining Institute

A circular from the secretary's office says that the subcommittee of the Council, deputed to determine the place at which the fifteenth annual general meeting of the Institute shall be held, has reluctantly concluded to reconsider the previous decision in favor of Ottawa; and members are notified that the meeting in question will be held at the King Edward Hotel, Toronto, Ont., on March 6, 7 and 8. In explanation of its action in this regard, the committee desires to state that although definite assurance had been given of adequate hotel accommodations at Ottawa, it did not feel justified in accepting these assurances.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

The Disinfection of Swimming Pools

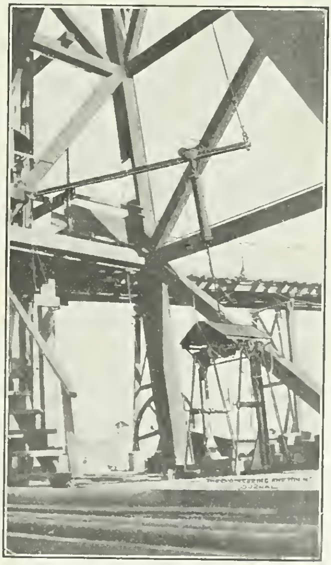
In view of the increasing construction of swimming pools by mining and metallurgical companies for the use of the men, some recent remarks on their disinfection by Norman Roberts[1] are of interest. One novelty is his suggestion that a 0.85% solution of sodium chloride be substituted for ordinary water in the pool. This solution is less irritating to the mucous membranes than any other and hence is less apt to predispose to infection.

Continuous circulation and continuous disinfection are almost necessary. The first should be attained by the use of large slow-speed rotary pump. Any aëration which can be carried on by this means is an advantage, as aiding disinfection. Disinfection can be done by heating the circulation flow in a Forbes or other regenerative sterilizer, which gives complete sterilization of the treated water but is comparatively cheap, as the effluent is only from 2 to 10° above the inflow. Ozonized air and ultraviolet light can be used also.

However, none of these is as effective as disinfection by sodium hypochlorite since the first described methods simply disinfect the water treated, whereas the last disinfects all water mixed with the treated portion, as long as the hypochlorite lasts. In general, keeping the water in the pool charged with hypochlorite to the highest degree compatible with not discommoding the swimmers is indicated. A small amount of ammonia is said to increase the effectiveness of the hypochlorite many times. Occasional tests should be run for organic contamination, for even with all care, the pool may be subject to a sudden large contamination, increasing the amount of hypochlorite needed beyond all reasonable expectation.

Air Cylinders for Changing Cages

At many shafts a small derrick is provided, as a part of the headframe, for lifting heavy objects and changing cages. At the shafts of the Tonopah Mining Company, air cylinders traveling on overhead trolley tracks are used for such work instead of derricks. Such cylinders have been described[1] as used at the Leonard No. 2 shaft, at Butte, although in a different manner.



Air Cylinder on Boom for Lifting Cage

The accompanying illustration shows the trolley track supported from the headframe and a cylinder suspended from it. The cylinder resembles those used for lifting around the ramming machines at a converter plant. The compressed air is obtained by tapping the air main at the shaft.

A trolley and air cylinder are provided for each hoisting compartment. The tracks are so arranged that a truck can be run under the cylinder. The cage to be changed is swung on the truck, run out of the way, and a new cage run in on another truck, attached to the hoisting rope and lifted into the shaft quickly and easily. The device works admirably.

Uses for Old Hoisting Cable

As old hoisting cable has had most of the stretch taken out of it, it makes good reinforcement for concrete work. At the Red Jacket shaft of the Calumet & Hecla company old hoisting cable is unstranded and the strands are also used on the underground-haulage systems for the wearing ropes. In removing the grease from the cable, burning was tried, but it took the temper out of the wires and the strands would untwist, so now only a part of the grease is taken off the cables before they are unstranded.

The unstranding is done in lengths of 600 ft. A block and tackle is fastened to each end of the cable and it is stretched so that it will be clear of the ground. In attaching the blocks to the cable a clamp is used consisting of a bar with a hinged top piece which is tightened on the rope by a bolt at the other end. The block and tackle at each end is fastened to a swivel so that the cable can twist in either direction as it is being unstranded. Two strands are unstranded at a time and each of these strands is fastened to a block so that they can be kept tight as they are being unstranded. These blocks are fastened at some distance from each other as well as from the main cable, so that neither one of them will interfere with either the other or the main rope while it is being unstranded.

About 2000 ft. of cable can be unstranded in a day, and about 12,000 ft. of single-strand rope obtained. Both 1-in. and ⅞-in. hoisting rope has been unstranded for the haulage systems. This old rope has been found to work quite satisfactorily for the hauling rope, but good rope must be used for the tail rope if a return rope from the same engine that does the hauling is used, as the unstranded rope will not readily pass through the pulleys. Strands of 1⅜-in. rope have also been tried, but they were found to be too stiff. In case a rope breaks or a broken wire begins to ball up on the rope, the individual wire or the ends of the broken rope are heated so as to take out the temper, and then the ends are tied together and hauling is continued until the rope can be spliced properly.

---

[1] Eng. News, Jan. 11, 1912.

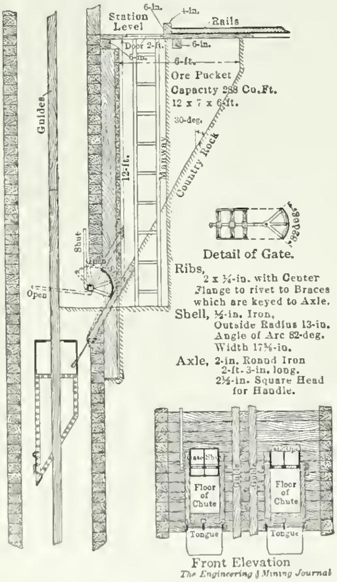
[1] Eng. and Min. Journ., Aug. 20, 1910.

This unstranded rope has been in use at the Red Jacket shaft on the haulage systems for about a year, and has been found quite good enough for the purpose at that mine. Already about 1000 ft. of old hoisting cable has been used in this way with a saving in the cost of 6000 ft. of ½-in. rope, as that was the size of rope formerly used.

Gate for Skip Loading Bins

By J. Nelson Nevins*

In the "Details of Practical Mining" of the Journal of Nov. 11, 1911, there is a description of the Cananea arc type gate that interested me, not because it was new to me, but because I think I can trace it further back. The accompanying illustration is of a similar type of gate designed by me for use in a shaft at Sombrerete, Zacatecas, Mex., in 1901, and which may be the prototype of the Cananea gate.



The Engineering & Mining Journal

Skip-loading Gate at Sombrerete Mine

The arc gate and ore pockets shown in the illustration were designed for use in the Santa Marta shaft of the Sombrerete Mining Co. This was an old vertical shaft 1200 ft. deep and cribbed, near the surface, into two 3½ ft. compartments. Some ore was found in the old workings near the shaft that could not be economically extracted through any of the main shafts, so a long, narrow skip was built for the Santa Marta shaft and this ore pocket and gate were designed to fill the skip at three levels without pouring a stream of ore down the shaft. As these were built for use for only a short time the runway down from the station to the handle of the gate was omitted, and to fill the skip the station tender rode from the station to the handle on a skeleton framework on top of the skip.

The principal feature of this form of gate is that it shuts with the flow of rock, and not across or against the flow, as is usual. Also if the radius of the arc is properly apportioned to the height of the chute, it opens easily, yet the weight of the rock precludes its opening accidentally. These features naturally are more important in a shaft than elsewhere.

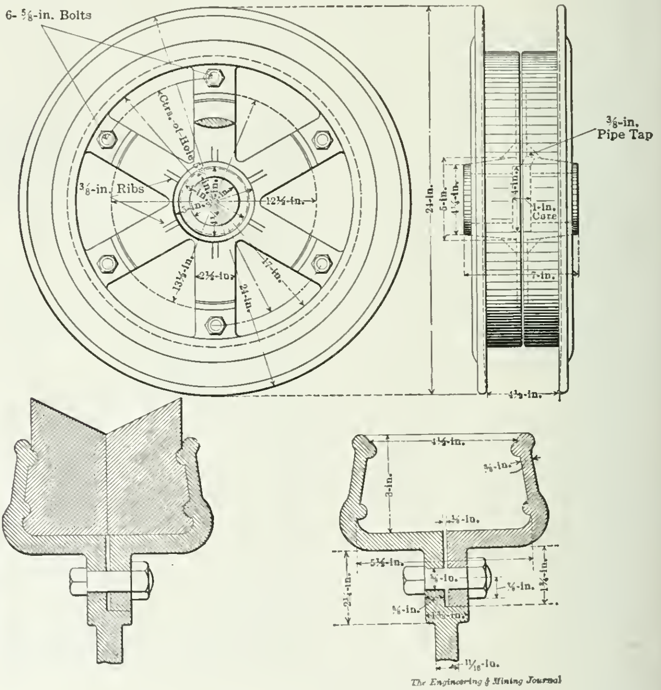
This gate was built in the company's shops at Sombrerete, and shortly after the gate had demonstrated its usefulness, the master mechanic and some of the shopmen removed to Cananea, where a few years later I was informed that they were successfully using this gate.

Quite recently I saw an attempt to use this idea in a copper mine in Arizona, where it had been imported from Cananea, but it was not satisfactory because the arc radius was too short for the height of the chute, so that the gate tended to lift the ore in opening.

Idler for Hoisting Rope in Inclines

In the shafts of the Copper Range Co. in Michigan which have a dip of about 70°, the hoisting ropes are carried on wood-lined idler sheaves at intervals of about 33 ft. The idler as shown in the accompanying sketch, is made of two malleable-iron castings bolted together so as to grip the wood lining pieces in the jaws of the wheel, the diameter being made 24 in. so as to increase the life of the lining. On the jaws are cast two beadings for cutting into the wood and holding it tightly.

The wood filling pieces, which are sawed so that they take the wear on the ends of the fibers on the wood, are in two pieces arranged so as to stagger the joints between the segments of each half of the lining. These segments are cut so as to have a chord of about six inches across their outer face. The wood pieces should be sufficiently thick so that when the nuts are brought tightly home on the bolts the two pieces of the frame will not quite touch. Then the bolts can be tightened so that the pieces of wood will be held securely even if they shrink considerably after being put in as happens in the case of the sheaves in the runways above ground, while in case ordinary



The Engineering & Mining Journal

Idler for Hoisting Ropes Used at Champion Mine cast-iron is used some trouble might come through the swelling of the wood as it absorbs moisture underground, in fact, that trouble was experienced to some extent at the Copper Range shafts when the idlers were made of cast iron.

---

*Mining Engineer, Pasadena, Calif.

Owing to the fact that the hoisting cable does not have much side play in these shafts, a face of 4½ in. on the idlers is plenty wide enough. Owing to the fact that the rim of the casting is much wider than the spokes, the bolts that hold the frame pieces together are well within the protection of the rim, so that in case the rope should slip off the idler it would not come in contact with the nuts on the clamping bolts and possibly be injured.

These idlers are carried on bearings that rest on I-beams carried on concrete pedestals coming up from the bottom of the shaft, and the whole frame is in turn protected from injury by the skip by means of wooden buffer pieces running along over the main I-beams and in turn carried on I-beam crosspieces.

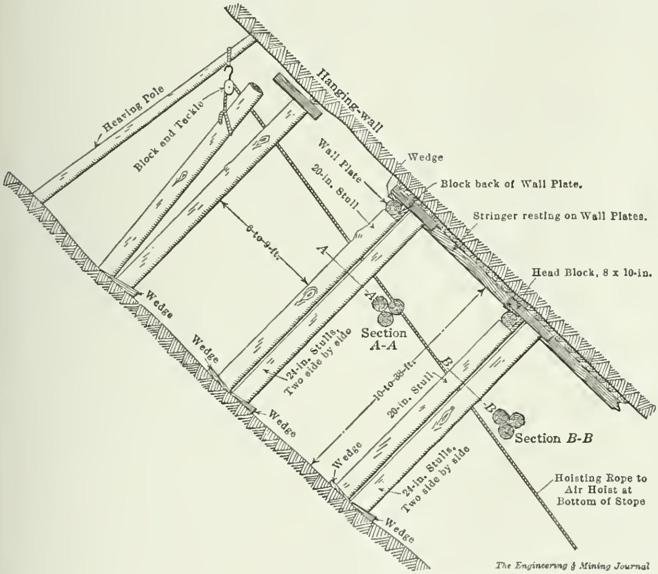
Neutralizing Powder Fumes

It is stated by Stewart W. Young (U. S. pat. No. 1,011,699) that by the use of a small cartridge containing ammonium carbonate, 65%; potassium bichromate, 33%; and camphor, 2%, in holes containing high explosives, the gases will be rendered inoffensive. A somewhat cheaper composition which he also proposes (U. S. pat. 1,007,409), is a mixture of 65 parts ammonium carbonate and 35 parts of manganese dioxide.

Battery Method of Stull Timbering

By Claude T. Rice

It is generally considered that stulls over 12 ft. in length have little supporting power in stopes. This is true where the ordinary method of stull or post timbering is used, but by standing the stulls in groups, or batteries, as they are called in the Lake Superior copper district, stulls can be made to support heavy roofs in stopes as wide as 40 ft. Indeed, this form of timbering has replaced the method of square-set timbering formerly used in the Calumet & Hecla mines in which the caps were parallel with and the posts at right angles to the lode.



The Engineering & Mining Journal

Battery Stulls in Calumet & Hecla Stopes

This grouping of the stulls gives them much greater strength than the same area of timber would have if placed in one stull, while by grouping them, poorer grades of timber, and smaller and therefore less expensive sizes can be used. In the Calumet & Hecla workings where this form of timbering originated, and where it alone is used at present, the battery consists of three posts or stulls. Two are placed in the line of the strike on the lower side of the battery, while in front of the two is stood a somewhat smaller post that supports the wall plate or cap that carries the stringers over which the lagging for the roof is laced. Formerly this wall piece was a piece of square timber, but now it is made of a cheaper and stronger piece of round timber flattened at the ends where it is to rest upon the posts of the battery so as to allow the cap piece to be blocked down on top of the front leg of the battery. In case the hanging wall is good so that it does not require top lacing between the batteries, a block is put in between the front leg and the top blocking so that it can be knocked out and the wall piece put in later if necessary.

The timbers of the battery are stood directly on the foot wall, but the top blocking over them is interlaced so as to tie the group together at the top when the battery takes weight.

The posts of the batteries at the Calumet & Hecla mines range in size from 16 to 30 in., according to the width of the stope and the condition of the hanging wall. These timbers are, therefore, quite heavy, but they are easily swung into place by means of a rope from a small air hoist placed out of harm's way at the bottom of the stope, and passing up through a pulley secured to the top end of a heaving pole, which is a well tested cedar telephone pole, put in above where the battery is to be stood. The rope is fastened to the post of the battery up toward its top so that it can be lifted free of the ground and swung into place without any trouble. Then the rope is slacked off somewhat and the post allowed to swing down to where its head ought to come. One of the six timbermen in a gang then climbs up on a ladder and works in some top blocking to steady the post; then resting against the rope that holds the post he works in more top blocking. The other one of the two bottom posts of the battery is then raised up into place and the process repeated, the top blocking being interlaced over the two posts so as to tie them together. The front leg is then swung up in place and allowed to rest against the other two.

The wall piece that extends from the next battery to this one is lifted up and blocked down from on top at both ends, this top blocking being interlaced with the top blocking of the other posts of the battery. After the three posts have been blocked down from on top as well as they can be, and a sprag has been put in at the top and the bottom to catch the two lower posts of the battery and brace them from the next lower battery, so that the upper battery will not be blasted out before the weight of the hanging wall comes down on it, the last of the wedging of the posts into place is done from below where the men can get a better swing with their hammers. The wedges that are used are broad and about 18 in. wide, and are brought into the mine in bundles to permit them to be carried around easily. After the battery has been properly wedged, small stringers of round poles are put in running from cap piece to cap piece, and across this a grillage of top lacing is put in to catch the rock that scales from the hanging wall.

There is a division of function in the different posts of the battery. The two main legs which are put in somewhat larger than the front leg carry most of the weight of the hanging wall and they also resist the bending tendency in the posts of the battery, while the main duty of the front leg is to carry the wall piece that supports the scalings that come from the roof later in the life of the stope as well as to take some of the weight of the hanging wall. As the top post rests on the other two posts of the battery, the lower two help take care of bending strains that come on the front leg. Consequently, two shorter pieces of stull can be put in, butt to butt with a tying piece of soft 3-in. fir between them, to serve as the front leg, and this spliced stull, unless the hanging is especially heavy, serves almost as well as a stull all in one piece would, for the pressure on it is mainly longitudinal. In this way short pieces of stull that have been recovered from batteries in old stopes before they caved can be used up in the narrower stopes.

In the conglomerate stopes of the Calumet & Hecla company these batteries are put in at intervals of six feet in the direction of strike of the lode and from six to nine feet or more apart on the dip, according to the heaviness of the hanging wall in that part of the mine. After the timbering of the stope is about halfway to the level above, the size of the stulls used in the batteries is reduced for it is in the bottom half of the stope that the most weight comes. In the Hecla workings where the stopes have a width of from 14 to 16 ft. on an average a gang of six timbermen can stand and lace two batteries in a nine-hour shift, while in the Red Jacket workings where the stopes vary in width between 16 and 25 ft. and have an average width of 20 ft., and the hanging wall is not generally as good as in the South Hecla stopes, a timber gang can only stand and lace up on an average three batteries in two shifts.

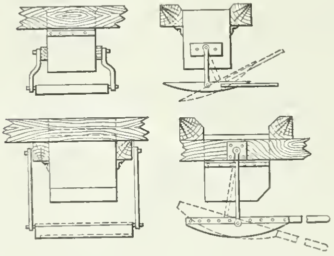
The resistance of this battery system against bending strains is amazing for in some parts of the Tamarack workings batteries are being used in stopes 42 ft. wide. In such cases foot blocking as well as head blocking is used, and in order to take care of bending stresses the three stulls of the battery are either wound with wire rope at their middle or else braced halfway down by struts from the other batteries. In this way the batteries are made to stand in such stopes for three or four months before the weight of the hanging wall becomes too great for them.

While square sets with filling would probably be found a cheaper method of supporting the walls in wide lodes than this battery system when the angle of dip is sufficient to let filling be run into them, still in veins where the dip is flat and timbering is necessary to support the walls the battery system will be found to be not only stronger but cheaper than square sets; at least that has been the experience of the Calumet & Hecla company where the weight on the roof of some of the stopes is especially great.

Gate for Vertical Ore Chutes

The gates shown in the accompanying illustration are described by L. Sanna Manunta[1] and seem to be well adapted for controlling the flow of ore or coal from pockets, the discharge openings in which are in the floor or bottom. For such work as loading cars, where the flow is intermittent, this type of gate has several advantages.

The chute consists of a square or rectangular box with flaring upper edge. The closing of the passage is effected by a swinging pan or scoop suspended from the box or the beams of the ore bin. The pan is wider and longer than the box and is suspended below it at such a distance that when the pan is in a horizontal position the angle from the horizontal of any line from the edge of the pan to the edge of the box is less than the angle of repose of the material. The operation of the pan is apparent from the sketch.


The Engineering & Mining Journal

SWINGING GATES FOR VERTICAL ORE SHOOTS

When coarse ore only is to be handled the pan may hang at a greater distance from the iron box as shown by the lower figures in the sketch; for finer material, the suspension as shown in the upper figures is more desirable.

The advantage of the gate is that it can be swung entirely to one side, giving an unobstructed flow of ore. A quick downward and horizontal thrust on the long handle will bring the pan to a horizontal position under the box and stop the flow. The suspending arms and the pan must be strongly and rigidly built for the weight of the ore comes upon them as a sudden strain, and provision must be made for supporting the handle so that its weight will not cause tipping of the scoop.

---

[1] "Preparazione Meccanica dei Minerali."

"Don'ts" in Using Explosives

The following "Don'ts" were embodied in a lecture on explosives, delivered recently by A. E. Anderson before the mining men of Telluride, Colo. While many of them are by no means new, occasional repetition is not undesirable; if properly observed, fewer dispatches headed "Blown up While Thawing Frozen Dynamite," etc., would be seen.

Don't forget the nature of explosives, but remember that with proper care they can be handled with comparative safety.

Don't smoke while handling explosives, and don't handle explosives near an open light.

Don't shoot into explosives with a rifle or pistol, either in or out of a magazine.

Don't leave explosives in a field or any place where stock can get at them. Cattle like the taste of the soda and saltpeter in explosives, but the other ingredients would probably make them sick or kill them.

Don't handle or store explosives in or near a residence.

Don't leave explosives in a wet or damp place. They should be kept in a suitable, dry place, under lock and key, and where children or irresponsible persons cannot get at them.

Don't explode a charge to chamber a bore hole and then immediately reload it, as the bore hole will be hot and the second charge may explode prematurely.

Don't do tamping with iron or steel bars or tools. Use only a wooden tamping stick with no metal parts.

Don't force a primer into a bore hole.

Don't explode a charge before everyone is well beyond the danger zone and protected from flying dèbris. Protect the supply of explosives also from danger from this source.

Don't hurry in seeking an explanation for the failure of a charge to explode.

Don't drill, bore or pick out a charge which has failed to explode. Drill and charge another bore hole at least 2 ft. from the missed one.

Don't use two kinds of explosives in the same bore hole except where one is used as a primer to detonate the other, as where dynamite is used to detonate Judson powder. The quicker explosive may open cracks in the rock and permit the slower to blow out through these cracks, doing little or no work.

Don't use blasting powder, permissible explosives or high explosives in the same bore hole in coal mines.

Don't use frozen or chilled explosives. Most dynamite, except Red Cross, freezes at a temperature between 45° F. and 50° F..

Don't thaw dynamite on heated stoves, rocks, sand, bricks or metal or in an oven, and don't thaw dynamite in front of, near or over a steam boiler or fire of any kind.

Don't take dynamite into or near a blacksmith shop or near a forge on open work.

Don't put dynamite on shelves or anything else directly over steam or hot water pipes or other heated metal surface.

Don't cut or break a dynamite cartridge while it is frozen, and don't rub a cartridge of dynamite in the hands to complete thawing.

Don't heat a thawing house with pipes containing steam under pressure.

Don't place a hot-water thawer over a fire, and never put dynamite into hot water or allow it to come in contact with steam.

Don't allow thawed dynamite to remain exposed to low temperature before using it. If it freezes again before it is used it must be thawed again.

Don't allow priming, the placing of a blasting cap or electric fuse in dynamite, to be done in a thawing house or magazine.

Don't prime dynamite cartridges or charge or connect bore holes for electric firing during the immediate approach or progress of a thunder storm.

Don't carry blasting caps or electric fuses in wearing clothes.

Don't tap or otherwise investigate a blasting cap or electric fuse.

Don't attempt to take blasting caps from the box by inserting a wire, nail or other sharp instrument.

Don't try to withdraw the wires from an electric fuse.

Don't fasten a blasting cap to the fuse with the teeth or by flattening it with a knife; use a cap crimper.

Don't keep electric fuses, blasting machines or blasting caps in a damp place.

Don't attempt to use electric fuses with the regular insulation in unusually wet work. For this purpose secure special waterproof fuses.

Don't worry along with old, broken leading wire or connecting wire. A new supply won't cost much and will pay for itself many times over.

Don't handle fuse carelessly in cold weather, for when cold it is stiff and breaks easily.

Don't store or transport blasting caps or electric fuses with high explosives.

Don't store fuse in a hot place, as this may dry it out so that uncoiling will break it.

Don't "lace" fuse through dynamite cartridges. This practice is frequently responsible for the burning of the charge.

Don't operate blasting machines halfheartedly. They are built to be operated with full force. They must be kept clean and dry.

Don't cut the fuse short to save time. It is dangerous economy.

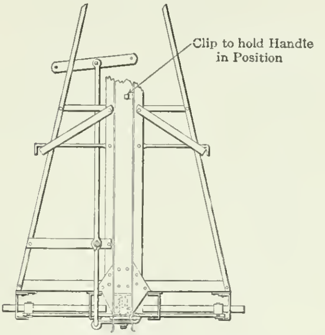
Don't expect explosives to do good work if it is attempted to explode them with a detonator of insufficient strength.

Landing Chair for Cage

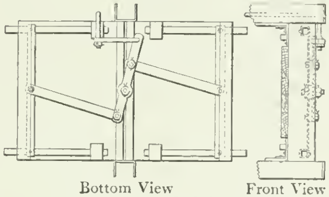
By C. L. Severy.*

The cage chair shown in the accompanying illustration was designed at the Poderosa mine, Collahuasi, Chile, to overcome the difficulties in the use of the ordinary kind where the timbers of the shaft were continually shifting due to bad ground. Since this chair was put into use no trouble whatever has been experienced, for as long as the cage will pass through the shaft the chairs are ready for use.

The advantages of this style of chair are many. Only one chair is needed for each cage. They are quicker to operate in changing levels and in case of accident with men aboard they can be seated on any set in the shaft. This feature is convenient in shaft repair work, as the chair can be seated anywhere in the shaft and the cage held with perfect security. They add little more weight to the cage and are so simply and easily operated that boys of twelve years who can hardly reach the handle operate them here. They also can be easily attached to any cage.



Side View



Bottom View Front View

The Engineering & Mining Journal

Cage Fitted with Landing Chairs

The construction of the chair is simple, being a system of levers to throw out four iron rods, one at each corner of the cage, for it to rest upon, these levers being operated by another upright lever extending above the top of the car, on the cage. The four rods for seating the cage are of 1¼-inch square iron and upset at the proper point for a pin run through holes in channel irons as guides, the channel irons being riveted to the bottom of the cage. The center pivot for the levers is riveted to the middle of the T-iron on the under side of the cage. The long arm of the operating lever is made of 1 by ⅝-in. steel to pass through to give the handle the travel desired in opening and closing the cage chair. This handle is made of steel for two reasons: firstly, to make it "fool proof" against being broken off, wilfully or otherwise; and secondly, to give it the necessary spring to hold it behind a pin at the side of the cage to keep the chair from jarring open while the cage is in motion. At the upper end of the operating lever is a cross bar with a handle at each end so that it may be operated more easily from the stations on either side of the shaft.

---

*Mining engineer, Poderosa Mining Co., Collahuasi, Chile.

Safeguarding Ore Chutes

Where winzes, ore chutes or ore passes open into a floor of a drift they are a constant source of danger to the miners and trammers who have to pass through the drift. In a large mine there are usually many such openings in the floors of the various drifts and unless they are protected in some way, accidents, such as men falling into the openings, are sure to occur.

It is an excellent plan to cut all such passes so that they will open to one side of the drift or into a niche cut into one wall. In such cases there need be no opening in the floor of the drift itself, but it is not always possible to offset the winzes in such a manner. Wherever there is an opening in the floor of a drift through which miners pass, some provision should be made so that a man cannot fall into it. Preferably the opening should be closed by a gate or else by a rough grizzly of logs or timbers. Where the run-of-mine ore is coarse, it may not be possible to use log grizzlies. In such a case some warning should be given the passer-by in order to make him aware of the fact that he is approaching the collar of a winze.

At the Ray Consolidated mine in Arizona a device, similar to that used on railroads to warn trainmen that they are approaching a bridge, is employed at all places where there are openings in the floor of a drift into which a man might fall. The device consists of a beam set in the roof of the drift about four feet from the edge of the opening; one beam is used on each side of the opening. From this beam a number of heavy cords, knotted at the end, hang low enough to strike the face and shoulders of anyone who passes below it. He is thus made aware of the fact that he is approaching a winze or chute and must be careful about passing that place.

December Operations at Goldfield Consolidated

During December, 1911, the total production of the Goldfield Consolidated Mines Co. was 29,127 tons, containing $769,169, or an average of $26.41 per ton; this was milled with an average extraction of $24.76 per. ton, or 94.01%. The total net income was $503,476, or $17.29 per ton. During the month 3415 ft. of development work were done.

At the Clermont, the 413 sill was extended and produced 1076 tons of $24 ore. The 495 crosscut in the hanging wall of the 420 stope is being extended in ore averaging $20. The 604-H raise from the 1000-ft. level produced 150 tons of $41.34 ore. At the Mohawk, the 3-E sill on the 150-ft. level, near the old Sheets-Ish workings, was again extended considerably, and produced 2223 tons of $23.35 ore. The sill in the K section of the 111 stope on the first level was extended, and produced 38 tons of $43.82 ore. The 293 drift on the second level produced 37 tons of $16.53 ore. The 406-X crosscut from the 495 intermediate, between the third and fourth levels, produced 218 tons of $23.15 ore. The 490-B raise, from the 495 intermediate, produced 108 tons of $23.15 ore. At the Red Top, the 353 intermediate, between the second and third levels, north of the shaft, produced 56 tons of $20 ore. The 305-DX raise, from the 353 intermediate, produced 217 tons of $35.14 ore. The 352 sill, on the third level, north of the shaft, was extended and produced 228 tons of average $29.14 ore. The third level main crosscut from the shaft is being driven across to the Laguna shaft, and a station and pocket cut at the Laguna. Upon the completion of, this work the Laguna shaft will serve both mines, and the Red Top surface plant will be dismantled.

DECEMBER COSTS AT GOLDFIELD CONSOLIDATED

Mining:		
Development	$0.93	
Stoping	2.31	
		$3.24
Transportation		0.08
Milling		2.13
Marketing		0.60
General expenses		0.56
Bullion tax		0.24
Construction		0.69
Total cost of operation		$7.54
Miscellaneous earnings		0.07
Net cost per ton		$7.47

At the Laguna, the 718-ft. level of the Hazel is being driven toward the Laguna shaft, and will be connected by a vertical upraise with the bottom of the shaft. The shaft will be carried down to the 725-ft. level, and all work will then be done through the one central shaft for this section of the property. Supt. J. F. Thorn states that the total construction expenditure for December was $42,000, and that inasmuch as this construction extended over a period of several months, the total amount is not being charged off in December, but will be charged off at the rate of from $15,000 to $20,000 per month, until the total amount is cleaned up. One of the furnaces in the roasting plant has been completed and will be in operation by Feb. 1. The other will be completed within a few days.

California Oil in December

The total net production of California petroleum in December (31 days) was 7,016,896 bbl.; increase over November, 275,178 in total and 1628 bbl. in daily average. Consumption of field fuel makes the total gross production in December approximately 7,400,000 bbl. The field consumption in November was 428,429 bbl., and the average for the year 1911 was 425,000 bbl. per month. There is a considerable decrease in December and January in field fuel, owing to the substitution of electric power in many large plants.

CALIFORNIA DECEMBER OIL PRODUCTION

District	Bbl.
Fresno County—	
Coalinga	1,537,692
Kern County—	
Kern River	936,307
McKittrick	467,086
Midway	2,045,352
Maricopa	527,544
Lost Hills	38,365
Total Kern County fields	4,014,947
Santa Barbara County—	
Santa Maria	518,728
Summerland	5,300
Southern Counties—	
Fullerton	472,617
Salt Lake	225,595
Whittier	65,642
Coyote	91,521
Los Angeles	36,100
Newhall	11,240
Ventura	47,517
Total Southern fields	940,231
Total all fields	7,016,896

There was a small decrease in stocks from the amount at the end of November to that at the end of December, amounting to 734,931 bbl., the difference between 40,258,446 and 41,093,377 bbl. The December shipments aggregated 6,669,644 bbl., an increase of 350,914 over November. Records of field development in all fields showed 45 new rigs in December, an increase over November; 76 wells completed, having a total output of 13,360 bbl.; active drilling wells, 478; idle, 347; active producing wells, 5363; idle, 742; abandoned, 6. The November record showed 5268 active producing wells; 771 idle, and 17 abandoned. The net production by fields and the distribution of stocks, as reported, are shown in accompanying tables.

DECEMBER OIL STOCKS

District	Bbl.
Kern River	25,613,655
Coalinga	2,111,897
Midway	1,130,200
McKittrick	1,100,809
Maricopa	637,918
Santa Maria	667,571
Los Angeles	402,624
Fullerton	368,770
Ventura	108,725
All other fields	8,116,479
Total stocks Jan. 1	40,258,446

Mining News Via the Daily Papers

BIG GOLD FIND

Minitonas Man Goes Wild Over the Discovery

Winnipeg, Jan. 26—Men and women and even children are flocking to Minitonas, a little town on the Canadian Northern Railroad, 268 miles west of here, for gold has been discovered there. It is thought to be the richest find in the history of western Canada, outrivaling even the Yukon fields.

For Christmas a farmer named George Elliott took into Minitonas several turkeys. Particles of gold were found in their crops. One had several small nuggets. The matter was kept as quiet as possible, while several went prospecting around the town, but without success.

Two days ago several drills were put to work, and yesterday gold in paying quantities was struck. Today five drills are at work around the town, and each one has struck gold in seams, some of it but 2 ft. from the surface. George Holroyd, a Yukon miner, started work yesterday morning with a pick and shovel. At noon he found a nugget weighing over 7 oz., and at the next shovelful he dug out a 4-oz. and a 3½-oz. nugget. Alex Mackenzie found two nuggets, each weighing about 5 oz., and many other finds have been reported in all directions from town.—*Evening Sun,* Jan. 26.

MANITOBA GOLD BUBBLE BURSTS

8000 Prospectors Had Staked Worthless Claims Near Winnipeg

Winnipeg, Jan. 27—The gold-mining bubble at Minitonas, Man., which has been exciting the people of the country for the last two weeks, burst last night, when mining experts, at a mass meeting of prospectors, after having examined samples, announced that they had been unable to find traces of gold of sufficient value to pay for development. It is said that 8000 claims have been staked out.—*Evening Post,* Jan. 27.

Danger in the Use of Sodium Peroxide

The recent deaths of two chemists in London calls attention to a possible source of danger in the use of sodium peroxide, says the *Chemical Trade Journal,* Jan. 13, 1912. The mixture with which they were working was apparently a mixture of sodium peroxide with oil, containing some water. This water reacted with the peroxide, producing oxygen with a rise in temperature. Apparently this in turn volatilized some of the oil, which formed an explosive mixture with the generated oxygen and the outside air, which ignited either from the heat of the reaction itself or some spark.

The Slow Speed Chilean Mill

By J. B. Empson*

Many of the slow chilean mills in Mexico are crude and inefficient. For fine grinding modernized forms of this mill show better results than stamps.

In this paper I wish to present the merits of the slow-speed chilean mill and also some data obtained from the use of a specially constructed mill now in use in Siberia. Probably the chilean mill that is now in use owes the idea under which it operates to the old arrastre which was one of the first forms of grinding machinery in use for the grinding of ore.

Changes in Motive Power

The first motive power used was either animal or water, later on to be displaced by steam engines to some extent, which in its turn gave way in some districts to electric power. I mention these various stages of power in order to show that the transmission gear that was used with the steam and water power should be changed to conform with the needs of the fast-running electric motor. The positive jaw clutch which could be used with success with a steam or water installation is an element of great danger for breakage of parts when used in conjunction with the electric motor. The slow speed of the mill and the more or less heavy torque at starting of all chilean mills must give an enormous strain on the gear moved by such a fast-running machine as a motor. Of course all this can be overcome by installing the proper transmission machinery according to the type of motive power available, but I believe that such simple things as these have in a way hindered the slow-speed mill from taking the place in modern metallurgy that it deserves.

Though much has been written as to the merits of the slow-speed chilean mill it would appear that this type of mill has been installed in but few of the modern mills either in Mexico or in the world generally. There are probably three reasons for this.

First. Mining Companies are too often influenced by the machinery sellers, who do not care to specialize in slow-speed chile mills but whose profit in stamp mills and their accessories is much larger than it probably would be in such a simple machine as the chile mill.

Second. The types of slow-speed chile mills at present operating in Mexico while they are efficient along certain lines are devoid of the necessary mechanical features to bring their work up to the point of efficiency to be desired.

Third. It is possible that engineers have been too conservative and in their efforts to protect their clients from experiments, have followed too closely behind those who believe that with heavy stamps and tube mills the last word in economical milling has been said.

Coarse crushing with heavy stamps appears to be an inefficient way of reducing ore from 1½ or 2 in. to ¼ in. or less. Then 1550-lb. stamps should crush about 150 tons of average ore per 24 hours consuming about 35 hp. A set of rolls 16x36 in. reducing ore from 1½ in. to ⅜ or ¼ in. will use about 20 hp. These are of course approximate figures depending on the hardness of the ore, etc. I think that I am right in saying that the cost of the installation of the rolls will be about 30% of that of stamps.

The objection made to the use of rolls in the past was that they were too difficult to keep in order. Difficulties in the alignment, bearings and in keeping the shells from corrugating have kept prospective users from investing. However, I believe that the present design of rolls has almost if not entirely eliminated most of these objections, and the fact remains that some of the cheapest crushing costs in the world today are in some of the large copper concentrating mills that are operating in the United States. I have gone a little into the question of rolls versus stamps in order to prove that rolls can easily compete with stamps under certain conditions, and that as a coarse crusher ahead of chile mills it has a field in which it would compete only with the secondary crushers.

First Cost of Chile Mills High

The types of chilean mills with which I am familiar are extremely crude both in the method of applying the power as well as to the impossibility of preventing the grit from entering the bushing in which the trunnion shaft turns, causing an altogether needless expense in the upkeep. The mills in use at La Union in Pachuca and at El Bote, Zacatecas, are of a different type to those above mentioned and are far superior in every respect. The main reason, I understand why these latter types of mills have not come into more general favor is that of first cost, which, if my information is correct, is excessive; probably owing to their great weight the question of freight and duties plays an important part.

There are several claims to be made in favor of the chilean mill in Mexico as compared with stamps, especially on small installations. People who argue in favor of stamps base their claims on the following or similar points; simplicity, ease with which repairs can be made, small space occupied, operation in units, availability of men who are familiar with their operation. Much can be written in favor of stamps especially as applied to ores which do not call for reduction to slime, but on which leaching of sand is possible. Under conditions where ore is to be crushed to ¼-in. mesh in stamps and reduced to 30 or 40 mesh in tube mills, the slow-speed chilean does not compete.

High Efficiency in Fine Grinding

The slow-speed chilean is essentially a fine grinder and as such can show a mechanical efficiency that cannot be obtained by stamps and tube mills. Hence its application to Mexican conditions where the latest metallurgical practice is to grind silver ore so that not more than 20% will remain on a 200-mesh screen. To do this work with stamps entails the installation of one tube mill to each five stamps when each stamp weighs 1250 lb. Putting these at their maximum capacity of 10 tons per stamp according to Mexican practice gives results as follows: 10 stamps, 1250 lb. each, 100 drops per min. require 27 hp. or 2.7 hp. per stamp. On a basis of 100 tons and deducting 10 tons for slime in batteries the charge to each of two tube mills is 45 tons. Then allowing two 5x16-ft. tube mills to do this work the rated running power required for each mill would be 46 hp. The total power required is, therefore, 119 hp. or 1.19 per ton. Tube mills require approximately 1 hp. for every ton ground to 200 mesh. To do the same work with slow-speed chile mills would call for an installation of four chile mills requiring 15 hp. each to crush about 25 tons per mill per 24 hours to an estimated degree of fineness shown by the following figures published by Mr. Megraw on work done at the Santa Elena mill at San Luis de La Paz: On 60 mesh, 1.15%; on 80 mesh, 5.65%; on 100 mesh, 0.15%; on 200 mesh, 25.75%; through 200 mesh, 67.30%.

This is stated to be an average result. Hence it is seen that in crushing 100 tons of ore by this method the amount to be reground is 34.75 tons of which only 8.95 tons can be classified as being coarse. To do this work would take a 4x16-ft. tube mill using 27 hp. at rated running,

---

Note—Excerpt from a paper read before the Mexican Institute of Mining and Metallurgy, December, 1911.

*Mining and metallurgical engineer, Apartado 1390, Mexico, D. F.

making a total of 87 hp. for the whole installation equivalent to 0.87 per ton of ores crushed to 200 mesh. Naturally the finer the product given to the tube mill to crush the greater will be the output of the mill. From experience gained from an installation of this kind it has been shown that the difficulty is to give the tube mill enough work to do in order to allow it to work efficiently. From the figures as given above it will be seen that with the chilean mill installation there is a saving of 0.32 hp. per ton as compared with stamps and tube mills.

Stamps vs. Chilean Mills

An extremely interesting comparison was made recently by W. H. Urbiter[1] between stamps and tube mills and slow-speed chilean mills. Mr. Urbiter in reviewing the situation gives figures as follows: Santa Elena, San Luis de La Paz, slow-speed chilean mills 2-roller type, 67.3% through 200 mesh; 1.84 tons per hp.-day; mechanical efficiency, 49.09%. Hacienda La Union, Pachuca, same as above; 80% through 200 mesh; 1.70 ton per horsepower day; mechanical efficiency, 46.13%. South Africa, heavy stamps and tube mills; 90% through 90 mesh; 1.53 tons per horsepower-day; mechanical efficiency, 40.48%.

Putting the South African practice on a par with Mexican practice, it would appear that if the South African mills were crushing to the same fineness as those in Mexico the relative mechanical efficiency would be much lower.

In American practice the three-roller fast chilean mill gives the following: 39.4% through 200 mesh; 2.35 tons per horsepower day, mechanical efficiency, 55.73%. Owing to the relatively small amount through 200 mesh, it will be seen that this class of mill when crushing to the same degree of fineness as the mills in Mexico would lose to a large extent its relatively high mechanical efficiency.

From the above figures it will be seen that when the fineness of the final pulp is taken into consideration, it is evident that the slow-speed chilean mill is a much more efficient machine to reduce ore to the required fineness as demanded by Mexican practice than any of the other combinations.

Comparative Costs Favor Chileans

Itemized costs per ton of ore ground, as published by Mr. Megraw on actual work done at the Santa Elena mill, are as follows: Labor, 0.03 pesos; lubrication, 0.01 pesos; power, 0.288 pesos; tires and dies, 0.129 pesos; extra repairs, 0.010 pesos; total, 0.467 pesos; Mr. Narvaez of La Union mill in Pachuca gives a cost of 0.558 pesos for reducing ore so that 80% will pass a 200-mesh screen. At the Santa Elena mill the ore is crushed so that 67.3% passes 200 mesh. Against this the cost of grinding a ton of ore to approximately the same fineness by the use of stamps and tube mills will range from 65 centavos to over a peso per ton according to the size of the mill and nature of power used. In these figures there is no allowance made for depreciation either in chilean mills or stamps; nor is there any allowance made for crusher power, this being the same in either case.

When one is confronted with figures such as these it must be evident to the most casual observer that either there must be great scope for improvement in the stamps and tube-mill work as at present carried out, or that through ignorance and prejudice the slow-speed chilean mill has not received the attention that apparently it deserves at the hands of engineers. On considering the matter I believe that it will be generally admitted that in the majority of cases the stamp and tube-mill work as carried out in Mexico in large installations is on the whole excellent, hence we have no other excuse than to say that we as engineers have failed to credit the slow-speed chilean with the numerous advantages that as far as I can learn it is entitled to.

I am not presenting this paper with the idea that I am suggesting any new idea to the mining fraternity, as of course we have all known for some time, that this form of mill has had merit. My aim is rather to suggest that on the latest results accomplished by a modernized form of this mill we cannot afford to shut our eyes to such a great difference in costs as apparently exists between the use of stamps and tubes as compared with the chile mills.

The following are some of the apparent benefits to be gained by the use of chilean mills as compared with stamps. Less height required; cheaper foundations; fewer repair parts required; ability to withstand the roughest handling; breakdowns and hence delays less than stamps; over feeding or under feeding does not hurt the mill; in some cases absence of all screens; absolutely unskilled labor can operate it; attendance if mechanical feeders are used is small; repairs to nearly every part can be made on the ground; minimum vibration and hence minimum depreciation of mill; steel wearing parts will last from 18 months to two years.

Doubtless there are other points which could be mentioned but I think that with the above sufficient has been said to show that more attention should be paid in the future to this type of mill.

Slow Chileans in Siberia

At a recent meeting of the Institute of Mining and Metallurgy, D. C. Bayldon read an excellent paper on the results accomplished in Siberia using a modernized form of slow chilean mill and from the discussion that this paper produced there was evidently considerable interest taken in the matter. The consensus of opinion apparently was that for all-sliming this form of chilean mill has a large field, but in South Africa where the practice is to grind to 30 or 40 mesh it would not apply. It cannot be too strongly emphasized that this type of chilean mill is a slimer and not a coarse crusher even as far as 30 mesh.

DATA OF SLOW CHILEAN MILLS OPERATING IN SIBERIA

	No. 1	No. 2	No. 3	No. 4	No. 5
Number of chilean mills	6	4	6	6	6
Number of runners per mill	2	2	2	2	2
Diameter of pan on bottom	7.6	8.9	8.2	10.6	9.4
Distance between runners, feet	6	6.9	6.6	8.3	7.6
Width of runner face, inches	10	10	10.5	10	12
Diameter of runner, feet	5.5	5.5	5.5	5.5	6.6
Weight of runner	5400	5400	5400	5400	10,800
Speed, r.p.m	12	14	13.5	12	11
Travel of runner, ft. per min	226	297	275.6	311	260
Height of discharge, inches	10	10	9¼	9½	8
Screen used	1 mm. slot	1 mm. slot	¼ punched	1 mm. slot	½ mm. slot
Water to ore ratio by weight	10:1	6.5:1	7:1	13:1	.....
Duty per 24 hr., tons	16	26	20	19	24

The old type of chilean mill which has been used in Siberia for years is similar to that in use in Mexico with the exception of a few points. The trunnion shaft in most cases is keyed solidly to the boss of the runner. The boss is provided with an annular recess for the reception of compensating weights when the tire becomes worn. The center bearing containing the trunnion shaft is movable vertically so as to allow the runner to accommodate itself to variations in the hight of feed.

Mr. Bayldon gives the particulars of some typical plants crushing ore similar in hardness and general character as shown in the accompanying table. Most of the mills are hand fed with ore broken to any size up to 4-in. ring. The power is estimated at from 7 to 12 hp. per mill. These mills are run solely for purposes of amalgamation. The percentage of amalgam collected directly from the mills averages 84% of the total recovered. The average result of screen tests on four of the above mills was: On 30 mesh, 0.22%; on 60, 5.44%; on 100, 15.14%; through 100, 79.44%.

The product is extremely fine and

---

[1] Eng. & Min. Journ., Aug. 5, 1911

of uniform even grade. The mills were designed with the idea of avoiding violent agitation of the pulp in the pan. Mr. Bayldon sums up the work of these mills as comparing most unfavorably with stamps on an output basis, in respect to power, space occupied and first cost.

BAYLDON'S IMPROVED CHILEAN

From experience gained in the operation of this old type of mill, Mr. Bayldon designed a modern mill of the same type concerning which he gives the following information, taken from actual working results: diameter of pan, 10 ft. 3 in.; distance between center of runners, 8 ft. 6 in.; revolutions of mill per minute, 14 and 16; mean runner travel per minute, 340 and 427 ft.; diameter of runner 72 in.; width of face of runner, 12 in.; weight of runners, each, 10,000 lb.; weight of tire alone, 6040 lb.; weight of die set, 4880 lb.; size of discharge opening 44x8 in.; gross weight of mill, 23 tons.

In an installation of six of these mills, the power to drive same is supplied by two 50-hp. motors. Three of the mills are run at 14 r.p.m. and three at 16. The capacity of the mills at present is limited to about 39 tons each, any output beyond this causing excessive overload. A screen analysis of the ore fed to the above mills follows: On 3-in. square, 5.7%; on 1½ in., 42.5%; on ¾ in., 27.6%; through ¾ in., 24.2%.

In the mills running at 14 r.p.m. it was found that a height of discharge of 9 or 10 in. and a water ratio of 4.5:1 to 5.5:1 with 1-mm. screens gave the best results. The water is regulated to form a thin layer about 1 to 1½ in. in depth immediately behind the runner and advances in front in a high wave. The product from a mill at 16 r.p.m. is slightly coarser than at 14 r.p.m. Mr. Bayldon gives the mechanical efficiency of the mill using the above mentioned ore feed and crushing through 1-mm. screen as 63.09%. With ½-mm. screen the efficiency is 63.97%. The net wear of tire and dies is estimated at 0.63 lb. for tires and 0.28 lb. for dies or 0.91 lb. total net consumption of steel.

Mr. Bayldon summarizes as follows: The mill is an extremely simple crushing machine requiring no skilled supervision and little attention and is almost foolproof. Temporary failure of the feeder has no other effect than to reduce the capacity of and power taken by the mill which is in marked contrast to stamps. The mill produces a product of uniform fine even grade and its mechanical efficiency as compared with stamps, producing in one operation a similar finely ground product, is vastly superior. The most suitable water to ore ratio by weight with these mills is low and compares favorably with that of stamps.

The most suitable capacity at 14 r.p.m. may be taken at 42 tons per 24 hours. At the higher capacity of 51 tons the mill is overloaded. The mill at 16 r.p.m. could be run for a capacity of 50 tons and at 20 r.p.m. for from 60 to 65 tons. If this mill were converted into a three-runner which could be done at little expense or trouble the capacity could be increased about 50%. The mill, however, as it stands compares favorably with stamps on a tonnage basis in respect to space occupied and in initial cost and erection the advantage is also with the former.

A MODERNIZED CHILEAN FOR MEXICAN USE

I was so impressed with Mr. Bayldon's paper as confirming to a certain extent the local practice in this type of mill, that in conjunction with another engineer I have attempted to combine the best features of the Mexican practice with those now existent in the mills of Siberia in the form of a modernized chilean mill. Our idea is not to ask for any patent as we have nothing really to patent, as the ideas which this mill embodies are those taken from existing practice.

We propose to have this mill manufactured locally, especially such parts as the heavy cast-iron castings, leaving for import only such parts as the steel wearing parts and such other parts which at present may be beyond our local capabilities. In this way we hope to be able to reduce the initial cost of the mill so as to be able to place it on the market at a reasonable figure. We understand that the high first cost of the imported chilean mill has been in the past one of the principal reasons why this mill has not received more attention. Our chief aim in the design of this mill has been to keep it as simple as possible and also not to add to the cost of the machine by specifying any expensive parts, but at the same time to allow of an ample factor of safety for any parts that may be liable to breakage or abuse.

The essential changes that we have endeavored to introduce are as follows: (1). Improvement in the method of applying power to the mill. (2) Complete change in the form of pan used. (3). The trunnion shaft turns in a center bearing and not on the boss of the muller, where it is subject to grit dripping down the side of the muller and cutting out the bushing in which the shaft turns. (4) Device for allowing the mullers to lift independently over any unbreakable object. (5) Improved method of feeding the ore. (6) More screen discharge with which either the overflow method or screens can be used. (7) Adjustable chuck blocks.

MANTEY OFFSET TO BE USED

We have embodied the adjustable Mantey offset as we believe that this device is of much benefit in the work of the mill. The muller besides revolving is given a dragging movement across the die by this offset. We have estimated the capacity of our proposed mill at 40 tons per day of 24 hours. We see no reason why this mill should not at least equal that in actual use in Siberia, as it is slightly heavier and at the same time embraces the use of the Mantey offset. Mr. Bayldon describes the ore on which his mills are operating in Siberia as a fairly tough quartz quite equal in hardness to the average commonly met with in gold mining the world over, and comparable in toughness and hardness to the Rand banket.

We estimate that the mill will require 17 to 18 hp. to do this work but allowing 20 hp. in order to be safe it only gives 0.5 hp. to reduce a ton of ore to practically 100 mesh. Taking Siberian practice as our guide we find that with a capacity of 39 tons per day and with a water to ore ratio of 4.8:1 the ore ground fine enough to pass 100-mesh screen is 78.26% and of the balance 16.37% will pass a 60-mesh screen but stays on 100 mesh leaving only 5.37 as the percentage on 60 mesh. From these figures we estimate that the installation of one tube mill say 5x20 ft. will be sufficient to take care of the oversize of three chilean mills, which gives the power consumption as follows: Three chilean mills, 60 hp.; one tube mill, 32 hp.; total, 92 hp.; or 0.766 hp. per ton of ore ground.

We submit the idea of the feed hopper revolving with the mill so as to spread the feed equally over the entire surface of the die ring. This we have taken from the practice of the fast-running chilean mills whose makers claim that when this system of feeding was introduced the capacity of their mills was increased 25%. If no other object has been attained by our efforts than that of promoting discussion of the merits or otherwise of the proposed innovation, we shall consider that our efforts have not been useless.

Mount Lyell Report

In the abstract of the Mt. Lyell Mining & Ry. Co.'s annual report, in the JOURNAL of Jan. 20, 1912, p. 154, the words "costs per ton of blister produced" should read "costs per ton of ore treated." The total cost per ton of fine copper was $207.15, of which $94.38 was for mining; $98.68 for smelting, and $14.09 for converting. Figured per lb. of copper, the cost was 9.24c., of which 4.21 was for mining; 4.41 for smelting; and 0.62c. for converting. The average selling price was 12.39c. per pound.

Nevada Consolidated Copper Company

The report of the Nevada Consolidated Copper Co. for the quarter ended Dec. 31, 1911, shows that 15,434,788 lb. of copper were produced. For the purpose of comparison the following figures of production are given: last quarter of 1910, 15,698,595 lb.; first quarter of 1911, 15,893,743 lb.; second quarter, 15,677,065; third quarter, 15,837,079 lb.; October, 1911, 5,547,131 lb.; November, 5,207,983; December, 4,679,674 lb. The production for December, 1911, was lower than any previous month in the 15-month period. This was due to unusually severe winter conditions.

The copper contents of the ore treated in the quarter are reported as 1.94%. The surplus earned amounted to $202,264, after payment of the ninth quarterly dividend of $749,389 and charging off $136,991 for Steptoe plant depreciation.

The Veteran mine, the fee of which was purchased from the Cumberland-Ely Copper Co. in August, 1910, was reopened during the quarter, after having remained closed since July 1, 1909, owing to a strike of the miners. The production of ore was limited, operations being confined to necessary repairs to shaft and surface works, to cleaning up the sub-level drives, which had caved, and in general preparations for enabling full tonnage to be mined as quickly as possible.

The Last Word on the Potash Settlement

A circular issued by the International Agricultural Corporation, under date of Jan. 22, says:

> Shortly after organization, in July, 1909, the company acquired the entire capital stock of one of the largest potash mines in Germany, Kaliwerke Sollstedt Gewerkschaft, for which it paid in stock of your company as follows: Preferred, $2,500,000; common, $1,500,000. As a result of its 2½ years' ownership of Kaliwerke Sollstedt Gewerckschaft, the company has received therefrom by way of dividends, from Sollstedt debentures paid to it as a consideration for its surrender of the seven-year potash purchase contract, from Kaliwerke Aschersleben as purchase price for one-half of Sollstedt shares, and from other sources resulting from the potash settlement, an aggregate cash amount in excess of $4,500,000. Taking into consideration the cash it has already received from the above-mentioned debentures, your company has given to Kaliwerke Aschersleben the option to purchase its remaining one-half of Sollstedt shares at a cash price of $1,500,000. Since the enactment of the recent German potash law, regulating prices and production, the ownership of an independent mine in Germany offers no particular advantages to American fertilizer manufacturers, and for this reason your company decided that it could use the funds which it had invested in Sollstedt before the passage of the law more advantageously in the expansion of its American fertilizer business. The settlement gives to the company not only the cash as above set out, but also provides for the settlement, without expense to it, of all pending litigation pertaining to its potash contracts, which naturally resulted from the passage of the German potash law, and also secures for your company its requirements of potash salts on a basis guaranteed to be as favorable as may be obtained by any other American buyer of potash.

E. R. Buckley

The many friends of Dr. and Mrs. E. R. Buckley will be grieved to hear of his death from pneumonia at Chicago, Jan. 18, followed by the tragic death of Mrs. Buckley. Those who knew the ideal happiness of their married life will not be surprised to learn that she was unable to recover from the shock caused by the loss of her husband.

Doctor Buckley graduated from the University of Wisconsin in 1895 with the degree of B.S., to which was added that of Ph.D. in 1898.

During the practice of his profession as a geologist he served upon the State Geological Survey of Wisconsin, and for seven years was State Geologist of Missouri and director of the State Bureau of Geology and Mines, at Rolla, Mo. He then entered the service of the American Smelters Securities Co. as geologist of the Federal Lead Co., Flat River, Mo., where he was engaged for several years in conducting its exploration work. Withdrawing from this a few months ago he began general consulting practice as a mining geologist with offices in Chicago.

Doctor Buckley was a member of various scientific and technical societies, and was especially active in the work of the American Mining Congress, having been president of that organization and a director at the time of his death.

He was a frequent contributor to professional journals and was the author of various works and reports, the best known of these being the "Geology of the Zinc and Lead Deposits of Granby, Southwest Missouri" and the "Geology of the Disseminated Lead Deposits of St. Francois and Washington Counties, Missouri."

The attainments and character of Doctor Buckley call for more than this formal record. To that record we wish to add that he was not only prominent and successful professionally but was influential as a man.

This was due to a high character and strong personality; and also to his active interest in public affairs and the general welfare of the mining industry.

It seems to us that in summing up the record of a man's life these latter qualities far outweigh the others. No one can live to himself alone, and the man who not only does his professional work well but also plays his part in the world of men, trying to make things better, is an inspiration to all.

Wet Assay of Copper Mattes

By Donald M. Liddell

In the assay of low-grade copper mattes by the ordinary combination wet-and-fire method, i.e., dissolving the matte in nitric acid, trouble is often experienced from the large amount of ferric oxide and unoxidized sulphur left after the action has ceased. In some cases there is so much ferric oxide as to render scorification of the residue impossible. An easy way to avoid this, although requiring some extra manipulation and time, is to treat an assay ton of the matte worked upon with about the theoretical quantity of dilute sulphuric acid necessary to dissolve the iron present, warming gently. When action has ceased, filter by decantation through a double filter. By this means two sources of trouble are simultaneously removed, the sulphur which is combined with the iron goes off as H_2S, the iron goes through the filter paper as $FeSO_4$.

The residue is then treated with HNO_3, in the same beaker, just as for the ordinary combination assay, except the acid is diminished to suit the small mass of residue remaining, and the same filters are used for the second filtration after the silver is precipitated. I have often tested the iron filtrates for silver, but have never found any; apparently the H_2S precipitates any silver or copper dissolved.

It is also worth remembering with some leady mattes that very dilute HNO_3 decomposes PbS with evolution of H_2S.

Farrell on Steel Prices

Before the Stanley committee, President Farrell of the Steel Corporation said that he would not object to publication of composite costs of making iron or blooms but would object to publication of costs of more finished products. Competitors would estimate bids of the corporation to a fraction before they were opened.

He asserted that manufacturers did not go into the question of costs even at the Gary dinners. It is the smallest manufacturer who makes the market. It is a mistake to suppose that the Steel Corporation makes the market. "If some one offers to sell an article at $1, we cannot sell at $1.25. The Republic company made its reduction because it expected to accomplish a reduction of 15% in wages, and it was surprised that other companies did not follow suit. The Republic has since been advancing its prices of its own volition because it found its cut rates unremunerative."

Mr. Farrell evidently has a clearer idea of what governs prices than Judge Gary possesses.

The Geology and Mining of Clay

By Edgar K. Soper

The formation and classification of clays and the methods of mining are discussed. The processes for making brick, the most important clay product, are also briefly reviewed.

Clay, which is one of the most widely distributed materials of economic value occurring in nature, may be defined as "a fine grained mixture of the mineral kaolinite with fragments of other minerals, such as silicates, oxides, hydrates and often organic compounds; the mass possessing plasticity when wet, and becoming rock hard when burned at least to a temperature of redness."[1] The most prominent property of a clay is its plasticity and it is due to this characteristic that clays may be molded into almost any desired shape, which they retain when dry. Furthermore, it is this plasticity that distinguishes a clay from certain varieties of shales, marls, and earthy mixtures.

ORIGIN AND CLASSIFICATION

Clays are always of secondary origin and are formed from the decomposition of other rocks. A very pure clay or kaolin is one consisting almost entirely of the mineral kaolinite, which is derived from the weathering and decomposition of feldspathic rocks. For this reason many geologists formerly intimated that all clays were due to the decomposition of rocks containing much feldspar. But it has been proved that some of the most plastic clays are directly derived from rocks such as serpentine or gabbro, which contain little or no feldspar.

There are many kinds of clays and many different processes are responsible for their accumulation. Several schemes have been suggested by various writers for the classification of these clays, some based on method of accumulation, and others upon the properties and characteristics of the clay, or upon both. One of the latest classifications based on properties and uses of clays is that suggested by Grimsley and Grout, and is given below.

GRIMSLEY AND GROUT'S CLASSIFICATION

I. *Residual Clays*:
  (1) Kaolin.
  (2) China or porcelain clay.

II. *Transported Clays*:
  (A) Refractory (fluxing impurities low).
  (3) Flint fireclay.
  (4) Plastic fireclay.
  (B) Semi-refractory clay (fluxing impurities medium).
  (5) Paving-brick clay and shale.
  (6) Sewer-pipe clay and shale.
  (7) Roofing-tile clay and shale.
  (8) Stoneware clay and shale.
  (C) Non-refractory (fluxing impurities high).
  (9) Pottery clay.
    (a) Ball clay.
    (b) Flower-pot clay.
  (10) Brick and tile clay and shale.
    (a) Ornamental-brick clay and shale.
    (b) Terra-cotta clay and shale.
    (c) Ornamental-tile clay and shale.
    (d) Common-brick and tile clay and shale.
  (11) Gumbo ballast clay.
  (12) Slip clay.

Perhaps the best classification, from the point of view of the prospector, is that suggested by H. Ries and is based on method of accumulation and physical properties. This classification is as follows:—

RIES CLASSIFICATION

I. Residual clays (by decomposition of rocks in situ).
  (1) Kaolin or china clays (white burning).
    (a) Veins derived from pegmatite.
    (b) Blanket deposits derived from extensive areas of igneous and metamorphic rocks.
    (c) Pockets in limestone (as indianaite).
  (2) Red burning residuals (from different kinds of rocks).

II. Colluvial clays, representing deposits formed by wash from the foregoing, and of either refractory or non-refractory character.

III. Transported clays.
  (1) Deposited in water.
    (a) Marine clays or shales (deposits often of great extent).
    (b) White-burning clays. Ball clays.
      Fireclays or shales; buff burning.
      Impure clays or shales; calcareous and non-calcareous.
    (c) Lacustrine clays (deposited in lakes or swamps).
      Fireclays or shales.
      Impure clays or shales; red burning.
      Calcareous clays, usually of surface character.
    (d) Flood plain clays, usually impure and sandy.
    (e) Estuarine clays (deposited in estuaries); mostly impure and finely laminated.
  (2) Glacial clays found in the drift and often may be red or cream burning.
  (3) Wind-formed deposits (some loess).
  (4) Chemical deposits (some flint clays).

The chemical changes involved in the alteration of orthoclase feldspar to kaolinite are probably represented in the following equation:—

$$KAlSi_3O_8 + H_2O = KOH + HAlSi_3O_8$$

The $HAlSi_3O_8$ formed is unstable and may lose some of its quartz (SiO_2), resulting in the formation of kaolinite which probably constitutes an essential part of most clays. Thus it is seen that the primary source of all clays is in the decomposition of the rocks.

RESIDUAL CLAYS

Where a clay is found overlying the rock from which it was formed, it is termed a residual clay, for it represents the residue from the decay of that rock. No matter what that rock may be, the weathering begins at the surface and gradually works downward. This will result in a gradual transition from clay through a mixture of clay and rock, to unaltered rock, as we pass from the surface downward. The contact between the altered clay and the unaltered rock is usually irregular and indistinct. Where cracks, joints, or porous strata exist in the rock, the weathering agencies are able to penetrate to greater depths than where the rock is hard, compact, and free from cracks.

As granite weathers, the feldspar decays, and the rock is gradually converted into a clayey mass. Pegmatites, which may be compared to very coarse-grained granite, are often altered to almost pure kaolinite near the surface, resulting in veins of white-burning kaolin clay. These are especially liable to be found in the southern Appalachian region. When a limestone weathers, the action is different from that in the case of granite. Limestone is a rock composed largely of $CaCO_3$, or carbonate of lime and magnesia, always with a variable quantity of clay impurities. In the process of weathering, the soluble carbonates are dissolved and the insoluble clay impurities are left behind as a residue, forming a mantle over the unaltered limestone beneath.

---

*Department of Geology, University of Minnesota, Minneapolis, Minn.

[1] H. Ries, "Economic Geology," 1910, p. 124.

A residual clay formed directly from the decay of feldspar is called a kaolin, and it is made up almost entirely, when pure, of the mineral kaolinite. Kaolins are usually white burning, and are used extensively in the manufacture of chinaware.

The forms which residual clay deposits may assume will depend upon the form of the parent rock. Clays derived from the breaking down of large masses of granite will be distributed over large areas, while pegmatite veins will give rise to long, narrow, tabular deposits. Limestones may form residual clay deposits of considerable horizontal extent, but of irregular depth. In general, the depth will depend upon the climate, topography, and situation.

Clay derived from rock having much iron oxide in it, will be yellow, red or brown, depending on the iron compounds present. Residual clays are found in many portions of the United States, but the richest field is that lying east of the Mississippi River and south of the southern margin of the ice sheet of the glacial epoch.

Sedimentary and Aeolian Clays

Sedimentary clays are derived from residual clays, which seldom remain long on steep slopes, but become washed away in rain storms and carried into streams where they may be transported to distant areas. In this manner, residual clays of entirely different nature may be washed into the same stream, where they become mixed. Later, when the stream deposits its burden of silt and clay, these mixtures of different residuals form deposits of sedimentary clays. All sedimentary clays resemble each other in being stratified, and this stratification is the best means of distinguishing them from the other varieties. Another important difference is the fact that they usually bear no genetic relation to the underlying rock upon which they rest.

In some regions of the West there are found deposits of silty, fine, calcareous clays termed loess. These are usually stratified water deposits, but they may be formed by wind action alone.

Secondary Changes in Clay Deposits

After clay deposits have been formed, various geologic agencies begin to act upon them to produce the secondary changes which are so often observed. These changes may be either mechanical or chemical.

In excavating clay beds, it is not uncommon to find streaks of sand extending down into the deposit, cutting through several layers and often reaching entirely across the width or length of the deposit. These sand streaks are due to the filling of channels which were cut in the clay beds after they were elevated to form dry land. Often a deposit of entirely different material may be dumped on top of the clay beds. This in turn may again be overlain by clay, giving rise to a succession of alternating layers of clay, sand, or gravel, and clay. If the clay bed is not much thicker than the sand, the deposit may be rendered worthless.

Another common feature of clay deposits of sedimentary origin is the tilting and folding of the strata after they were laid down. Both tilting and folding have an important influence on the form and extent of the outcropping beds. Where the crests of the folds are worn away by erosion, then the various strata will outcrop on the surface as parallel bands, the width of the outcrop depending upon the degree of dip. If the clay strata are so hardened that they break under the stresses and strains that produce folding, a fault may result. Indeed, faults are by no means uncommon in clay deposits. The gradual erosion of the surface may cut away the clay beds in places, leaving them only on the top of the higher hills or hillocks. This may give rise to a number of conditions that at first may seem somewhat puzzling.

When clays become covered with great thicknesses of other material, or when they are greatly folded, the pressure and heat thus produced may result in their alteration to a shale which is much harder, contains less moisture, is non-plastic, and often brittle. Many of these shales, however, when ground and mixed with water, possess as high a degree of plasticity as did the original clays from which they were derived. This fact is taken advantage of in numerous localities where plants manufacturing clay products are working with hard shales, or mixing shale with clay. In a broader sense, then, when the term clay is used, it includes these deposits of consolidated clayey matter from which the moisture has been squeezed.

Chemical Changes in Clays

Most all the chemical changes produced on clays are the result of weathering or percolating waters acting under superficial conditions. These changes may be grouped under the following heads: (1) Change of color. (2) Leaching. (3) Softening. (4) Consolidation.

It has already been shown how red, yellow, and brown clays usually owe their color to the presence of compounds of iron. It will be readily understood how a given deposit may gradually change color as the chemical combination of the minerals in the clay becomes altered. All changes in color of clay are not the result of weathering, for often the difference in color between various portions of the same deposit, may be due to original differences in chemical composition.

When surface waters seep into clays they may dissolve out much of the calcium carbonate or other soluble minerals that may be present. This explains why many clays are lean in lime in the upper layers, and richer in lime below. The softening of clay by weathering usually has a beneficial effect, and many manufacturers take advantage of this by spreading the clay out in thin layers in the sun before attempting to work it up. The effect is to disintegrate the clay, render it more plastic, and break up such injurious minerals as pyrite, etc. For this reason the clay near the outcrop of many deposits shows a higher plasticity than that below.

DISTRIBUTION OF CLAYS IN THE UNITED STATES

(Compiled by H. Ries)

Fireclays:
- (1) Carboniferous; Appalachian and Central States.
- (2) Cretaceous; New Jersey and West.
- (3) Tertiary; Pacific Coast, Missouri, Texas and Mississippi.

Pottery clays:
- (1) Kaolin or china clays; older rocks; Georgia, South Carolina, North Carolina, Pennsylvania and Delaware.
- (2) Ball clays (sedimentary); Tertiary; Kentucky, Tennessee and Florida.
- (3) Stoneware clays; (a) Carboniferous; Appalachian and Central States; (b) Tertiary, in the West; Cretaceous also.
- (4) Earthenware clays; found anywhere.

Vitrifiable clay (Sewer-pipe clay):
- (1) Devonian; in Eastern States.
- (2) Carboniferous; in Central States.
- (3) Cretaceous and Tertiary; in the West.

Brick and tile clays:
- Impure surface clays and shales; very wide distribution geologically and geographically.

When clays contain limonite or siderite (carbonate of iron) these sometimes tend to collect around nuclei such as pebbles and grains of sand to form hard ball-like concretions which become scattered through the deposit, especially in the more weathered portions. They often form along well defined zones such as stratification planes. Where these are numerous and widely scattered through the deposit, they do great damage and may render the clay worthless. Where they occur in localized zones it may be possible to throw them out or avoid them in mining.

Prospecting for Clay

Most clays outcrop at the surface so that in searching for deposits of this nature, the prospector has a great advantage. The exceptions to this rule are found in certain deposits of fire clay, especially those associated with coal seams, where the clays may only be exposed after mining excavations show them up; and in some clay beds, occurring in horizontally bedded strata which have been entirely covered by some younger sedimentary formation. The outcrops are usually found on steep inclined surfaces or in natural or artificial cuts; or along the banks of streams or gullies. If a bed of clay outcrops on a hillside, the clay, acting as an impervious stratum or dam, often diverts the ground water to the surface. Thus, springs occurring at about the same level along a slope often indicate the strike of a clay bed. In glacial drift the presence of ponds often indicates clay beneath. Since clay deposits are often found as the result of the weathering of various rocks, such as granite, sandstone and limestone, the prospector should bear in mind the characteristics of such residual deposits. In general they will be extremely irregular in both horizontal and vertical extent. In some places, clays produce vegetation of a different character from the growth on the other soils, but this cannot be relied upon as a criterion.

The character of the bottom of the clay bed is of great importance in excavation. A rough irregular bottom, with projecting pinnacles of unaltered rock extending up into the clay will preclude steam-shovel work.

All sedimentary clays present a stratified structure. Aside from this, however, different deposits may exhibit extreme irregularity of structure. They may be consolidated into a hard shale; they may have been truncated by erosion and a new material deposited upon this unconformable surface; the deposit may be of varying thickness; there may be pits or chimneys extending down and filling old depressions which will lead to false conclusions; the bed may be folded and faulted; there may be layers or streaks of sand and gravel; or there may be numerous concretions scattered through the mass. All of these possibilities should be investigated before arriving at a definite conclusion regarding the value of the deposit.

DETERMINING THE EXTENT OF THE DEPOSIT

Assuming that a deposit of clay has been found and proved to be of such a quality as to warrant further testing, what should be the method of procedure? First of all, the shape and extent of the deposit should be determined as accurately as possible. Next, a knowledge of its texture and uniformity must be had, i.e., whether the clay contains sand, gravel, concretions, etc. If these occur in streaks they may be avoided in mining. The character and thickness of the overburden is an important factor to be considered, for it influences largely the method and cost of extraction. If the clay bed is not exposed across its entire thickness, holes should be bored through it at several points and the borings carefully preserved for samples. A posthole auger, cutting a hole 3 or 4 in. in diameter, will be found to be convenient for this purpose up to depths of 30 to 40 ft. The size of the samples to be taken will depend upon the locality and convenience of transportation. When it is possible, 50-lb. samples should be sacked so as to insure plenty of material for a test on a working scale to supplement the laboratory tests. If it is not practicable to get samples of this size, 5 or 10-lb. samples should be taken as a minimum. The samples should be taken from several points on the clay bed and from the bore holes. If larger samples are desired for running large working tests, pits should be dug at the points where the borings were made. Clays are usually wet and sticky and for that reason any ordinary tag or label would be destroyed or the mark obliterated. Experience has shown that the best system of labeling clay samples is to use small tin discs upon which the mark is stenciled.

TESTING THE CLAYS

While almost any clay can be used for making common brick, many clays are especially suited to some particular use, depending upon their characteristic properties and also to a large extent upon the situation and prevailing industry of the region. This particular use is the one to which the clay should be put in order to insure the largest profit, so the problem at hand, after the discovery and location of a deposit, is to determine the use for which the material is best adapted. A chemical analysis of a clay is of little practical value, except in a few cases to be mentioned later. The commercial value of most clays will only be disclosed after a careful consideration of their physical properties. The most important tests to make are the following:—(1) water required to attain maximum plasticity; (2) the air shrinkage; (3) fire shrinkage; (4) percentage of absorption after burning at different temperatures; (5) color after burning at different temperatures; (6) fusibility; (7) tensile strength; (8) plasticity; (9) rapid drying test.

A mechanical analysis is often desirable to determine the relative amounts of the different sizes of the constituent grains. If the clay is to be subjected to artificial rapid drying, it should be tested to see whether it will stand it without warping or cracking. A simple chemical test often made is the determination of soluble salts. In clays to be used in the manufacture of portland cement, the percentage of $CaCO_3$ or dolomite, is important. All of the physical tests enumerated above are made in the laboratory on small bricklets about 4x1x¾ in. The question as to how these laboratory results will compare with those obtained in actual practice is one which is commonly raised. In general, if the tests are carefully conducted, the results will be close. The air shrinkage is sometimes higher than in the factory on account of better mixing facilities at the latter place. In very sandy clays the error will be the other way. In practice the kilns are fired slower than in the laboratory and this generally results in brighter colors at the factory for the iron in the clay has a better chance to oxidize.

MINING METHODS

Clays and shales are commonly worked as open pits or quarries, but in some instances underground methods are employed. If the deposit lies near the surface and but little overburden must be removed, then open quarries are universally employed. Clays are usually soft and do not require the use of explosives. In small operations where only a limited amount of clay is mined, hand labor with pick and shovel is commonly used, but in more extensive plants, plows and scrapers, or even steam shovels are in use. In some deposits of tough clay or hard shale, blasting is frequently necessary in order to loosen up the material. Clay pits are usually drained by a series of ditches.

If the clay bank is high (over 75 ft.) it is usually carried down in a series of steps or terraces in order to prevent sliding when the clay gets soaked. This slipping or sliding along some seam or contact zone in the clay is a danger constantly present in high banks of wet clay and the factory or structure of any kind should never be placed at the base of such a bank. In several instances entire clay yards have become buried beneath one of these landslides.

Where the clay is not uniform in character, but contains alternate layers of material of variable composition, it is often desirable to excavate these different grades by layers and store them in separate piles. Another method of mining deposits of mixed clays is by a series of small pits dug by hand with a gouge-spade. The material is graded and thrown into separate heaps at the surface. Where the pit is too deep for the workmen to throw the clay to the rim a platform is constructed half way to the surface, and the material is shoveled from the platform to the top of the pit. Buckets and windlasses are also used.

---

[2] "Prospecting and Testing of Clay Deposits," E. K. Soper, Min. and Sci. Press, June 4, 1910, p. 827.

[3] J. H. Collins, "The Mining Industry," Vol. XIII, p. 472, 1905.

The method of haulage from the bank to the shipping point or works will depend chiefly on the distance and quantity of material to be hauled, and also upon the topographical conditions. If the works be near at hand the clay is trammed by hand or in barrows from the pit. Mules are often used to haul a train of six or eight cars, or horses and carts may be employed. Where the pit is roughly circular, in plan, and carried down in a series of steps or terraces, horses and carts are convenient and can be placed at the bank and the clay can be broken directly into the carts. In regions of a precipitous character, or where the works are placed at elevations considerably above or below the clay pit, aerial tramways are often employed. Steam haulage is used only in the larger works, and in general is economical only for distances greater than 1000 ft., and where the locomotive is kept more or less constantly employed. Various methods of stripping the clay beds are in use in different localities. Where the overburden is thick and extends over the entire deposit, steam shovels may be profitably employed. Wheel scrapers are often used where the distance to the dump is short. Some large clay beds have been stripped by hydraulic methods.

Kaolin Mining

Since most of the kaolin deposits worked in the United States are long and narrow, a method often adopted consists in sinking a circular pit in the kaolin about 25 ft. in diameter. As the pit proceeds in depth, it is lined with a cribwork of wood. This lining is extended to the full depth of the pit which varies from 50 to 100 ft. When the bottom of the good clay is reached, the filling in of the pit is begun, and the crib-work is removed from the bottom and the timber recovered. Another pit is then started, adjoining the first one. Often several pits are carried down together. In the Cornwall district of England a somewhat unusual method is employed for mining a sandy kaolin at considerable depth. This method is as follows[3]:—

A shaft is sunk in the firm rock of the foot wall of the deposit, which occurs as a steeply dipping kaolin vein. The shaft is continued down to a depth of about 20 fathoms and from the bottom a crosscut is driven to tap the vein. A raise is then put up through the clay and extended to the surface. In this raise a tight wooden launder is placed, and this is provided with lateral openings about two feet apart, each of which is closed by a temporary wooden cover. This is called a "button-hole" launder. The shaft is equipped with suitable pumps and work is ready to begin. The clay ground around the top of the launder is loosened to a depth of 6 or 8 ft. and a strong stream of water played on it. The clay becomes disintegrated and the fine clay particles are washed down the launder, through the crosscut to the sump of the shaft, from where the mixture is pumped to the surface. Here the milky mixture of clay and water is conducted through a series of broad shallow troughs. These are set nearly horizontal, and the stream is divided again and again to lessen the rate of flow and allow the fine sandy and micaceous particles to settle. The refined clay stream is finally conducted to vats where the clay substance is settled out, pressed, dried, and is then ready for use.

A. R. Ledoux describes[4] a similar method recently adopted to work the kaolin deposit at West Cornwall, Conn. This deposit is not a sediment, but is a residual deposit in place. The clay lies in steeply dipping veins, between a foot wall of limonite and a hanging wall of gneiss and schist. The scheme of mining is to disintegrate the kaolin in place by jets of water under pressure, and to float the resultant product to the surface. To accomplish this, holes are drilled through the overlying gneiss, a pipe of 4-in. internal diameter is inserted in the hole and driven in the clay to within a few feet of the foot wall. The wells in operation are from 50 to 198 feet deep. A 2-in. pipe is inserted in the 4-in. one, thus leaving an annular space around the inner pipe for the upward flow of the slip. The clay particles are thus brought to the surface by the same general method that drill cuttings are brought up in churn-drill operations.

Underground Methods

When a clay bed is covered by such a great thickness of overburden as to render openpit excavation out of the question, underground methods may be adopted if the clay is of high enough grade to make the operations, profitable. Such methods, as a rule, are justified only in the case of fireclays or high-grade kaolin. If much water is present, it may render the deposit unworkable. The output from such clay mines is usually restricted, unless the workings underlie a large area and can be worked from several shafts or adits. Underground methods in clay deposits are chiefly developed in Maryland, Indiana, Pennsylvania, Missouri, and a few other states where fireclays associated with coal seams are mined in this manner.

Preparation for the Market

Most clays do not require much preparation before they are ready for the plant. Occasionally they are hand picked to rid them of concretions, pyrite balls, etc. Often the clay is spread out in the sun to dry for a few days before being sent to the mixing pit. In the case of high-grade kaolin and china clay, they are often subjected to a washing process to eliminate any sand, pebbles, and other impurities. The disintegration of the kaolin is usually accomplished in washing-troughs, in which there revolves a shaft, carrying a series of arms or blades which mix the clay thoroughly with water. The water and suspended clay is then discharged into a series of shallow wooden troughs set nearly flat. As the slip passes through these troughs the heavier particles of sand settle out first, and lastly the fine clay substance is settled in large settling tanks.

Methods of Brick Making

There are so many clay products manufactured for various purposes that it will be quite impossible to discuss them even in a general way in a paper of this nature. The commonest clay product, and the most important of all, is brick. The manufacture of brick is such an important industry and one so widely carried on that a brief consideration of the methods in use may not be out of place.

There are three ways of molding brick. These are: (1) Soft-mud process; (2) stiff-mud process; (3) dry-press process. The clay to be molded, if either of the first two methods be used, must first be ground and then mixed with water to a plastic mass. In the dry-press method, the ground clay is pressed dry, without the addition of water.

In the soft-mud process, the bricks are molded in individual molds, either by hand or by a molding machine. Most plants in the United States now use machines which commonly mold six bricks at once. The clay is worked up to the consistency of a soft mud or paste, and pressed into these wooden molds. To prevent the sticky clay from adhering to the molds, sand is added to the sides of the mold before ramming in the clay. Soft-mud bricks therefore usually show five sanded surfaces, which distinguish them from bricks molded by the other processes. The soft-mud process of molding is adapted to a wider range of clays than any other method, for obviously any clay that is plastic may be worked up by adding the proper amount of water.

In the stiff-mud process, the ground clay is mixed with less water than in the former case, and to the consistency of a stiff mass of sufficient plasticity to be molded to shape, and yet retain its shape while still wet. The plastic mass is fed into a long cylindrical drum which tapers to a small end in which there is a rectangular opening or die, the desired size of the bricks. The clay is forced toward this small end by a revolving screw, and is finally squeezed through the die from whence it emerges in the form of a long continuous bar of rectangular section. This bar is received on a moving table which carries it past a row of knives or wires operating on a lever which is lowered at proper intervals and cuts the bar of clay into bricks. The capacity of a stiff-mud machine is from 45,000 to 60,000 bricks per 10 hours, as compared with 40,000 by the soft-mud method. The stiff-mud process is not adapted to so wide a range of clays, however, for only clays of medium plasticity are used.

---

[4] Trans., A. I. M. E., p. 379, 1906.

In the dry-press process, the clay is powdered and then pressed into steel molds in a dry, or semi-dry condition. The faces of the molds are of hard steel and are heated by steam to prevent the clay from adhering to them when pressed. They are also provided with air holes to allow the air to escape during pressing, for if the air were imprisoned with the clay, when the pressure is removed the air would expand and split the brick. The dry-press process is used extensively, for the manufacture of front or facing brick, for in one operation a brick is produced with sharp edges and smooth surfaces. If six bricks are molded at a time, the dry-press machines have a capacity equal to that of the soft-mud machines.

Drying

Before bricks from the soft- or stiff-mud processes can be burned, they must be dried to free them from most of their water. This drying is done (1) in open yards; (2) in pallet driers placed indoors or in sheds; or (3) in drying tunnels. The advantage of the latter method is that drying may continue without break throughout the year. Several tunnels or chambers are constructed side by side, and various plants differ only with regard to the method of heating the tunnels. Steam or hot-air pipes are often employed, or parallel flues underneath the tunnel floor may be used. The green bricks, as they come from the molds, are loaded on cars and run slowly through these tunnels. The temperature to which the tunnels are heated seldom exceeds 120° Fahrenheit.

Burning of Bricks

Clay wares are burned in a variety of kilns, but these all operate with either an updraft or downdraft. The simplest and earliest type of kiln with rising draft is known as a "scove" kiln and is still in use at many smaller plants. These kilns are temporary in nature and are generally constructed from the bricks which are to be burned. The bricks are set in large rectangular blocks, 38 to 50 courses high. As the mass is built up a series of parallel arches are left running through the mass from side to side. The entire mass is then surrounded by a wall of brick, which is daubed over with clay to confine the heat within. The fire is built in the arch-like openings underneath the pile.

In downdraft kilns, the heat is conducted by suitable flues to the top of the kiln chamber, and then down through the ware, whence it is carried out to the stock through flues in the bottom. The bricks on the top receive the greatest heat. while in the updraft type the brick on the bottom get the most heat. The advantage is with the downdraft kiln, for should the top bricks become overheated or semi-fused, no damage would result to the main mass beneath. But in the case where the bottom brick become overheated or fused, they will cause the entire mass to sag and perhaps topple over. thus ruining the entire batch.

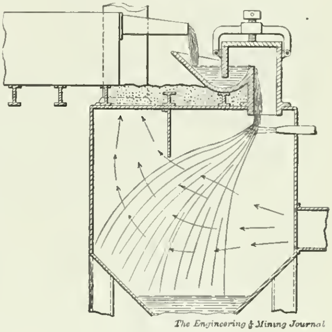
The latest type of kiln, however, and the ones in use in the larger plants, are known as continuous kilns. These were originally designed to utilize the waste heat in burning. They consist essentially of a series of chambers arranged in a line or circle, and connected with each other and also with a central stack by means of flues. Each chamber holds about 22,000 bricks. When the chamber is first fired, the water vapor, smoke, etc., is conducted to the stack for a brief period, but as soon as this ceases, the heat and gases are conducted to the next chamber ahead and forward through several chambers, preheating them before they are actually fired. There is thus a wave of maximum temperature continually passing along the line, ahead of which the kilns are being preheated, and behind which the kilns are being cooled and emptied of their finished ware.

Clay Output of the United States

Owing to the fact that most clay products are manufactured by the producer, and no record is kept of the raw material, the figures for the value and production of clay must be for the manufactured product. In 1907, according to the United States Geological Survey, the total value of brick, tile and pottery manufactured in the United States was $158,942,369. The year 1908 was remarkably dull in the building trades, and the production of clay products showed a great falling-off for that year, the total value being $133,197,762. Of this total figure, brick and tile furnished about 81% of the value. In 1909 the production showed a substantial increase, valued at $166,321,213; in 1910, it amounted to $170,115,974. Accurate figures for 1911 are not available at this time.

Utilization of the Waste Heat in Slag

One of the recent attempts to utilize the waste heat in slag is that of Walter G. Perkins and William H. Barker (U. S. pat. 996,132). This consists in an apparatus by which the molten slag is granulated by a high-pressure air blast while the air for the furnace is then passed through the falling stream of granulated slag. The slag enters the blast chamber in one of two ways, either the slag is injected and atomized at the same time by the air, or else an inverted siphon is arranged, the high-pressure blast hitting the slag immediately as it falls from the siphon outflow. The chilled slag is withdrawn from time to time from the blast chamber, which has a hopper bottom, through a water-sealed trap or by other suitable means. The accompanying illustration shows the arrangement of the apparatus with the inverted-siphon trap.


The Engineering & Mining Journal

Recovery of Heat from Molten Slag

Binder for Copper Chips

A new process for briquetting materials for smelting was recently patented by Max Glass of Vienna, Austria-Hungary. The application is more particularly in the smelting of copper-bearing material that is rather rich in metal, such as grindings and chips.

The material is first treated with ammonium-chloride solution so that all portions are covered. A 5% solution is employed and 1000 parts of the material are mixed with 10 parts of the solution. The mass, states the *Brass World*, is then mixed with quicklime and heated to about 212° F. slowly after pressing in the briquetting press in the usual manner.

The theory of the process, the inventor says, is that cupric oxide is formed on the surface of the metal which, with the lime acts as a binder. The calcium chloride, with the excess of lime, also forms an efficient binder.

Diamonds in the Belgian Congo

By Sydney H. Ball*

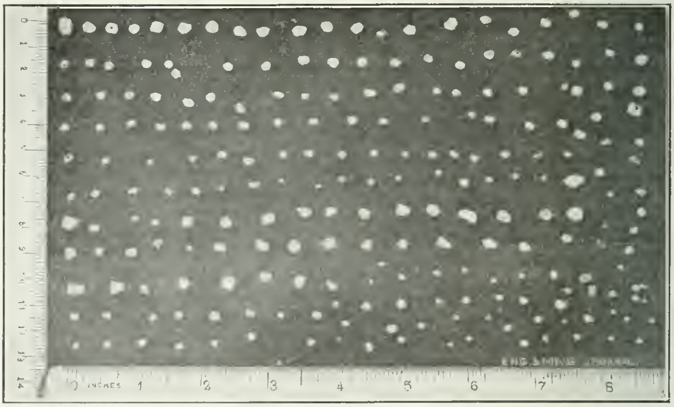
An American company recently found over 270 diamonds along the Kasai River in the southwestern part of the Belgian Congo. Another company is prospecting in the southeastern part of the colony on the Kundelungu Plateau and along the Lualaba River, on a tributary of which diamonds were first discovered in this part of West Africa.

The Belgian Congo, more familiarly known to most of us by its former name, the Congo Free State, has been recently added to the list of countries in which diamonds have been found. Detailed prospecting of the world is showing the diamond, like gold, to be widely distributed, if not in paying quantities, at least as a mineralogic curiosity. In 1906 prospectors of the Tanganyika Concessions Co. found a small diamond in the gravels of Mutendele River, a tributary of the Lualaba (Congo), flowing from west to east. Later other stones (three in 1907, 11 in 1908, and 5 in 1909) were found in the gravels of the Lualaba River not far from the original discovery. The known diamondiferous region includes the bed of the Lualaba and the lower reaches of its tributaries from 9° 30′ to 10° 30′ South Latitude, a distance of 82 miles roughly. The largest stone found to date is reported to have weighed 0.28 carat.

H. Buttgenbach[1] reports that the form of but few of these stones is determinable crystallographically, but that among the perfect crystals the octahedron and dodecahedron predominate. Twins are common, and the crystal faces are frequently curved. About one-half the stones are colorless, several others yellow, and brown, rose, and opaque stones are mentioned.

PROSPECTING THE LUALABA RIVER AND KUNDELUNGU PLATEAU

A rock similar petrographically to kimberlite, the basic igneous rock in which the diamonds occur at Kimberley, South Africa, has been found in the Kundelungu Plateau south and southwest of Lake Moero. This rock is reported to occur in about eight pipes, cutting red sandstone of Permo-carboniferous age. At the surface this appears as "yellow ground," turning in depth to a green color resembling typical "blue ground." The concentrates obtained by washing include garnet, diopside, diallage, biotite, phlogopite, olivine, zircon, wollastonite, aragonite, calcite and goyazite. The assemblage of minerals is quite similar to that which accompanies diamonds in the South African pipes. A company (the Kundelungu-Lualaba Co.) has been formed to prospect these two areas, and machinery to wash the ground on a considerable scale has been installed. The stock of this company, which has the exclusive right to prospect for diamonds over an area covering about 2400 square miles along the Lualaba River, and 8160 square miles on the Kundelungu Plateau, is owned by the Katanga Special Committee and the Tanganyika Concessions Co. To date it is believed that no diamonds have been found in association with the pipes, although in the summer of 1910 this company obtained about 12 diamonds presumably from the gravels of the Lualaba River.



DIAMONDS FOUND ON THE KASAI RIVER—APPROXIMATELY ONE-HALF SIZE

DIAMONDS ALONG THE KASAI RIVER

In 1906 American capitalists, prominent among whom is Thomas F. Ryan, joined with a group of Belgian capitalists under the name of the Société Internationale Forestière et Minière du Congo, and took over as a mining concession about 370,000 square miles in the Belgian Congo. In the following summer while searching for gold at Mai Munene in the Kasai River, one of this company's prospectors found a small, although beautifully clear, diamond among his concentrates. Work here was recommenced last summer, and at the mouth of Kabambaie Creek, about 55 miles northwest of Mai Munene, 240 stones were found in two weeks by one man. Since then about 10 stones have been found on the Kasai to the north of the Kabambaie Creek mouth, and several in another region. So far, for about 75 miles along the Kasai River, diamonds have been found either in the main stream or in the lower courses of its tributaries. Prospecting is naturally being continued and further reports are awaited with interest.

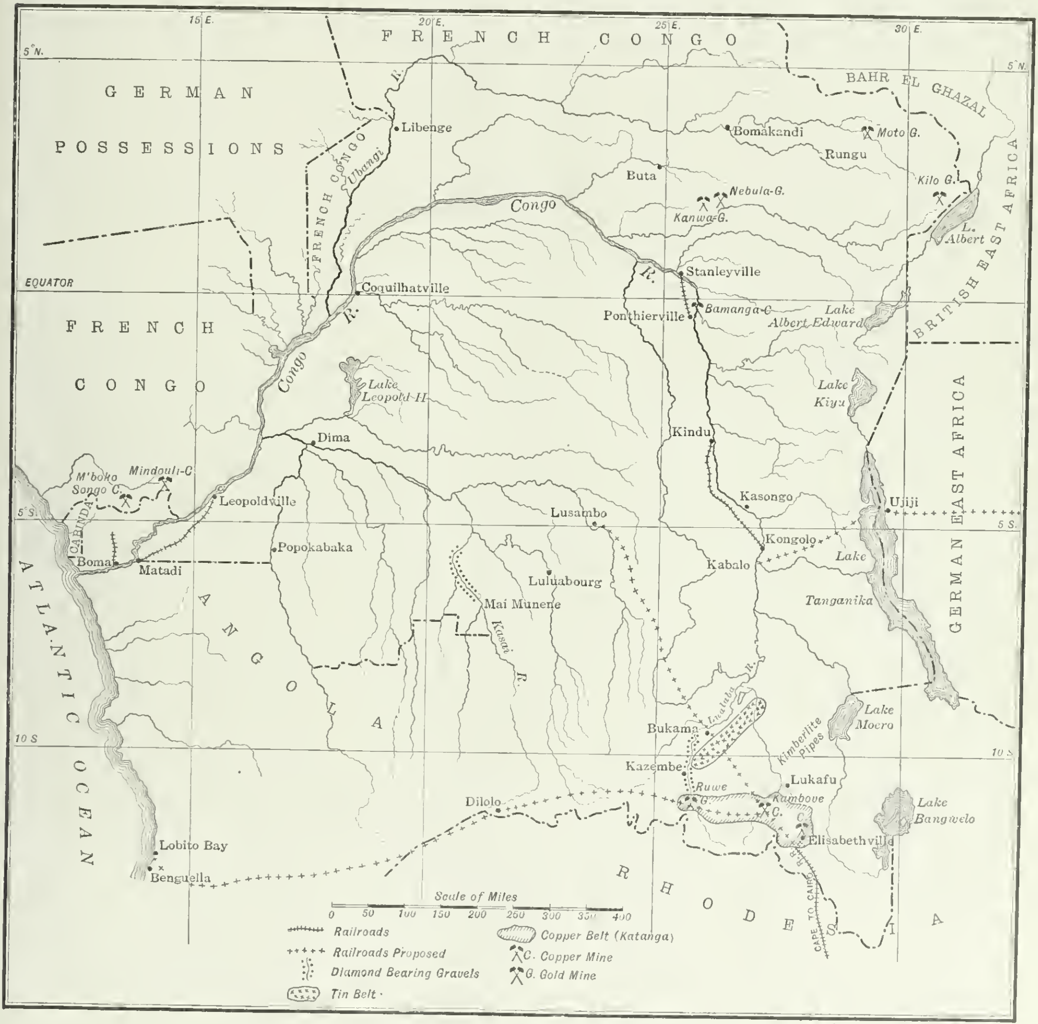
The stones occur in riffles or pot-holes in the river bed or in sands along their banks. That they are locally abundant is shown by the recovery of 15 diamonds from about one-fifth ton of gravel. Some of the gravel is cemented by limonite, thus resembling the *cascalho* in which the Brazilian stones occur in places. The cementation is, however, not sufficient to interfere materially with recovery. These stones are in greater part at least well crystallized, the largest weighing about 1 carat. Octahedrons predominate, though dodecahedrons are unusually common, and trisoctahedrons occur. Determination of the more complex forms have not as yet been made. The octahedral faces are frequently curved or show triangular etchings, usually elevations. Interpenetration twins with the octahedral face, the twinning plane, are common and others occur after the Spinel law. An unusual percentage of the diamonds are water white, while the rest are in part yellow and off-color stones, and in part deep yellows, topaz and apple-green stones fit for fancy gems. Among the minerals associated with the diamonds are gold, quartz, cyanite, magnetite, zircon, ilmenite, feldspar, mica, garnet, epidote, rutile and hematite.

---

*Mining geologist, 71 Broadway, New York.

[1] "Description des Mineraux du Congo Belge," Annales du Musée du Congo Belge, Bruxelles, 1910, p. 5-10

in addition to carnelian, chalcedony, agate, jasper, chert, diorite, schist and granite pebbles; in short, such minerals and rocks as form the complex of the country upstream. The region is a comparatively healthy one and the more northerly of the finds is but 15 miles from the head of navigation on the lower Kasai on which stern-wheelers ply.



The Engineering & Mining Journal

Map of the Belgian Congo, West Africa

Jura-triassic Sandstones Cut by Basic Pre-cambrian Intrusions

This general region consists of a basement series of folded and faulted micaceous schists, quartzite and granitic and basic igneous gneisses, intruded by granites, diabases and gabbros. The series is certainly older than the Permo-carboniferous and is presumably as its general appearance indicates, of Pre-cambrian age. In what was presumably Paleozoic time these rocks were planed down to an almost level surface from which, however, a few low ridges protruded. Later, in Jura-triassic time, the Congo basin became an inland lake or possibly a brackish gulf in which a considerable thickness (at least 1500 ft. locally) of sandstones and shales were deposited. These rocks were then lifted above the sea and although they dip slightly to the north, are still approximately flat-lying. They completely cover the central basin of the Congo River, but toward its rim the deeper streams in places have cut down through this rock blanket into the older rocks. At such places rapids occur and the valleys become narrow.

It is in such a stretch of the Kasai River that the diamonds have been found. The diamonds may possibly have originated from one of the basic igneous rocks of the old Pre-cambrian-like series, or they may have once formed pebbles in the flat-lying sandstones. It is believed more probable, however, that they will be found in basic intrusive masses which cut the Jura-triassic sandstone. It is of interest to note in this connection that these beds are the stratigraphic equivalent of the Stormberg beds of South Africa, which are the youngest sedimentary rocks cut by the Kimberley diamond-bearing plugs.

Recent Developments in Explosives

By A. E. Anderson*

First black-powder factory built in the United States in 1802. A great variety of high explosives has been developed, fitting every requirement of mining. The most recent development is the manufacture of Red Cross powders, from nitroglycerin, nitrotoluene and with or without nitrate of ammonia.

In 1802 the first powder factory in the United States was built along the banks of the historic Brandywine River in Delaware, Md. The explosive manufactured here was the old black blasting and sporting powder, and it was made in wheel mills consisting of huge stone wheels revolving in a circular wooden track. These mills resembled the chilean mills used by the Mexicans, and were driven by water power, the machinery being all constructed of wood. The buildings were made of stone walls 4 ft. in thickness on three sides, the side facing the river and the top being constructed of light lumber. Every time a chip broke off the stone wheel or any metallic substance was dropped in the track, an explosion resulted which threw the men into the river and blew off the board sides and the top of the mill. After the men had picked themselves out of the river, if they were able, they returned, reboarded the building and started in again making powder.

These old mills with their wooden machinery can still be seen in position, and between them are situated the modern uptodate buildings and machinery which are now used in the manufacture of explosives. In those days these explosions were considered a matter of mystery that could not be explained. However, a close study of the conditions and circumstances has enabled the manufacturers to determine the exact causes; as a result, the wheels are now built with rubber tires and run in a rubber track. Other improvements of course, have also been made so that while the old water power is used and the same process of manufacturing is practiced, an explosion in these mills is extremely rare. The same close study of the characteristics and features of the materials used in the manufacture of explosives has been continued so that from the one explosive then known, common black blasting powder, a large number of explosives of various kinds have been developed, fitting every possible condition and requirement in mining, warfare, hunting and even farming.

Development of New Explosives

In experimental and research work in explosives, the greatest precaution must be observed. The chemists must be thoroughly conversant with all the characteristics and qualities of the materials with which they make their experiments, and also with the compounds and combinations which they make. The least carelessness or lack of knowledge may cause permanent injury to the experimenter. When he develops new explosives he must catch the features as to the strength, quickness or velocity of detonation, quantity and quality of gases produced which make up the fumes or smoke, the ability of the product to withstand water and cold, also its density and stability, and in recent years the size and duration of the flame, and the amount of heat evolved in detonation. After many months of experimental work when he has finally devised some combination of chemicals which forms an explosive which has the proper qualities, the product must be turned over to experts in the field who test it out under actual working conditions to determine the results it produces and the impression it makes on those who are to use it. This makes the process of developing explosives a long, tedious task, which requires the utmost care and knowledge of the subject.

Common Impressions of Explosives

The common idea of explosives is that they are mysterious forces, wrapped up in packages of small size, which are liable to cause most tremendous and disastrous results for no apparent reason and at times when they are least expected to explode. This, however, is entirely erroneous. The du Pont company alone manufactures about 150,000,000 lb. of high explosives per year, at several different factories, and these are transported all over the United States and even to foreign countries, in all kinds of vehicles and under all possible conditions; yet the accidents resulting are extremely rare and the amount of explosives involved in these accidents is an extremely small percentage of the amount handled. When it is considered that a large part of this is handled by unskilled labor, by foreigners who have been in this country but a few months, or a few years, it is remarkable that the percentage of accidents is so small. Many of these men have never had any previous experience in mining, yet underground and on surface they handle explosives without any knowledge of their qualities or how they should be handled. Whenever an accident happens, it is because of some good and sufficient reason, that is, there is always a cause. The idea of mystery that is attached to these accidental explosions is due to the fact that the evidence of the cause is usually destroyed, and the persons involved are usually killed or rendered unfit to give careful testimony as to the reasons for the accident.

Classes of Explosives

Explosives in general are divided into three classes, namely, propelling, bursting and blasting. Propelling explosives are those which, when exploded exert a pressure that propels a projectile a greater or less distance from shotguns, rifles, revolvers, mortars or cannons. Of the bursting explosives, which act quicker and are used principally for exploding projectiles in warfare, we will not deal at this time. Under the blasting explosives, with which we will deal principally, there are two general classes: (1) high explosives, which are quick acting, and (2) low explosives which are slower acting. The high explosives, otherwise known as the detonating explosives, are extremely quick in their action and are composed of definite chemical compounds which are broken up by the use of a powerful detonator.

Fulminates and Nitroglycerine

Generally classed with these high explosives are the fulminates, which are used in detonating the other high explosives. They differ from the others in the fact that full explosive force is generated by simple ignition. Fulminates can be made of most of the metals, even of gold, silver and platinum, but they are so extremely sensitive to the slightest shock, heat or friction, that they cannot be used in ordinary work. The fulminate of mercury, however, has the necessary characteristics to render it valuable as a detonating agent.

Nitroglycerine, which is made by treating glycerine with nitric acid in the presence of sulphuric acid, forms the main basis of the high explosives which are in practical use at present. Nitroglycerine freezes at a temperature of from 45 to 50° F., and its sensitiveness to shock, heat and friction varies directly as the temperature, so that it is necessary to have it at a temperature of from

---

*Mining engineer, technical division, E. I. du Pont de Nemours Powder Co., P. O. Box 1535, Denver, Colo.

Note—A paper read at Telluride Colo., Dec. 8, 1911, under the auspices of the Colorado School of Mines and the Colorado Scientific Society, as one of a series of "Practical Talks" on mining and metallurgy.

55 to 75° in order to produce the maximum results and still have it in a condition safe to handle. As nitroglycerine in a liquid state is dangerous as well as inconvenient to handle, the first development in the manufacture of high explosives was to absorb the liquid nitroglycerine in a porous material, the first of which was infusorial earth. This, however, has been replaced by wood pulp as an absorbent, and to this are added active chemicals, which are not only consumed in the explosion but also aid in the sudden production of gases and greater heat, the latter giving these gases the greatest possible explosive force.

Gun Cotton or Gelatin Explosives

The next step was the use of guncotton in combination with nitroglycerine. Alfred Nobel discovered that about one part of guncotton dissolved in nitroglycerine, produced a jelly-like mass which had a greater explosive force than either or both of them uncombined. This material is used as a base of the blasting gelations and gelatin dynamites which are largely used in western mining at present. They have many advantages over the old-fashioned straight dynamite, in that they are practically waterproof, more dense and plastic, and are safer to handle, as they have little tendency to leak or exude nitroglycerine. Between the nitroglycerine dynamites and gelatins, we have recently developed the semi-gelatins, whose features and qualities are practically between those of the other two.

Nitrate of Ammonia

Later it was discovered that nitrate of ammonia, a compound which in itself is not explosive, could be combined with nitroglycerine to produce an explosive which is also safer to handle, less sensitive to shock and friction, and has a slower and more rending effect than the straight nitroglycerine dynamites. The nitrate of ammonia is a crystalline compound which is extremely insensitive to shock, friction or heat, and has a great affinity for moisture. These explosives are therefore not as good to use in wet work as either the dynamite or gelatin, but they evolve less noxious fumes than the dynamite, and for certain classes of work are superior to either of the others.

The most recent development has been the introduction of nitrotoluene, which has the property of reducing the freezing point of nitroglycerine. This is also an explosive compound when mixed with nitroglycerine, and explosives made of this mixture do not freeze above a temperature of 32° F.,—that is they will not freeze until water freezes and will thaw when ice melts. The explosives made of this combination of nitroglycerine, nitrotoluene, and with or without guncotton or nitrate of ammonia, are called Red Cross low-freezing powders. They are of especial advantage for use in work that is wet, and where there is a variation of from 35 to 50° F. in the temperature of the water.

Permissible Explosives

Following the actions of foreign governments in investigating explosives manufactured and used, the U. S. Government formed a technologic branch of the Geological Survey, for investigating causes and remedies for accidents in mining. This work has recently been transferred to the Bureau of Mines. A large part of the work done by this bureau has been a thorough investigation of the explosives used in the United States, with the special object of determining what explosives are safest for use in coal mining. These explosives are listed by the Government as permissible explosives. The requirements which these explosives must fulfill are, that they can be used under certain conditions in the most explosive mixture of gas and dust without causing the mixture to explode. The special features to be noted are the size and duration of the flame and the amount of heat evolved in detonation. It requires about one second to ignite mine gas at a temperature of 1000° F. If the amount of heat is less the time required for ignition is longer. If the heat is greater the ignition will be obtained in a shorter time. With the dynamite the heat produced is about 1500 cal. per kg. and the duration of the flame is a fraction of a second. In exploding a stick of dynamite in the dark and photographing it, the size of the flame produced is small but intense, making a charge limit of 4 grams. With black blasting powder, commonly used in coal mines heretofore, a temperature of about 600 cal. per kg. was produced, but the size of the flame was large and lasted sometimes almost a minute, making a charge limit of 5 grams. In these permissible explosives the temperature produced is not over 600 cal. per kg., the duration of the flame is about 1/25 of a second, and the visual flame produced is extremely small, so they have a charge limit of 500 to 1000 grams.

The explosives which have passed this test in the United States so far are of two kinds. First, the low-flame, nitroglycerine explosives, which are simply dynamites in which chemicals have been added to reduce the heat and quench the flame, and make the action of the powder slower. The second class, and the one which is in more general use, comprises the nitrate-of-ammonia explosives. These are made largely of nitrate of ammonia with the introduction of some other explosive compound as a sensitizer to render the nitrate of ammonia explosive. These permissible explosives are rapidly superseding both black blasting powder and dynamite, in the mining of coal. One of the great features of these nitrate-of-ammonia explosives is that the nitrate of ammonia is not affected by the lower temperatures, so that they can be used without being thawed. Another feature is that nitrate of ammonia is extremely hard to ignite and therefore a burning hole is unheard of with this explosive. On account of its safety in handling, nonburning and nonthawing properties, this explosive has also come into extensive use in outside work of all kinds in dry material, such as quarrying and open-pit mining.

Low Explosives

These are explosives in which the explosive force is generated by the simple ignition and burning of the charge. They have been made in practically the same way for over 100 years. They consist of 75% of potash or sodium nitrate, 15% carbon in the form of charcoal, and 10% of sulphur. The potash powders, known as the A blasting powders, are little used in mining work and they are more expensive than the soda powders. The black sporting powders and ammunition come under this class. The B blasting powder, made of sodium nitrate or Chile saltpetre, is a common black blasting powder used in mining work. This powder is made in different sized grains which regulate the speed of burning. The nitrate of sodium being easily affected by moisture the grains are protected by a glaze or covering of graphite.

Until recently this powder was always exploded by means of a fuse or squib. The fuse is the same as used in metal mining and consists of a core of fine powder wrapped in and surrounded by hemp cords and waterproofing material. The squib is merely a pencil of powder wrapped in a piece of paper so that when the paper is ignited it sets fire to the powder, and they are so constructed that the explosion of this powder shoots the squib for a distance of several feet into the charge of the blasting powder. Recently, however, we have been able to manufacture an electric squib, consisting of a small capsule of powder which is ignited by means of an electrical current passing through a small platinum bridge.

A few years ago an explosive was manufactured in which the burning effect of the black blasting powder was augmented by the addition of a small percentage of nitroglycerine. This is called Judson powder, and is exploded by means of a primer consisting of a ½-lb. stick of 40% dynamite for each 10 lbs. of the Judson powder.

Packing, Storage and Handling

Due to the accidents that have occurred in the use of explosives, the packing, transportation, storage and handling of explosives is regulated to a large degree by a branch of the Interstate Commerce Commission, called the Bureau for the Safe Transportation of Explosives. This Bureau has formulated rules and regulations which regulate the exact way in which the explosives must be packed, to the minutest detail, even to the number of nails used in fastening the covers. Explosives must be transported in cars of a certain kind and in perfect condition. They must be stored in buildings which are remote from dwellings or highways, and must be fireproof, bulletproof, and well ventilated. So well are these things regulated that the number of accidents have been extremely few. In the handling of explosives after they leave the hands of the transportation agent or the dealer, regulations are less severe, and the conditions are so varied that it is almost impossible to make up a set of rules and regulations governing this feature. The fact of the matter is that the explosives now manufactured and in general use are safe enough to stand any reasonable handling.

THAWING

The main source of danger is that of thawing the explosives when they have become frozen, to render them in proper condition to produce maximum results. Most of the accidents with explosives have occurred while they were being thawed. Every box of dynamite contains a pamphlet of instructions which tells the proper and safe ways of handling and thawing them, and they should be followed out to the letter. Explosives should never be subjected to direct dry heat. That is, they should not be thawed on heated stoves, rocks, sand, brick, or metal, or in an oven, or in front of or near or over a steam boiler or fire of any kind.

PREPARING PRIMERS

In the use of explosives one of the most important features is the proper detonation of each individual charge. This is obtained by using the correct detonator and by the proper preparation of the primer. In preparing a primer, the fuse and cap should be inserted into the cartridge in one of two ways. Either a hole should be made in the end of the cartridge large enough and long enough to put the whole cap into the powder, and the paper on the end of the cartridge should be tied securely with a string around the fuse, or the other way is to punch a slanting hole into the side of the cartridge of the same size as the cap and fasten the fuse securely by tieing a string around the cartridge. The fuse should not be laced through the powder, as there is a possibility of the fire spitting out of the fuse and igniting the explosives. A sharp kink should not be made in the fuse, as it is liable to break the train of powder and cause the fuse to stop burning at that point, especially if water is present.

POSITION OF PRIMER

With the explosives in use in Colorado namely, the gelatin dynamites, there is no doubt but that the proper position for the primer is near the bottom of the hole, and the best results will be obtained by pointing the closed end of the cap toward the center of the charge. There are two reasons for this; (1) because if the primer is near the bottom of the hole there is less liability of one hole cutting off the fuse in an adjacent hole ahead of the burning powder and (2) because the explosion of the powder starts at the detonator and the force is greatest at that point; the bottom of the hole being the strongest, it is the part that requires the greatest explosive force. For instance, if a primer stick is laid on the ground with two or three sticks touching it end to end, it will be found after exploding, that the primer stick has made the largest hole in the ground. If this test is carried out further, and a long string of powder is laid along the ground with a detonator at one end, you will find by actual measurements that the hole produced in the ground by each succeeding cartridge will be slightly smaller than the one before. The less sensitive the powder, the more marked this difference will be. Therefore it is proven that caps should be inserted in the powder at about every 5 ft. along the charge in order to regenerate the explosive wave.

STRENGTH OF CAPS

A few years ago the common cap in use in Colorado and other districts was the 3X blasting cap. This contained 8.3 grains of fulminate of mercury. At present the cap in general use is the No. 6, containing 15.4 grains of fulminate, which is practically twice the strength of the former, and the tendency is still toward the larger cap. One of the reasons for this is that the explosives used now are less sensitive, safer to handle, and are also of a different nature than those used originally. Gelatin powders, composed of a jelly-like mass, have a tendency to retard the explosive wave which carries the detonation through the powder. It takes therefore a greater initial force to carry that wave at the same speed and with the same force through a substance which tends to retard the wave, than through the old nitroglycerine dynamites.

The resultant gases under complete detonation are mainly carbon dioxide and nitrogen, with a little excess oxygen. These are all harmless gases and the excess of oxygen prevents the formation of carbon monoxide gas, which is poisonous. The best way to insure complete detonation is to use a strong cap. If the detonation is incomplete, we have a deficiency of oxygen, and carbon monoxide is likely to be formed. It is also true in cases of incomplete detonation that nitroglycerine is sometimes volatilized, which also has an injurious effect.

QUICKNESS OF GELATIN

The gelatin dynamites or blasting gelatin differ from all other explosives, in the fact that the quickness does not increase with the strength. That is, 35% gelatin has the same quickness as 80% gelatin. It has been found that the only way to quicken gelatin powder is to us a stronger detonator. For instance, gelatin dynamite detonated with a No. 6 cap is much slower than nitroglycerine dynamite detonated with the same size cap. However, if a primer composed of one stick of nitroglycerine dynamite is used to explode the gelatin, it makes the gelatin even quicker than the straight nitroglycerine dynamite of the same grade. However, as it is inconvenient to use two kinds of explosives in the same hole, the added quickness can be better obtained by using a stronger detonator. It has been my experience that rock which could not be broken with 40% gelatin dynamite using a No. 6 cap, could be broken in excellent shape with the same charge of powder by using a No. 8 cap, which is almost twice as strong as a No. 6, and contains 30 grains of fulminate of mercury.

ELECTRIC DETONATORS

One of the recent developments in the use of explosives has been the manufacture of electric detonators These are the same as the ordinary blasting cap, except that on top of the pressed charge of fulminate of mercury is a loose charge, imbedded in which are the ends of the two wires of the fuze, connected by a platinum-wire bridge. The passing of an electric current of 1½ volts and 1½ amp. through the bridge will raise it to a temperature sufficiently high to ignite the loose charge of fulminate and to set off the exploder. The most recent invention along this line has been the delay-action exploders, in which a piece of fuse of a certain length is inserted between this loose ignition charge and the pressed charge, delaying the explosion of the fuze for about two seconds in the first-period delay fuzes, and four seconds in the second-period delay fuzes. By using the no delay, first-period delay, and second-period delay fuzes, the shots can be fired in three distinct rounds, the idea being that while the rock from the first round is in the air the second round will explode and while this is in the air the third round will explode, thereby avoiding the necessity of relifting the material already blasted. In actual practice it has developed that a round of holes can be blasted in this way with considerably less powder than either with fuse and cap or with all instantaneous exploders. This system of firing is especially advantageous in shaft-sinking and rapid tunnel-driving. In order to make electric blasting surer and safer, we have recently devised an instrument for measuring directly in ohms the resistance of a blasting circuit without exploding any of the fuzes. This Dupont galvanometer is composed of a delicate chloride-of-silver cell which produces just sufficient current to deflect the needle of the galvanometer, and not enough current to heat the platinum bridge in the exploders. With this it can be determined if there is a circuit through all the exploders and if not, the break in the circuit can be easily detected.

Blasting Machines

Electric exploders can either be exploded by means of a current from any electric circuit of over the required voltage, or by means of blasting machines of various capacities, which are made for the purpose. We have recently devised an instrument for testing the capacity of these blasting machines, without using a large number of fuzes. This is a delicate rheostat which has known resistance; thus, a resistance equivalent to a certain number of exploders is put in series with one exploder, and if the machine will explode this one through this resistance, it will explode the full number of exploders having that resistance.

Handling of Explosives in Mining

In the early days of mining the miners were composed largely of Americans or North Europeans, who were intelligent men and knew how to handle explosives better, in most instances, than even the officials of the mining companies. In later years the use of the new explosives and the necessary introduction of less intelligent labor has necessitated the more careful supervision of the use of explosives. In the larger mines some detailed and efficient systems have been devised for handling, distributing and keeping track of the amount of explosives used in each part of the mine, and by each set of men.

In the coal mines the adoption of permissible explosives has developed several different forms of shot-firing systems where the drilling, loading and firing of the holes is being done directly under the supervision of skilled shot-firers. Electric detonation is usually used, and in some cases the shots are all fired at once from outside the mine and no one is in the mine at the time. In some of the larger metal mines, where a great number of men are employed, the man in charge of blasting in each place usually writes an order for the exact amount of explosives he needs and the number of primers. This order is prepared, filled, and sent in to him and the order is kept on file so that a record can be made of the quantity of explosives that each man uses, the results he obtains and the cost thereof. The mere fact that a record is kept of this, and the work of different men is compared, induces the men to use careful judgment in the amount of explosives used and the results obtained. The preparation of the primers by a man whose duty it is to prepare them properly and have them kept in good condition, reduces the number of misfires.

Calculation of Charges

There is no exact method of calculating the charge of explosives in any particular kind of ground, but the amount used must be judged by the experience of the miner and the results obtained under similar conditions. However, there is a way of calculating the charge after one trial has been made. For instance, if a round of holes has been loaded with 100 lb. of 40% gelatin and has only pulled 4 ft. in a 5-ft. round, the following system could be used in calculating the proper charge:

The units of strength in a certain weight of explosives can be calculated by multiplying the weight by the rated strength, so that 100 lb. times 40½ strength gives 4000 units in strength. If the 4000 units has only pulled four-fifths of the round, it will require 5000 units to break bottom. However, results could be more economically obtained by substituting a higher grade in place of part of the 40%, so that if 50 lb. of 40% are used, which would be 2000 units of strength, this would still leave 3000 units to be supplied by, for instance, 80% gelatin, to be placed in the bottom of the holes. Three thousand units divided by 80% gives 37½ lb. of 80% gelatin. The cost of the 80% gelatin in the bottom of the holes plus the cost of the 50 lb. of 40% on top of that, would be no greater than for the 100 lb. of 40%, and would pull at least 1 ft. more of ground This method of calculation can be used whenever one explosive is substituted for another. Eighty per cent. gelatin dynamite and blasting gelatin are never loaded alone in a round of holes, but are loaded in the bottom and some lower grade used on top. This system produces a maximum of economy and is still safe if the primers are placed in the higher grade explosive.

Fast Tunnel-Driving

Recently rapid strides have been made in the driving of tunnels through hard rock. This fast progress has been accomplished in several ways: (1) by drilling deep rounds of holes; (2) by using powerful explosives, which enabled the breaking of deeper ground, and (3) by doing the work in a systematic manner. A noteworthy case of this recently, has been the breaking of the record for fast tunnel-driving in the United States, which was made in the Laramie-Poudre irrigation tunnel by J. A. McIlwee, contractor. In this tunnel, 7 x 9 ft. in size, the holes were drilled from 10 to 12 ft. in depth, using two short cut holes in the center and giving the cut holes all the lift that was possible both in a horizontal and vertical direction. By using blasting gelatin 100% strength in the bottom of the holes and 50% gelatin on top of that, with the primer in the blasting gelatin, it was possible to pull 10 ft. clean per round in the toughest kind of blue, close-grained granite. Two of these rounds per day were put in so that in one month 653 ft. were made, or over 20 ft. per day.

Tamping Explosives

With the gelatin explosives, the more closely they are packed in the hole the less air space there is in the charge and the greater the force developed. It is also true that if the explosive is confined by means of tamping, a greater force is produced. In holes which point downward water tamping can be used to the best advantage. In upper holes the best material is damp clay placed in special tamping bags, which are made for this purpose.

In the San Juan region, Colorado, no attempt has been made to introduce new explosives since the gelatin powders replaced the nitroglycerine dynamites. The reason for this has been that no explosive has been developed that is superior to the gelatin for the conditions in that district. However, the use of No. 6 caps has been urged and put in practice in place of the smaller sizes.

British Cement Combination

A new amalgamation of British cement works to have an issued capital of $17,032,000 is proposed. This is to be known as the British Portland Cement Manufacturers (Ltd.), says *Daily Consular and Trade Reports*, and the annual capacity will be about 1,500,000 long tons of cement. In addition there will be a working agreement with the Associated Cement Co. It is claimed that the two will control five-sixths of the British cement output, and their combined capital will be about $58,398,000. There will be no public issue of stocks or shares.

Power System Cleveland Cliffs Iron Co.

By C. A. Tupper*

The Carp River is being harnessed to provide power for Michigan iron mines. The system when completed will consist of one large hydro-electric plant supplemented by two steam plants, each distributing current at 60,000 volts over an area of 40 square miles.

The Cleveland Cliffs Iron Co. is constructing a hydro-electric power system which will serve all of its mines on the Marquette range, a district in which this corporation is the largest operator. The Carp River is being harnessed and about 6000 kw. will eventually be developed. The project is the second of its kind upon which this company has embarked, the first having been on the Au Train River, and is one of the most important undertaken in upper Michigan. Much important preparatory work has been done with the installation of a large quantity of electrical machinery at the mines and shops, including motor-driven trams, hoists, pumps, compressors, tools, etc., the construction of transmission lines, and the establishment of two large central generating stations, equipped with steam turbines, which now furnish the power required and will later serve as auxiliaries to the hydro-electric plants.

Concrete Dam

The site chosen for the water-power station is a mile from the point at which the Carp River empties into Lake Superior, at the foot of Mt. Mesnard. The concrete dam now under construction is about four miles from the generating plant. Its spillway is 120 ft. long and 48 ft. high, and secure protection against washouts has been provided by a curved retaining wall 150 ft. long and 7 ft. wide, reënforced horizontally with old cables at the point where it joins the main spillway.

The water will be carried to the wheels in a steel and stave pipe line 21,500 ft. in length, and 60 to 66 in. in diameter, 8567 ft. being of lock-bar steel, 2233 ft. of welded steel and the remainder of wooden staves. A surge tank 16 ft. in diameter and 130 ft. high will be placed at the top of Mt. Mesnard; the available head is about 600 ft. At the power plant two 3000-kw. Allis-Chalmers hydraulic turbine units and three 1900-kilovolt-ampere transformers are being installed. The system is designed to carry 60,000 volts, but, for the present, current, will be transmitted at 30,000 volts. It is expected to have the new plant in operation early next spring.

Transmission Line

The transmission line under construction, which consists of No. 2 B. & S. solid-copper cable carried on steel towers, will connect the Mt. Mesnard power house with the auxiliary and distributing station already in service at the Maas mine, Negaunee, which is in turn connected similarly with a plant of the same kind at the Princeton mine in the Swanzy district and with the Cleveland Cliffs properties in the Ishpeming and North Lake fields. Altogether the transmission system covers a territory of 40 square miles, and there will be a double circuit over the entire line.

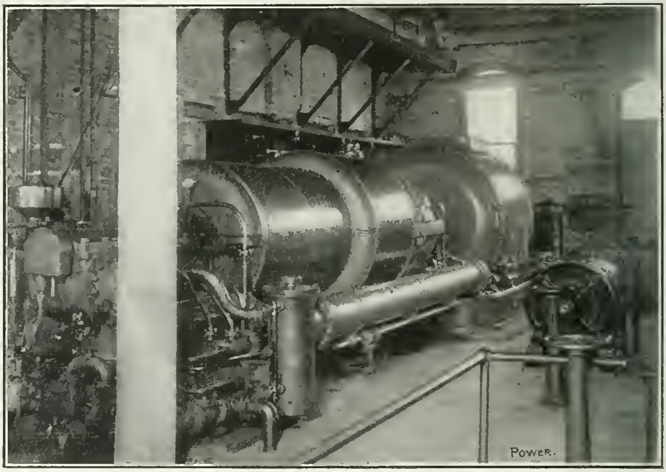


Fig. 2. 1500-kw. Turbine at Maas Mine Plant

Steam-turbine Plant

The steam-turbine plant at the Maas mine (see Fig. 1) is laid out in accordance with good engineering practice. The boiler room contains four 350-hp. Stirling boilers, with Murphy stokers, the furnace fronts being set out 7 ft. from the boiler fronts. This gives room for bins directly over the furnaces, which are supplied with slack coal by cars which run over the top of the bins and which are raised by a steam-hydraulic elevator. Induced draft is provided by a Sturtevant engine-driven fan, delivering the products of combustion to a 25-ft. steel stack set inside the building on a concrete foundation.

Fig. 1. Exterior View of Maas Mine Plant, Showing Condenser

---

*Consulting engineer, 389 Thirty-first Ave., Milwaukee, Wis.

Note—Reprinted from Power, Jan. 9, 1912.

ENGINE ROOM

In the engine room all the auxiliaries, except the exciter and switchboard, are placed beneath the concrete floor. The electric-generating apparatus consists of a 1500-kw. Allis-Chalmers steam-turbine set, which delivers three-phase, 60-cycle current at a terminal pressure of 2300 volts. The turbine receives steam at about 150 lb. pressure and exhausts at about 28 in. vacuum to an Allis-Chalmers condenser, of the barometric type, which consists of a 42-in. head provided with an air cooler, water distributor, spray plates and equalizing pipes. With this is operated a horizontal, double-acting, rotative dry-air pump, with cylinders in tandem, protected by a water and air separator on the condenser head; also a motor-driven centrifugal pump for circulating the condensing water, and a small drain pump for automatically removing the condensation from the exhaust piping. The latter pump, however, is used only in emergencies, as the exhaust line is drained by a 3-in. pipe which runs down the shaft a vertical distance of 60 ft. and then turns up vertically for a distance of 17 ft. This automatically seals the vacuum and allows any accumulated water to drop down the shaft, as shown in Fig. 3. A 10-in. motor-driven centrifugal pump lifts the water from the hotwell to the top of a cooling tower from which it is returned to the injection system after being cooled as falling spray. Approximately 3125 gal. are used per minute.

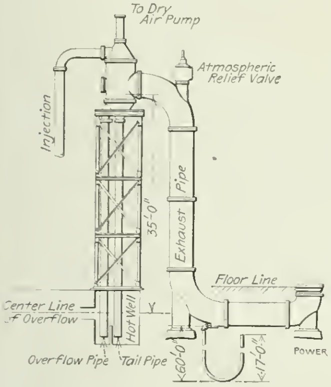


FIG. 3. CONDENSER WITH AUTOMATIC DRAIN TRAP

POWER

There is a completely equipped switchboard, and current is led from the busbars to three oil-insulated, water-cooled transformers having a capacity of 500 kilovolt-amperes each, which step up from 2300 volts to 30,000 volts for transmission. As the transmission line will be operated when necessary at 60,000 volts, the transformer secondary coils are so wound that they may be easily changed to that voltage.

In addition to the generating unit, the station at the Maas mine contains two steam hoists and a two-stage air compressor furnishing 4800 cu.ft. of free air per minute. The Princeton station is similar to the Maas station.

The work is being carried out under the supervision of O. D. McClure, resident engineer for the company, and Viele, Blackwell & Buck, of New York, as consulting engineers.

The Barker District, Montana

By J. R. VILLARS*

The first discovery of ore in the Barker district, Montana, is said to have been made by accident in 1879, in the bed of Galena Creek, and for a number of years following the district was the scene of considerable activity. A large amount of ore was shipped and a smeltery was built to treat the ores. The latter are galena carrying silver, pyrite, some zinc and a small amount of gold. The orebodies occur either on contacts between limestone and porphyry or in the porphyry. In 1891 the railroad was completed and shipping to Great Falls was made possible. In 1893 the camp was practically abandoned and from that time until 1908 little was done except on a few claims by leasers.

RECENT OPERATIONS

In 1908 the Barker Mines Co. was organized and incorporated for the purpose of taking over and working the Barker, Gray Eagle, Gibson Fraction, Belt and Defiance claims. Since that time this company has patented two more claims, the Phœnix and the Snow Drift. On the Barker claim the shaft was sunk to a depth of 400 ft., and the vein opened by drifts both east and west on the different levels. During the last summer a new hoisting plant was installed, consisting of engine, boiler, pumps and headframe; some money was also expended in building and repairing roads and in opening and patenting the Snow Drift and Phœnix claims. The company has shipped about 51 cars of ore, averaging about $40 per ton, to the American Smelting & Refining Co.'s works at Helena. This ore had to be hauled by wagon to Monarch, 12 miles distant, since the railroad spur from Monarch to Barker was taken up some years ago.

A 50-ton concentrator has been erected and was started on Nov. 16, 1911; this is reported to be working successfully. It consists of one Blake crusher; two sets of rolls, one for coarse and one for fine grinding; three Harz jigs and three Wilfley tables. The power is furnished by a 50-hp. engine and a 70-hp. boiler. Vanners will be put in later. The Great Northern Railway Co. has guaranteed to rebuild the line from Monarch to Barker as soon as this company guarantees shipments of 1000 tons per month; it is hoped that early in 1912 this can be done.

UNDERGROUND DEVELOPMENT

The development work on the Barker claim shows the following results: The tunnel level driven west on the vein 1200 ft., shows 480 ft. of ore 3½ ft. wide; about one-third of this is shipping and the rest milling ore. The 175-ft. level driven 675 ft. west was in ore 3½ ft. wide for 400 ft. In places the orebody is 6 ft. wide and about one-third of this is shipping ore that will average over $40 per ton. The 300-ft. level, driven east 380 ft. and west 180 ft., was all in ore averaging 3½ to 4 ft. thick. On this level there is a solid streak of shipping ore about 1 ft. thick throughout the entire length of both the east and west drifts. The 400-ft. level for 250 ft. both east and west disclosed ore averaging about 5 ft. wide, about one-third of it being shipping ore. On this level there is a fair percentage of copper not shown in the upper levels. On the Gray Eagle claim the tunnel level opened milling ore for 250 ft. On the Phœnix a crosscut was driven to the south 280 ft., and a vein was cut having a width of 40 ft. A drift was then run 140 ft. to the west and the vein again crosscut, showing a width of 40 ft. The entire 140-ft. drift on this vein, as well as the two 40-ft. crosscuts, are in low-grade milling ore. Some native copper has also been found in this vein.

The Barker Mines Co. is a close corporation. Henry Tegtmeier is superintendent and C. N. Loring, formerly of Park City, Utah, is mill foreman. George B. Gunn, of Salt Lake City, president of the company, has made a number of trips to the properties at Barker, and has expressed himself as well pleased with the outlook. There are other properties in the Barker district that formerly were large producers of lead-silver ore, and it is hoped that with good management and proper development some of these old mines may be made productive again.

Serpek Process of Nitrogen Fixation

In the Serpek process for the fixation of nitrogen, bauxite is heated with coal to a temperature of 1700 to 1800° C. (*Journ. Soc. Chem. Ind.*, Nov. 30, 1911). From 15 to 18% of nitrogen is absorbed as aluminum nitride. When this nitrogen-bearing bauxite is treated with caustic soda, ammonia escapes and is caught, the profits from which materially reduce the costs of alumina and aluminum.

---

*Villars-Barnum Engineering Co., Great Falls, Mont.

The Mining Index

A Classified Bibliography of the Current Literature of Mining and Metallurgy

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print), in the original language, for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COAL AND COKE

17,703—ACCIDENTS—Coal Mine Mortality Statistics. Frederick L. Hoffman. (Coal Age, Jan. 6, 1912; 2¾ pp.) 20c.

17,704—AUSTRIA—Die Kohlenflöze in der Molasse bei Bregenz. Schmidt and Müller. (Zeit. f. prakt. Geol., Oct., 1911; 4 pp., illus.) 40c.

17,705—BITUMINOUS COAL MINING. Engineering Requirements in. William E. Fohl. (Proc. Eng. Soc. W. Penn., Dec., 1911; 52 pp.) 40c.

17,706—CANADA—The Production of Coal and Coke in Canada during the Calendar Year 1910. John McLeish. (Canada Dept. of Mines, Mines Branch, 1911; 29 pp.)

17,707—COAL DUST—Die Bekämpfung der Kohlenstaubgefahr in Frankreich. (Bergbau, Dec. 21, 1911; 2¾ pp.) The fighting of coal-dust danger in France. 20c.

17,708—COKE—Retort Oven Plant at Gary, Ind. (Coal Age, Dec. 23, 1911; 4½ pp., illus.) 20c.

17,709—COKE-OVEN PLANT—Operating on Coke-Oven Gas vs. Steam Turbines. C. A. Tupper. (Min. and Eng. Wld., Dec. 23, 1911; 5 pp., illus.) 20c.

17,710—COKING—Continuous Coking in Vertical Retorts. (Coal Age, Dec. 16, 1911; 1⅓ pp., illus.) 20c.

17,711—COLORADO—Conditions in the Yampa Coal Field of Colorado. W. Weston. (Min. and Eng. Wld., Dec. 16, 1911; 1⅓ pp., illus.) 20c.

17,712—ELECTRIC TRANSMISSION in Coal Mines. Henry D. Jackson. (Coal Age, Jan. 20, 1912; 1¼ pp.) 20c.

17,713—ELECTRICAL EQUIPMENT of the Craighead and Bothwell Castle Collieries. (Elec. Rev., London, Jan. 5, 1912; 2 pp., illus.) 40c.

17,714—EXPLOSION at Briceville, Tenn. (Coal Age, Dec. 16 and 23, 1911; 5½ pp.) 20c.

17,715—EXPLOSIONS—Stone Dust in Mine Explosions. R. Dawson Hall. (Coal Age, Nov. 25, 1911, 1½ pp.) 20c.

17,716—FIRE—Extinguishing the Majestic Mine Fire. R. Y. Williams. (Mines and Minerals, Jan., 1912; 2 pp., illus.) 20c.

17,717—GAS—Release of Gas Accumulations. W. H. Cunningham and C. R. Conner. (Coal Age, Dec. 30, 1911; 2 pp., illus.) Paper before December meeting of Kentucky Mining Institute. 20c.

17,718—GASES—Methods of Testing for Mine Gases. W. R. Crane. (Coal Age, Dec. 30, 1911; 1 p., illus.) Paper before Coal Mining Institute of America, Dec. 20, 1911. 20c.

17,719—GERMANY—Coal Situation in Germany, 1911. O. H. Hahn. (Coal Age, Jan. 20, 1912; 1½ pp., illus.) 20c.

17,720—HAULAGE—Gravity Planes with Monitors. (Coal Age, Dec. 16, 1911; 2½ pp., illus.) 20c.

17,721—ILLUMINATING GAS—Coals Available for the Manufacture of Illuminating Gas. A. H. White and Perry Barker, compiled and revised by Herbert M. Wilson. (U. S. Bureau of Mines, Bull. 6, 1911, 77 pp., illus.)

17,722—NOVA SCOTIA—The Coal Trade of Nova Scotia during 1911. F. W. Gray. (Can. Min. Journ., Jan. 15, 1912; 5¼ pp., illus.) 20c.

17,723—PEAT—Is Peat an Important Fuel in the United States? Charles A. Davis. (Power, Dec. 19, 1911; 3 pp.) 20c.

17,724—PICKING BELT—Ein neues Kontrolleseband. Weise. (Glückauf, Dec. 9, 1911; 1¼ pp., illus.) A new picking belt for checking the quality of coal in coal mines. 40c.

17,725—PLANT—Penn-Mary Coal Co. Plant. (Mines and Minerals, Dec., 1911; 2¾ pp., illus.) Description of tipple, combined electric and tail-rope haulage, and power-plant arrangements. 40c.

17,726—PRODUCTION AND CONSUMPTION—World's Coal Production and Consumption. (Iron and Coal Tr. Rev., Dec. 29, 1911; 1¼ pp.) 40c.

17,727—ROOF SUPPORT—Permanent Roof Sustention. R. Dawson Hall. (Coal Age, Jan. 20, 1912; 1¾ pp., illus.) 20c.

17,728—SCREENING—A New System of Screening and Loading Coal. (Iron and Coal Tr. Rev., Dec. 8, 1911; 2⅓ pp., illus.) 40c.

17,729—SHAFTS for American Coal Mines. R. G. Johnson. (Mines and Minerals, Jan., 1912; 4 pp., illus.) Methods employed in sinking, lining, etc. 20c.

17,730—STORAGE—Deterioration and Spontaneous Heating of Coal in Storage. Horace C. Porter and F. K. Ovitz. (Eng. Rec., Dec. 23, 1911; 1⅔ pp.) 20c.

17,731—TIPPLE—Model Steel Tipple at Annabelle Mines. Wm. Archie Weldin. (Mines and Minerals, Jan., 1912; 10 pp., illus.) An example of the newest methods in building construction and in the methods of handling coal. 40c.

17,732—UNITED STATES—Reviews of Coal Industry for 1911. (Coal Age, Jan. 6, 1912; 12 pp.) 20c.

17,733—WASHING—A Test for Coal-Washing Economy. (Coal Age, Jan. 30, 1912; 1 p., illus.) From Rev. Univ. des Mines. 20c.

17,734—WEST VIRGINIA—Method of Mining in Southern W. Va. J. J. Marshall. (Coal Age, Dec. 16, 1911; 5 pp., illus.) 20c.

COPPER

17,735—ARIZONA—Copper in Arizona in 1911. James Douglas. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,736—ARIZONA—The Miami District, Arizona. W. R. Ingalls. (Eng. and Min. Journ., Jan. 13, 1912; 3½ pp., illus.) 20c.

17,737—AUSTRALIA—The Whim Well Copper Mine, West Pilbara, North-West Australia. H. R. Sleeman. (I. M. M., Bull. 80, 1911; 19 pp., illus.)

17,738—LAKE SUPERIOR District in 1911. Carl L. C. Fichtel. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,739—LEACHING Applied to Copper Ore. W. L. Austin. (Mines and Methods, Dec., 1911; 4 pp.) Thirteenth article of series dealing especially with the Laszczynski process. 20c.

17,740—LONDON COPPER MARKET, The. (Eng. and Min. Journ., Jan. 6, 1912; 1¼ pp.) 20c.

17,741—METALLURGY of Copper in 1911. Arthur L. Walker. (Eng. and Min. Journ., Jan. 6, 1912; 2¾ pp.) 20c.

17,742—NEVADA—Boyer Copper Deposits, Nevada. Arthur Howe Carpenter. (Min. and Sci. Press, Dec. 23, 1911; 2 pp., illus.) 20c.

17,743—PRODUCTION AND MARKET—The Copper Industry in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 3½ pp.) Review by states; world's production; New York and London markets. 20c.

17,744—PYRITIC SMELTING—Notes on Pyritic Smelting. George A. Guess. (Eng. and Min. Journ., Jan. 13, 1912; 5⅓ pp.) 20c.

17,745—SMELTING of Copper-Bearing Magnetite. B. H. Bennetts. (Min. and Eng. Wld., Dec. 9, 1911; ⅔ p.) 20c.

GOLD DREDGING

17,746—ALASKA—Gold-Dredging Industry on Seward Peninsula. T. M. Gibson. (Min. and Sci. Press, Jan. 6, 1912; 4 pp., illus.) 20c.

17,747—CALIFORNIA—Gold Dredging in California. Charles Janin. (Min. and Sci. Press, Jan. 6, 1912; 2¾ pp., illus.) 40c.

17,748—DREDGING PREVIOUSLY WORKED DEPOSITS. A. H. Martin. (Min. and Eng. Wld., Dec. 9, 1911; ¾ p.) 20c.

17,749—ELECTRICAL EQUIPMENT of California Dredges. A. H. Martin. (Min. and Eng. Wld., Dec. 16, 1911; 1 p.) 20c.

17,750—EXPLORING DREDGING GROUND. Al. H. Martin. (Mines and Methods, Dec., 1911; 1¼ pp.) 20c.

17,751—MONTANA—Gold Dredging at Ruby, Mont. Hennen Jennings. (Min. and Sci. Press, Jan. 6, 1912; 1½ pp., illus.) 20c.

17,752—REVIEW of Gold Dredging in 1911. Charles Janin. (Min. and Sci. Press, Jan. 13, 1912; 2½ pp., illus.) 20c.

17,753—RUSSIA—Gold Dredging in Russia. Charles Janin. (Min. and Sci. Press, Jan. 6, 1912; 1¾ pp., illus.) 20c.

GOLD AND SILVER—CYANIDATION

17,754—AGITATION—A Modified Form of Pachuca Tank. J. F. Buel. (Trans. Am. Met. Soc., Dec., 1911; ¾ p., illus.)

17,755—CONSOLIDATED MERCUR—Metallurgy of Mercur Gold Ores. Theo. P. Holt. (Mines and Minerals, Jan., 1912; 2¾ pp., illus.) 40c.

17,756—DECANTATION—Cyaniding by Continuous Decantation in Clear County, Colorado. H. C. Parmelee. (Met. and Chem. Eng., Jan., 1912; 4¼ pp., illus.) 40c.

17,757—FILTRATION—Solution Clarifier Used at Tonopah-Liberty Mill. C. R. Olson. (Eng. and Min. Journ., Jan. 20, 1912; ½ p., illus.) 20c.

17,758—MODERN PROCESSES—High Extraction Processes in the Metallurgy of Gold and Silver. T. Lane Carter. (Eng. Mag., Jan., 1912; 25 pp., illus.) 40c.

17,759—PROGRESS—Cyanidation in 1911. Burr A. Robinson. (Eng. and Min. Journ., Jan. 6, 1912; 2 pp.) 20c.

17,760—RETREATMENT OF MILL TAILINGS at Cripple Creek. W. R. Dodge. (Min. Sci., Dec. 14, 1911; 2 pp., illus.) Description of the methods followed in the handling of cyanide residues at the Isabella Mine. 20c.

GOLD AND SILVER—GENERAL

17,761—AUSTRALIA—Distribution of Gold in Australia. Gerard W. Williams. (Aust. Min. Stand., Nov. 23, 30 and Dec. 7, 1911; 3¾ pp.) $1.

17,762—BRITISH COLUMBIA—The Bluebell Mine, Kootenay Lake, B. C. (Can. Min. Journ., Dec. 15, 1911; 1½ pp.) 20c.

17,763—CALIFORNIA—Mining in California in 1911. Lewis H. Eddy. (Eng. and Min. Journ., Jan. 6, 1912; 1 p.) 20c.

17,764—CALIFORNIA—Plymouth Consolidated Mines, California. Lewis H. Eddy. (Eng. and Min. Journ., Jan. 20, 1912; 1⅓ pp.) 20c.

17,765—CALIFORNIA—The Seneca Mining District, California. F. L. Wilson. (Min. and Sci. Press, Nov. 25, 1911; 1¾ pp., illus.) 20c.

17,766—CALIFORNIA AND NEVADA—Mines of the Southern Sierras of California and Nevada. Mark B. Kerr. (Min. and Sci. Press, Jan. 6, 1912; 1½ pp., illus.) 20c.

17,767—CHIHUAHUA—The Cusihuiriachic District of Chihuahua, Mexico. W. D. Pearce. (Min. and Eng. Wld., Jan. 6, 1912; 2 pp., illus.) 20c.

17,768—COLORADO—Common Geological Features of Silver Districts with Special Reference to the Silver-producing Areas of Colorado. W. G. Matteson. (Mines and Minerals, Dec., 1911: 2¼ pp., illus.)

17,769 — COLORADO METALLURGICAL PROGRESS. P. H. Argall. (Min. and Sci. Press, Jan. 6, 1912; 3½ pp., illus.) 40c.

17,770—GEOLOGIC STRUCTURE of Silver Districts. W. G. Matteson. (Mines and Minerals, Jan., 1912; 2¾ pp., illus.) The common features of the world's greatest silver districts, volcanic and sedimentary formations. 40c.

17,771 — GUANAJUATO — Mining at Guanajuato in 1911. Austin C. Brady. (Eng. and Min. Journ., Jan. 6, 1912; ¾ p.) 20c.

17,772 — MADAGASCAR — Mining in Madagascar. T. Draper. (Min. Mag., Dec., 1911; 5 pp., illus.) 40c.

17,773—MILL—Construction Costs at the New Portland Mill, Cripple Creek, Colo. G. M. Taylor. (Min. and Sci. Press, Jan. 6, 1912; 1 p.) 20c.

17,774—MONTANA—Gold-Silver Mines of Montana. George T. McGee. (Min. and Sci. Press, Jan. 6, 1912; 1⅓ pp., illus.) 20c.

17,775—NEVADA—Geology of the National Mining District, Nevada. Waldemar Lindgren. (Min. and Eng. Wld., Dec. 9, 1911; 1 p., illus.) 20c.

17,776—NEVADA—The Position on the Comstock. George J. Young. (Eng. and Min. Journ., Jan. 20, 1912; 6⅓ pp., illus.) 20c.

17,777—NEW ZEALAND—The Blackwater Mine. Harold Sharpley. (Min. Mag., Dec., 1911; 1 p.) 40c.

17,778—NICARAGUA in 1911. T. Lane Carter. (Eng. and Min. Journ., Jan. 6, 1912; ½ p.) 20c.

17,779—ONTARIO — Silver and Gold Mining in Ontario. H. E. T. Haultain. (Can. Engr., Jan. 11, 1912; ¾ p.) 20c.

17,780 — OREGON — Mining in Oregon in 1911. Frederick W. Scofield. (Eng. and Min. Journ., Jan. 6, 1912; ¾ p.) 20c.

17,781—PLACER MINING — Principles of Gravel Mining. William H. Storms. (Min. and Sci. Press, Dec. 2, 1911; 1 p.) 20c.

17,782 — PORCUPINE — Character of Ore Deposit and Probable Milling Methods at Porcupine. Louis D. Huntoon. (Can. Min. Journ., Dec. 15, 1911; 4 pp.) 20c.

17,783—PORCUPINE—The Rea Mine, Porcupine. T. H. Rea. (Can. Min. Journ., Jan. 1, 1912; 2 pp., illus.) 20c.

17,784—PRODUCTION of Gold and Silver in 1910. H. D. McCaskey. (Advance Chapter from Mineral Resources of the United States, 1910; 39 pp.)

17,785—PRODUCTION AND PRICES—Gold, Silver and Platinum in 1911. Frederick Hobart. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,786—RAND—Mines of the Witwatersrand. (South African Min. Journ., Nov. 25, Dec. 2, 9 and 16, 1911; 7 pp., illus.) I, City and Suburban Gold Mining Co.; II, Ginsberg Gold Mining Co.; III, Cinderella Cons. Gold Mines; IV, Robinson Deep Gold Mining Co. $1.20.

17,787—RAND—The Geological Problem of the West Rand. (South African Min. Journ., Nov. 25, 1911; 1½ pp., illus.) 40c.

17,788 — REDUCTION — Future Economies in Rand Reduction Plants. C. O. Schmitt. (Journ. Chem., Met. and Min. Soc. of South Africa, Nov., 1911; 7¼ pp.) Author's reply to discussion. 80c.

17,789—SOUTH AFRICA—Recent Progress at Piggs Peak Mine. (South African Min. Journ., Dec. 9, 1911; 2 pp., illus.) 40c.

17,790—SOUTH DAKOTA—Mining in South Dakota in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 1 p.) 20c.

17,791—STAMP MILLING in 1911. Louis D. Huntoon. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,792—STAMP MILLS—Notes on Cams for Stamp Mills. G. M. Adams (Journ. South African Inst. Engrs., Nov. and Dec., 1911; 15 pp., illus.) $1.20.

17,793—TRANSVAAL GOLD MINING. Rowland Gascoyne. (Min. and Sci. Press, Jan. 6, 1912; 2½ pp., illus.) 20c.

17,794—TUBE MILLING—Pebble Efficiency in Tube Milling. A. W. Allen. (Min. and Sci. Press, Jan. 6, 1912; ½ p.) 20c.

17,795—UTAH—Mining in the Tintic District, Utah. Leroy Palmer. (Mines and Minerals, Jan., 1912; 3 pp., illus.) The Godiva-Sioux zone; peculiar caves filled with ore; methods of mining and milling. 20c.

17,796—WEST AFRICA — The Gold Coast Mines, West Africa. (Min. and Eng. Rev., Dec., 1911; 2 pp., illus.) Continuation of article previously indexed. 40c.

IRON MINING AND ORE DRESSING

17,797 — FRANCE — Die französischen Eisensteinvorkommen. B. Simmersbach. (Oest. Zeit. f. B. u. H., Nov. 11, 1911; 3½ pp.) Iron-ore deposits of France. 40c.

17,798—LAKE SUPERIOR—Iron Ore in Lake Superior District. Dwight E. Woodbridge. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,799—MAGNETIC IRON ORE CONCENTRATION. C. A. Tupper. (Mex. Min. Journ., Jan., 1912; 4 pp., illus.) 20c.

17,800—MAGNETITE — The Cornwall, Penn., Magnetite Deposits. E. B. Wilson. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 12 pp., illus.)

17,801—MINNESOTA—A Diamond Core Section of the Mesabi Rocks—IV. N. H. Winchell. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 9 pp.)

17,802 — MINNESOTA — Historical Sketch of Menominee Range. Thomas Conlin and P. O'Brien. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 10 pp.)

17,803—MINNESOTA—Iron Mines on Mesabi and Vermilion Ranges. W. J. Lauck. (Min. and Eng. Wld., Dec. 23, 1911; 1⅓ pp.) 20c.

17,804—NORWAY'S IRON-ORE DEPOSITS. Editorial. (Engineering, Dec. 29, 1911; 1½ pp.) 40c.

IRON AND STEEL—METALLURGY

17,805 — BLAST FURNACE — Thin-Lined Blast-Furnace Construction. David Baker. (Iron Age, Dec. 28, 1911; 1¾ pp., illus.) Designs for controlling heat losses applicable to both old and new furnaces. 20c.

17,806—BLAST-FURNACE GASES in the Foundry. R. Busk. (Iron and Coal Tr. Rev., Dec. 1, 1911; 1¼ pp., illus.) Abstract of article in Stahl u. Eisen. 40c.

17,807—CHROME-VANADIUM STEELS—The Determination of Chromium and Its Separation from Vanadium in Steels. J. R. Cain. (Journ. Ind. and Eng. Chem., Jan., 1912; 1¾ pp.) 80c.

17,808—CORROSION—Recent Progress in the Rust Proofing of Iron and Steel. Percy S. Brown. (Metal Industry, Jan., 1912; 1¾ pp., illus.) 20c.

17,809 — FERRO-ALLOYS — Ueber die Verwendung von Ferrolegierrungungen im Eisenhüttenwesen. Venator. (Chem. Ztg., Dec. 26, 1911; ½ p.) On the application of ferro-alloys in iron smelting.

17,810 — FERROMANGANESE — Remelting of Ferromanganese in the Electric Furnace and the Use of Molten Ferromanganese for Deoxidation. (Met. and Chem. Eng., Dec. 19, 1911: 1½ pp., illus.) 40c.

17,811—LABORATORIES — Ueber den Bau von Eisenhüttenlaboratorien mit besonderer Berücksichtigung der Lüftungseinrichtungen. H. Kinder. (Stahl u. Eisen, Dec. 14, 1911: 3 pp., illus.) On the construction of iron-works laboratories with special regard to ventilation arrangements. 40c.

17,812—PROGRESS in Metallurgy of Iron and Steel. Bradley Stoughton. (Eng. and Min. Journ., Jan. 6, 1912; 2⅓ pp.) 20c.

17,813—NOMENCLATURE of the Microscopic Constituents of Iron and Steel. Henry M. Howe. (Met. and Chem. Eng., Jan., 1912: 3¼ pp.) 40c.

17,814—OPEN-HEARTH FURNACES—Dimensions of Open-Hearth Furnaces Based on Practical Data. (Met. and Chem. Eng., Jan., 1912: 1⅓ pp.) 40c.

IRON AND STEEL—GENERAL

17,815—CANADA—The Production of Iron and Steel in Canada during the Calendar Year 1910. John McLeish. (Canada Dept. of Mines, Mines Branch, 1911; 38 pp.)

17,816—IRON-ORE MOVEMENT on the Great Lakes in 1911. George H. Cushing. (Min. and Sci. Press, Jan. 6, 1912; 2 pp.) 20c.

17,817—MARKET—The Chicago Iron Market. E. Morrison. (Eng. and Min. Journ., Jan. 6, 1912: ½ p.) 20c.

17,818 — MARKETS — Pittsburg Iron and Steel Markets. B. E. V. Luty. (Eng. and Min. Journ., Jan. 6, 1912; 1 p.) 20c.

17,819—PRODUCTION—The Iron and Steel Industry in 1911. Frederick Hobart. (Eng. and Min. Journ., Jan. 6, 1912; 2 pp.) 20c.

LEAD AND ZINC

17,820—COLORADO—The Marion Zinc Mine of Custer County, Colorado. E. C. Babbitt. (Min. Sci., Dec. 21, 1911; 1¼ pp., illus.) 20c.

17,821 — CONCENTRATION — Igneous Concentration of Zinc Ore. F. L. Clerc. (Eng. and Min. Journ., Jan. 13, 1912; 5 pp.) 20c.

17,822—JOPLIN DISTRICT in 1911. Jesse A. Zook. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,823—METALLURGY OF LEAD in 1911. H. O. Hofman. (Eng. and Min. Journ., Jan. 6, 1912: 1½ pp.) 20c.

17,824—METALLURGY OF ZINC. W. R. Ingalls. (Eng. and Min. Journ., Jan. 6, 1912; 2½ pp.) 20c.

17,825—MISSOURI—Southeastern Missouri in 1911. H. A. Wheeler. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,826—PRODUCTION—Lead in 1910. Smelter Production. C. E. Siebenthal. (Advance Chapter from Mineral Resources of the U. S., 1910; 43 pp., illus.)

17,827—PRODUCTION of Lead in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 2¼ pp.) Production; New York and London markets, prices, etc. 20c.

17,828—PRODUCTION AND PRICES—The Zinc Industry in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 2 pp.) 20c.

17,829—ROASTED BLENDE—A Rapid Method for the Determination of Sulphur in Roasted Blende. C. C. Nitchie. (Journ. Ind. and Eng. Chem., Jan., 1912; 2¾ pp.) 80c.

17,830—WISCONSIN—Zinc Mining in Wisconsin. J. E. Kennedy. (Eng. and Min. Journ., Jan. 6, 1912; ⅔ p.) 20c.

OTHER METALS

17,831—ALUMINUM — Electroplating on Aluminum. O. P. Watts. (Wisconsin Engr., Jan., 1912; 5 pp.)

17,832—CERIUM — Properties of Metallic Cerium and Its Alloys. (Brass Wld., Dec., 1911; 2 pp.) 20c.

17,833—MANGANESE—A New Manganese Deposit in Tennessee. Wilbur A. Nelson. (Resources of Tenn., Dec., 1911; 9 pp., illus.)

17,834—NICKEL—The Alexo Mine. A New Nickel Occurrence in N. Ontario. W. L. Uglow. (Bull. Can. Min. Inst., Oct., 1911; 26 pp., illus.)

17,835—QUICKSILVER in the United States. (Eng. and Min. Journ., Jan. 6, 1912; 1⅓ pp.) "California," by L. H. Eddy; "Texas," by W. B. Phillips. 20c.

17,836—TIN—Die Wichtigeren Zinnerzbergbaugebiete. Simmersbach. (Glückauf, Nov. 25, 1911; 9 pp.) The important tin ore fields. 40c.

17,837—TIN—London Tin Market in 1911. (Eng. and Min. Journ., Jan. 13, 1912; 1 p.) 20c.

17,838—TIN—The Tin Fields Revisited—III. (South African Min. Journ., Nov. 25, 1911; ¾ p.) Continuation of article previously indexed. 40c.

17,839—TIN DREDGING in Alaska. H. G. Peake. (Min. and Sci. Press, Nov. 18, 1911; ¾ p.) 20c.

17,840—TIN INDUSTRY in 1911. (Eng. and Min. Journ., Jan. 6, 1912; ½ p.) Production and prices. 20c.

17,841—TUNGSTEN in the Black Hills and Methods for its Determination. E. H. Quinney. (Pahasapa Quart., S. D. School of Mines, Dec., 1911; 7½ pp.)

17,842—VANADIUM—Carnotite in Paradox Valley, Colo. Thomas F. V. Curran. (Eng. and Min. Journ., Dec. 30, 1911; 1½ pp.) 20c.

NONMETALLIC MINERALS

17,843—CEMENT, LIME, ETC.—The Production of Cement, Lime, Clay Products, Stone and Other Structural Materials in Canada during the Calendar Year 1910. John McLeish. (Canada Dept. of Mines, Mines Branch, 1911; 60 pp.)

17,844—CLAY AND SHALE DEPOSITS of the Western Provinces of Canada. Heinrich Ries (Bull. Can. Min. Inst., Oct., 1911; 50 pp., illus.)

17,845—CORUNDUM—On Corundum-Syenite (Uralose) from Montana. Austin F. Rogers. (Journ. Geol., Nov.-Dec., 1911; 4 pp.) 60c.

17,846—DIAMONDS—The Bloemhof and Mooifontein Diamond Diggings—II and III. (South African Min. Journ., Nov. 25 and Dec. 2, 1912; 2 pp.) Continuation of article previously indexed. 60c.

17,847—GYPSUM DEPOSITS of Nova Scotia. (Can. Min. Journ., Jan. 1, 1912; 5 pp., illus.) Continuation of article previously indexed. 20c.

17,848—PHOSPHATE ROCK in Tennessee. (Am. Fertilizer, Jan. 13, 1912; 5 pp.) Gives list of producers, amount of production, etc. 20c.

17,849—POTASH—The Search for Potash in the United States: A Report of Progress. Hoyt S. Gale. (U. S. Geol. Surv., Bull. 530-A, 1911; 27 pp.)

17,850—PRECIOUS STONES in 1911. George F. Kunz. (Eng. and Min. Journ., Jan. 6, 1912; 1¼ pp.) 20c.

17,851—SALT—Moderne Salzmühlen-Anlage. C. Meuskens. (Bergbau, Nov. 2, 1911; 3 pp., illus.) Modern salt mills. 20c.

17,852—TURQUOISE—Crystallized Turquoise from Virginia. W. T. Schaller. (Am. Journ. of Sci., Jan., 1912; 6 pp.) 40c.

PETROLEUM

17,853—APPALACHIAN AND LIMA OIL FIELDS in 1911. H. C. George. (Eng. and Min. Journ., Jan. 6, 1912; ⅜ p.) 20c.

17,854—CALIFORNIA—Petroleum in California in 1911. Mark L. Requa. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,855—ILLINOIS—Petroleum in Illinois in 1911. Raymond S. Blatchley. (Eng. and Min. Journ., Jan. 6, 1912; 1 p.) 20c.

17,856—MAIKOP BORING WORKS in 1911. E. de Hautpick. (Min. Journ., Jan. 13 1912; 1¼ pp., illus.) 40c.

17,857—MID-CONTINENTAL FIELD—Oil and Gas in Mid-Continental Field. Erasmus Haworth. (Eng. and Min. Journ., Jan. 6, 1912; 1 p.) 20c.

17,858—ORIGIN—The Various Theories of Origin of Petroleums. Carpel L. Berger. (Min. and Eng. Wld., Dec. 16 and 30, 1911; 5⅜ pp.) 40c.

17,859—RUMANIA—Oil Industry of Rumania. R. C. N. Twite. (Min. Mag., Dec., 1911; 4¼ pp., illus.) 40c.

ECONOMIC GEOLOGY—GENERAL

17,860—NEW YORK—Geological Problems, Presented by the Catskill Aqueduct of the City of New York. J. F. Kemp. (Bull. Can. Min. Inst., Oct., 1911; 7 pp.)

17,861—ONTARIO—The Character and Possible Origin of the Green Dolomites of New Ontario. N. B. Davis. (Bull. Can. Min. Inst., Oct., 1911; 15 pp., illus.)

17,862—ORE DEPOSITS—Decrease of Value in Ore Shoots with Depth. F. Lynwood Garrison. (Bull. Can. Min. Inst., Oct., 1911; 15 pp.)

17,863—ORE DEPOSITS—Replacement Ore Bodies and the Criteria for Their Recognition. John D. Irving. (Econ. Geol., Oct.-Nov., 1911; 54 pp., illus.) 60c.

17,864—PROSPECTING—Systematische Erforschung des Erdinnern mittels elektrischer Wellen. H. Löwy. (Oest. Zeit. f. B. u. H., Nov. 18 and 25, and Dec. 2, 1911; 7 pp., illus.) Systematic exploration of the interior of the earth by means of electric waves. $1.

17,865—UNSOLVED PROBLEMS of Geology. Hiram W. Hixon. (Mines and Methods, Dec., 1911; 7 pp., illus.) 20c.

MINING—GENERAL

17,866—ACCIDENTS in Cornish Mines. R. H. Coulson. (Eng. and Min. Journ., Jan. 20, 1912; ⅜ p.) 20c.

17,867—ACCIDENTS—Ueber einige Grubenkatastrophen in Grossbritannien. Seidl. (B. u. H. Rundschau, Oct. 20, 1911; 3¼ pp.) On some mine disasters in Great Britain

17,868—ALASKA—Mining in Alaska in 1911. Alfred H. Brooks. (Eng. and Min. Journ., Jan. 6, 1912; 5 pp., illus.) 20c.

17,869—ARIZONA in 1911. C. F. Tolman, Jr. (Eng. and Min. Journ., Jan. 6, 1912; ¾ p.) 20c.

17,870—AUSTRALASIA—Mining in Australasia. F. S. Mance. (Eng. and Min. Journ., Jan. 6, 1912; 2⅓ pp.) 20c.

17,871—BRITISH COLUMBIA—Mining in British Columbia in 1911. E. Jacobs. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,872—BRITISH COLUMBIA—Mining on the Coast of British Columbia. Percy Williams. (Min. Mag., Dec., 1911; 3½ pp., illus.) 40c.

17,873—CALIFORNIA'S MINERAL INDUSTRY in 1911. William H. Storms. (Min. and Sci. Press, Jan. 6, 1912; 1 p., illus.) 40c.

17,874—CANADA—A General Summary of the Mineral Production of Canada during the Calendar Year 1910. John McLeish. (Canada Dept. of Mines, Mines Branch, 1911; 37 pp.)

17,875—CENTRAL AMERICAN MINES in 1911. T. Lane Carter. (Min. and Sci. Press, Jan. 6, 1912; 1½ pp., illus.) 40c.

17,876—CHINA—Mining in China in 1911. Thomas T. Read. (Min. and Sci. Press, Jan. 6, 1912; ½ p.) 40c.

17,877—COLOMBIA—Traveling in Colombia. R. D. O. Johnson. (Eng. and Min. Journ., Dec. 30, 1911; 2¾ pp.) 20c.

17,878—COLORADO—Metal Mining in Colorado in 1911. George E. Collins. (Eng. and Min. Journ., Jan. 6, 1912; 2 pp.) 20c.

17,879—COMPRESSED AIR—Untersuchungstelle für Pressluftmaschinen. K. Wortmann. (Glückauf, Dec. 9, 1911; 1½ pp., illus.) Testing station for machines using compressed air at Consolidation colliery, near Gelsenkirchen. 40c.

17,880—COST ENGINEERING. Lewis B. Skinner. (Colo. School of Mines Mag., Jan., 1912; 5½ pp.)

17,881—DIAMOND DRILLING—Surveying and Sampling Diamond Drill Holes. E. E. White. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 21 pp., illus.)

17,882—DIVIDENDS—Mining Company Dividends in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 2¼ pp.) 20c.

17,883—DRILLING—New System of Drilling in Stopes at the Jupiter Mine. (South African Min. Journ., Dec. 9, 1911; 1 p., illus.) 40c.

17,884—DUST—The Prevention of Dust in the Development Drives of Mines during Drilling Operations. C. J. N. Jourdan. (Journ. South African Inst. of Engrs., Dec., 1911; 2 pp., illus.) Discussion on paper previously indexed. 60c.

17,885—EXPLOSIVES—Einiges über brizante Sprengstoffe. Neumann. (Zeit. f. angew. Chem., Nov. 24, 1911; 7½ pp., illus.) Some remarks on shattering explosives.

17,886—FILING NOTES—Keeping or Filing of Engineering Notes. R. Stuart Browne. (Trans. Am. Met. Soc., Dec., 1911; 4 pp.)

17,887—FILING SYSTEM Suggested for Use of Engineers. H. L. Botsford. (Min. and Eng. Wld., 3¾ pp., illus.) 20c.

17,888—FILLING MINE WORKINGS under Railway Bridges with Concrete. C. L. Camp. (Eng. News, Jan. 11, 1912; 1 p., illus.) 20c.

17,889—FINANCE OF A MINE, The—VI. M. H. Burnham. (Min. Mag., Dec., 1911; 4 pp., illus.) 40c.

17,890—GERMANY—The Mining Industry in Germany. O. H. Hahn. (Eng. and Min. Journ., Jan. 13, 1912; 1 p.) 20c.

17,891—GREAT BRITAIN—Mining in Great Britain in 1911. (Eng. and Min. Journ., Jan. 13, 1912; 1⅓ pp.) 20c.

17,892—HAULING—Die Verwendung von Stellwerken bei der elektrischen Lokomotivförderung unter Tage. Kliver. (Glückauf, Dec. 2, 1911; 2½ pp., illus.) The application of central safety switches in underground hauling by electric locomotives. 40c.

17,893—HEAD FRAMES for Small Shafts. Hugh G. Elwes. (Mex. Min. Journ., Jan., 1912; 1 p., illus.) 20c.

17,894—IDAHO—Mining in Idaho in 1911. Robert N. Bell. (Eng. and Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

17,895—ITALY—Bergbau und Hüttenindustrie Italiens im Jahre 1910. (Glückauf, Dec. 16, 1911; 5¾ pp.) 40c.

17,896—JALISCO—Mining in Jalisco in 1911. Austin C. Brady. (Eng. and Min. Journ., Jan. 13, 1912; 1 p.) 20c.

17,897—JAPAN—The Fujita Co., Osaka, Japan. (Far Eastern Review, Nov., 1911; 6 pp., illus.) 40c.

17,898—JAPAN'S MINERAL PRODUCTION. H. Foster Bain. (Min. and Sci. Press, Jan. 6, 1912; 2½ pp., illus.) 20c.

17,899—LAWS—The Mineral Land Laws of the United States. James Douglas. (Min. and Sci. Press, Dec. 23, 1911; 2½ pp.) 20c.

17,900—LIGHTING BY CANDLES—The Cost of Illumination by Candles. Fred MacCoy. (Mex. Min. Journ., Jan., 1912; ½ p.) 20c.

17,901—MANAGEMENT Principles of Mine Management. Charles A. Chase. (Eng. and Min. Journ., Dec. 30, 1911; 4¼ pp.)

17,902—MAPS—Electrical Symbols for Mine Maps. H. H. Clark. (Coal Age, Dec. 30, 1911; 3½ pp., illus.) Paper before Coal Mining Institute of America, Dec. 20, 1912. 20c.

17,903—MEXICO—Mining in Mexico in 1911. Kirby Thomas. (Eng. and Min. Journ., Jan. 6, 1912; 2½ pp.) 20c.

17,904—MINE ATMOSPHERE—Pathogenic Mine Atmospheres—I. Edwin M. Chance. (Coal Age, Dec. 30, 1911; 3 pp.) 20c.

17,905—MINING METHOD—Square Set Mining at the Vulcan Mines. Floyd L. Burr. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 12 pp., illus.)

17,906—MINING METHOD—Top Slicing at the Caspian Mine. Wm. A. McEachern. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 5 pp., illus.)

17,907—MINING METHODS—New Zealand and Nevada Mining Methods Compared. F. C. Brown. (Min. and Sci. Press, Jan. 13, 1912; 1¼ pp.) 20c.

17,908—MONTANA in 1911. F. L. Fisher. (Eng. and Min. Journ., Jan. 6, 1912; 1¾ pp.) 20c.

17,909—NEVADA—Mining in Nevada in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 2½ pp., illus.) 20c.

17,910—OAXACA—Mining in Oaxaca in 1911. (Eng. and Min. Journ., Jan. 6, 1912; ¾ p.) 20c.

17,911—ONTARIO MINERAL OUTPUT in 1911. Thomas W. Gibson. (Eng. and Min. Journ., Jan. 6, 1912; 2½ pp., illus.) 20c.

17,912—ORE HANDLING—Modern Ore-Handling Methods in Spanish Mines. C. A. Tupper. (Min. Wld., Jan. 20, 1912; 2 pp.) 20c.

17,913—PHILIPPINES—The Mineral Resources of the Philippine Islands, with a Statement of the Production of Commercial Mineral Products during the Year 1910. (Div. of Geology and Mines, Bureau of Science, Manila, P. I., 1911; 80 pp., illus.)

17,914—PHOTOGRAPHY—Negative Making on Mexican Trails. M. MacFarlane. (Mex. Min. Journ., Jan., 1912; 1 p.) 20c.

17,915—PRODUCTION of Metals and Metallic Ores in 1909 and 1910. H. D. McCaskey. (Advance Chapter from Mineral Resources of the U. S., 1910; 8 pp.)

17,916—PRODUCTION, COSTS, ETC.—Data of the World's Principal Mines. S. F. Shaw. (Eng. and Min. Journ., Jan. 13, 1912; 3 pp.) 20c.

17,917—QUEBEC—The Mineral Industry in the Province of Quebec during 1911. Theo. C. Denis. (Can. Min. Journ., Jan. 1, 1912; 1½ pp.) 20c.

17,918—RESCUE WORK—Use of Oxygen Helmet in High Temperatures. H. H. Sanderson. (Mines and Minerals, Jan., 1912; ½ p.) 20c.

17,919—RHODESIA—Mining in Rhodesia in 1911. H. F. Marriott. (Eng. and Min. Journ., Jan. 6, 1912; 1 p.) 20c.

17,920—RUSSIAN EMPIRE in 1911. J. P. Hutchins. (Eng. and Min. Journ., Jan. 6, 1912; 3 pp.) 20c.

17,921—SHAFT—The Shape of a Shaft. E. Mackay Heriot. (Eng. and Min. Journ., Dec. 30, 1911; 2½ pp., illus.) 20c.

17,922—SHOVELS—The Use of Long and Short Handle Shovels. (Eng. and Min. Journ., Jan. 20, 1912; ¾ p.) 20c.

17,923—SIGNALLING—Recording and Signalling Device for Mines. John M. Johnson. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 12 pp., illus.)

17,924—SOUTH AMERICA in 1911. (Eng. and Min. Journ., Jan. 6, 1912; 1 p.) 20c.

17,925—SPAIN—Mining Conditions in the South of Spain. Henry F. Collins. (Min. and Sci. Press, Jan. 6, 1912; 3 pp.) 20c.

17,926—STREAM DIVERSION—Diversion of the Sturgeon River at the Loretto Mine. Charles H. Baxter. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 3 pp., illus.)

17,927—SWEDEN—Schwedens Bergbau und Eisenindustrie im Jahre 1910. (Glückauf, Nov. 25, 1911; 3¾ pp.)

17,928—TAXATION of Mineral Rights in Michigan. P. B. McDonald. (Eng. and Min. Journ., Jan. 13, 1912, 1 p.) 20c.

17,929—TIMEKEEPING SYSTEM of the Crystal Falls Iron Mining Co. Jas. D. Vivian. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 7 pp.)

17,930—TRACK ARRANGEMENT for Shaft Bottoms. Oscar Cartlidge. (Mines and Minerals, Jan., 1912; 1¼ pp., illus.) Four plans and their respective advantages for handling cars at foot of shafts. 20c.

17,931—TRANSVAAL—Mining in the Transvaal in 1911. Hugh F. Marriott. (Eng. and Min. Journ., Jan. 6, 1912; 2⅝ pp.) 20c.

17,932—TUNNEL LINING—Grouting the Concrete Lining of the Rondout Pressure Tunnel. Herman L. Wittstein. (Eng. Rec., Dec. 30, 1911; 3 pp., illus.) 20c.

17,933—TUNNEL SUPPORT—Steel Arch Supports in Tunnels. C. C. Semple. (Eng. and Min. Journ., Jan. 13, 1912; ⅜ p.) 20c.

17,934—TUNNELING—Driving the Big Savage Railroad Tunnel with Compressed Air. (Eng. Rec., Dec. 23, 1911; 1½ pp., illus.) An inrush of soft material prevented progress by customary methods and necessitated the use of air pressure for 200 ft. 20c.

17,935—TURKEY—Mining in Turkey in 1911. Leon Dominian. (Min. and Sci. Press, Jan. 6, 1912; 2 pp., illus.) 40c.

17,936—UTAH—Mining in Utah in 1911. Edward R. Zalinski. (Eng. and Min. Journ., Jan. 6, 1912; 2 pp.) 20c.

17,937—WOOD STAVE PIPES—Experiments on the Flow of Water in Wood Stave Pipes. (Proc. A. S. C. E., Dec., 1911; 13 pp.) Discussion of paper previously indexed.

ORE DRESSING—GENERAL

17,938—CONCENTRATION—The Future of Concentration. M. P. Boss. (Min. and Sci. Press, Jan. 6, 1912; ¾ p.) 20c.

17,939—CRUSHING—Feeding Boulders to Crushers. Claude T. Rice. (Eng. and Min. Journ., Jan. 20, 1912; 1 p., illus.) 20c.

17,940—PRUSSIA—Die Zentral-Erzaufbereitungsanlage der königlichen Berginspektion Clausthal im Harz. (Oest. Zeit. f. B. u. H., Dec. 9 and 16, 1911; 6¼ pp., illus.) The Central Ore Dressing Works of the Clausthal district in the Harz. Abstract from a paper by Schennen in Glückauf, 1907. 60c.

17,941—SCREENING—A Study of the Comparative Efficiencies of Certain Methods of Screening and Classifying Fine Material and a Comparison of Screened with Classified Feed on the Wilfley Table. J. R. Cox, G. G. Gibbons and J. B. Porter. (Bull. Can. Min. Inst., Oct., 1911; 71 pp., illus.)

17,942—SEPARATION—Notes on a Simple Method of Separating Rock from Stiff Clays at Totok Gold Mine., Dutch East Indies. F. A. Killik. (Bull. 87, I. M. M., Dec. 14, 1911; 7 pp., illus.)

METALLURGY—GENERAL

17,943—AUSTRIA—Die Bergwerks- und Hüttenindustrie Oesterreichs im Jahre 1910. (Glückauf, Dec. 9, 1911; 3¼ pp.) 40c.

17,944—ELECTRIC FURNACE—Der elektrische Vakuumofen und seine Verwendung. O. Goecke. (Metallurgie, Nov. 8, 1911; 8¾ pp., illus.) The electric vacuum furnace and its use. 40c.

17,945—FLAMELESS COMBUSTION of Gas. William A. Bone. (Eng. and Min. Journ., Jan. 20, 1912; 4 pp., illus.) 20c.

17,946—FURNACE CHARGES—Calculation of Furnace Charges. Regis Chauvenet. (Met. and Chem. Eng., Jan., 1912; 3 pp.) 40c.

17,947—REVERBERATORY FURNACES—Die Anwendung der Gesetze der Hydraulik auf die Berechnung der Flammöfen. (Stahl u. Eisen, Dec. 7 and 14, 1911; 10½ pp., illus.) Application of hydraulic laws to the calculation of reverberatory furnaces. 40c.

17,948—ROASTING—Efficiency in Ore Roasting. Arthur S. Dwight. (School of Mines Quart., Nov., 1911; 17 pp.) 60c.

17,949—SILVER-LEAD SMELTING. L. S. Austin. (Min. and Sci. Press, Jan. 6, 1912; 1⅓ pp.) 40c.

17,950—SMELTER FUME—Beiträge zur Frage der Gewinnung des Flugstaubes aus dem Hüttenrauch. A. Rzehulka. (Zeit. Oberschlesischen B.- u. Hüttenmännischen Vereins, Oct., 1911; 5 pp.)

17,951—WELDING—Symposium on Welding. Modern Welding Processes with Special Reference to Flame Welding. H. R. Cobleigh. (Journ. A. S. M. E., Jan., 1912; 31 pp., illus.)

17,952—WELDING—Thermit Welding. G. E. Pelissier. (Journ. A. S. M. E., Jan., 1912; 11 pp., illus.)

MINING AND METALLURGICAL MACHINERY

17,953—AIR COMPRESSORS—Operation of Air Compressors. E. A. Rix. (Min. and Sci. Press, Jan. 6, 1912; 1½ pp.) 20c.

17,954—BELT CONVEYORS—Capacity and Speed of Belt Conveyors. (Eng. and Min. Journ., Dec. 30, 1911; 1½ pp., illus.) 20c.

17,955—BELTING—The Use and Care of Belting—IV. (Eng. Digest, Jan., 1912; 4 pp., illus.) 40c.

17,956—COAL HANDLING—Standard Boiler House and Coal-Handling System of the Crystal Falls Iron Mining Co., Menominee Range. J. S. Jacka. (Proc. Lake Superior Min. Inst., Vol. XVI. Aug., 1911; 6 pp.)

17,957—CONVEYING AND ELEVATING MACHINERY, Its Cost and Commercial Value.—IV.—Bucket Elevators. Reginald Trautschold. (Eng. Digest, Jan., 1912; 4 pp.) 40c.

17,958—ELECTRIC FURNACE—The Present Status of the Electric Furnace. C. B. Gibson. (Elec. Journ., Jan., 1912; 2½ pp.) 20c.

17,959—ELECTRICAL OPERATION of the Plants of the Penn Iron Mining Co. Frank H. Armstrong. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 9 pp., illus.)

17,960—GAS ENGINE—The Bituminous Gas Engine at the Groenfontein Tin Mine, South Africa. (South African Min. Journ., Dec. 16, 1911; 2½ pp., illus.) 40c.

17,961—GAS-ENGINE PLANTS—Colliery Gas Engine Plants. Frank C. Perkins. (Mines and Minerals, Jan., 1912; ¾ p., illus.)

17,962—GAS PRODUCER—Tests of a Suction Gas Producer. C. M. Garland and A. P. Kratz. (Univ. of Ill., Bull. 50, 1911; 91 pp., illus.)

17,963—GAS TURBINES—Ueber Gasturbinen. Langer. (Stahl u. Eisen, Oct. 19, 1911; 5 pp., illus.) 40c.

17,964—HOISTING—Electric Winding Gear at the West Rand Consolidated Gold Mines. (Engineering, Dec. 8, 1911; 2⅓ pp., illus.) 40c.

17,965—HOISTING—Electrically Driven Winding Machines. (A. E. G. Journ., Nov., 1911; 6 pp., illus.)

17,966—HOISTING—Neue elektrische Haspelförderung für schlagwettergefährliche Gruben. H. Reiser. (Bergbau, Nov. 23, 1911; ¾ p.) 20c.

17,967—HOISTING—Note on the Use of Induction Motors for Driving Winding Engines. H. J. S. Heather. (Electrician, Nov. 10, 1911; 1½ pp., illus.) 40c.

17,968—HOISTING—5500-Horsepower Two-Cylinder Corliss Winding Engine. (Engineering, Oct. 27, 1911; 2⅜ pp.) 40c.

17,969—HOISTING ENGINES—Electrically-Driven Winding Engines. Bertram Wood. (Aust. Min. Stand., Nov. 30, Dec. 7 and 14, 1911; 6 pp., illus.) 80c.

17,970—HOISTING MACHINERY—Untersuchungen an elektrisch und mit dampf betriebenen Fördermaschinen. (Glückauf, Dec. 2, 1911; 3 pp., illus.) Continuation of article previously indexed. 40c.

17,971—HOISTS—Electric Hoists for Mines. D. B. Rushmore. (Eng. and Min. Journ., Dec. 16, 1911; 2 pp.) From a paper read before Am. Min. Congress, October, 1911. 20c.

17,972—HOISTS—Electric Motors Versus Compressed Air Engines for Driving Deep-Mine Hoists. K. A. Pauly. (Bull. A. I. M. E., Dec., 1911; 28 pp., illus.)

17,973—INTERNAL COMBUSTION ENGINE in Modern Practice. Robert L. Streeter. (Eng. Mag., Jan., 1912; 17 pp., illus.) Fourth article of series dealing with cost of power generation in small plants. 40c.

17,974—LOCOMOTIVE—Storage Battery Mine Locomotive at the Big Five Tunnel, Idaho Springs, Colo. H. B. Barnes. (Eng. and Min. Journ., Dec. 30, 1911; 1½ pp., illus.) 20c.

17,975—MICROSCOPES—Universal Metalloscope—Perfected Microscope for the Examination of Metals. Albert Sauveur. (Bull. A. I. M. E., Dec., 1911, 11 pp., illus.) 40c.

17,976—MINE EQUIPMENT—New Equipment at Negaunee Mine, Michigan. P. B. McDonald. (Eng. and Min. Journ., Dec. 16, 1911; ½ p.) 20c.

17,977—MOTOR TRUCK for Mines. Rex Beresford. (Eng. and Min. Journ., Dec. 9, 1911; ¾ p., illus.) 20c.

17,978—POWER PLANT—The Ray Consolidated Power Plant. C. A. Tupper. (Eng. and Min. Journ., Dec. 2, 1911; 1¼ pp., illus.) 20c.

17,979—PRODUCER-GAS PLANTS—The Internal Combustion Engine in Modern Practice. III. Machinery of Producer-Gas Power Plants. Robert L. Streeter. (Eng. Mag., Dec., 1911; 22 pp., illus.) 40c.

17,980—PUMPS—German Electric Mine Pumps. Robert Grimshaw. (Eng. and Min. Journ., Jan. 20, 1912; ⅜ p., illus.) 20c.

17,981—PUMPS—Kreiselpumpen für Grubenwasserhaltungen. (Bergbau, Nov. 16, 1911; 1¼ pp.) Centrifugal pumps in mine drainage. 20c.

17,982—SAFETY DEVICES of the Oliver Iron Mining Co. Alex. M. Gow. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 12 pp., illus.)

17,983—SKIP for a Vertical Shaft. (Min. and Sci. Press, Dec. 9, 1911; 1 p., illus.) 20c.

17,984—STORAGE BATTERY for Goldfield Consolidated Mines. (Journ. of Elec., Power and Gas, Dec. 30, 1911; 3¾ pp., illus.) 20c.

17,985—TURBO-COMPRESSORS—Pokorny and Wittekind Turbo-Compressors. (Engineering, Dec. 15, 1911; 3¼ pp., illus.) 40c.

SAMPLING AND ASSAYING

17,986—ANALYSIS—Rapid Methods of Technical Analysis. Frank D. Aller. (Colo. School of Mines Mag., Jan., 1912; 1 p.) Continuation of article previously indexed.

17,987—ELECTRIC LABORATORY FURNACE. Raymond C. Benner. (Journ. Ind. and Eng. Chem., Jan., 1912; 3¼ pp., illus.) 80c.

17,988—MINE SAMPLING. S. F. Shaw. (Min. Mag., Dec., 1911; 3 pp., illus.) 40c.

17,989—NITER ASSAY CALCULATIONS, Graphic Methods for. Philip D. Wilson. (Eng. and Min. Journ., Dec. 30, 1911; 1 p., illus.) 20c.

17,990—SAMPLING—Principles in the Practice of Sampling. E. A. Hersam. (Trans. Am. Met. Soc., Dec., 1911; 3½ pp., illus.)

17,991—SPLITTING PULP SAMPLES, Device for. (Eng. and Min. Journ., Jan. 13, 1912; 1⅓ pp., illus.) 20c.

INDUSTRIAL CHEMISTRY

17,992—LITHOPONE—The Manufacture of Lithopone. (Eng. and Min. Journ., Dec. 16, 1911; 1 p.) 20c.

17,993—SULPHURIC ACID—Das Oplsche Tumrsystem der Ersten Oesterreichischen Sodafabrik Hruschau zur Herstellung von Schwefelsäure 60 deg. Bé. Hartmann. (Zeit. f. Angew. Chem., Dec. 1, 1911; 2¾ pp., illus.) The Opltower system of the Ersten Oest. Sodafabrik. Hruschau for the manufacture of sulphuric acid of 60 deg. Bé. 40c.

17,994—SUPERPHOSPHATE—Manufacture of Superphosphate in Western Australia. M. W. von Bernewitz. (Min. and Sci. Press, Oct. 28, 1911; 1 p., illus.) 20c.

MATERIALS OF CONSTRUCTION

17,995—CEMENT—Die Entwicklung der Zementindustrie. Goslich. (Zeit. f. Angew. Chem., Sept. 15, 1911; 14½ pp., illus.) The evolution of the cement industry. 40c.

17,996—CEMENT—Retrogression in the Tensile Strength of Cement. J. M. O'Hara. (Proc. A. S. C. E., Oct., 1911; 6 pp., illus.)

17,997—CEMENT INDUSTRY in the United States in 1910. Ernest F. Burchard. (Advance Chapter from Mineral Resources of the U. S., 1910; 71 pp., illus.)

17,998—CEMENT MANUFACTURE—Utilizing Waste Heat of Rotary Kiln. H. E. Boyrie. (Cement Age, Dec., 1911; 4 pp., illus.) 20c.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

T. H. Leggett has gone to Europe.

B. B. Lawrence has gone to Panama.

J. R. Finlay has returned to New York.

E. B. Kirby, of St. Louis, is visiting New York.

Courtenay De Kalb has been visiting mines in Oregon.

J. M. Garza Aldape, of Torreon, Mexico, is in New York.

Dr. Walter Harvey Weed was in Duluth, Minn., recently.

W. W. Mein is consulting engineer for the Dome Mines Co.

W. C. Ralston, of San Francisco, has been visiting New York.

William Crosley, of Chihuahua, Mexico, is on his way to London.

B. B. Gottsberger, of Miami, Ariz., expects to visit New York this month.

Fred T. Williams has been in the northern part of Utah on professional business.

Mark L. Requa, of San Francisco, has returned from a professional visit in Arizona.

A. N. C. Treadgold of Dawson, Yukon, was in New York last week, on his way to England.

Arthur Selwyn Brown has just returned to New York from a professional trip to Europe.

Alexander P. Rogers, of New York, is at present engaged in examination work in Arizona.

H. W. Turner passed through New York this week on his way from Siberia to San Francisco.

T. Lane Carter, of Chicago, recently lectured at Yale University, New Haven, Conn., on "Mining in Africa."

Ernst A. Sjostedt, of Sault Ste. Marie, Ont., is going to Europe for three months, to study the position of electric smelting there.

R. B. Brinsmade has opened an office for consulting work in mining and metallurgy at No. 7 Meson del Angel, Puebla, Mexico.

Joseph A. McDonald, late of the Ohio works of the Carnegie Steel Co., will go to the new Brier Hill Steel Co., as general manager.

Hoyt T. Gale, of the U. S. Geological Survey, engaged in exploration of potash deposits at Fallon, Nev., was in San Francisco recently.

H. B. Barling has been appointed manager in Honduras of the New York & Honduras Rosario Mining Co., at San Juancito, Honduras, Central America.

Arthur E. Woolsey, recently with the Illinois Steel Co. at South Chicago, has been appointed general superintendent of the works of the Tata Iron & Steel Co., at Sakchi, India.

Herman L. Schneider, for over six years with the Rio Tinto Copper Co. at Terrazas, Mexico, has resigned his position as manager and will be for the present at El Paso, Texas.

Sir William Mackenzie, president of the Canadian Northern Ry., and heavily interested in mining enterprises, has returned to Toronto after a month spent in England on financial busines.

Alonzo F. Bardwell has purchased the entire business of Bettles & Bardwell, assayers and chemists, Salt Lake City, Utah, since the recent death of Mr. Bettles. He will conduct the business for the present under the old firm name.

V. R. Garfias, of the U. S. Bureau of Mines, and W. F. Durand, of the mechanical engineering department of Stanford University, are at Bakersfield, Calif., for the purpose of studying the production and transportation of petroleum.

Frank McGovern announces that the partnership heretofore existing under the name of MacGovern, Archer & Co., has been dissolved by mutual consent and he has organized the corporation of MacGovern & Co., with offices at 114 Liberty street, New York.

George J. Henry, Jr., after an experience of 18 years with the Pelton Water Wheel Co., of San Francisco and New York, during the last 10 of which he was chief engineer, has resigned to open an engineering office at No. 737 Rialto Building, San Francisco.

S. T. Wellman of the Wellman-Seaver-Morgan Co., is in San Francisco recovering from a broken leg caused by an accident at the Heroult works of the Noble Electric Steel Co. Mr. Wellman had started for Cleveland when the accident occurred, for business purposes.

Albert Burch, Gelasio Caetani and Oscar H. Hershey announce that they have entered into partnership under the firm name of Burch, Caetani & Hershey, consulting engineers in mining, metallurgy and mining geology. Their offices are in the Crocker Building, San Francisco, California.

T. A. Jagger, Jr., professor of geology at the Massachusetts Institute of Technology, has been granted leave of absence for the remainder of the year, in order that he may perfect plans for the institute's volcanic laboratory at Halemaumau, in the Hawaiian Islands. He will spend several months on this work. The laboratory was in charge of Prof. Parret last summer.

C. M. Eye left Aroroy, Masbate, Philippine Islands, on Jan. 1, after two years' engagement as general superintendent for the Colorado Mining Co. During the period of this engagement, the mine was further developed and equipped to furnish 100 tons of ore per day, a jig-back tramway built, and a 20-stamp all-sliming cyaniding plant erected and put into successful operation. Mr. Eye will go to Europe and will be in New York about June 1, 1913. His address will be 1012 Sahwatch St., Colorado Springs, until further notice.

Obituary

Antonio Surial, a mineowner of Peru, who has been visiting this country, was killed at Newark, N. J., Jan. 23, in a trolley-car accident.

Harry C. Smith died at Morrison, Colo., Jan. 21, aged 35 years. He was born in Denver and graduated from the Colorado School of Mines in 1898. He was employed as a mining engineer at several places in Colorado, but recently purchased a ranch at Morrison.

Charles Leonard Hill died at Santa Monica, Calif., Jan. 20, aged 83 years. He was one of the best known mining men in the state of Colorado and a prominent factor in the mining history of the state. He was born in Maine in 1829. In 1860 he went to Colorado, crossing the plains from the Missouri River with an ox team. He went immediately to what was then the most promising mining camp in the state, Black Hawk and Central City, in Gilpin County. A few years later he went to Summit County and engaged in mining in Alma and Oro City. There he was appointed superintendent of the Printer Boy mine, operated by J. Marshall Paul, of Philadelphia, and acted in that capacity for several years. He then took charge of the Moose mine where he lived four years. In 1878 he went to Leadville and took charge of the A. Y. & Minnie mine. After leaving that mine he operated other mines at Leadville, where he resided for many years. Mr. Hill retired six years ago at the age of 77. In July, 1911, he suffered from an attack of paralysis, and was immediately taken to Santa Monica, where he remained until his death.

Societies and Technical Schools

Southern Oregon & Northern California Mining Congress—This body was to meet at Medford, Ore., on Feb. 2. This will be the second meeting of an organization of mining men, representing the counties near the California-Oregon line, whose commercial relations are divided between San Francisco and Portland. In practical mining the operators in Douglas, Jackson and Josephine Counties, in Oregon, and Siskiyou County, in California, are closely related. They are all producers of gold from placers and silicious ores, and have a common interest in the activity of the entire district. The sessions of the congress will occupy two days.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Jan. 24—The installation of the first new dredge in the California fields in 1912, at Oroville, by Lawrence Gardella on Jan. 12, has revived the discussion of the probability of redredging portions of that and other fields when there shall be demonstrated a device for saving the fine gold that is supposed to have escaped the standard types of tables employed in the operation of California bucket-elevator dredges. There are two positive opinions expressed on the subject: One, that there is not enough gold of any character remaining in the Oroville field so far dredged, to pay for the expense of the experiment; the other, that not only is there fine gold remaining, but that in many operations the gold contents that are capable of being saved by the methods employed have not been fully secured.

Should there be no redredging of the field, the Gardella dredge, Oro Vista No. 1, may be the last new boat installed at Oroville, as the number of dredges now in operation is equal to the present estimated life of the ground remaining to be worked. There have been various gold-saving devices offered for experimentation, but the larger operators have come to disregard them as of economic value when applied to boats of large capacity, the contention being that the results compared with the yield under the present method would not be commensurate with the necessary expenditure of installation and operation. There is one feature of the redredging possibility that is generally overlooked. That is the deepening of the field, particularly in the Yuba River district. The fact that the large boats in the field are digging 65 ft. below the water line is not evidence of limitation of the depth of the field. The prospecting drills in some instances indicated gold at 90- and 100-ft. depth.

A suit has been filed by the United States attorney at Los Angeles, to annul the patents to Southern Pacific R.R. lands in southeastern Kern County, on the line of the S. P. R.R. from Ventura to Mohave. The land is in the center of a gold-bearing mineral zone. It is generally supposed that when the Government attempts to recover mineral lands from the S. P. R.R. that the mineral is petrolific, but in this case there is not known to be any oil-bearing lands within the township described. The patent to these lands was issued in 1906, and hence it was necessary to begin suit within six years from that time. The usual charge of fraud is made in the complaint. It is common report that the Government purposes following up with similar suits all the lands of the railroad within the district, extending from a point a little north of the line between Los Angeles and Kern Counties, south to the Mexican line and east to the Arizona line. The railroad from Mohave to Needles is included in the district; it was built and operated as the Atlantic & Pacific R.R., but is now owned and operated by the Santa Fé R.R. The initial construction and ownership is said to have been a part of the Southern Pacific system, and that road controls the right to the lands in the railroad zone, but it has never obtained patents; an effort was made about a year ago to do this, but the Los Angeles Chamber of Mines and Oil interfered; since then the Government has made surveys of the region. Both oil and other minerals exist, though commercial quantities of oil have not been developed.

Butte

Jan. 24—It has been announced by Harry Gallwey, general manager of the Butte, Anaconda & Pacific R.R., after a conference with G. P. Armstrong, an electrical engineer of the General Electric Co.; Max Hebgen, manager of the Butte Electric & Power Co., and F. M. Kerr of the latter company, that the work of electrifying the road will begin soon, with the expectation of completing it within a year, at a cost of approximately $1,000,000. This move is a continuation of the policy of retrenchment being put in force by the Anaconda company, as several noteworthy economies will result, the chief one being the saving of fuel. The electric power used will be generated at the plant of the Great Falls Water Power Townsite Co., which is already supplying power to Butte and Anaconda. Seventeen new motors will be required for the line and they will be run by the overhead trolley system. Both the freight and passenger trains will be run in this way, the motors being the same type but geared differently for the two kinds of service.

On Jan. 18 at 11:00 a.m. it was discovered that the old Anaconda fire had broken out in a drift on the 600-ft. level of the Mollie Murphy shaft, in the fire zone between the Anaconda and St. Lawrence mines. The fire had been working along a vein of ore from the center of the Anaconda fire and it spread through the drift on the 600-ft. level to the south raise, where it attacked the timbers, creating a hot fire and causing a portion of the timbering to cave in. For a time the flames shot above the collar of the shaft, as it is an upcast air shaft, but by evening it had burned itself out. It was in the center of the fire zone and at no time endangered other properties, as bulkheads prevented it from spreading. No shutdowns or laying off of men occurred, and no harm was done aside from a small amount of timbering destroyed in the shaft.

Denver

Jan. 25—The flow from the portal of the deep-drainage tunnel is now about 9200 gal. per min. and within 10 months the water level of the district has been lowered an average of 85 ft. It is now headed for the Mabel M. or Gold Dollar watercourse which will probably be reached within the next 500 ft. The main volcanic or breccia area is about 1000 ft. beyond and when that is reached the main watercourse of the district will have been tapped and this great work completed. There is enough money on hand to drive the next 500 ft. and after that about $25,000 more will have to be raised in order to reach the main volcanic plug where it is believed an enormous flow will be tapped. The Strong mine has recovered its 10th level and the Portland is mining ore at its 15th level. The recession in the Battle Mountain section is about 4 in. per day.

Salt Lake City

Jan. 24—Fire at the loading station of the Daly West and Ontario mines Jan. 20, caused a loss estimated at between $10,000 and $20,000. The large iron doors at the mouth of the tunnel were closed to keep the mines from being filled with smoke. The tunnel usually carries an in-draft, but for some reason during the fire the current of air was in the opposite direction. There were no fatalities. The loading station was destroyed, and in addition there were burned about 200 tons of coal, $3000 worth of lumber, a sawmill and six railroad cars loaded with ore and concentrates. The building destroyed was constructed as a mill by the Ontario company in 1892, and was to have been equipped for the Russell process. It was subsequently used as a loading station and spur tracks were built to it from the Denver & Rio Grande and the Union Pacific railroads. The Daly West mine and mill has closed down for a few days, on account of lack of space for storing ore and concentrates. It is thought that repairs will be completed by the first of the month or before, so that work and shipments can be resumed.

The tramway or elevator connecting the Bingham & Garfield R.R. passenger station with the town of Bingham in Carr Fork has been finished and was placed in operation Jan. 21. The incline is about 500 ft. from the cañon to the station and the difference in elevation is about 200 ft. vertical.

The mining costs at the Utah Apex for November were $3.37 per ton. The net smeltery returns on the shipments brought $10.94 per ton on the crude ore, and $11.96 on the concentrates. For the six months ended Oct. 31, 33,037 tons of ore and concentrates were produced, on which net profits of $77,266 were made. At present the output is 175 tons of milling ore and 100 tons of shipping ore per day. A lease has been given to Kirk & Leavell on the upper workings above the 400-ft. level, including parts of the Andy, Petro, York and Minnie claims, and the Phoenix section of the property. There are both copper and silver-lead ores in this territory. About 12 men have been put to work, preparing for active operations, and a large number of applications for subleases have been received.

Deadwood

Jan. 26—The annual report of the Homestake Employees Aid Fund has been made public, showing the following receipts: Balance in treasury, Dec. 31, 1910, $9569; from employees, $33,546; from Homestake company, $12,000; interest, $224; refund, account overpayment, $30; total, $55,396. Disbursements were: Death benefits, $20,000; injury benefits, $3205; sick benefits, $7277; insane benefits, $200. On Dec. 31, 1911, there was a cash balance of $14,686.

This fund is supported by a contribution of $1 per month from each employee of the Homestake company, and the company itself contributes $1000 per month. During the last year the employees averaged about 2900, and deaths numbered 25, or four-fifths of 1%. Not all of these deaths were the result of accident about the mine or plant. The Aid Fund pays a death benefit upon the demise of any member of the fund, no matter what the cause may be. This benefit is $800. Other benefits are paid for partial and total disability, in varying amounts, and for time lost through sickness or incapacity resulting from injury, the benefit is $1 per day.

The fund is administered by a board of directors elected by the employees from among their number. T. J. Grier, superintendent of the company, is treasurer. All clerical work, office room, stationery, etc., is furnished free by the company. The idea was fostered and promoted by Mr. Grier and officers of the company, and in the matter of benefits, and low cost to the laborer, the fund is one of the most liberal of any of the benefit associations maintained by large employers in the United States.

The recent purchase by Boston men of the Gladiator property, in Deadwood Gulch, is regarded as highly important, as the purchasers are preparing to develop extensively in a district which, up to the present, has received but slight attention, notwithstanding the fact that at numerous points ore stringers, giving high assays, have been discovered. The formation is almost entirely igneous, the principal instrusive being a fine-grained phonolite. Many of the veins carry fluorite and pyrite, and it is claimed that sylvanite has been identified. The ores have a striking resemblance to the Cripple Creek, Colo., high-grade ores.

Negaunee, Mich.

Jan. 26—The U. S. Steel Corporation has issued its annual pension report. The sum disbursed during the last year by its mining department in the Lake Superior region, the Oliver Iron Mining Co., amounted to $6936. The majority of this applies to the older Michigan mines, and over one-half, or $3736, went to former employees of the old Lake Superior mine at Ishpeming. The oldest man in point of service, whose name is on the pension roll, is Capt. John McEncroe, who has been at the Lake Superior mine for 53 years. This mine has shipped ore every year since 1857, amounting to a total of over 15,000,000 tons, and is reported in the appraisal of Michigan mines, by J. R. Finlay, to be good for 20 years more.

Cobalt

Jan. 26—Surveys for the extension of the Temiskaming & Northern Ontario Ry. into the Elk Lake district are being completed rapidly and it is expected that within a month the Temiskaming & Northern Ontario Ry. Commission will be in a position to call for tenders for the construction of the line. The route has not yet been definitely decided upon, but it is understood that the choice lies between a branch from the main line near Earlton, following the general direction of the present wagon road, and an extension of the present Charlton branch, the latter involving less outlay. On the Pearl Lake branch, steel has been laid for most of the way and the line will be run as far as the Timmins mine in a few days, after which work will be suspended until spring.

Toronto

Jan. 27—In that portion of the report of the Commission of Conservation of Canada, devoted to mine accidents, it appears that the death rates in Canada and the United States are greater than in any country for which statistics are obtainable. Moreover, the fatalities in Canada and the United States are known to be on the increase, while in Great Britain, Belgium, Prussia and France, there is a gradual decrease. During the period 1900-09, the average fatality ratio per 1000 in Canadian coal mines was 4.79, whereas in Belgium the highest rate for any year during the period 1901-08 was 1.16. During the '50s, the Belgian death rate was as high as the present death rate in Canada. The steady improvement is attributed to the combined efforts of the mine owners, the workmen and the Belgian administration of mines, and the diffusion of technical and professional knowledge. A factor in reducing fatalities due to gas and dust explosions has been the work of the Belgian testing station.

Porcupine

Jan. 26—The dissatisfaction of Temiskaming shareholders over the purchase of the North Dome property culminated recently in the holding of a meeting in Montreal, for the purpose of electing delegates to the annual meeting, to protest against the action of the directors. In reality the meeting was largely the result of another attempt to overthrow the Cartwright management. At the meeting it was disclosed that the directors had acted in a legal manner when they purchased the shares of the North Dome company and that even if the present management should be forced to retire, the bargain would still be binding. It was stated that while the Temiskaming company had paid $1.66 per share for the stock, 30,000 shares had previously been offered to a firm of New York brokers for $1 per share. Two of the shareholders were delegated to secure proxies from local shareholders with a view of electing new directors, the local men to act in conjunction with the dissatisfied shareholders in Buffalo and New York.

The *Ontario Gazette* has announced the incorporation of two new Porcupine mining companies with $3,000,000 as the aggregate capital.

There has been considerable delay in the operation of the electric line from Sandy Falls on the Mattagami River to Porcupine, owing to the slow arrival of the machinery, but some of the mines including the McIntyre, Vipond and McEnaney, have secured their supply of power, and the Hollinger and Pearl Lake will soon have completed their equipment. The advent of electric power will give a stimulus to the development of the Pearl Lake district.

The Mining News

The Current History of Mining

Alaska

It is reported that a large shipment of gold dust has been received at Seward, from Iditarod. This arrived by dog team and is *en route* to Seattle.

Alaska Gold Exploration Co.—The head office of the company is reported to have been transferred from Seattle to San Francisco. Members of the company, including Joseph H. Hutchinson, Judge J. P. O'Brien, John B. Coleman and S. I. Silverman, are said to have organized a holding company under the laws of California, known as the Turnagain Arm Co., which has taken control of the properties of the Alaska Gold Exploration Co., near the terminus of the Alaska Northern Railroad.

Big Kink—Justice Van Fleet, of the Federal Court of San Francisco, has rendered a decision in the suit of William Wehner against Alexander Bauer, of Chicago, growing out of the expenditure of money in the opening of hydraulic mines and installing a plant at this property. The suit has been in the courts for 10 years. Wehner will recover $60,000.

Seward Gold—This company is planning the installation of considerable new machinery as soon as the weather permits. F. W. Isham, Seward, is manager.

Alaska-Treasure — Operations have been resumed at this mine, under the direction of T. A. Harper, Juneau, and considerable work will be done this season.

Arizona

GILA COUNTY

Miami—The orebody has been cut on the 570-ft. level by the crosscut from the main working shaft at a distance of 580 ft. from the shaft. A churn drill is being set up near No. 3 shaft, about 1500 ft. northeast of the present developed orebody, and drilling will start soon. Surface indications are considered favorable to the development of another body of ore.

Live Oak—Shaft No. 2, near the western end of the property, will be enlarged from two compartments to three, and excavation is in progress for a new and larger hoist. A new air compressor will also be erected. This shaft is 928 ft. deep and the orebody has been shown to be over 200 ft. thick at this point, with an average copper content of 2¾ per cent.

Inspiration—Contracts have been signed for much of the material to be used in construction work during the next two years. W. H. Aldridge, managing director, Dr. L. D. Ricketts, representing the controlling interests in the company, and C. H. Repath, who will design the concentrator and other works for the Consolidated company, have visited the mines recently, and an announcement of the results of the examination and conference is expected soon.

Barney—The churn-drill hole in the bottom of the 400-ft. shaft, has been started, and drilling is proceeding steadily. The hole is in silicified schist, the ore-bearing formation of the Miami district.

Southwestern Miami—Churn-drill hole No. 2 is 440 ft. deep and progressing steadily.

Schultze—This group of 16 claims, five miles west of Miami, was bonded recently by L. D. McClure and H. E. Dunn for $250,000, for Eastern people. McClure and Dunn have left for New York.

Old Dominion—The Kingdon shaft has been temporarily retimbered for 175 ft., preparatory to putting in the concrete lining, which will be done in sections.

Mineral Farm Development—This company is developing the Mineral Farm group of 21 claims, three miles northeast of Globe. At a depth of 400 ft. in the vertical shaft, a crosscut is being driven north toward two veins that outcrop prominently for several thousand feet. The surface showings are considered favorable for the presence of sulphide ore at depth. Two miners and a hoisting man are employed. Robert H. Griffith is in charge of the work.

Iron Cap Copper Co.—Directors of this company, which is the reorganized National Mining & Exploration Co., have announced that subscriptions have been received for more than $25,000 of the proposed $50,000 bond issue under the offer to stockholders of Jan. 1. The new bonds are a first mortgage on the entire property. There is a present indebtedness of about $40,000. With the new bonds it is expected to discharge the mortgage and to retire the floating debt, leaving about $10,000 for working capital.

Superior & Boston—The crosscut north from the McGaw shaft, on the 12th level, is within a short distance of the vein and is purposely being advanced slowly so as not to cut the Great Eastern vein before the arrival of 200 ft. of 12-in. pipe for the water column between the 12th and 10th levels. When this is in place, everything will be in readiness to handle any flow of water that may be encountered upon cutting the vein. The present flow is about 750,000 gal. per day, most of which comes from the upper levels.

SANTA CRUZ COUNTY

In the Montana camp, William McDermott, formerly superintendent of the United Verde and lately manager of the Twin Buttes, and Captain Hoatson, of Calumet, Mich., and Bisbee, are opening a vein carrying gold, silver, copper, lead and zinc. Part of this at least makes an attractive milling ore, and it is expected that enough of this ore will be found to warrant a good-sized plant.

Old Dominion — Messrs. Craig and Stover, representing California capital, are opening this property with a 300-ft. shaft. This is a gold *antigua*, which had a record of shipments when this country belonged to Spain, and produced some high-grade ore about 20 years ago. The new interests have a bond on the group.

Ivanhoe—James Johnson, superintendent, is now shipping ore which he states is high grade. He has had assays of 10,000 oz. per ton silver.

World's Fair—It is stated that an option has been given on this mine for $750,000 by Frank Powers and wife, owners. The ore shipments from this mine average about $12,500 per car, mostly from silver contents. Copper is coming into this vein with depth, and there is a large body of milling ore that has not been touched.

Mineral Hill—John Allen, one of the owners of this group, has just shipped 100 tons of ore that runs high in silver with some copper. This mine is an *antigua*.

Austerlitz—This mine, in the Oro Blanco, is now being systematically developed by W. J. Partridge, for Los Angeles and Nogales men. The ore carries gold and silver, and there is a large body exposed, upon which the work is being done.

Arkansas

Southwestern Mining & Smelting Co.—This company has undertaken to develop a deposit of antimony ore in Sevier County, and will put up a smelting plant as soon as sufficient ore is taken out. George B. Hall, Rochester, N. Y., is president.

California

AMADOR COUNTY

Lincoln Consolidated—A stockholders meeting will be held on Mar. 16, to consider an increase in stock.

Keystone—A large supply of lumber and shaft timbers is being received; repairing the shaft is in progress.

Central Eureka—The mill has resumed operation with 20 stamps, after two months' idleness. It is proposed to keep the 20 stamps dropping while the mine is being prospected, and to put the 20 idle stamps in commission when sufficient pay ore is developed.

South Eureka—It is reported that negotiations for the sale of this mine to an English syndicate have been discontinued. Henderson Scott, of London, who appeared for the prospective purchasers, has returned to England.

BUTTE COUNTY

Ramona Mining & Leasing Co.—This is a new incorporation capitalized at $50,000. The directors are Fred R. Daniels, W. F. Pierce of Chico, E. A. Wilmunder of Sacramento. The head office is at Chico.

Union Mining & Power Co.—Articles of incorporation have been filed; capitalization, $500,000; directors, F. L. Hutchinson, C. M. Shrader, W. F. Aram, F. M. Read and W. A. Patterson.

CALAVERAS COUNTY

Penn Mining Co.—The county board of supervisors has decided to take no present action against this company at Camp Seco; the company is experimenting in a small way upon the treatment of the smoke from its McDougal roasting furnaces, by the "thiogen process," invented by Prof. S. W. Young.

ELDORADO COUNTY

Pacific—Alexander Barring, of London, president of the Placerville Gold Mining Co., visited the mine and consulted with A. Barring-Gould as to the advisability of installing a mill. The mine is being extensively developed. The company owns mining property for a length of five miles in the Mother lode district.

FRESNO COUNTY

Reports are insistent that the recent renewed activity at Dunlap is indicative of the development of a permanent gold camp. Three of the mines in the district are reported to have developed high-grade ore, the Brushy Ridge, Lucky Boy and Rose. The situation of the camp is on Mill Creek, where there is abundant water supply. The Dunlap district has the advantage of a year of prospecting and developing without attracting undue attention. There are no well authenticated reports of operations.

Dunlap Development Co.—This company contemplates the installation of a stamp mill on the property at Dunlap. Mr. Macdonald is superintendent.

INYO COUNTY

Southern Belle—Forty tons of ore will be milled as a test run, both as to the value of the ore mined and the capacity of the mill which has been overhauled.

MARIPOSA COUNTY

Treasure—Five new stamps are being added to the mill. The plant is driven by electric power furnished by the San Joaquin Power Company.

Virginia—S. E. Lewis, former superintendent of the Crown Lead, has taken a lease on this property, purposing to develop it extensively. This is an old mine that was closed for some years on account of litigation.

NEVADA COUNTY

Coan—The deepening of the shaft for 250 ft. from the 100-ft. level, is in progress.

PLACER COUNTY

Pioneer—A large amount of ore has been mined ready for milling at this mine, near Alta, as soon as there is sufficient water.

Last Chance—The 5000-ft. tunnel through Eldorado mine ground into the Home Ticket is about completed. The Frankmount Mining Co., San Francisco, is the owner. W. S. Keith is consulting engineer.

SHASTA COUNTY

Quartz Hill—It is reported that this mine will be closed temporarily by the Mammoth Copper Co., which has been operating it under lease. The quantity of ore required to be mined by the terms of the lease has been extracted for the present period.

SIERRA COUNTY

Alaska—Machinery is on the ground to replace the power house and hoist recently burned, and the work of installing is being rushed.

Emerald—The arrastre on this group in Jim Crow Cañon has been completed and the crushing of high-grade ore has been begun by the owners, Smith & Shippsy.

Tightner—Unusually rich gold ore has been taken recently in quantity from this mine at Alleghany.

Ante Up—At this mine on the serpentine belt, near Mountain House, rich ore has been encountered while extending a new tunnel. Horace A. Morse is superintendent.

SONOMA COUNTY

Sonoma Magnesite Co.—This company is building a 12-mile railroad from its mines to Watson, on the Northwestern Pacific Ry. This gives a 70-mile haul to San Francisco. The mines will be opened in the spring, and include about 600 acres of land. The property contains both crystalline and amorphous magnesite; the former is used in the manufacture of steel and brick and the latter in the paper industry.

VENTURA COUNTY

Russell—This borax mine, on the border of Kern County, is delivering borax at Bakersfield, for shipment on a foreign contract for 10,000 tons. Sixty mules are employed in the hauling, working in relays. About 3000 tons have been delivered.

Colorado

BOULDER COUNTY

Milwaukee—This mine, at Sunnyside, is an instance of reclamation of old mines; the old workings have been placed in shape, a hoist installed and shipments commenced. There are 1200 ft. of levels driven from the main shaft.

Gold Bullion Mining Co.—This company was organized by Boulder men and capitalized for $1,500,000. A 75-ton mill, with Monell concentrators, is to be installed. The property includes the old Prussian group on Left Hand Creek, comprising the Prussian, Slide and Corning groups of 28 claims.

CRIPPLE CREEK DISTRICT

Mary McKinney—This company, that has produced about $8,000,000 from its Mary McKinney mine in 19 years, is to be reincorporated next year, according to the laws of Colorado, as its charter was for 20 years. The main oreshoot has now been reached at a depth of 810 ft., and shipments are to be begun soon.

Moose—Seventeen tons of ore from the tunnel level of the Moose mine, on Raven Hill, have lately been shipped by Frank Guan, lessee, the returns being about $100 per ton.

Elkton Consolidated—The annual stockholders meeting will be held Feb. 12, at Colorado Springs. The company is capitalized for 3,000,000 shares, of which 500,000 are in the treasury. A dividend of 1½c. per month is paid, and the gross production up to Jan. 1 was $10,000,000. E. M. De La Vergne is general manager.

Golden Cycle—The company is reported to be enlarging its mill at Colorado City, in order to take care of the contracts of the United States Reduction & Refining Company.

Union Leasing Co.—The output for December from the Gold Sovereign and Mable M. was 57 cars.

Vindicator—The December output of this mine was 100 cars, 35 by lessees and 67 on company account, the latter averaging $35 per ton.

LAKE COUNTY—LEADVILLE

Garbutt—It is reported that a high-grade streak of ore has been opened in this mine, on Bruce Hill. The mine adjoins the Little Jonny, which has long been a producer of gold.

Yak Tunnel—The ore shipments by lessees and on company account continue at about 10,000 tons per month.

Forfeit—Two cars of lead-carbonate ore per week are being shipped from this mine, in California Gulch. One shift of lessees is doing the work.

Famous—A small streak of gold ore is being mined by G. Bennet, lessee in this mine, Big Evans Gulch.

Ouray County

Camp Bird—Estimated net profit for December is £39,164; balance applicable to profit, £38,864. No. 2 drift west from winze No. 527 has been advanced 120 ft. in continuous ore of about 3 ft. average width and assaying $40 per ton.

San Juan County

Frisco Mines Co.—Charles Gagner, manager, has driven the Bagley tunnel 5800 ft., and has made a connection to surface through the Red Cloud workings; he is now seeking a proper milling system for the ores, which are lead, silver and zinc sulphides.

Highland Mary—This mine, operated by Daniel McLane and George Hill, has been shipping when conditions warranted. The mine produces argentiferous gray copper ore, averaging, crude, about $50 per ton. The orebody passes from the overlying andesite down into the schist, where good ore is developed 1200 ft. in vertical depth below the outcrop.

Summit County

Dunkin—From this lease, on Nigger Hill, near Breckenridge, a strike of carbonate-of-zinc ore, carrying gold and silver, is reported. T. H. Knorr & Co., are the lessees.

Kimberly-Wilfley—This lead-silver-zinc mine, at Kokomo, in which many Lake Superior men have been interested, has been purchased by Judge Patrick Flannigan, of Sagola, Mich., for $60,000, to protect his interests in the property. The latter includes about 100 acres of land and a partially completed mill. No dividends have been paid in recent years.

Idaho

Coeur d'Alene District

Knickerbocker—This company has finished sinking 200 ft. of winze. Good ore was encountered for the entire distance. An upraise to the surface will be driven, after which the mill will be started. The showing made thus far in the development is satisfactory.

Coeur d'Alene Standard—A contract has been let for 100 ft. of tunneling at this property, which is situated in Revenue Gulch, west of Wallace. Considerable work has already been done here and new work should help greatly in opening the orebody.

Federal—The contract for the erection of the building for the new Macquisten-tube plant has been let, and work has been started. The new equipment is expected to double the amount of zinc saved from the Morning ore.

Caledonia—Trouble with water is being met with in the first raise to the vein and has delayed the work. Three sets of contractors have given up their contracts. The main tunnel is within 250 ft. of the supposed position of the vein.

Michigan

Copper

Hancock—Sinking is going forward in the vertical shaft at a depth of about 3265 ft., having passed through the lode recently encountered and designated as No. 7. The opening made by the shaft showed the lode to be about 38 ft. thick, measured along the dip, and well mineralized throughout.

Indiana—The shaft is down about 590 ft., and is sinking in a felsite formation, showing an encouraging amount of copper. At 600 ft. a crosscut will be driven to cut the No. 9 drill hole, which revealed a good drill core at that depth. It is estimated that the drill hole is from 50 to 60 ft. from the shaft, horizontally.

North Lake—Breaking ground for a shaft has started near drill holes Nos. 3 and 7. No. 15 drill has been discontinued after sinking the sand pipe over 500 ft. in the overburden without striking bedrock.

Lake—The new shaft is down to the ninth level, where a station has been cut, and drifting will be started soon. Drifting is going on at all the levels below the third and the character of the ground being opened is fully up to any that has previously been exposed. The property is being put in shape and an early resumption of production may be expected.

Wyandot—The company will increase its operating force and will begin to open No. 8 lode, which is about 35 ft. wide and well mineralized throughout. The conglomerate recently encountered in the crosscut will be given attention as well as some of the other formations that have been exposed by the exploratory crosscut.

Victoria—Some good ground has been encountered in the new No. 6 shaft, at a depth corresponding to the 12th level of No. 2 shaft. At this level of No. 2 shaft, the east drift opened a good stretch of ground, which is probably the same as that exposed in the shaft, although the two are separated by about 2000 feet.

Mohawk—A partial shutdown is reported to have been caused by labor trouble. The point at issue relates to the proper care of rock drills and the proposal by the company to charge employees with the cost of repairs or breakage due to improper handling. The situation is not believed to be serious.

Iron

Iron River Steel Co.—This company has been incorporated recently, under Utah laws, to operate in the Iron River district. It is composed of Iron River mining men, and the following are officers: President, I. W. Byers; vice-president, W. H. Selden, Sr.; secretary, F. A. Morrison; treasurer, E. S. Coe; general manager, W. H. Jobe. The directors are I. W. Byers, W. H. Selden, F. A. Morrison, E. S. Coe, W. H. Jobe, Dr. E. M. Libby, N. E. Fisher, E. J. Van Ornum and Joseph Konwinski. The capital stock is $300,000. W. H. Jobe has resigned as district superintendent of Pickands, Mather & Co., to become general manager of the new organization.

McGreevy Iron Co.—This company has recently been incorporated under Utah laws, to operate in the Iron River region. Following are the officers: President and manager, J. C. McGreevy, of Duluth; vice-president, Capt. J. N. Porter, of Iron River; secretary, John B. Weimer, of Iron River; treasurer, A. E. Neff, of Gladstone. The directors are: J. C. McGreevy, Capt. J. N. Porter, John B. Weimer, A. E. Neff and James D. Pardee, of Salt Lake City. The company has options on the southwest quarter of Sec. 27—T. 43 N.—R. 35 W., and the northwest quarter of the northeast quarter of Sec. 34—T. 43 N.—R. 35 W. The former tract was held until lately by the Oliver Iron Mining Co., and adjoins the Buckholtz property of the Iron River Ore Co.; the latter tract lies just south of the Buckholtz and north of the Cortland property of the Wickwire Mining Co. Drilling will be carried on for the company by the Cole & McDonald Exploration Company.

Huron Mining Co.—At the Groveland mine of this company, four miles east of Randville and 24 miles north of Iron Mountain, the old shaft has been sunk to the fourth level; a crosscut will be driven to the new shaft and connected by raising. Exploration work continues at the McDonald property, at Crystal Falls; the shaft has been sunk to the fourth level, and a crosscut will be driven to the ore. At the company's Youngs mine, at Iron River, a winze is being sunk to the sixth level. At the Sec. 26 exploration, in the village of Iron River, a concrete dam is being put in on the first level, to catch surface water; sinking will be commenced soon. The river near-by makes the water problem a serious one. J. P. Diederichs is mining engineer for the Huron Mining Company.

Minnesota

MESABI RANGE

Nashwauk—This mine, which is operated by the International Harvester Co., has closed down operations for the season, on account of severe weather conditions. B. W. Batchelder, superintendent, is in charge of the mine and of the new washing plant, which will be in operation at the commencement of the next season's work. Practically the only properties where stripping operations are being carried on are those operated by the Oliver Iron Mining Co., under the Hill lease.

Great Northern Ore—The annual report for the year ended Dec. 31, 1911, shows: Dividends, $2,365,434; surplus for year, $1,539,242; total surplus, $1,572,073. Under "old leases," the report shows: Tons mined in 1911, 1,758,182; average royalty, 17.3525c.; revenue, $305,089. Under Great Western Mining Co., the following figures were given: There were 5,344,078 tons shipped averaging 58.21% iron, on which the average royalty was 94.5c., and 155,681 tons, averaging 49% iron, on which the average royalty was 30c. per ton.

Montana

BUTTE DISTRICT

East Butte—With a view of increasing its output to about 1,500,000 lb. per month, the company is making additions and improvements in its smeltery. It is planned to enlarge one of the furnaces by adding to its length, which is expected to give it a capacity of 500 tons of ore per day, and the plant a total capacity of 750 tons per day. The material for another 250-ton furnace has arrived and will be erected soon.

North Butte—During the last quarter, stations and skip chutes were completed on the 2600- and 2800-ft. levels of the Speculator shaft. Crosscutting has been started north and west on the 2600-ft. level and north and south on the 2800-ft. level. The south crosscut on the 2800-ft. level has encountered vein matter which seems to be part of the vein encountered in the shaft above the 2800-ft. level. A total of 4103 ft. of opening work was done during the quarter, in raising, sinking, drifting, crosscutting and station-cutting.

JEFFERSON COUNTY

Boston & Corbin—The ore in the drift on the 1200-ft. level is high-grade copper sulphide. A raise has been started from this level to open the ore to the 900-ft. level and to furnish air connections. A station is being cut on the 1300-ft. level, and a crosscut will be driven to tap the Bertha vein. Sinking will be resumed to the 1500-ft. level, a distance of 150 ft. from the present sump.

MADISON COUNTY

Glenn—W. C. Hosking, of Missoula, associated with Missoula, Helena and Duluth men, has taken over this group of mines between Rochester and Camp Creek, the price being $35,000, and work will be started in about two weeks. The claims are the Madison, Star and Blue Jay gold properties.

Nevada

COMSTOCK LODE

Ward—Good progress is reported in the Gold Hill drainage plans, the old north drift from the Bullion incline on the 2000-ft. having been entered for a distance of 150 ft., where further progress was prevented by a cave. Air is being forced into the workings by means of blowers, and the cave will be cleared away at once. The old bulkhead, which is the objective point, is about 600 ft. to the south, and it is believed it will be reached soon, when diamond drilling will be started from that point. All the territory to the north of the bulkhead has been well drained, and only a limited flow of water is now noted in the Gold Hill drainage drift.

Mexican—The new mill is running on about 50 tons per day and the heads are being gradually increased in grade. During the cleanup to be made, Feb. 1, a larger classifier will be installed, which is expected to bring the capacity up to 100 tons per day. A high percentage of extraction is being secured.

Belcher—Extensive preliminary work continues for future operations below the 1400 level. At the 1400, ground is being broken down over the incline shaft, preparatory to timbering for a large station. The blower station has been completed and foundations are now being constructed for air compressors. Low-grade ore is being extracted from north drift No. 2, on the 1400 level.

ELKO COUNTY

Bourne—The mill is running steadily and is treating about 45 tons of ore per day. The grade of ore is improving and the shipments of bullion have increased. Development work is going on in the mine with the result that more ore is being blocked out.

Pavlak—The mill is treating a good grade of ore. In the mine connections are being made to improve the ventilation and these will be completed soon.

Buckeye—The company has bought off the contractor who had charge of the development work on this property and it is expected that the Syracuse, N. Y., men, who have an option on the property for $250,000, for 75% of the stock, will now take hold The vein is showing a large quantity of milling ore with streaks of high grade.

Bluster-Success—At these properties which are under option to George Wingfield, about 30 miners are employed. Four tunnels on the Success have been driven on the vein, all showing good milling ore with a fair amount of high grade. At the Bluster the crosscut tunnel will soon cut the vein at a depth of about 300 ft. Good ore has been uncovered on both properties.

Alpha—This and the Flaxie, two of the large properties in the camp, are under option. Development work is being carried on.

ESMERALDA COUNTY

Goldfield Consolidated—The production and operating expenses for the year 1911, are reported by dispatches as follows: Tons milled, 330,062; value, $10,586,936; tons shipped, 487; value,, $173,262; total production, 330,549 tons; total value, $10,760,198; loss in tailings, $597,071; realized, $10,163,127; net operating expenses, $2,498,450; operating profit, $7,664,677; deductions, $137,831; net operating profit for year ended Oct. 31, 1911, $7,526,846; amounting to 69.95% of the total production. For the year ended Oct. 31, 1911, the total earnings were $9,890.029; expenses, $2,363,183; and $7,526,846 operating profit after depreciation. The ore reserves on Oct. 31 are given as 600,000 tons, value not stated, but Superintendent Thorn states that the latter will be somewhat lower than in the past.

NYE COUNTY

Tonopah ore shipments for the week ended Jan. 18 were: Tonopah Mining, 3500 tons; Belmont, 2350 tons; Montana-Tonopah, 1015 tons; Tonopah Extension, 948 tons; West End, 700 tons; total, 8513 tons. Estimated value of shipments, $212,825.

Round Mountain Tungsten Mining & Milling Co.—The power line is reported to be completed and the transformers placed. Ore is being taken from the mine under the direction of Frank Anderson. The milling will be in charge of C. A. Homer.

Nevada Leasing & Ore Purchasing Co.—A meeting of the company will be held in Los Angeles soon to raise funds for remodeling the mill to suit the requirements of ordinary amalgamation and concentration. Stamps may be adopted for crushing. It is proposed to place the new mill on Ladd Mountain, at Rhyolite.

WHITE PINE COUNTY

Nevada Consolidated—Three oil-fired reverberatory furnaces are reported to be in operation at the Steptoe plant. The plant includes five furnaces, but the change to oil fuel has increased the capacity so that now one and sometimes two furnaces can be held in reserve. The new pumping plant is said to be working well.

New Mexico

Sante Fe County

Santa Fé Gold & Copper—On Jan. 1, the company had $27,984 in the treasury as compared with $38,832 on the corresponding date last year. President Westervelt has stated that both smeltery and mine have been idle during the year, as it was not deemed advisable to start operations on account of the high cost of coke and supplies. Ore reserves are said to be ample for four years. Treasurer Westlake says that expenses during the last year amounted to $13,280.

Sierra County

Rebate Mining Co.—The company is enlarging the engine and boiler room. Some extensive mining is being done, the shaft being down nearly 400 feet.

Dude Good Luck—At the property about six miles south of Lake Valley a new steel headframe is being erected. It is said that the 300-ft. shaft will be sunk to the 500-ft. level.

Socorro County

Ozark Smelting & Mining Co.—This company is the owner of the Graphic mines, and is a subsidiary of the Sherwin-Williams Paint Co.; a large tonnage of low-grade, complex, zinc-lead-iron sulphide ore is being developed. Experimenting with a flotation process is being done to find the best method of separating these ores.

Oregon

Dixie—About 50 tons of concentrates are reported to have been shipped to Salt Lake City recently, from this mine, 12 miles north of Prairie City, Grant County. Additional equipment will be installed.

McGuire—This hydraulic property in the southern part of Josephine County has been purchased by Daniel Hearne, of Grants' Pass, who is planning to operate it on a larger scale this spring.

Vanguard—Operations at this mine near Kerby, Josephine County, are to be resumed soon, with Samuel Bowden in charge. The camp is to be overhauled and new equipment installed as soon as possible.

Major Gilsan—This property in Baker County has been bonded to Marie Gifford, of Oakland, Calif., and considerable development work will be done.

South Dakota

Black Hills District

Gladiator—Boston men have purchased this property from the owners, Burt Rogers, R. N. Ogden and the estate of W. L. McLaughlin, of Deadwood, and will inaugurate a thorough and systematic plan of development in the spring.

Golden Crest—The funds realized from the recent assessment of 10c. per share will be used in paying off judgments which were secured last fall against the corporation.

Homestake—During 1911 the mines yielded 1,514,035 tons of ore from which bullion was recovered, worth $6,040,000. During the year $1,310,400 were paid in dividends, and large disbursements were made on account of the Spearfish hydro-electric plant.

Iron Creek Placer Mining Company—This company has been incorporated to install a hydraulic plant on Iron Creek, in western Lawrence County, and will start work early in the spring. Columbus, Ohio, men are furnishing the capital.

Utah

Beaver County

Red Warrior—Over four feet of carbonate ore has been cut on the 500-ft. level. The strike is regarded as important, indicating the continuance of pay ore on the deeper levels.

Horn Silver—The orebody on the 400-ft. level has been followed for 40 ft., and continues to open. Raising is being done on the ore and shipments are in progress.

Beaver Gold—This property, in the Newton district, has a shaft 50 ft. deep, and a vein of gold ore has been opened. The property is three-fourths of a mile north of the Sheep Rock.

Iron County

Gold Springs Mining & Power Co.—It is understood that arrangements for reorganizing or financing the company are being made in the East.

Bull Hill—This property is near the Gold Springs district, northwest of Modena, and 1¼ miles east of the camp of Fay. A tunnel is reported to have cut a large quartz vein, carrying some gold and silver.

Juab County

Tintic shipments for the week ended Jan. 19 amounted to 179 cars.

May Day—More cars are available and shipments have been resumed. During the last week six cars were marketed.

Chief Consolidated—Shipments of high-grade ore running up to 135 and 260 oz. silver per ton have recently been made. Conditions are reported to be improving. Small net earnings are being made.

Gold Chain—There has been an improvement on the 700-ft. level. During the last week production was increased, and 12 cars were marketed. The 300 and 400 levels also have a good showing of ore. Operations are on a more efficient basis since the installation of new equipment.

Eagle & Blue Bell—A body of shipping ore has been opened on the 1300 level, and has been followed for 200 ft. A full face of lead-carbonate ore has been opened on the 700. The territory now being prospected is in the northern section and it is here that the new shaft is being sunk from the 1000 to the 1300.

Sioux Consolidated—The annual report has been mailed to stockholders. Ore sales for the year ended December, 1911, totaled 7884 tons, bringing $78,244, and dividends of $89,446 were paid. Including cash on hand at the beginning of the year, the total receipts were $160,654. Disbursements amounted to $159,940, leaving cash on hand, $714. The shaft was sunk 130 ft. during the year, making the present depth 600 feet.

Santaquin Chief—A vein carrying lead-silver ore has been cut in a short tunnel. In following this vein, a cross fissure carrying zinc ore was opened.

Salt Lake County

Montana-Bingham—The main tunnel, which is being driven toward the Bingham Amalgamated, is in about 900 ft., the greater part of this distance being in quartzite, which shows occasional copper stains.

Bingham-New Haven—A report recently issued shows that during 1911, 85,426 tons of ore were shipped and sold for $838,780. The net earnings were $546,446. Dividends of $228,689 were paid, all debts canceled and $133,128 charged off for depreciation. At the close of the year there was $188,565 cash on hand. During the last year the ore averaged 4.65%.

Tooele County

Bullion Coalition—Work is being done both on company account and by leasers. Ore is being mined from the 1600-ft. level and above, and is reported to run well in lead and silver. The company is earning more than expenses.

New Stockton Mining & Milling—Work has been started on the old Ben Harrison mine by Campbell & Reese, who have taken a lease and bond.

Wisconsin

Winskell—This mine, at Shullsburg, is working a breast of ore 45 ft. high and 120 ft. wide, and is one of the largest producers in the field since outside interests secured it.

Fox—This mine, at Benton, owned by the New Jersey Zinc Co., has a face of ore 410 ft. wide by about 20 ft. high.

Cleveland—This mine, at Hazel Green, which was thoroughly drilled before the shaft was started in old lease diggings, has one of the finest plants in the district. The ore face is 75 ft. high and 100 ft. wide, and the concentrates run 50 to 54%. Some of the ore sheets are 1 ft. thick.

Canada

ONTARIO

Ophir Consolidated Mines Co.—This company has been organized, with $5,000,000 authorized capital, and head office in Toronto, to take over the old Ophir property, Lake of the Woods, and to operate it on a more extensive scale.

ONTARIO-COBALT

Cobalt shipments for the week ended Jan. 26 were as follows: La Rose, 130,580 lb.; Cobalt Townsite, 130,580; Nipissing, 70,500; McKinley-Darragh, 63,600; Hudson Bay, 62,840; Buffalo, 58,920; Crown Reserve, 45,900; total, 562,920 pounds.

Doctor Reddick—The stamp mill is steadily in operation at this Larder Lake mine, all the ore extracted being put through. When the orebody is sufficiently opened a Hardinge mill will be added to the plant.

Harris-Maxwell—A 40-stamp mill is being erected on this property at Larder Lake. It is expected that hydro-electric power will be available early in April.

British-American—A reorganization of this company is being undertaken. The capital will be reduced from $2,500,000 to $1,000,000, of which $200,000 will be preferred stock to be issued to shareholders at 5c. per share.

Calcite Lake Mining Co—This company at Elk Lake has been fined $100 and costs for a breach of the Mining Act. On Dec. 26 Sigmund Terdk, a miner, fell out of a bucket in the shaft and was killed. the accident being caused by the striking of the crosshead in the shaft. An investigation by the mine inspector showed that the mine was not equipped with a safety appliance so arranged that on the crosshead sticking the bucket would also stop. The company made no defense.

Trethewey—The output of this mine during 1911 totaled 716,464 oz.; $273,486 total value.

Crown Reserve—The annual report for 1911 shows: Value of the production for the year, $1,833,516; net profits, $1,279,739; dividends, $1,061,288; total surplus, $764,851 and $500,000, estimated value of ore on dump.

Wettlaufer-Lorrain—The report for the year ended Dec. 31, 1911, shows that 925,017 oz. of silver were shipped, having a net value of $464,901. The cost, including equipment expenditures, was 19.89c. per oz. Profits were $313,390. A new orebody, recently opened, is expected to add materially to the reserves. The company has acquired an option on the Keeley mines and the Silver Eagle and has purchased outright an undivided one-tenth interest in the Curry silver mines.

ONTARIO-PORCUPINE

Jupiter—Good ore has been discovered on the 200-ft. level of No. 2 vein. The vein is about 4 ft. wide.

Night Hawk Lake—This company has commenced operations on its newly acquired properties in Langmuir Township.

East Dome—Work has been started on these claims and a small plant will be installed.

Northern Ontario Exploration—A crosscut from the shaft at No. 1 camp at the 150-ft. level has encountered a 5-ft. vein. At the 100-ft. level this vein was 1 ft. wide.

Schumacher—A series of testpits are being put down on a gold-bearing quartz vein that has been stripped for 250 feet.

West Dome—In No. 3 shaft, 10 ft. of mineralized schist carrying sulphides have been cut at the 100-ft. level, being the same shoot that dipped out of the shaft at 75 feet.

Dome Extension—Gold-bearing stringers have been encountered at 90 ft. in No. 4 shaft and in drifting on the 100-ft. level from No. 8 shaft.

Dome—The stamp batteries and tanks are in place at the mill. The new compressor is working and good progress is being made in blocking out ore on the 50-ft. level.

Porcupine Gold—The 12-drill compressor is running with power from Sandy Falls, operating six drills. No. 3 vein at the 200-ft. level has been cut and found to be 20 ft. wide, with ore similar to that on the 100-ft. level. No. 2 vein has been drifted on for 120 ft. at the 200-ft. level. Raises will be commenced soon to block out the ore.

Mexico

CHIHUAHUA

San Toy—For the year ended Dec. 31, 1911, the gross receipts were $769,525; net, $496,493; dividends, $360,000, and $136,493 surplus.

JALISCO

Mololoa—During 30 days recently the company shipped 120 tons of rich ore to the Aguascalientes smeltery. A thousand tons of this ore went to the El Favor plant for milling, and a silver extraction of 86% and a gold extraction of 98% were obtained by cyanidation. A reduction plant will be built by the company.

El Favor—Sixty drillers are at work on the upper levels, stoping high-grade ore for shipment to the San Luis Potosi smeltery. One hundred mules are in service packing the ore to Magdalena, the shipping station. The seventh level is being driven east with the expectation of opening bodies of sulphide ores.

Casados—Shipments of high-grade ore from the Casados mine, of the Consolidated Mining Co., have been resumed. The ore shipped is taken out in the course of development, no stoping being done. Much development has been accomplished during the last few months.

Espada—The company has a large tonnage of high-grade milling ore ready for the Marquetas mill, which is under lease. An aërial tramway from the mines to the mill has been completed, and milling will be in progress soon.

Magistral—A drift on the second level has opened an oreshoot 10 ft. wide, averaging from 7 to 8% copper. Some of the ore runs higher. A crosscut from an old drift has cut the same shoot, 70 ft. ahead. The company has resumed sinking the double-compartment shaft.

Almoloya y Anexas—A new oreshoot has been opened in this mine, and the company's small concentrating plant is again in operation. The ore runs from 4 to 5% copper.

MICHOACAN

Dos Estrellas—This company produced in 1911 ore worth approximately 11,000,000 pesos. Definite reports for 11 months show a production of 10,067,697 pesos from 435,317 tons of ore milled. The best month was June, when the output reached a value of 1,175,120 pesos. In March and September, the output also exceeded 1,000,000 pesos. The profits during the 11 months reached a total of 5,563,487 pesos. During the year 6,000,000 pesos were paid in dividends.

South America

CHILE

Braden—The old mill has been increased in capacity, and since Aug. 1, 1911, has been treating about 350 tons per day. The normal capacity of 500 tons is expected to be reached soon. The new mill has been in operation with three units for two months, each unit treating 500 tons per day. The second section was to have been completed in January, and the third in February. The blast furnace is treating concentrates, and the converter will soon be turning out blister copper. The experimental lixiviation and electrolytic plant is well advanced. Three of the six units of the hydro-electric plant are in operation and are transmitting to the mine, 25 km. distant. The electric railway connecting the mine and reduction plant has been working satisfactorily for some time. About 3000 men are employed at present.

Africa

WEST AFRICA

Gold production of the Gold Coast and Ashanti is reported by the West African Chamber of Mines for the year ended Dec. 31 at 185,493 oz. bullion in 1910, and 261,784 oz. in 1911; an increase of 76,291 oz. The bullion reported in 1911 was equal to 251,560 oz. fine gold, or $5,199,752 in value.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Jan. 31—Interest in the West seems to be centered on the Indianapolis meeting. The miners have definitely asked for an increase of 10c. per ton on the wage scale and for shorter hours. A conference is now going on between committees composed of eight miners from each of the districts—Western Pennsylvania, Ohio, Indiana and Illinois—and of eight operators from each district. The matter was complicated a little by the demand of the operators from the Fifth and Ninth districts of Illinois to be considered a separate division, apart from the rest of the state. The outcome of this conference is quite uncertain.

Trade is rather more normal, though there is still much complaint about the slowness of transportation and difficulty in obtaining cars. The same conditions rule in the East. Stormy weather has also delayed the coastwise trade materially.

It is reported that British dealers are seeking options on large quantities of West Virginia coal, which may be needed in case of a general strike of the British miners.

Coal and coke carried over all lines of the Pennsylvania R.R. east of Pittsburg and Erie, year ended Dec. 31, short tons:

	1910	1911	Changes
Anthracite........	11,596,233	11,957,149	I. 360,916
Bituminous......	41,497,912	42,419,445	I. 921,533
Coke..............	12,822,695	10,639,107	D. 2,183,588
Total............	65,916,840	65,015,701	D. 901,139

The increase in coal was 2.4 per cent., and the decrease in coke 17 per cent.; the total showing 1.4 per cent. decrease for the year. In 1911 anthracite was 18.4 per cent. of the total tonnage; bituminous, 65.3; and coke, 16.3 per cent.

IRON TRADE REVIEW

New York, Jan. 31—Conditions have changed little in the iron and steel markets. A fair business is being transacted, though less than in the December spurt. Prices have not improved much, in some lines not at all. Specifications on contracts are coming in well, and mills are generally busy. Several large orders for rails have been placed.

In pig iron a moderate business has been done. Foundry and basic iron especially have been in demand. Prices do not advance; in the Central West, especially, there seems to be a general move to hold down the merchant furnaces to present quotations.

The owners of the Great Northern ore lands have filed their individual answers in the suit against the Steel Corporation, to which they were made parties. They claim that their leases were simply business transactions, made without any desire or intention to aid or establish monopoly.

A semi-official statement says that in 1911 the United States Steel Corporation made approximately 10,750,000 tons of pig iron and 12,770,000 tons of steel ingots. The output of finished steel products was about 10,250,000 tons. This shows a decrease from 1910 of about 1,080,000 tons of pig iron and 1,400,000 tons of steel ingots.

The bill amending the tariff on iron and steel has passed the House of Representatives by a large majority, a number of the insurgent Republicans voting for it with the Democrats. Practically no amendments were made to the bill as introduced.

United States Steel Corporation—The statement for the December quarter is as follows, net earnings being, as usual, the balance after paying operating expenses and ordinary repairs; comparisons are with the December quarter of 1910:

	1910	1911
Net earnings	$25,990,978	$23,105,115
Depreciation and replacement funds	$5,528,518	$3,126,594
Interest and sinking funds........	7,311,963	7,311,963
Total charges..	$12,840,481	$10,438,557
Surplus	$13,150,497	$12,666,558
Adjustment of accounts	83,766	81,780
Surplus for the quarter	$13,066,731	$12,748,338

From this surplus in 1911 appropriations were made for dividends on preferred, $6,304,919; common stock, $6,353,781; total, $12,658,700, leaving an undivided balance of $89,638 for the quarter. No appropriations were made for new work. This statement completes the year, making the net earnings $104,355,563 for 1911, against $141,143,941 in 1910; $131,479,975 in 1909, and $91,847,710 in 1908. After payment of preferred dividends in 1911, the balance was equal to 5.9 per cent. on the common stock.

Pig-Iron Production—Pig-iron production in 1911, as reported by the American Iron & Steel Association, was 23,649,344 gross tons, agreeing closely with the forecasts. This was a decrease of 13 per cent. from 1910, the record year, and 1911 yields in tonnage to 1906, 1907, 1909 and 1910. Bessemer pig iron decreased 16 per cent., and basic pig iron 6 per cent., which is quite in alignment with the precedents, as bessemer steel has been steadily losing ground ever since the basic openhearth process appeared. From the pig-iron figures it may be estimated roundly that production of bessemer steel ingots and castings in 1911 was about 8,000,000 gross tons, and of basic openhearth steel ingots and castings about 14,000,000 tons, indicating, with allowance for 1,000,000 tons of acid openhearth steel, and perhaps 250,000 tons of miscellaneous steel, a grand total of steel ingots and castings for the year of about 23,000,000 tons.

Baltimore

Jan. 29—Exports for the week included 219,800 lb. iron ore to Leith, Scotland; 43,300 lb. lead and 5,386,854 lb. miscellaneous iron and steel to Panama. Imports included 60 tons spiegeleisen and 3739 tons ferromanganese from Liverpool; 6500 tons manganese ore from Bombay, India; 6700 tons iron ore from Cuba; 52 casks barytes from Bremen.

Birmingham

Jan. 29—There is a little business still being transacted by Southern iron manufacturers, one trade during the past week being reported at 26,000 tons, delivery extending over six to eight months. The prices are around $10.25 per ton, No. 2 foundry, and there is considerable firmness at that figure. Inquiries are being received which indicate there will be need for a large tonnage of iron before the year is out. The production is still off. During this week the Sloss-Sheffield Steel & Iron Co. will blow in a furnace to replace the one which met with an accident last week and which will be out of the running for several months. There will be no effort made to increase the make until the demand is stronger. While there has been considerable iron sold ahead, there is not a great tonnage disposed of for immediate delivery. As far as can be learned, there has been no trouble experienced in making deliveries in this section of the country. The weather has not been so bad either as to affect the outdoor work to any great extent.

Southern manufacturers are still

worrying in reference to the freight rates and are hoping for relief through the Interstate Commerce Commission. During the past week representatives of the Interstate Commission sat in New Orleans and heard the complaint raised at that place anent the rate of $3 out of the Birmingham district. Shortly there will be filed with the commission a request to bring about a reduction of at least $1 per ton in rates from the Birmingham district to the Ohio gateway points. The consumers from the Middle West have joined with the independent iron makers in the South in the effort to get a reduction in rates.

Announcements are made of more orders for steel rail. The steel plants are doing well. There is a slight improvement in steel-wire products, and prices are up.

Chicago

Jan. 29—Quiet conditions continue in the iron market, with a waiting mood evident in both buyers and sellers of pig iron and finished products. The sales of pig iron in the last week have been encouraging; two or three contracts have been for more than 1000 tons, but in general the foundry melter on whom this market depends is buying in small quantities and often.

Sales of pig iron are mostly for first-half delivery, with an increasing though small number running into third quarter and last half. No. 2 Southern still sells for $10 Birmingham, or $14.35 Chicago, as a minimum, and No. 2 Northern for $14. There are some large inquiries out which may make large sales in a few days. The market for Lake Superior charcoal iron has been depressed in the last week, the quoted price of $16.50 having been shaded 50c.@$1, but effect on the coke foundry-iron market has been small.

For iron and steel products the market continues to be fairly good. Structural material shows a good aggregate tonnage each week. Railroad supplies continue doubtful, though one purchase of 2500 tons by a Chicago transfer line has given the market an appearance of activity.

Soft steel bars, for some time the weak point in the local market for finished products, are selling at 1.25@1.33c. Chicago, these prices cutting out Pittsburg competition almost wholly. Plates are quiet and sheets active, at unchanged prices. Billets show no change. Wire products sell lightly as a result of the recent advance in price.

Philadelphia

Jan. 31—Active interest in the pig-iron market has temporarily subsided and makers express satisfaction with the outcome of the business of the first month of the year. No unusual development is now looked for until near the time when buying for the second quarter will be necessary. Makers are a little concerned at the efforts of two or three Southern concerns to get second or even third-quarter business. Low-grade iron for pipes, however, keep selling well and some exceptionally large orders have been placed with more in sight. Central Pennsylvania furnaces are already low in stocks. On the whole pig-iron consumption is increasing. No. 2 X foundry is around $15 for both Northern and Southern. Forge sold at $14.25; basic quoted at $14.25 per ton.

Steel Billets—The week has passed without notable transactions. Open-hearth is quoted at $22.40 delivered, with business in sight; forging billets around $27 with the usual hand-to-mouth sales.

Bars—Operations at mills have not been seriously interfered with—but cold weather has interfered with deliveries. Jobbers are still sorting up.

Pipes and Tubes—A general improvement in tubes has set in but only for urgent wants.

Plates—Some of the largest inquiries for some time have been gone over within a week. The local and all eastern shipyards have been good buyers; car-building orders have helped out. Quotations 1.30@1.35c. New business is offering daily.

Structural Material—New business covered a dozen or more orders for early delivery chiefly.

Scrap—With better weather the scrap yards will be filled up from country sources. The week's sales show an improvement.

Pittsburg

Jan. 30—Conditions in the iron and steel trade have shown no material change from a week ago. If there has been any change at all, it has been in the direction of slightly more pronounced quietness. This is a disappointment to the trade, which, before the holidays, looked for a continuance of the activity which marked November and the fore part of December, while, furthermore, when quietness set in just before the holidays, the expressed expectation was that the fore part of January would be quiet, with a general loosening up in the second half of the month. This has certainly not occurred.

Apparently the only cases in which there has been an improvement during January has been in the case of steel mills which insisted upon closing strictly upon the date the contracts they had expiring Dec. 31, such mills naturally experiencing a lull in the early part of January, with which the latter part makes a favorable comparison. Other mills, which did not construe contracts so closely, have seen no material improvement during the month, and in some cases the specifications received in the second half of the month have not been as heavy as in the first half.

Prices of finished-steel products have shown no material change in the week. They are fairly well maintained all along the line, but slight weaknesses in plates and sheets, already observed, are a trifle more pronounced. Hoops are being sold by two of the local producers at 1.25c., in the case of attractive orders, while the leading interest adheres to 1.30c. The important contracts with large consumers, of course, were made at less than 1.30c.

Pig Iron—A Cleveland consumer has purchased 10,000 tons of basic iron, for delivery over the next three months, at $13.15, delivered. Half came from a Cleveland furnace with a 25c. rate and the other half from a Sharpsville furnace at a 90c. rate, making the price at Valley furnace $12.25, and this may now be quoted as the minimum of the market. Some odd lots have been sold at about 5c. concession from the usual asking price of $12.50. Bessemer iron is definitely quotable 25c. lower, on the basis of one or two sales recently made at cut prices, but small lots still bring $14.25, Valley. Foundry iron is quiet, but there is no particular effort to sell and the price is maintained. Malleable iron is distinctly firmer. We quote: Bessemer, $14@14.25; basic, $12.25@12.50; foundry, $13@13.25; malleable, $13@13.25; forge, $12.50@12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Steel—Two mills in Youngstown are ready to sell bessemer billets and sheet bars, and the market is lower as compared with the nominally advanced prices recently quoted, $20 for billets and $21 for sheet bars, Pittsburg. The leading Pittsburg producer is entirely out of the market, but another Pittsburg producer would probably sell some tonnage. We quote bessemer billets at $19 and bessemer sheet bars at $20, Youngstown, quotations for Pittsburg on both bessemer and openhearth being $19.50@20 for billets and $20.50@21 for sheet bars. Rods are quotable at $25, Pittsburg, with occasional quotations at $26 per ton.

Ferromanganese—The market continues quiet. The price is well maintained but very little interest is manifested. We quote $41, Baltimore, for prompt and forward, freight to Pittsburg being $1.95 per ton.

Sheets—The occasional shading already noted has increased somewhat, and on desirable orders some of the mills are regularly cutting the openly recognized prices $1 a ton. Tonnage is good with some mills but poor with others, the market being in an unusually mixed condition. We quote regular prices at 1.90c. for black, 2.90c. for galvanized, 1.40c. for blue annealed, $1.33@1.35 per square for painted corrugated and $2.47@2.50 for galvanized corrugated.

St. Louis

Jan. 30—The market continues to improve slowly, both for pig iron and finished products. Pig orders are rather larger in quantity, as a rule. Northern No. 2 foundry sells at $14.50@15, St. Louis. Southern No. 2 is held at $10.25, Birmingham, or $14, St. Louis. The bulk of the business has been in Southern iron.

Sault Ste. Marie Canal Traffic

The total business of the Sault Ste. Marie canals for the season is reported as below. All freights are in short tons, except salt, which is in barrels. Mineral freights are included in the totals:

	1910	1911	Changes
Freight carried..	62,363,218	53,477,216	D. 8,886,002
No of vessels.....	20,899	18,673	D. 2,226
Average cargo....	2,983	2,865	D. 118
Minerals			
Coal	13,513,727	15,332,876	I. 1,819,149
Iron ore	41,603,634	30,731,235	D. 10,871,399
Pig and mfd. iron	444,669	412,269	D. 32,400
Copper	148,070	132,481	D. 15,589
Building stoe.....	9,635	5,342	D. 4,293
Salt, bbl..........	528,610	764,308	I. 135,698

In 1911 there were 11,870 vessels passed through the American canal and 6803 through the Canadian. The American canal was open Apr. 24 to Dec. 16, or 237 days; the Canadian, Apr. 22 to Dec. 13, or 238 days.

Iron Ore Trade

The Canadian-Venezuelan Ore Co., of Montreal, has so far advanced in the work on its Imataca iron-ore deposits on the Orinoco River, in Venezuela, that it will be able to ship from 10,000 to 15,000 tons monthly. The ore is a hard hematite, running about 65 per cent. iron, 0.035 to 0.045 phosphorus and 2.5 to 3 per cent. silica. It is being offered to Eastern furnaces on the basis of about 8c. per unit. Naylor & Co., of New York, are the sales agents for the United States. Some sales of trial lots have been made.

British Iron and Steel Trade

Exports and imports of iron and steel, and of machinery, in Great Britain, year ended Dec. 31, are valued by the Board of Trade returns as below:

	Exports	Imports	Excess
Iron and steel	£43,751,618	£11,144,211	Ex. £32,607,407
Machinery...	30,977,408	6,769,274	Ex. 25,208,134
Cutlery and hardware..	10,221,680	6,708,637	Ex. 3,513,043
New ships....	5,662,045	....	Ex. 5,662,045
Total..... ..	£90,612,751	£23,622,122	Ex. £66,990,629
Total, 1910..	91,544,552	19,917,125	Ex. 71,627,427

Decrease in exports, £931,801; this was entirely in new ships. Increase in imports, £3,704,997, almost entirely in crude iron and steel. The quantities of iron and steel exports and imports were, in long tons:

	1910	1911	Changes
Exports	4,588,009	4,579,109	D. 68,900
Imports	1,367,343	1,764,489	I. 397,146

Tinplate exports to the United States decreased from 73,619 tons in 1910 to 13,997 tons last year.

METAL MARKETS

New York, Jan. 31—The metal markets have not been especially active, and no important changes are noted.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Dec. 1911..	$ 994,677	$ 4,707,330	Exp. $3,712,565
" 1910..	1,330,400	4,976,632	Imp. 3,646,232
Year 1911..	37,183,074	57,445,184	Imp. 20,262,110
" 1910..	58,774,822	59,222,518	Imp. 447,696
Silver:			
Dec. 1911..	6,997,360	3,306,727	Exp. 2,690,630
" 1910..	6,061,060	4,398,450	Exp. 1,662,618
Year 1911..	65,664,646	43,746,571	Exp. 21,918,073
" 1910..	57,360,973	45,878,168	Exp. 11,482,805

Exports from the port of New York, week ended Jan. 27: Gold, $160,200; silver, $786,998, chiefly to London. Imports: Gold, $499,910, principally from Mexico; silver, $92,858, largely from Central and South America.

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was some demand for India and Egypt. In New York $500,000 gold was taken for Costa Rica, on French account.

Platinum—The market is a little unsettled, but prices are unchanged. Dealers still ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal.

Our Russian correspondent writes, under date of Jan. 18, that the market is unchanged. The present uncertain position is believed here to be the result of a struggle between the foreign refiners and the Société Industrielle de Platine, which controls about 55 per cent. of the Russian production. Current prices are 9.95 rubles per zolotnik—$37.41 per oz.—for crude metal, 83 per cent. platinum, at Ekaterinburg; and 38,500 rubles per pood—$37.73 per oz.—for the same grade at St. Petersburg.

Silver—The better outlook in the China situation, together with the demand from India, indicate a reasonable probability that silver may show some advance from present quotations.

SILVER AND STERLING EXCHANGE

Jan.	25	26	27	29	30	31
New York....	57¾	57¾	57¾	58⅛	58¼	58¼
London .	26$\frac{9}{16}$	26$\frac{9}{16}$	26$\frac{9}{16}$	26¾	26$\frac{11}{16}$	26$\frac{11}{16}$
Sterling Ex.	4.8730	4.8745	4.8750	4.8740	4.8740	4.8730

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Jan. 18, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India...	£ 312,500	£315,300	I. £ 2,800
China	116,000	110,000	D. 6,000
Total.....	£ 428,500	£425,300	D. £ 3,200

India Council bills in London averaged 16.09d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

Jan.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
25	14¼ @14⅜	14.00 @14.10	42⅞	4.45	4.32½ @4.37½	6.40 @6.50	6.26 @6.35
26	14⅛ @14¼	13.85 @14.00	42⅝	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
27	14⅛ @14¼	13.80 @13.90	42⅝	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
29	14⅛ @14¼	13.80 @13.90	43	4.45	4.32½ @4.37½	6.40 @6.50	6.25 @6.35
30	14⅛ @14¼	13.75 @13.85	42¾	4.25	4.12½ @4.16	6.40 @6.50	6.25 @6.35
31	14⅛ @14¼	13.85 @13.90	42⅞	4.25	4.12½ @4.15	6.40 @6.50	6.25 @6.35

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Jan.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
25	62⅛	62$\frac{15}{16}$	66½	194	192	15⅝	26⅝
26	61$\frac{15}{16}$	62¼	66¼	193	191	15⅝	26⅜
27	......	......	......	......	......	......	....
29	60$\frac{13}{16}$	61$\frac{9}{16}$	65¾	194¾	192¼	16½	26⅜
30	61¾	62½	65¾	194½	191½	15[illegible]	26⅛
31	62$\frac{3}{16}$	62$\frac{15}{16}$	66¼	194¾	192¼	15$\frac{9}{16}$	26⅛

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—Early in the week of Jan. 25-31, the conditions materialized that were indicated at the end of the previous week. While certain agencies that have well filled their books were continuing to quote a price "asked," others were seeking business and making concessions to secure it, but carefully refraining from signaling their operations by any blowing of horns. Even sharper concessions were made by second hands It was natural after a period of this policy, during which buyers failed to evince any great interest, that the mere desire to sell should become converted into pressure. This happened about Jan 26, when one of the leading agencies made drastic cuts in its efforts to consummate business with foreign buyers, in which it was followed by three other agencies. Those who continued to remain out of the market stuck to their asking price of 14½c., delivered, usual terms, but might as well have called their price 15@16c. The agencies soliciting business sold at 14c., delivered, usual terms, corresponding to about 13.85c. cash New York as late as Jan. 26, and upon Jan. 30 sales were made as low as 13.90c., delivered, usual terms, corresponding to about 13.75c. cash, New York. On Jan. 31 there was a little rally. The business in Lake copper during the week was practically nothing and quotations for this kind are consequently but nominal. The Lake producers have not yet cut their price, and, of course, have been unable to sell in competition with electrolytic under the conditions of the last week. Lake from second hands has been freely offered at 14¼c. without attracting buyers. At the lower level of price for electrolytic business increased somewhat, but the volume of transactions was by no means of unusual proportions. The market closes uncertain at 13.85@13.90c. for electrolytic copper in cakes, wirebars and ingots, while Lake is altogether nominal at 14⅛@14¼c. Casting copper is quoted nominally at 13½@13⅝ cents.

The standard market reached the low point on Jan. 29, when spot was quoted at £60 16s. 3d. and three months at £61 11s. 3d. At this level, the bears decided to take profit, and under the stimulus of their purchases the market advanced, closing steady at £62 3s. 9d. for spot, and £62 18s. 9d. for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for smaller quantities. Copper wire is 15¾c. base, carload lots at mill.

Copper exports from New York for the week were 11,994 long tons. Our special correspondent gives the exports from Baltimore at 2433 tons.

Official reports give the quantity of copper smelted in Russia in the nine months ended Sept. 30, 1911, at 1,121,257 poods, or 40,434,014 lb.; an increase of 86,801 poods over the previous year.

Tin—The market in London displayed a firm tone. Good-sized orders were placed by American interests during the latter half of last week, but with the beginning of this week the markets both here and abroad have become dull. There were no arrivals of tin in this port, and none are expected for about a week, so that spot supplies are becoming very small again and are subject to a premium of about 1c. per lb. The market closes firm at £194 15s. for spot, and £192 5s. for three months in London, and about 42⅞c. in New York for February tin.

Lead—Rather unexpectedly to the trade at large , the American Smelting & Refining Co. announced a reduction in its price on Jan. 30 of $4 a ton, which the independent sellers met. The market closes unsettled at 4.25c., New York, and 4.12½@4.15c., St. Louis.

The London market is again lower, the close being cabled at £15 11s. 3d. for Spanish lead, and £15 13s. 9d. for English.

Spelter—The market is quiet, but current orders are still in sufficient volume to take care of the amounts which are unsold for near-by shipment. The close is unchanged at 6.25@6.35c., St. Louis, and 6.40@6.50c., New York.

The London market has had a decided decline, closing at £26 2s. 6d. for good ordinaries, and £26 7s. 6d. for specials.

Zinc dust is quoted at 7⅜@7½c. per lb., New York.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business continues steady and quotations hold at 19@19½c. per lb. for No. 1 ingots, New York. The foreign market is reported firm at about 12c. for ingots.

It is stated that an addition to the reduction plant at New Kensington, Penn., will be erected by the Aluminum Co. of America.

Antimony—Business has been quiet during the week. The price of Cookson's has been reduced and is now 7¼c. per lb. Hallett's is unchanged at 7⅜@7½c., while 6¾@7c. per lb. is still named for Chinese, Hungarian and other outside brands.

Quicksilver—The market is strong. New York quotation is still nominally $43, but an advance is expected very shortly. San Francisco also nominally unchanged. The London price has been advanced 5s. to £8 5s. per flask, with £8 2s. 6d. quoted from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Platteville, Wis., Jan. 27—The base price paid this week for 60 per cent. zinc ore was $46@46.50. The base price paid for 80 per cent. lead ore was $58 per ton.

SHIPMENTS, WEEK ENDED JAN. 27

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	714,100	......	......
Galena	678,900	......	......
Benton	581,850	......	301,600
Platteville	457,700	66,000	......
Hazel Green	382,300	......	......
Shullsburg	230,790	......	......
Cuba City	230,240	......	......
Highland	105,400	......	......
Montfort	72,000	......	......
Rewey	61,000	......	......
Total	3,514,280	56,000	301,600
Year to date	11,537,960	192,560	655,600

The letter of Jan. 20, delayed in the mails, reports base price of 60 per cent. zinc ore, $45@46; no lead sales. Shipments for the week, 2,980,520 lb. zinc ore and 217,100 lb. sulphur ore. Deliveries to concentrating plants, 1,051,750 lb. zinc ore.

Joplin, Mo., Jan. 27—The highest price paid for zinc sulphide ore was $50 per ton, the base, per ton of 60 per cent. zinc, $44@47. Zinc silicate sold at $24@27 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $42.16. Lead sold as high as $60 per ton, the

SHIPMENTS, WEEK ENDED JAN. 27

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,209,420	......	1,048,800	$103,201
Joplin	1,582,860	......	171,210	41,555
Alba-Neck	1,016,620	......	63,370	25,759
Galena	429,010	......	126,370	13,165
Granby	64,600	921,160	24,050	12,520
Duenweg	344,130	......	47,250	9,135
Spurgeon	65,820	270,060	80,520	7,430
Miami	212,530	......	55,200	5,655
Oronogo	261,090	......	......	5,004
Jackson	130,820	......	65,660	4,810
Aurora	209,890	......	......	4,195
Carthage	185,790	......	......	4,087
Carl Junction	146,980	......	......	3,675
Cave Spriugs	119,690	......	......	2,630
Lawton	65,850	......	......	1,480
Totals	8,045,100	1,191,220	1,682,430	$244,311
1 mo.	32,436,300	1,708,400	5,010,390	$894,168

Blende val., the week, $180,285; 1 mo., $720,485
Calamine, the week, 14,500; 1 mo., 22,015
Lead value, the week, 49,526; 1 mo., 148,668

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41 85	.....	$40 55	......	$55.68	......
February	40 21	....	39.16	......	54 46	......
March	39.85	......	38.45	......	54.57	......
April	38 88	......	37 47	......	56 37	......
May	38.25	......	36 79	......	55 21	......
June	40.50	......	38.18	......	56 49	......
July	40 75	......	38 36	......	58 81	......
August	42 50	......	41 28	......	60 74	......
September	42 63	......	41 29	......	59 33	......
October	42.38	......	40.89	......	54.72	......
November	45.40	......	43.25	......	57 19	......
December	44.13	......	40.76	......	62 03	......
Year	$41.45	.....	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

greater bulk of the sales being at $58@59, with the average price of all grades $58.86 per ton.

The heavier portion of the winter for this region is over, and the ground has thawed until it is said to be without a bottom off of the macadam roads. This, and a shortage of cars, is holding back shipments that would otherwise have made the week an exceptionally heavy one for the season. One of the features of the better weather is the reopening of a number of the abandoned mines in the Chitwood group, adjacent to Joplin. Some new developments are being made on the old level, but the greater evidence of a new record comes from a lower level that is now being easily drained, the large pumps, four miles away, being given credit for this change.

Chemicals

New York, Jan. 31—The general trade is fair, but there is no special activity.

Copper Sulphate—Business is steady and prices are unchanged. Quotations are $4.90 per 100 lb. for carload lots, and $5.15 per 100 lb. for smaller orders.

Nitrate of Soda—A little better business is reported, but quotations are the same as last week. Spot nitrate is 2.20c. per lb.; while 2.20c. is asked for futures up to July 1, and 2.17½c. for deliveries after that date.

Sulphate of Ammonia—Production of sulphate of ammonia in Great Britain in 1911 was 378,500 long tons. Exports were 292,000 tons; home deliveries, 85,500; total, 377,500 tons. Stocks, Dec. 31, were 13,000 tons.

Arsenic—Demand continues good and prices are a shade firmer. For white arsenic $2.50@2.75 per 100 lb. is asked.

Petroleum

The buying price of best quality Pennsylvania crude oil was advanced this week to $1.50 per barrel. This is the fourth advance since Dec. 24, when the price was $1.30. A further advance is expected.

MINING STOCKS

New York, Jan. 31—On Jan. 25, stocks on the Exchange were quiet, with light dealings and few changes. On the Curb all mining stocks were slow, with a light demand for copper shares and only small variations in prices.

Jan. 26 the tone of the Exchange was variable and unsettled, some prices advancing and others receding. On the Curb, Cobalt and Porcupine stocks were more active. Inspiration Copper sold largely, but other coppers were rather quiet.

On Jan. 27 trading on the Exchange was slow and no pronounced tendency was developed. On the Curb trading was not at all active, and mining stocks were rather neglected.

Jan. 29 the Exchange showed more activity. There was a considerable selling movement and prices on some of the active stocks showed a weaker tendency. Mining stocks on the Curb were more active, especially the coppers, in which a good business was done at small and irregular price changes. Cobalt and outside stocks were inclined to be weaker.

On Jan. 30, the general market was stronger and the tendency upward. Business on the Curb was quite active, especially in the coppers. Cobalt stocks about held their own. On Jan. 31 there was little change, trading being rather quiet on both Exchange and Curb, with the tendencies unchanged.

There was one sale of Homestake at $90 per share.

At auction in New York, Jan. 25, a lot of $400 Rex Carbon Coal Co. bonds, lumped with some minor securities, brought $100 for the lot; 962 shares Shenandoah Iron & Coal Co., $100 par, $105 for the lot; 4000 shares Old Hundred Mining Co., $5 par, $2 for the lot; 8000 shares Vulcan Mining, Smelting & Refining Co., $1 par, $6 for the lot; 100 shares Bismarck Consolidated Mines Co. preferred and 1000 shares common, $90 for the lot.

Boston, Jan. 31—Copper-share prices have weakened with the metal market, but aside from this there is an absence of outside interest, with some exceptions, which goes to make a lazy market. Old Colony and Mayflower continue in the limelight, although transactions in the main are more or less speculative and professional. Both have had substantial reactions yet show a firm tone. Mayflower ranged from $6.75 to $10 during the week and Old Colony from $5.75 to $7.50. Franklin, Victoria and Algomah have also come in for considerable attention as recent developments in the Lake Superior territory tend to strengthen the positions of these properties. Franklin, after expending over $250,000 in equipping its No. 1 shaft with a new and enlarged hoist, expects to commence production at the rate of 5,000,000 lb. per annum.

Indiana, after a $3 jump to $15, lost a good portion of it. Inspiration continues active, although at slight price changes. The new Consolidated stock has been transferred from the Curb to the Stock Exchange. The Cole-Ryan stocks all carry a heavy tone in sympathy with the weakness of Amalgamated. Arrangements have been perfected to introduce a portion of the share capital of Chino and Ray Consolidated on the Paris Coulisse. About 200,000 shares of each are available. These will follow Utah Copper stock, which was given a quotation in Paris some time ago.

Curb trading has been active in spots, but generally at lower prices. Rhode

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	October	Nov.	Dec.
Alaska shipments.	2,704,802	1,274,655	4,995,008
Anaconda	21,400,000	20,850,000	....
Arizona, Ltd.	2,720,000	2,960,000	3,100,000
Balaklala	....	....	....
Copper Queen	7,786,218	6,946,775	8,365,265
Calumet & Ariz.	4,784,000	4,390,000	4,486,000
Detroit	2,086,624	1,941,498	1,969,313
East Butte	920,000	983,405	....
Mammoth	1,865,846	1,793,181	1,721,404
Miami	....	....	2,500,000
Nevada Con.	5,547,931	5,207,983	4,679,674
Old Dominion	2,050,000	2,082,000	2,610,000
Ray	2,069,287	2,517,000	2,660,000
Shannon	1,124,000	1,256,000	....
South Utah	326,578	361,681	267,514
United Verde*	2,750,000	2,500,000	2,000,000
Utah Copper Co.	8,660,729	9,117,961	9,039,557
Lake Superior*	18,440,000	18,600,000	17,500,000
Non-rep. mines*	13,564,713	11,483,000	....
Total production.	98,800,728	94,265,139	....
Imports, bars, etc.	22,960,027	17,224,725	....
Total blister	121,760,755	111,489,864	....
Imp. in ore & matte	4,137,431	4,767,217	....
Total	125,898,186	116,257,081	....
Brit. Col. Cos.:			
British Col. Copper	778,586	....	....
Granby	....	....	....
Mexican Cos.:			
Boleo	1,245,440	....	2,645,640
Cananea	5,804,000	....	3,706,000
Moctezuma	1,719,643	1,682,768	2,864,464
Other Foreign:			
Cape Cop., S. Africa	....	857,920	....
Spassky, Russia	672,000	685,440	....
Famatina, Argen.	....	174,720	....
Exports from:			
Chile	4,816,000	4,704,000	5,824,000
Australia	7,056,000	7,168,000	11,200,000
Arrivals in Europe from other count.†	11,782,400	12,064,640	16,331,840

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,557	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233

	VISIBLE STOCKS		
	United States	Europe	Total
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Island Coal struck a low level at 25c. As yet the plan of reorganization has not been issued. United Verde Extension took a perpendicular drop from 73 to 52c., with partial recovery.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1 00
Alta, Nev	Jan. 26	Feb. 16	0.05
Andes, Nev	Feb. 7	Feb. 28	0.05
Black Jack, Utah,	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0 50
Bruns. C. V. M., Nev	Jan. 12	Feb. 2	0.02
Bullion, Nev	Jan. 12	Jan. 29	0.05
Confidence, Nev	Jan. 16	Feb. 6	0 20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev	Feb. 14	Mar. 6	0 05
Federal Ely, Nev	Jan. 5	Jan. 27	0 01
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0.05
Hancock Con., Mich	Jan. 10	....	1.00
Hancock, Mich	Mar. 28	....	1.00
King David, Utah	Feb. 13	Mar. 6	0 005
Ojibway, Mich	Jan. 10	....	1 00
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0 10
Seven Troughs Mon., Nev	Jan. 10	Jan. 31	0.002½
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz.	Jan. 15	......	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea Con., Utah	Jan. 17	Feb. 8	0 015
Tintic Standard, Utah	Jan. 8	Feb. 5	0 00
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24 154	24.865	25.887
February	51.534	52.222	......	23.794	24.081	......
March	51.454	52.745	......	23.690	24.324	......
April	53.221	53.325	......	24 483	24.595	......
May	53.870	53.308	......	24.797	24.583	......
June	53.462	53.043	......	24.651	24 486	......
July	54 150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24.428	24 082	......
September	53.295	52.440	......	24.567	24 209	......
October	55.490	53.340	.....	25.596	24.594	......
November	55.635	55.719	.....	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53.486	53.304	.....	24 670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	......	12.611	.....	54 974	......
March	12 139	......	12 447	.....	54.704	......
April	12 019	......	12.275	.. .	54 034	......
May	11.989	......	12.214	.. .	54.313	.. ...
June	12 385	......	12 611		56 365	.....
July	12 463	......	12.720	.. .	56 673	....
August	12 405	......	12 634	....	56 266	....
September	12 201	......	12.508	. ..	55 253	......
October	12 189	......	12.370	...	55 170	.....
November	12 616	......	12 769	.. .	57 253	.....
December	13 552	....	13 768	..	62 068	....
Year	12 376	.....	12.634	...	55.973	.....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	.. ...
February	41 614	.. ..	August	43 319	. ....
March	40 157	. .	September	39 755	.. .
April	42 185	.. .	October	41 185	. ..
May	43 115	. .	November	43 125	......
June	44 606	.....	December	44 655	. ..
			Av. Year	42 281	......

Prices are in cents per pound.

LEAD

Month	New York		St Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4 435	4 334	4.327	13 009	15.619
February	4 440	......	4 266	......	13 043	......
March	4 394	.....	4 238	......	13 122	.....
April	4 412	......	4 262	......	12.889	.....
May	4 373	......	4 223	......	12 984	......
June	4 435	.. ..	4 292	.. ..	13.260	......
July	4 499	....	4 397	......	13 530	......
August	4 500	......	4 406	......	14.260	......
September	4 485	.....	4 356	......	14 744	......
October	4.265	.....	4 139	.....	15.332	......
November	4.298	......	4.181	......	15.821	......
December	4 450	......	4 332	......	15.648	......
Year	4.420	......	4 286	......	13.970	... ..

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	......	5 368	......	23 276	......
March	5.563	......	5.413	......	23 016	......
April	5 399	......	5 249	......	23 743	......
May	5 348	......	5 198	......	24.375	......
June	5 520	......	5 370	.....	24 612	......
July	5 695	......	5 545	......	25 006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	.....	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26 849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14 75	$14.00
February	15 90	......	14 50	......	14 81	......
March	15.90	......	14 65	......	14.96	......
April	15 90	......	14 65	......	15 00	......
May	15.90	......	14 30	......	14 72	......
June	15 90	......	14 06	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	.....
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15.72	......	$13 94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Jan. 30		SALT LAKE Jan. 30	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.04¾	Beck Tunnel	.13
Cripple Cr'k Con.	02⅞	Black Jack	.10½
C. K. & N.	‡ 14	Carisa	‡ 17
Doctor Jack Pot.	05⅞	Cedar Talisman	.02½
Elkton Con.	.62⅞	Colorado Mining	.32
El Paso	.70½	Columbus Con.	22
Findlay	.05	Daly-Judge	‡5.20
Gold Dollar	.17	Grand Central	.73
Gold Sovereign	02⅞	Iron Blossom	1 05
Isabella	.14½	Little Bell	.40
Jack Pot	.05⅜	Lower Mammoth	.02¾
Jennie Sample	.06½	Mason Valley	11 00
Lexington	01	May Day	15
Moon Anchor	01½	Nevada Hills	2 25
Old Gold	03	New York	‡.07
Mary McKinney	.50½	Prince Con	81
Pharmacist.	.02½	Silver King Coal'n	1 40
Portland	.93	Sioux Con.	.11
Vindicator	63	Uncle Sam	33
Work	.02½	Yankee	‡ 24

TORONTO Jan. 30

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7 00	Pearl Lake	10
Hudson Bay	70 00	Porcu. Gold.	34
Temiskaming	30	Porcu. Tisdale	03
Wettlaufer-Lor.	80	Preston E. D.	05
Apex.	08	West Dome	25
Central.	‡3 62½	Standard.	15
Doble	50	Foley O'Brien	25
Dome Exten.	28	Rea	1 18
Hollinger	12 00	Crown Chartered.	07
Imperial	05	Swastika	.20

SAN FRANCISCO Jan. 30

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.01	Belmont	8.72
Belcher	48	Jim Butler	32
Best & Belcher	.13	MacNamara	.26
Caledonia	1.35	Midway	28
Challenge Con.	.14	Mont.-Tonopah	1 02½
Chollar	16	North Star	.31
Confidence	70	West End Con.	.76
Con. Virginia	.76	Atlanta	.18
Crown Point	48	Booth	.05
Gould & Curry	08	C.O.D. Con.	.13
Hale & Norcross	.17	Comb. Frac.	.13
Mexican	4.00	Jumbo Extension	.20
Occidental	.50	Pitts.-Silver Peak	1.25
Ophir	1.45	Silver Pick	.06
Overman	1.05	St. Ives	.30
Potosi	07	Tramps Con.	.01
Savage	.14	Argonaut	2.50
Sierra Nevada	.40	Bunker Hill	‡3 00
Union Con.	1.20	Cent. Eureka	‡.36
Yellow Jacket	.41	So. Eureka	‡6.00

N. Y. EXCH. Jan. 30

Name of Comp.	Clg.
Amalgamated	62½
Am Agri. Chem.	61⅝
Am.Sm.&Ref.,com	70¼
Am. Sm.& Ref., pf.	103¼
Am. Sm. Sec., pf. B	86½
Anaconda	34⅝
Batopilas Min.	1⅜
BethlehemSteelpf	60⅜
Chino	26
Federal M.& S.,pf.	38
Goldfield Con.	4½
Great Nor., ore ctf.	38¼
Homestake	90
Miami Copper	23⅞
Nat'nalLead,com.	54
National Lead, pf.	105
Nev. Consol	18½
Pittsburg Coal, pf.	85
Ray Con.	16¾
RepublicI&S,com	23¾
Republic I & S, pf.	81
SlossSheffi'd,com.	39¼
Sloss Sheffield, pf.	108¼
Tennessee Copper	36¼
Utah Copper	54¼
U. S. Steel, com.	64
U. S. Steel, pf	110½
Va. Car. Chem	55½

N. Y. CURB Jan. 30

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con.	.44
Braden Copper	5⅛
B. C. Copper	4⅛
Buffalo Mines	1.20
Butte & Vipond	.53
Butte Coalition	22⅛
Cobalt Central	‡.01
Con. Ariz Sm.	11/16
Davis-Daly	11/16
Diam'field-Daisy.	12
Ely Con.	½
Florence	.55
Giroux	4 7/16
Gold Hill Con.	‡5/16
Greene Cananea.	8
Greenwater	07
Guggen. Exp.	180
Inspiration	10
Internat. S. & R.	‡124
Kerr Lake	2⅞
La Rose	3⅞
McKinley-Dar-Sa.	1⅝
Min. Co. of A. new	4
Nev. Utah M. & S.	⅛
Nipissing Mines.	7⅝
Ohio Copper	13/16
Pacific Sm. & M.	5/16
Porcupine T'nsite	‡ 03½
Precious Metals	‡1⅜
Ray Central	1 11/16
Red Warrior	‡1½
South Utah M & S.	13/16
Standard Oil (Old)	625
Stand'd Oil of N.J.	362
Stand'd Oil Subs.	330
Stewart	1¼
Tonopah	7⅛
Tonopah Ex	1½
Tri-Bullion	½
Tularosa	3[illegible]
Yukon Gold	3⅜

LONDON Jan. 31

Name of Com.	Clg.
Camp Bird	£1 12s 9d
Dolores	1 10 0
El Oro	0 19 0
Esperanza	2 10 0
Mexico Mines	7 7 6
Oroville	0 6 3
Stratton's Ind.	0 3 1½
Tomboy	1 2 6

BOSTON EXCH. Jan. 30

Name of Comp.	Clg.
Adventure	5
Algomah	6½
Allouez	39
Am. Zinc	25
Ariz. Com., ctfs.	3
Bonanza	.46
Boston & Corbin	7¾
Butte & Balak	3⅞
Calumet & Ariz	58¾
Calumet & Hecla	420
Centennial	17⅞
Con. Mercur	.06
Copper Range	50
Daly West	5
East Butte	12½
Franklin	12¾
Granby	34
Hancock	33¾
Hedley Gold	15½
Helvetia	1
Indiana	13¼
Island Cr'k, com.	86¼
Isle Royale	21¼
Keweenaw	1¼
Lake	33⅛
La Salle	4¾
Live Oak	40½
Mass	7¾
Michigan	3¼
Mohawk	52½
New Arcadian	3½
New Idria Quick.	7⅝
North Butte	24
North Lake	5¼
Ojibway	5½
Old Dominion	45
Osceola	107
Quincy	75
Shannon	9 7/16
Shattuck-Ariz	17
Superior	25½
Superior & Bost.	4 9/16
Tamarack	26
Trinity	5⅝
Tuolumne	3 11/16
U. S. Smelting	35
U. S. Smelt'g. pf.	48
Utah Apex	3
Utah Con.	15¼
Victoria	4¾
Winona	5¾
Wolverine	‡97½
Wyandot	2

BOSTON CURB Jan. 30

Name of Comp.	Last
Ahmeek	245
Bingham Mines	2⅞
Boston Ely	1¼
Boswyocolo	09
Cactus	15
Calaveras	2
Chief Cons	83
Corbin	3
Cortez	1½
Crown Reserve	3
First Nat. Cop.	2⅜
Majestic	41
Mazatan	1
Moneta Porc.	14
Nevada-Douglas.	2 15/16
New Baltic	4½
Oneco	2½
Raven Copper	.23
Rhode Island Coal	.29
San Antonio	‡3½
South Lake	5¾
Trethewey	.50
Union Mines	‡¾
United Verde Ext.	.53
Vulture	‡5¾

‡Last quotation.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Enginjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9300 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Editorials:
  Government Experiment Stations.. 295
  Pig Iron Production in 1911....... 296
  Stratton's Independence Mill...... 296
  The Cut in Lead.................. 296
Metallics—By the Way............. 297
Correspondence and Discussion:
  The Basis of Calculating Tonnage Costs....Coöperation in Research Work....Gold Mining near Washington, D. C.......... 298
American Institute of Mining Engineers 299
What's In a Name....R. W. Raymond 299
President Urges Leasing System.... 300
Federal Control of Coal Prices...... 300
Details of Practical Mining:
  *A Six-Ton Skip Loading Device ....Rotary Rig for Deep Drilling....*Combination Post and Set Timbering in Shafts.... *Structural and Corrugated Steel Stack....*Separating Rock from Clay....*A Car Dumping Device 301
A New Gold Dredge at Oroville. Lewis H. Eddy 306
Utah Copper Co.................... 306
Pig Iron Production in 1911........ 307
The Sitka District, Alaska.......... 308
Portland Cement in 1911........... 308
Aluminum Dust Explosions......... 308
*Link-Belt Elevators. Benedict Shubart 308
Giroux Consolidated................ 309
The Flameless Combustion of Gas.. 309
Mining Explosives Used in Great Britain 310
The Experiment Station Bill........ 310
Diamonds in the Belgian Congo.... 310
Mining in Great Britain in 1911...... 310
*Stratton's Independence Mill. T. C. Linderfelt and J. K. Stewart 311
Zinc Smelting at Trollhattan....... 314
Rules for Coal Storage............. 315
*Righting Overturned Gold Dredges. Lewis H. Eddy 316
Goldfield Consolidated Report....... 317
Depreciation of Gas and Oil Fields.. 319
*The Buffalo Spiro Turbine......... 319
Roller Bearings on Mine Cars....... 320
Prevention of Blue Powder Formation 320
*First Aid to Mining Machinery—VII. Henry M. Lane 321
Magnesite in 1911................. 324
The Payne Electrostatic Separator.. 324
New Electric Hoist at West Rand Consolidated Mines.............. 324
Cripple Creek Drainage...W. Weston 325
Duty on Zinc from Imported Ores... 325
Cooling Pyrite Burner Gases....... 326
New Kink in Iodide Copper Assay.. 326
Hudson River Tunnel Holed Through 326
Personal, Obituary and Societies.... 327
Editorial Correspondence.......... 328
Mining News 330
Markets 336
*Illustrated

The Engineering and Mining Journal

Vol. 93. FEBRUARY 10, 1912. No. 6.

Government Experimental Metallurgical Stations

The Committee on Mines and Mining of the House of Representatives recently conducted hearings on H. R. bill 11,414 to establish a mining experiment station in Colorado. The following are some of the gems of thought expressed by advocates of this measure, the interpolated comments being our own.

> There has not been, so far as I know, one dollar expended by the Federal government in this state in the way of erecting experimental plants, so that our mine owners and mining men may have some knowledge of what kind of reduction plants are most suitable and adapted to the treatment of the different characters of ore that are mined in certain mining districts in this state.

Colorado includes within its limits a large number of experienced and competent mining and metallurgical engineers who are able to supply the knowledge needed by mine owners and mining men. Places in which experiments may be suitably conducted exist within the state.

> Today we have nothing but monuments, one after another, of mills strung from one end of the different gulches to the other end, which are absolutely worthless, all on account of the owners not knowing just what kind of a plant to erect that would save values.

The first part of the foregoing statement is undeniable, but the second part is too sweeping. Almost all mining districts are "over-milled." The reason is rather mistaken estimates of the resources of the mines than ignorance of the proper kind of plant to provide, although the latter is sometimes a reason. In either case many of the "monuments" would have been avoided if proper engineering advice had been taken.

> If the Government could evolve processes of handling low-grade ores—that is, ores running below $10 per ton—thousands of mines would be opened, and the wealth of the world would be added to by many hundreds of millions of dollars. We have lost many thousands of miners from the State of Colorado in the last 10 or 15 years because the Smelting Trust and the railroads have very largely consumed the values in our low-grade ores and we have been unable to treat them in a way that would be profitable; and there are a larger number of valuable substances we know that cannot under present processes be handled at all, and the problem of the continued prosperity and rejuvenation, we might say, of the mining industry depends upon the establishment of metallurgical experimental stations, or at least a great deal of scientific work being done along that line.

The "smelting trust" has about 1,500,000 tons of annual capacity in its Colorado plants which are able to secure only about 700,000 tons of ore per annum. We surmise that it would take ore at but little over the cost of smelting if it could get it in order to employ its idle capacity; and that the railways would be equally generous. For the same reason we have no doubt that the smelters are not disregarding any "valuable substances" that may be treated or are refraining from doing scientific work for the development of improved processes:

> We want experts to go into those camps themselves and examine the ores and examine the manner in which they are found in the ground and the topography of the country and ascertain on the ground the best manner of treating the ores found there.

Is not this what experienced engineers have been doing during the whole history of the mining industry? And when any more than nowadays?

> Colorado has appropriated $125,000 for the purpose of erecting and equipping a metallurgical testing plant at the school of mines at Golden, and they have erected a building and have some equipment and hope to secure further appropriations from the state and finish the equipment and get the plant in operation.

This seems to take the wind out of the demand upon the Federal government.

The following is a supreme expression of nonsense.

> There is some difference in the ores, of course, in all of the states. I doubt

very much whether you will be able to have one station do all the work. If you do confine yourself to one station, we will have to ship ore from all over the West to that one station, or else we will have to have experts do it in traveling experimental cars or investigation trips to examine on the ground the different kinds of ore that may be found in the several localities.

This whole ridiculous movement simmers down as a raid to get something for nothing; to get the Federal government to organize a corps of engineers to do gratuitously that for which a large body of experienced engineers exists and does all the time as a matter of professional practice. It will be absurd and scandalous if Congress allows itself to be imposed upon by such nonsense as that which we have quoted.

Pig Iron Production in 1911

We have now the complete figures for the make of pig iron in the two larger producing nations of the world, the United States and Germany. For Great Britain, the third producer, the statistics are not available; but its output falls considerably below that of Germany, having averaged not far from 9,000,000 tons for several years past. The accompanying table gives the production of the United States and Germany, classified according to the uses for which the iron was intended; our figures being reduced to metric tons, for purposes of comparison.

PIG IRON IN THE UNITED STATES AND GERMANY

In metric tons

	Germany		United States	
	Tons	Per Ct.	Tons	Per Ct.
Foundry & forge.	3,575,375	23.0	5,340,924	22.3
Bessemer.........	374,455	2.4	9,559,653	39.8
Basic	9,851,113	63.4	8,656,349	36.1
Charcoal	....	....	283,135	1.1
Spiegel, ferro, etc.	1,733,280	11.2	187,672	0.7
Total...... . .	15,534,223	100.0	24,027,733	100.0
Total, 1910......	14,793,325	.....	27,740,424	.. ..

Germany reports no charcoal iron. The proportion of foundry and forge iron in the two countries is nearly the same. The German classification of steel pig is much wider than our own, which is limited to spiegeleisen and ferromanganese; but the figures serve to show to what an extent the various ferro-alloys are made in Germany, which exports them largely to other countries. The strongest contrast is in the proportions of bessemer and basic pig. In this country bessemer iron still leads, while in Germany it is almost a negligible quantity. The German production of basic iron is much nearer to that of basic steel than our own, owing to the extensive use of the basic converter. Our basic steel is made entirely in the openhearth furnaces and with the use of a larger proportion of scrap than is usual in Germany. Germany had a rather prosperous year, while reverse conditions prevailed here. It is, moreover, always the case that the fluctuations in the foreign markets—the differences between a good and a bad year—are proportionally much smaller than in America.

Stratton's Independence Mill

Recent innovations in the metallurgy of the low-grade ores of the Cripple Creek district make it worth while to review the scheme used in one of the large mills of the district. At Stratton's Independence mill, which is described in this issue of the JOURNAL, dump-ore and some low-grade mine ore are successfully treated by means of concentration and cyanidation.

The natural acidity of the ore is neutralized by lime automatically added dry to the ore just before it is elevated to the rolls. The aim, of course, is to obtain a uniform mixture of ore and lime before cyanide solution is added. Besides neutralization, lime has the further function of aiding in the settlement of the slime. The quantity of lime to be added daily varies, because of changes in the character of the ore to be treated, and is largely controlled from the laboratory, the circulating mill solution being tested each morning for alkalinity. When a streak of oxidized ore is struck in the dump, the settlement of slime becomes a problem and the addition of lime requires careful adjustment for a large excess of lime defeats its object.

Crushing in solution, before the removal of some of the cyanicides, must cause some loss, but it is probably more than compensated by the fact that a fair percentage of the precious metals goes into solution early in the process, permitting later chemical treatment to be concentrated on the refractory residue.

The reconcentration of the second-grade concentrate seems to offer a nice means of control for the production of an especially clean first-grade concentrate and a low-grade tailing. The favorable rates available make it advantageous to ship this high-grade concentrate to smelters rather than to treat it locally.

While the extraction is not as high as desired, it has exceeded the expectations of many who formerly looked with skepticism on the proposal to treat "waste" rock at a profit. That this venture has been profitable is now beyond question, and for that reason is noteworthy.

The Cut in Lead

The reduction by the American Smelting & Refinng Co. of 0.45c. per lb. in its price for lead within less than a fortnight has excited more than the usual gossip. One hypothesis is that it is a warning to Congress to refrain from reducing the tariff on lead and lead ore. If the price for lead be low the producers of lead ore receive less, howl and write to their representatives in Congress, who may thereby be influenced. The recent drastic reduction is to be an object lesson, Q. E. D. However, this is something like cutting off the nose to spite the face. A more rational hypothesis is that the smelting company wanted to sell lead and having found the demand sluggish at the previous price made a series of cuts in order to stimulate consumption and make its supplies move.

We continue to hear about a prospective copper famine, producers sold out cleanly, shipping metal hot from the cathode furnaces, etc., although these conditions do not deter some of the larger agencies from causing pain in many quarters by their efforts to sell their copper, even if they have to make concessions to do so. The simple fact is that there is no such dearth of copper yet as some would fain have it believed. We have previously estimated that Europe and America ought to have a stock of about 100,000,000 lb. to insure the ordinary smooth movement of trade. At the beginning of 1912 the actual visible supply was about 248,000,000 lb. The division between Europe and America does not matter, because if surplus be merely transferred from America to Europe the situation is not helped at all until consumption has finally absorbed it.

The index to Vol. XCII of the ENGINEERING AND MINING JOURNAL is mailed with this issue. Any subscriber not receiving same should notify the subscription department at once.

Metallics

Concrete is about three times as heavy as timber, but the allowable working stress is only half as great.

While it is essential for good precipitation that the gold-bearing solutions be distinctly alkaline, an excess of alkali may result in the formation of white foam, caused by the too rapid evolution of hydrogen.

The *Echo des Mines* is authority for the statement that palladium and rhodium now cost 10 guineas per troy ounce. The increased demand from America has raised the value of iridium to about £13 per oz., a higher price than has ever been attained.

The freight and treatment charges on siliceous ore from the Parral, Chihuahua, Mexico, camp sent to the smelters amounts to about 17.50 pesos. The taxes are about 4% of the gross value on the precious-metal content. The smelters pay for 95% of the silver and $19 an ounce for the gold.

At the Alaska-Treadwell cyanide mill the concentrates are ground to pass 200 mesh, given a preliminary agitation with 2-lb. lime solution, thickened by decantation, and cyanided. The treated pulp is filtered in Kelly presses, from which the solution passes to Merrill precipitation presses. The precipitate is acid treated, melted in a specially constructed oil-burning furnace, and refined in Faber du Faur tilting furnaces.

An ingot of cast manganese steel is as brittle as glass, but when reheated to a temperature of 1000° C. or more and suddenly chilled by plunging in water, it becomes as ductile as soft carbon steel or wrought iron, and has three times their tensile strength. Manganese steel cannot be forged except with great difficulty and as no method is known for softening it, cannot, to all practical purposes, be machined. Objects of manganese steel are, therefore, cast, reheated and chilled.

Limes containing less than 10% MgO are classified as high-calcium limes; those containing more than 10% MgO, as magnesian limes. There is a great difference of opinion among users as to which class is better. Magnesian limes slake slowly with little evolution of steam, so that there is danger of the mixer not thoroughly slaking the lime before use. They swell but little upon slaking, hence are less bulky. Some contractors believe the high-calcium limes cheaper for this reason. A given weight of magnesian limestone, can, however, be mixed with a greater weight of sand than the same quantity of high-calcium limes. Magnesian-lime mortar sets more slowly than high-calcium-lime mortar, but is much stronger.

By the Way

The U. S. Steel Corporation does not seem to have stifled competition wholly. The Inland Steel Co., a relatively new concern, which owns ore lands on the Mesabi range and a steel plant near Chicago, in 1911 declared an extra dividend of 3% in addition to the regular 7% and then gave the stockholders the right to subscribe to $900,000 new stock at a price far below the market. This year the performance is repeated, an extra dividend of 3% being declared and a new stock issue to the amount of 10% of that outstanding being authorized. This certainly does not look as if the Steel Corporation had "unreasonably restrained" trade from flowing into the mills of its smaller competitor.

The "bull crowd" in copper, both the shares and the metal, is understood, says the *Evening Post*, to have taken it ill that the Guggenheims recently went so far as to sell some metal abroad "at the market." Selling a thing that way means to sell it on the bid price, rather than on the asking price, and recently the copper boom has been resting rather heavily upon the asking price. The metal forced to a sale went for less than 14c., whereas the asking price on this side of the ocean had not been below 14⅜c. But a bull crowd must always expect something like that to happen.

A photographic campaign against coal-mine accidents, projected some time ago, has taken shape in an illustrated textbook just issued by the coal-mining department of the Delaware, Lackawanna & Western R.R., for the benefit of foreign mine workers who cannot speak English. It shows both the mistakes that cause accidents and the way to avoid these mistakes. Two hundred photographs are included in the volume, depicting on opposite pages the right and the wrong method of procedure in mining. In explanation of the pictures, text matter is given under them in the plainest of English; the "don'ts" on the accident side of the page being emphasized strongly by the use of red ink.

J. Parke Channing, at the recent annual dinner of the Mining and Metallurgical Society, related in Cornish dialect, of which he is a past master, one of his early experiences in the Lake Superior country. He had been assisting Messrs. Van Hise and Irving in the study of the ore occurrence on the Gogebic range. Mr. Channing said: "I was full of youthful enthusiasm on the subject and one day was going through the Colby mine with a party of vistors, which was being led by a Cornish mining captain. I have no doubt that my description of the formation was rather too much for him and he felt that he was being relegated to the background. During a rest in the trip he said to me: 'Mister Shannon, wheer did you learn all that to?' I said, 'Captain, some of it is the result of my own observation, and some of it is information that has been published in a monograph of the United States Geological Survey.' 'Monograph, what do'ee call a monograph?' 'A monograph," said I, 'is a book.' 'A book,' said he; 'how big is that book?' I replied that it was about twelve inches high, eight inches wide, and about an inch thick. 'Huh,' said he, 'I've got a book at 'ome and its three feet 'igh, two feet wide and six inches thick, and damme it ain't in theer.' "

The answer of the United States Steel Corporation to the complaint in the government suit has been filed. It is a comparatively brief denial of the charges made, and sets forth that full publicity has always been given to the company's affairs; that it has made no attempts whatever to monopolize trade; that it has not attempted to control or to interfere with its independent rivals, large or small. It is especially emphatic in denying all intention or attempt to monopolize supplies of iron ore. On the whole the answer is just what was expected, and contains nothing new and no special pleading beyond the general statement of the case.

The "Blue Sky" law of Kansas, under which stock venders must secure a license from the state bank commissioner, is coming in for a good deal of attention recently. Even the popular magazines have taken it up, and we presume no one will be swindled in Kansas any longer. The law was no doubt intended to protect the people of Kansas, and we hope it will do so. We shall be interested, however, in learning just what protection the people are securing from the sellers of wildcat mining shares. The bank commissioner naturally does not recommend the securities of companies, but only licenses a company or its agents to sell shares to Kansans, and it is difficult to see just what sort of examination or judgment his department will make that will be of value to Kansas. We have before us the advertisement of a Kansas gold-mining company, which starts off: "Fourteen per cent. on the original investments—Stop!—Investors—Think! . . . We are offering our 7 per cent. preferred stock at 50c., par value $1, full paid and nonassessable. This means 14 per cent. or better on your investment. We offer a limited amount only in lots of $100. Books now open for a subscription. This will not last long. *This has been investigated and approved by the state bank commissioner.* Address —— —— Milling Co." This has an almost familiar ring. The limits of "high finance," as actually established by the "Blue Sky" law, seem to be reflected in the sobriquet.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Basis of Calculating Tonnage Costs

The article by William Hague under the above caption in the JOURNAL of Feb. 3, 1912, and the editorial comment published in the same issue, afford an opportunity to discuss a subject on which opinions and ideas are at great variance among mining engineers. He who would attempt to standardize the practice of cost keeping at mines has an unhappy task before him, and little hope of success.

The so called systems of cost keeping at mines are really more or less arbitrarily chosen systems of distributing the expense of production over a number of operations, so that a comparison of costs can be made between one day's or one month's work and another's. Whether the unit is the ton mined, raised or milled is really of little consequence to the manager, to whom the cost sheet is the pulse of the mine, provided the same standard is always used.

The tonnage milled is perhaps the most generally used basis, because, under normal conditions, there will be less variation from month to month in that figure than in the tonnage raised or mined. Moreover, it is generally the case that the weighing and sampling of the ore can be most conveniently done as it comes to the mill bin. Of course, at many mines the ore is not actually weighed. A tally of the cars is made and the tonnage estimated. Furthermore, it is a growing practice to abandon sampling of the mill feed, the tailings being sampled and the assay of the heads being calculated. The practice is, and rightly, varied to meet the needs of each individual case, just as Mr. Hague states that the manager of the North Star mine found that the basis of tonnage raised better suited his purpose than the tonnage-milled basis.

As for basing costs on the tonnage of ground broken, and regarding all elimination of waste as a step in concentration, there are many more objections than to a tonnage-milled basis. The variation in tonnage broken is usually greater from month to month than the tonnage milled, and at most mines it is customary to break ground in excess of the mill capacity; it is also more difficult to estimate such tonnage and satisfactorily sample the ore. If the tonnage-milled basis represents or is to be regarded as a partially concentrated ore, the question might be raised: Why not base the costs on the unit of salable product, just as is done in most manufacturing industries? This is often done, and affords a means of drawing interesting and valuable conclusions from the cost sheets, but it is also desirable to keep costs figured on some tonnage basis besides that of salable product. Insofar as it affects the operations at any particular mine, I fail to see how it matters what unit is used.

When it comes to comparing the costs of operations at different mines, the matter takes an entirely different aspect. Then, in my opinion, the costs should be based on the unit actually involved. Comparisons should be made as to the costs per foot of hole drilled, or per ton of ground broken, or material raised. The statement that at a certain mine drilling costs 10c. per ton of ore milled means nothing unless it is also stated how many feet of hole is required to break a ton of ground and how many tons of ground must be broken to yield a ton of milling ore. Unless figured on such a basis, I fail to see how any comparison of costs between one mine and another can possibly be made, except when they are, as rarely is the case, being operated under identical conditions.

Such a system of cost keeping could easily be standardized, but the increased expense of clerical and surveying work, would, in most cases, be attended by too few advantages to be generally adopted. On the other hand, as costs based on tonnage milled or raised depend upon so many varying factors, governed by the occurrence of the deposit, as well as the local conditions and methods of mining, no very illuminating comparisons can be drawn between different mines, and the manager should be, as he is now, free to select the basis that best suits his needs.

CLARENCE C. SEMPLE.

New York, Feb. 5, 1912.

Co-operation in Research Work

I have read R. C. Benner's reply in the JOURNAL of Dec. 16, to B. F.'s letter of May 15, 1911, and am of the opinion that while B. F. was shown to be somewhat ill-advised in some of his statements, Mr. Benner's letter does everything but convince. Mr. Benner says, "In all cases the relations of research men with practical engineers are meant to be coöperative, a friendly aid in the bringing about of economical solutions of the worrisome problems of the industrialist." How will he do it? Are we research chemists to write him stating our problems and receive an answer by return mail, giving us a free solution of our troubles? Or will he charge us or our employers for his service? If the latter, will not employers eliminate us entirely, and deal direct with him? And in case we are doing general consulting work, cannot he cut into our prices, because he is sure of a steady college salary even when work is slack? And he pays no office rent for his laboratories, or taxes on office equipment. So that apparently all that will be left us is to crawl under the protecting *aegis* of some technical school, and conduct a campaign against the works' chemists, who would hold out longer, owing to being on a salary basis, and see whether, supported by taxpayers' money, we cannot do their work at less than cost.

Mr. Benner's letter states, "the system of industrial fellowships takes care of the fellows as well, if not better, than some industrial engineers take care of themselves." How? By making two industrial problems grow where one did before, or underbidding the industrial chemist?

The parting of the ways of research seems clear. Either the college laboratory becomes a subsidized research bureau, doing work at less than cost, or its investigations are carried on in the realms of pure science, with an occasional purely practical byproduct, such as Rowland or Pupin or Nernst produced. In pure science I would certainly include certain practical problems of wide interest, such as the smoke nuisance, the influence of the barometer on liability to coal-mine explosions, and others of like generality of interest, but for the solution of which the consulting chemist can get no reward except the consciousness of benefiting the race.

CONSULTING CHEMIST.

Newark, N. J., Feb. 1, 1912.

Gold Mining near Washington, D. C.

I have been informed that gold mining is being carried on actively near the Falls of the Potomac, near Washington, D. C. Can any reader of the JOURNAL tell me whether this is the case, and give me a reference to something showing the financial returns of the mine in question?

SOUTHERN GOLD INVESTOR.

New York, Feb. 2, 1912.

American Institute of Mining Engineers

The proposed amendments to the constitution of the A. I. M. E., including change of name, increase in dues and classification of its membership, is exciting opposition. We have received the following letter with the request that we publish it:

Washington, Jan. 30, 1912,

EDITOR ENGINEERING AND MINING JOURNAL,

Sir—On Jan. 27 a meeting was held in Washington of the members of the American Institute of Mining Engineers who are also members of the U. S. Geological Survey to consider the proposed amendments to the constitution of the Institute. At this meeting were present G. A. Ashley, State Geologist of Tennessee; G. F. Becker; A. H. Brooks; E. F. Burchard; R. H. Chapman; Frank L. Hess; W. Lindgren; H. D. McCaskey; E. W. Parker; F. L. Ransome; C. E. Siebenthal; George Otis Smith; A. C. Spencer; D. B. Sterrett. Arnold Hague was prevented from attending, but he, as well as George P. Merrill, of the National Museum and J. A. Holmes, of the Bureau of Mines, desires to express his concurrence in the action taken.

The following resolutions were passed after full discussion and without a single dissentient vote:

"The members of the American Institute of Mining Engineers present do not approve of the proposed change of name of the Institute to 'American Institute of Mining and Metallurgy.'

"The members of the American Institute of Mining Engineers present are not in favor of the change in classification of members on the basis proposed in the circular, which is not a re-classification based upon professional standing.

"In the absence of a financial statement showing that an increased income is necesary, the members present are opposed to the proposed increase in dues."

A committee was also appointed to communicate the resolutions to the mining press in the hope of eliciting expressions of opinion from other members of the Institute. This committee consisted of the undersigned.

Waldemar Lindgren,
George F. Becker,
A. H. Brooks.

A similar movement has been going on contemporaneously in New York and the following circular letter has been sent to all members of the Institute in the United States, Canada and Mexico.

New York, Feb. 3, 1912,

To the Members and Associates of the American Institute of Mining Engineers.

Dear Sirs—At the annual meeting of the A. I. M. E. in New York, on Feb. 20, some radical changes in its constitution are to be considered. Among these is a proposal to increase the dues of all corporate members.

We, the undersigned, intend to vote against an increase of dues, and we ask the coöperation of members unable to attend the forthcoming meeting, who are of the same mind in this matter as we are.

The reasons for an increase of dues offered officially by the Secretary of the Institute are, in our opinion, vague and unsatisfactory. Without denying that an increase may be advisable, we propose to contest such a measure until full information respecting the situation has been communicated to all members of the Institute; and until after it has been determined by a careful investigation of the Institute's affairs that the same purpose cannot be accomplished by economies in administration.

We intend to vote against the proposed increase in dues, and to offer a resolution to appoint an independent committee to study the affairs of the Institute before any further action be taken. If you desire us to vote for you upon these principles, please execute the proxy that we inclose herewith.

If you have already given your proxy to someone else you have the right to cancel it. If you now give us your proxy you will thereby cancel all those previously given.

Yours truly,

George C. Stone,
C. R. Corning,
W. R. Ingalls,
J. Langeloth,
Otto Sussman,
Allen H. Rogers,
Lewis G. Rowand,
H. M. Chance,
F. L. Garrison,
John H. Allen,
J. R. Finlay,
J. Parke Channing
F. F. Sharpless,
W. H. Nichols, Jr.,
J. A. Van Mater,
Arthur Thacher,
Robert Peele,
W. C. Ralston,
Richard H. Vail,
E. B. Kirby.

The proxy accompanying this circular is made out in the names of George C. Stone, 55 Wall St., New York, and J. R. Finlay.

The meeting of the Institute at which the proposed changes in the constitution will come up for action will be held in New York, Feb. 20 at 10 a.m.

Elsewhere in this issue Doctor Raymond discusses the proposed change in the name of the society.

What's in a Name?

By R. W. Raymond*

When the Institute was organized, the rules of the North of England Institute of Mining Engineers were adopted for temporary use, and its name was copied without debate. The rules were soon after rewritten to suit the conditions of our society; but the name remained unchanged. The North of England Institute was, in fact as in title, made up of mining engineers—mostly colliery managers—whereas the American Institute included from the beginning the representatives of metallurgy, chemistry, mechanical engineering, geology—in fact, all the arts and sciences auxiliary to mining.

That no change of name was made in the early years was due, I think, largely to the feeling that it was better to let the term mining engineers cover the whole field than to create a long and cumbrous title by attempting to state in it all the branches represented in our membership and proceedings. It was deemed unnecessary to make a complete table of contents out of a title page.

After a few years, there was another reason for conservatism in this respect, namely: the members of the institute became fond of its name, and listened with impatience to any proposal of amendment. It was, at the worst, they said, a lucky misnomer, under which the Institute had prospered, and the wide range of activities covered by it was well understood throughout the world. Moreover, although an institute, strictly speaking, was not a body of men, yet this institute "of mining engineers" was just that; and the fellowship of its human members was as important and as dear as the information contained in its volumes. Finally, a good many of us remembered from our school days the old maxim that when a debating society of boys began to tinker its constitution and change its name, it was pretty sure to be moribund; and we had seen the same phenomenon in struggling periodicals, and even in the history of nations.

Having been asked from many quarters to express my opinion concerning the present proposal to change the name of the Institute, I must say frankly that I have no strong opinion one way or the other, apart from the consideration of sentiment and habit which would have weight only with the old members who, like myself, are soon to pass from activity. When the Institute was organized, I do not think I would have objected to any respectable designation; but having loved it long under the name by which it happened to be baptized, I might naturally find difficulty in transferring my affections to another. And I confess that the substitution of impersonal abstractions, like "Mining and Metallurgy," for a term of personality, like "Mining Engineers," seems to me somewhat chilly, and to put us somewhat out of touch with our sister national societies of civil, mechanical and electrical engineers.

Yet the proposed title is perhaps better English than the old one; and if it will give deeper satisfaction, arouse more enthusiasm, command wider support and lead to better work, by all means let the new label be pasted over the one which has been with us round the world. It is really a small matter, unless it be made a large one by over-estimating its importance. And my advice to everybody is, vote with the majority! Only, do not stop satisfied with a mere pedantic improvement, but go ahead with all your might to make the married as glorious as the maiden name!

---

*Secretary Emeritus of the American Institute of Mining Engineers, New York.

The disinterested character of my advice may be inferred from the circumstance that my election as honorary member of the institute deprives me of the right to vote, and therefore I must preserve the dignified attitude of a veteran observer only.

President Urges Leasing System

President Taft, in a message to Congress, read in the House on Feb. 1, again recommends the adoption of the leasing system for public lands valuable for minerals. He says in part:

> The chief change, however, which ought to be made . . . is that by which Government lands containing coal, phosphat and other nonmetalliferous minerals shall be leased by the Government, with restrictions as to size and time, resembling those which now obtain throughout the country between the owners in fee and the lessees who work the mines, and in leases like those which have been most successful in Australia, New Zealand and Nova Scotia. The showing made by investigations into the successful working of the leasing system leaves no doubt as to its wisdom and practical utility. Requirements as to the working of the mine during the term may be so framed as to prevent any holding of large mining properties merely for speculation, while the royalties may be made sufficiently low, not unduly to increase the cost of the coal mined, and at the same time sufficient to furnish a reasonable income for the use of the public in the community where the mining goes on. In Alaska there is no reason why a substantial income should not thus be raised for such public works as may be deemed necessary or useful.
>
> There is no difference between the reasons which call for the application of the leasing system to the coal lands still retained by the Government in the United States proper and those which exist in Alaska.

Federal Control of Coal Prices

WASHINGTON CORRESPONDENCE

Representatives of the American Mining Congress including Secretary James F. Callbreath, Jr., appeared before the Senate Committee on Interstate Commerce on Feb. 2, for the purpose of urging the amendment of the Sherman act in such a way as to permit coal operators to unite in the establishment of trade agreements that would allow the fixing of rates and the regulation of output subject to such kinds of control as the Government sees fit.

It was stated that at present the bituminous industry is in an exceedingly depressed condition. Men are idle about one-third of the year and as about 500,000 men are engaged in the industry, the loss is said to be great. It was urged that at present railroads are getting a large share of the price of coal to the consumer and a concession is seriously needed permitting operators to unite in agreements for the establishment of satisfactory living conditions in the business. By so doing, it was alleged, there would be a saving of money to the public at large, as unnecessary production would be stopped and the coal supply would thus be economized, thereby rendering prices more stable over long periods.

Tables were submitted to show the actual condition of the industry, the witnesses depending largely upon the figures submitted by the Pittsburg Coal Operators Association in cases which are now pending before the Interstate Commerce Commission designed to test the equitableness of the rates between Pittsburg operating points and lake ports. The demands made by the representatives of the mining congress are similar to those made by coal operators in the past. Should a mining commission be created it would be desired to subject to it other mining operations besides coal mining.

Chronology of Mining for January, 1912

Jan. 2—High Ore mine of Anaconda company resumed operations. Picher Lead Co. secured control of the lead smelteries at Webb City, Mo., and Galena, Kansas.

Jan. 6—Mason Valley smeltery at Thompson, Nev., was blown in.—Final announcement made of organization of Inspiration Consolidated Mining Company.

Jan. 9—Six men were reported killed and two injured by an explosion of dynamite in the Parrish mine, near Plymouth, Penn.—Dynamite explosion destroyed powder house and damaged other buildings at the Hollinger mine at Porcupine.

Jan. 11—Lehigh Valley R.R. announced plan to separate the railroad from its coal properties.—An anti-Japanese riot occurred at Hayden, Arizona.

Jan. 15—Converters at Braden mines in Chile, were started, marking final commission of entire smeltery.—Utah Copper Co. placed the seventh section of the Arthur mill in commission.

Jan. 16—Fire at property of Canadian Copper Co., in the Sudbury district, Ontario, destroyed the hospital.—Two men were killed by a falling timber in Kingdon shaft of Old Dominion company.

Jan. 17—Four men were killed in a mine of the Central City Coal & Iron Co. at Central City, Kentucky.

Jan. 18—Vote of British miners was announced as 445,801 for a strike on Mar. 1, and 115,921 against.

Jan. 20—Fire at loading station of the Daly West and Ontario mines in Utah, caused loss of about $20,000 and necessitated temporary shutdown of former mine.

Jan. 21—Five men were reported killed or injured in a dust explosion at No. 4 mine of Kemmerer Coal Co., at Kemmerer, Wyoming.

Jan. 22—Oro Vista No. 1 dredge in Oroville district, California, was placed in commission.

Jan. 31—Fire destroyed surface works at the W. Y. O. D. mine, near Grass Valley, Calif., entailing $30,000 loss.

January Dividends

The accompanying table shows the amount per share and total amount of the dividends paid during January, 1912, by a number of mining and industrial companies in the United States, Canada and Mexico.

UNITED STATES MINING COMPANIES	Situation	Per Share	Total
Ahmeek, c	Mich.	$3.00	$150,000
Amer. Zinc, Ld. & Sm.	U. S.	0.50	40,060
Anaconda, c	Mont.	0.50	2,166,250
Bunker Hill Con., g	Cal.	0.07½	15,000
Bunker Hill & Sull., l.s.	Ida.	0.20	65,400
Copper Range Con., c	Mich.	0.50	192,093
Champion, c	Mich.	1.00	100,000
Daly West, s.l	Utah	0.45	81,000
Homestake, g	S.Dak.	0.50	109,200
Iron Blossom, s.l.g	Utah	0.07	70,000
Hecla, l.s	Ida.	0.02	20,000
Goldfield Con., g	Nev.	0.50	1,779,574
New Idria, q	Cal.	0.60	60,000
North Butte, c	Mont.	0.30	123,000
Portland, g	Colo.	0.02	60,000
Ophir, s.g	Nev.	0.10	20,160
Old Dominion, c	Ariz.	1.00	162,000
Osceola, c	Mich.	3.50	336,525
Pittsburg-Idaho, l	Ida.	0.04	32,120
Tonopah-Belmont, g.s.	Nev.	0.25	375,000
Tonopah Mining, g.s	Nev.	0.40	400,000

CANADIAN, MEXICAN AND CENTRAL AMERICAN COMPANIES	Situation	Per Share	Total
Crown Reserve, s	Ont.	$0.05	$88,441
La Rose, t	Ont.	0.10	149,840
McKin-Dar.-Sav., s	Ont.	0.10	224,769
Mines Co. of America	Mex.	0.15	135,000
Nipissing, s	Ont.	0.07½	450,000
Nova Scotia Stl. & Coal, com	N. S.	1.50	90,000
Nova Scotia Stl. & Coal, pfd	N. S.	2.00	20,000
Temiskaming & Hudson Bay, s	Ont.	3.00	23,283

COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES	Situation	Per Share	Total
Am.Ag.Chem., com	U. S.	$1.00	$171,141
Am.Ag. Chem., pfd	U. S.	1.50	275,730
Am.Sm. & Ref.Co.,com.	U. S.-Mex.	1.00	500,000
Am.Sm. & Ref. Co.,pfd.	U. S.-Mex.	1.75	875,000
Am. Coal Products, pfd.	U. S.	1.62½	169,299
Cen. Coal & Coke, com.	U. S.	1.50	76,875
Cen. Coal & Coke, pfd.	U. S.	1.25	23,437
Consolidated Coal	Md.	1.50	258,389
General Chem., com.	U. S.	5.00	407,565
General Chem., pfd.	U. S.	1.50	150,000
Guggenheim-Expl	U. S.-Mex.	2.50	519,832
Harbison-Walker Refractories	U. S.	1.50	144,000
Nat'l Carbon, com	U. S.	1 50	82,500
Monon. R. Coal, pfd	Pen.	1.00	100,000
Old Dominion of Me	Ariz.	1.00	293,241
Pittsburg Coal	Penn.	..25	371,262
Republic I. & S.	U. S.	1.75	357,296
Sloss-Sheffield, pfd	Ala.	1.75	117,250
U. S. Sm., R. & M., pfd.	U. S.-Mex.	0.87½	425,425
U.S. Sm., R. & M., com.	U. S.-Mex.	0.50	175,525
Vir. Car. Chem. Co.,pfd.	U. S.	1.75	360,000
Vulcan Detin ing	N. J.-Ill.	1.75	26,250

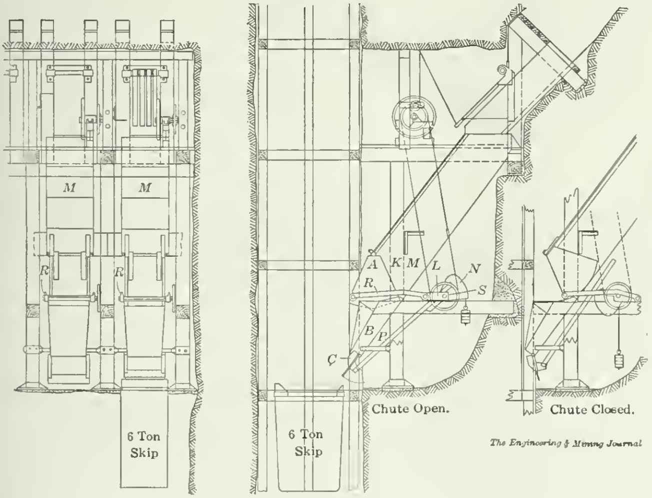
The dividends shown in the table amount to $13,418,735, which compares unfavorably with $14,478,609 in January, 1911.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

A Six-Ton Skip Loading Device



A 6-TON LOADING CHUTE IN THE RAND COLLIERIES GOLD MINES

The following particulars and the accompanying drawings of the six-ton skip-loading device used at the Rand Collieries gold mines are given by Roger Price in a paper read before the South African Institute of Engineers. This device is of the type known as the Kimberley magazine loader. The magazine *M* in the accompanying illustration is a steel box of the same capacity as the skip, 123 cu.ft., which is closed at the bottom by a swing door *A* with wing plates. It is filled from the shaft ore bin of 1000 tons capacity by a chute with a finger door operated by hand.

Below the door is a fixed apron plate *B* with wing plates extending inside the line of the shaft timbers. At the end a short lip plate *C* with wing plate is hinged to the fixed plate. The inside of the magazine swing door, apron plate and lip are provided with renewable liner plates. The liner plate of the lip *C* is in two parts, the lower, 9½ in. wide, being secured by two bolts to the upper portion of *C*. When the chute is open this portion projects into the shaft over the edge of the skip and catches most of the spill. The device is so arranged that the swing door and lip when full open are clear of the skip. The liner plate, in the event of untimely starting of the skip, would be torn off and only the two bolts would be fractured without further damage being done.

The swing door is operated by two side rods *R* connected at one end to a cross bar on the door and at the other to two levers *L* shrunk on the square drive shaft *S*. The toggle action of the crank keeps the door closed while ore is being loaded into the magazine. The hinged lip *C* is controlled by a third lever *N* in the center of the driving shaft *S*. This engages a crosshead between the links *P* controlling the swinging lip. These links hang loose on a turned portion of the shaft *S* and the shaft being rotatable outward, the center lever *N* releases the links *P* which fall and elevate the lip *C*, which is then locked in place by the toggle action of the links *P*. On the back of lever *N* is built a chain wheel with balance weight to reduce the turning movement to a mimimum.

To make it impossible to give any starting signals unless the chute is closed and the lip swung back, one of the levers is connected with a switch on the bell signal which is cut off when the lip is lowered.

The driving shaft *S* is made of square iron turned at the journals with levers shrunk on and it carries a sprocket chain wheel which is connected by a chain gear to the control wheel on the platform above, where the finger doors of the chute are operated.

Rotary Rig for Deep Drilling

By L. H. Eddy

The capability of the rotary rig for deep drilling in California oil fields has been so successfully demonstrated that by many it is now believed the depth of 6000 ft. may be reached with this type of rig, should it be necessary. A depth of 4900 ft., drilled by a rotary, was reported in December to have been reached in Lakeview No. 4 well. At Lakeview Annex well, drilled with a rotary, 6-in. casing was put in at 4500 ft. Lakeview No. 1 suspended at 3950 ft. and Lakeview No. 3 at 3945 ft., both having been drilled with a rotary rig. The 4900-ft. well represents an advancement in rotary drilling, of 1600 ft. in depth in about one year; considering the fact that the rotary has been in successful operation for only about three years in California, the achievement of 3300 ft. in the Coalinga field in October, 1910, and 4900 ft. in the Maricopa field, in December, 1911, is evidence of rapid progress in drilling methods.

While true that there are formations which cannot be successfully and economically explored with a rotary, it is likewise true that some other formations can be more economically drilled by this method than with the standard rig. The introduction of the standard rig in California fields dates back to 1884. Prior to that year the springpole was the only means for drilling employed. The rotary was introduced in California several years prior to its successful employment, but was not considered economically available until it had been so demonstrated in the Louisiana and Texas oil fields; in the first two years of its successful operation in California the maximum depth for which it was deemed available was about 2000 ft., until the 3300-ft. well was drilled in the Coalinga field. In Maricopa flat it is said the formation is such that it would have been extremely difficult to reach with the standard rig the depth that has been drilled with the rotary; that the running sand encountered could not have been drilled economically with standard tools, while the rotary was driven through without difficulty. The usefulness of wells 5000 or 6000 ft. deep, should that depth be necessary and attainable, is problematical, and is dependent upon the gas pressure and the capacity of pumping machinery.

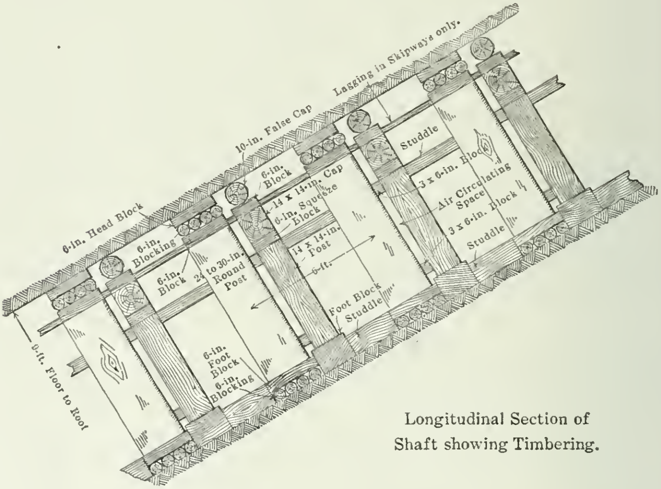
Combination Post and Set Timbering in Shafts

By Claude T. Rice

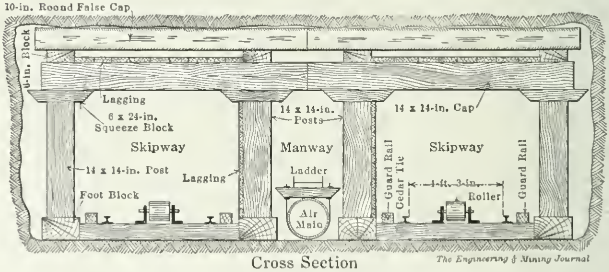
The ground in the inclined shafts that follow the Calumet & Hecla conglomerate is heavy, so that a crew of seven men is kept at work easing the timbers. The manner of supporting the roof when it gets heavy is novel, in that the main part of the top weight is carried on posts while the scalings from the roof are supported by lagging carried on regular shaft sets. When the shaft is first sunk, only the posts, or the "end timbers," as they are called locally, are put in, and the shaft is made 22x9 ft., but after a time the weight begins to come on the roof and the shaft pillars begin to flake away under the pressure, increasing the width to about 25 ft. by the time that the shaft sets are put in.

The posts are put in with foot and head blocks, built up of 6-in. pieces crisscrossed to make a head block 18 to 24 in. thick, and a foot block about 12 in. thick. Then when the weight comes on the posts the crushing of these thick head blocks gives the ground a chance to adjust itself to the new conditions before the posts are injured. Indeed, these built-up head blocks serve quite well to take up what is called the initial creep in ground—the settling of the ground until it has adjusted itself so that it takes most of the weight itself by forming an arch as it were—possibly better than a solid block would. The posts when first put in are about 6½ ft. long, from 2½ to 3 ft. in diameter, and the best of them are Georgia pine, a resinous variety which resists attack by fungus spores quite well. Posts of Georgia pine last about two years before they need to be reheaded and will stand three reheadings, each of which lengthens the post's life two years, so that the Georgia-pine posts have a life of seven or eight years in these shafts. Some hemlock posts are used, which last about two years before they have to be replaced. No reheading of the hemlock posts is possible, as they rot too fast for it to pay. A few hardwood posts have been tried, but last scarcely a year, rotting into a mush-like pulp, in an amazing manner. Indeed so short is their life that it hardly pays to use them.

The post is reheaded as soon as the head block has been compressed to the limit and before compression of the post itself has begun. Owing to the pieces in the head block being laid so that they take the weight across their fibers instead of along them, the compression is confined entirely to the block until the last, when the wood fiber has become so compacted that it is as firm as the fiber of the posts. This reheading consists of sawing and chiseling out a cut across the top of the post so as to allow the post to be knocked out. About 6 in. is lost in this way at each reheading. Then a new set of foot and head blocks is put in, and the post is good for another two years, being practically as strong as when first put in. When the second set of head blocks has been compressed to the limit, the post is again reheaded, but before the post has had to be reheaded, the roof has begun to scale off partly under the weight and partly because of swelling, caused by oxidation of lime minerals in the hanging wall. Lagging has, therefore, to be put in over the skip compartments, and this lagging is carried on regular sets such as are commonly used in inclined shafts. Owing to the swelling of the foot wall, which gives especial trouble through raising and warping the tracks so that the skips will not stay on them, no sill is used under the posts of the shaft set; instead foot blocks of liberal proportions are put in.



Longitudinal Section of Shaft showing Timbering.



Cross Section

Posts and Square Timbers in an Inclined Shaft

The lagging rests on 14x14-in. caps of pine. In a shaft having two hoisting compartments, the cap is in two pieces that butt against one another over the manway, which is placed in the center, as shown in the accompanying drawing. Above the cap proper is carried a false cap of round timber whenever there is room enough. This rests on blocks placed on the cap pieces directly over the posts. Under the cap and between the posts and the cap are squeezing pieces of 6x

14-in. timber, about 24 in. long, with their ends beveled so that they will bend and have less tendency to cut into the caps. The squeezing pieces take most of the crushing in these sets, as by them the pressure is distributed over a larger area on the cap than on the post. In other words, there is a concentrated pressure on the underside of the squeezing pieces, and a distributed pressure on the top side. Consequently, the post cuts up into the underside of the squeezing piece, but the squeezing piece does not in turn cut into the cap. As the weight comes end-on on the fibers of the post, it sustains little injury when it cuts into the squeezing piece.

Studdles are put in to brace the timbers, always at the bottom and generally also at the top of the posts. In order to provide room for the circulation of air between the stull, or end-timber posts and the square-timber posts, as the shaft sets are called, a 3-in. block is put in between. This prevents decay starting on the posts where the two would otherwise be in contact, as it is where there is dead air that the fungus spores which cause the decay first find lodgment and get a foothold.

In easing the timbers, the men work on top of the lagging that is carried on the square timbers, and throw the rock that comes from the easing of the roof off principally at the far sides of the shaft, as it can be scraped down to the level and loaded on the sides more easily than if it were allowed to fall in the manway. Some of it cannot be prevented from falling into the manway and is worked down to the level that way. By this arrangement the timbermen are able to work over the skipways without interfering with the hoisting in the least; indeed it is in order to permit that, as much as for any other reason, that the square timbers are put in.

The combination of posts to take the bulk of the top weight with sets to carry the lagging is a most admirable scheme for timbering inclines in heavy ground, for it throws the most of the wear and tear on the round posts, which are the cheapest elements in the combination to replace. Moreover, by using the squeezing pieces, owing to their acting much as head boards between the caps and the posts, the caps are saved from injury and the life of the square-timber sets is increased.

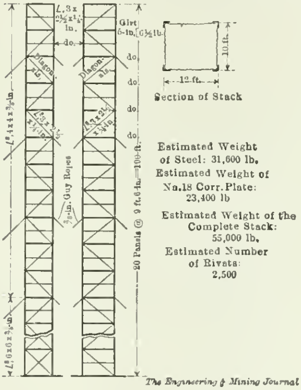
The manway is put in the center of the shaft, so that the men who replace the rope idlers can inspect the track between idlers without entering the skip compartments. The ladder is carried on pieces of timber clamped to the air main, the ladder being bolted to the crosspieces by staples. There is some objection to this arrangement, as if any repairs have to be made on the airmain, the ladder has to be taken off. Still this is a small drawback, and there is the advantage that the ladder is kept clear of the ground, so that rocks cannot accumulate under it to make the securing of a good hold on the ladder rungs difficult. Accumulation of loose rock under the ladder is one of the things that has to be guarded against in an inclined shaft. The rungs of the ladders are 12 in. apart, just as in a ladder for a vertical shaft.

Structural and Corrugated Steel Stack*

By Percy E. Barbour†

The temporary stack shown in the accompanying illustration is an interesting example of unusual practice. I have never heard of any other stack of this size built of corrugated plates and structural steel.

At the Garfield smeltery, Garfield, Utah, an additional stack was required in short order, and one was constructed of wooden posts and braces with a lining of corrugated iron. It served the purpose fairly well, but frequently caught fire and always required watching. The blowing in of another basic converter required an immediate increase in stack capacity, which, it was required, should be cheap and temporary, as an elaborate and expensive flue and stack system for all the converter gases was being designed.


L, 3x2½x¼-in.
Girt 5-in. [6½-lb.
do.
do.
do.
do.
do.
do.
Diagonals
Diagonals
L, 3x2½x¼-in.
L, 3x2½x¼-in.
⅜-in. Guy Ropes
L, 4x4x⅜-in.
L, 6x6x⅜-in.
20 Panels @ 9 ft. 6 in. = 190 ft.
10 ft.
12 ft.
Section of Stack
Estimated Weight of Steel: 31,600 lb.
Estimated Weight of No. 18 Corr. Plate: 23,400 lb
Estimated Weight of the Complete Stack: 55,000 lb.
Estimated Number of Rivets: 2,500
The Engineering & Mining Journal

Steel Stack for Smeltery

This stack, designed and built by me, was 10x12 ft. inside, 190 ft. high, and rested on the steel work of the old structure, which was 20 ft. 6 in. high, thus making the top of the stack 210 ft. 6 in. from the ground. The corner members of the structure were of 6x6x⅜-in. angles for the lower nine panels and of 4x4x⅜-in. angles for the remaining upper eleven panels. Each panel was 9 ft. 6 in. high. The girts were of 5-in. 6½-lb. channels, and the diagonal ties were 3x2½x¼-in. angles with the long leg outstanding. The panels were made 9 ft. 6 in. in order to take a 10-ft sheet of corrugated metal, and, because this was too long an unsupported span, a 3x2½x¼-in. angle girt was put in the middle of each panel. At the base of the structure a 6x6x⅜-in. angle was used on all four sides to connect the stack to the old steel work. At all panel points ⅜-in. gusset plates were used.

The corrugated plates were bolted on with ⅜-in. bolts through the channel girts and held on the inside by means of straps of ¼x1¼-in. iron, and were fastened to the angle iron girts by means of 9-in. clinch nails.

The steel erection gang consisted of five men, including the boss who operated the air hoists with which the hoisting was done. Three of the men were topmen. The riveting gang consisted of four men and a gang of four men was put on the corrugated plates.

COST OF A TEMPORARY STEEL STACK

			Cents per lb.
Labor:			
Erection contract*	$650.00		
Erection gang, extra labor	106.90		
Total erection		$756.90	1.376
Machine and boiler shops	$659.30		
Carpenter shop	69.45		
Mason	1.45		
Common labor	40.00		
Hauling	6.35		
Total fabrication and outside		776.55	1.412
Materials:			
Structural steel	$804.44		
Corrugated iron	768.00		
Round iron and steel plate	487.22		
Rivets, bolts and clinch nails	175.86		
Total structural		2235.52	4.064
Cast iron	$6.94		
Guy wire	265.29		
Paint	105.14		
Cement	15.00		
Lumber	7.63		
Tools and sundries	8.92		
Total sundries		408.92	0.744
Supervision, city office		709.73	1.290
Total cost of stack completed		$4887.62	8.886

*The actual cost to the contractor for erection was $708.23, but the extra work due to a multiplicity of shop errors in fabrication more than offset the contractor's loss, which is therefore not taken account of in the per pound cost.

After the skeleton was erected and riveted, it was painted, two men doing this in 1½ shifts of eight hours, with two men below to lower staging which was inside the skeleton and slung from a single block at the top. The corrugated plates were painted on the ground before they were put in place.

The total estimated weight of stack was 55,000 lb. The total cost of the stack completed was $4,887.62. This cost is given in detail in the accompanying table.

---

*An article in the Journal of the Worcester Polytechnic Institute for November, 1911.

†Superintendent, Uwarra Mining Co., Candor, N. C.

Of course this is a high cost per pound, but the structure is a skeleton, the shop was unused to fabricating work of this kind, and the erection was done under great difficulty, as the sulphur smoke was at times heavy enough to drive the men to the ground. My original estimate of the cost was 10c. per pound.

Separating Rock from Clay*

By F. A. Killik

For the purpose of separating a large proportion of stiff wet clay from the ore delivered to the mill of the Totok gold mine, Celebes, Dutch East Indies, the following method was employed:—The clay occurs with the quartz, and formerly gave great trouble in the bins, breakers and automatic feeders. The ordinary puddler did not prove a suitable machine for effecting the necessary separation, on account of its high cost of installation, heavy running charges and other drawbacks, and therefore it became necessary to find a better method. Owing to the fact that water under pressure was available at the mine, the present plant was devised, and has proved eminently satisfactory in the reduction of labor and other costs, besides being beneficial in other ways. I am not aware that any description of a similar method has been published.

In Fig. 1 is shown a strongly constructed V-shaped hopper *A* made with water-tight joints and set at an agle of 25° to the horizontal; the front or mouth of this hopper is four feet wide, and is closed to within two feet of the level of the washing plate *B*. Six inches in front of this is an adjustable board *C*, 10 in. wide, so set as to form a space between it and the plate *B*, which is four feet wide, four feet long, and has a fall of three inches. It is boarded in at the sides from a hight of from three to four feet; fitted under the forward end is a grizzly *D*, four feet in width, set at an angle of 45°, the bars of which are 10 ft. long and spaced ¾ in. apart.

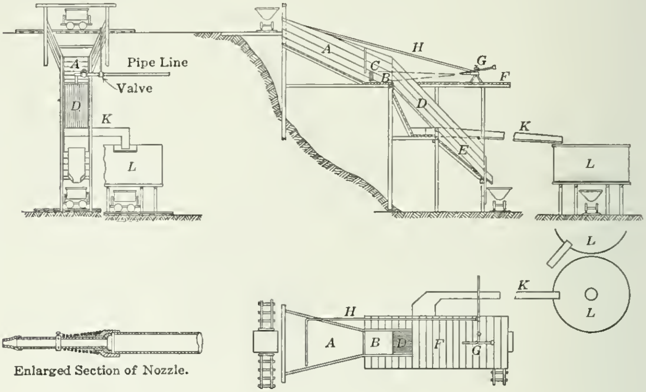
The ore bin *E* is placed 18 in. below the grizzly at an angle of about 38° from the horizontal, the boarding around the bin being extended up both sides of the grizzly. The bin front is of the usual construction, fitted with an adjustable door and butterfly in the chute.

The timbers carrying the washing-plate are extended some 15 ft. and supported by the front posts of the bin. Upon this extension is the operating platform *F* about 18 in. above the level of the washing-plate. A pipe line is provided, terminating in a nozzle *G* controlled by a valve. The nozzle *G* of the washing-pipe is afforded change of direction by means of a ball-and-socket joint of simple construction, the details being shown in the sectional drawing. It will be noticed that the ball-and-socket joint is kept tight, when the high-pressure water is shut off, by means of a spiral spring that keeps the two parts in bearing. A lever is clamped loosely to the nozzle for the purpose of directing it where required; this is attached in position by a bolt on a bridge support in the same manner as is practiced with hydraulic monitors. A ¾-in. pipe *H*, with a controlling valve, is taken off the pipe line at a convenient point before it reaches the nozzle, and this pipe is carried up above the hopper, over which it is extended by a right-angle bend provided with perforations, for the purpose of spraying the material as it is dumped into the hopper from the trucks above.

A waste-rock "sollar" is built below in a convenient position for sorters. Immediately below the grizzly is a wide launder *K* closed in to prevent loss from splashing, the bottom being kept well inclined to one side, where it is narrowed down and connected with a launder leading to settling tanks *L*. The hopper *A*, and also the sides of the grizzly compartment and bin, are lined with ⅛-in. flat steel sheets; for the bottom and sides of the washing-plate *B*, old side plates from mortar-boxes are used. The settling tanks *L* are of the usual construction, with filter bottoms and bottom-discharge doors, and of a size and number suitable to the capacity of the plant.

The total height, as shown in Fig. 1, is 28 ft., but to meet the circumstances of the installation, the measurements may be reduced in the following respect; the hopper may be shortened, the grizzly cut down to six feet, or somewhat less, and the ore bin below the grizzly set at an angle of 35° and shortened.

The foregoing description is of the No. 1 plant. The No. 2 plant varies from that already described in having a fine



Enlarged Section of Nozzle.

Fig. 1

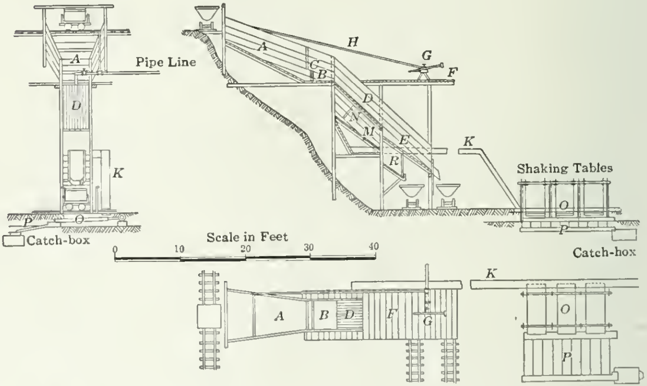


Fig. 2

The Engineering & Mining Journal

Plants for Separating Stiff Clay from Ore removable screen M, Fig. 2 under the grizzly, and the baffle-board N set at right angles to the latter to throw sand on the screen; a second small bin R to take the product remaining on the screen, together with shaking tables O and blanket tables P, all of which are shown in the accompanying illustration.

---

*Excerpt from an article entitled "Notes on a Simple Method of Separating Rock from Stiff Clays." Bull. 87, I. M. M.

If a large quantity of ore has to be handled it must be ascertained if the fines (say the material passing an 8- or 10-mesh screen, after contact with mercury on the shaking tables) are worth collecting and milling. If so, the plant would be constructed according to the arrangement shown in Fig. 1, using the grizzly only, with settling tanks. If, on the other hand, the fines be poor enough to discard after mercury contact, an 8- or 10-mesh screen must be placed immediately below the grizzly, as shown in Fig. 2. The fines passing the screen are led to shaking tables, the first two compartments of which contain mercury, and they are run at a speed to give some 200 shakes per min. After this treatment the sands are run over a wet blanket table and thence into the catch box.

Should the material to be treated contain but a small percentage of rock, and this not of sufficient size to act as a disintegrator on the plate, rock must be added at this point, and the opening exposed to the water jet diminished to prevent too rapid feeding. The larger pieces of rock on the plate may be retained there by a few bars through which the fines and water pass.

The material dumped into the hopper is subjected to a constant spray of water by means of the sprinkling pipe H, which thoroughly moistens the clay and aids the subsequent disintegration of the charge when it is attacked by the water jet.

When the hopper is well filled, water from the nozzle is caused to play upon the opening; the rock washed out lies on the washing plate and sets up a grinding action upon the material. As the washing process continues the rock accumulates on the plate and is gradually worked forward until it drops into the bin below, the fines and water passing through the grizzly, whence they are conveyed by launder to the settling tanks. The hopper should be well supplied during the time of filling the settlers, and the flow of water maintained in order to prevent settlement of slimes in the tanks which would hinder their subsequent draining.

The material actually being treated at the mine with one washer is about 200 tons per 24 hours, and consists of:—Rock retained upon 3/4-in. grizzly, 30%, assaying 10 grams of gold per ton; fines passing grizzly, collected in settling tanks, 23%, assaying 16 grams; waste rock sorted out, 7% and slimes discarded, 40%, assaying one gram.

The pressure of water at the nozzle is about 125 lb. per sq.in., but if necessary a lower pressure could be used efficiently. A 7/8-in. nozzle is fitted, but the valve is never opened full, from 15 to 20 cu.ft. of water per min. being used.

The cost of treatment per ton, based on 200 tons per day actually treated, was: Labor (8 hours per day), hydraulicking, 3 natives, at 24c. per day 72c.; sorting and trimming, 12 natives, at 20c. per day, $2.40; discharging tanks, 4 natives, at 20c. per day 80c.;—total, $3.92. The cost on total amount treated was 1.96c. per ton; on total amount recovered, 3.6c. per ton. The cost of treatment by the older method, with puddlers and shaking tables (on contract), upon the basis of 400 tons daily of material, containing 21% rock, 6.5% sands, 10% waste sorted out, and 62.5% passed away over shaking tables, was, on total amount treated 6c. per ton; and on total amount recovered, 22c. per ton.

Upon this material the costs under the new method would be:—On total amount treated, 1.8c.; and on total amount recovered, 6.4c. per ton. These figures do not include the power for driving the puddlers, etc., required by the older method, which would amount to 1.2c. per ton of material treated.

The disadvantages of the older system, compared with the new, were: higher first cost, power required to drive puddlers; great wear and tear of plant; increased labor; lack of continuity; increased time required for clean up and excess of water required.

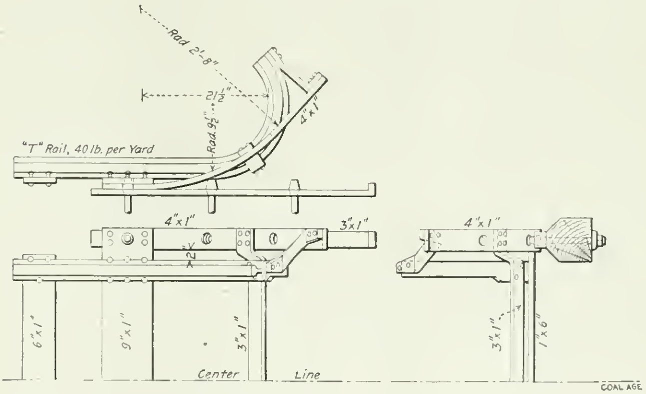
The advantages of the new method are: a continuous plant working almost automatically; no gold settling anywhere except in the tanks, or upon the shaking tables; uniform flow of water, facilitating good running of the tables; minimum wear and tear and constant feed of rock into bin, assisting sorting.

A Car Dumping Device*

By R. O. Burt†

The dumping device shown in the illustration consists of a movable platform which stops and supports the car as it tips over for dumping. There are two stationary guide plates on either side, outside the rails. These plates are of 1x3-in. iron, mounted on longitudinal timbers. Two lengths of 40-lb. T-rail are bent to form horns for engaging the car wheels on each side and just outside the rails, 1x4-in. roller bars are carried by the same plates, which act as spreaders for the rails.

In operation the carriage is held to its proper position by tapered studs which project from the guide plates and engage corresponding holes in the rollers. The force and the angle of the tip is so great that the car is pitched forward until the hind wheels leave the track, the car balancing on its front wheels.



A Quick-acting Mine-car Dump

The dumps are set close up to the switch of the track for empty cars, so that the car on being dumped immediately switches out of the way of the approaching loaded car. The distance of the heel of the rocker from the point of switch is 2 ft. 2 in. and the lead of the switch is 9 ft. 4 in. As much as 6061 tons have been dumped in 10 hours over a device of this sort, and the dump has a capacity of at least 6700 tons when the loaded cars are kept ready on the side track all day long. The approaching grade is 3 per cent.

The mine cars carry a net load of 4704 to 5152 lb. Running to the dump at a good speed, they would jerk the structure considerably were it high or long, so the dumping device should be used only where the structure is low and short.

---

*Abstract from an article in "Coal Age," Jan. 6, 1912.

†Chicago, Ill.

A New Gold Dredge at Oroville

By Lewis H. Eddy

Oro Vista No. 1 dredge, installed at Oroville, Calif., by Lawrence Gardella and put into active commission on Jan. 22, is the first new gold dredge in the California fields in 1912. This is the fourth boat built by the Risdon and the Union Iron Works for Mr. Gardella. It was the last dredge designed by the Risdon prior to the taking over of the plant by the Union Iron Works in July, 1911, and was the only uncompleted one on the Risdon books at that time. It is probable that this installation will be the last new boat in the Oroville field of the Feather River district, as the field is now covered with a full complement of dredges necessary to the area remaining to be worked.

Severe Digging Requirements

This is a 5-cu.ft. bucket-elevator Risdon-type dredge designed to dig 35 ft. below the water line in average operation, but equal to a depth of 42 ft. below the water line under extreme conditions and to handle a bank 12 ft. above, making a total depth of 54 ft. The ground which is situated between two sections of the town of Oroville is hard-digging material, necessitating especial strength in design and construction to withstand the severe strains to be encountered. The dredge is equipped with revolving screen, belt conveyor and standard-type gold-saving tables. It is electrically driven, the total power being 200 hp. The yardage capacity is 80,000 cu.yd. per month.

The hull is 108 ft. long, 42 ft. wide, 8 ft. deep; the frames are cut of 8x10-in. timbers extra well braced. All planking is of 4x12-in. lumber; the gantries and housings are made especially strong; all lumber is of the best quality, selected to withstand hard service.

The base and hood of the buckets are cast in one piece of manganese steel; the lip is of manganese steel rivéted to the bucket; no other rivets are used in the construction of the bucket. There is no extra thick metal used, although great strength is assured in the design, which is different from any other bucket made. The bucket pins are of high-carbon steel, each pin being subjected to shearing in four places, making them smaller in diameter than for the usual bucket of this size; they are held from turning by a large cross cotter which eliminates expensive forge work and machining. The pins are reversible so that the bucket line does not get badly out of pitch before the pins are worn down; and they are longer than the usual pin for a 5-cu.ft. bucket in order to give the necessary wearing surface.

The digging ladder is of solid-girder type, 78 ft. long, fitted with sluiceway; also equipped with an indicator and automatic device to register the depth below the water line at which the dredge is digging, which is deemed necessary in this ground as it is rich at bedrock. The lower tumbler is six-sided, lined with manganese-steel wearing plates on treads and side flanges; the bearings are watertight, lubricated by compression grease cylinders fitted on the ladder above the water line, thus providing for lubricating without going off the ladder. The upper tumbler is five-sided. It is carried on a steel frame which extends down and forms the dump box or hopper. The hopper is supported by four vertical posts, passing through the steel work, and resting on top of the posts. Two fore-and-aft stringers 12x20 in. extend from the bow to the stern gantry, thoroughly braced in all directions.

The upper-tumbler shaft is 14½ in. diameter in the center; the tumbler center is lined with manganese tread plates. The single driving gear, 12 ft. in diameter, is cast steel; the teeth are double shrouded. The pinion driving the gear is situated forward and below the tumbler shaft; thus the strains of the bucket line and the strains exerted by the pinion in driving the gear counterbalance one another to a great extent. The intermediate gear and pinion are of cast steel and have cut teeth; the usual friction mechanism is attached to the pinion, and is also of cast steel, and has cast-steel shoes lined with friction fiber. All this arrangement is simple as compared with former construction of this character. The main-drive motor is 100 hp., driving with a 16-in. belt, a solid wooden pulley being used on the first countershaft.

Riffled Collecting Box Beneath Revolving Screen

The revolving screen is 32 ft. long, 6 ft. diameter, fitted with screen plates having ⅜-in. perforations. The screen is driven by friction gearing at the lower end. The gold-saving device is fitted with a steel collecting box or pan set beneath the revolving screen and lined with riffles; 90% of the gold being saved in these riffles. The material then passes to the lower end of the box and runs forward on an inclined sluice where it is divided and passes on to the side tables on both sides of the dredge; all the discharge is at the stern of the boat through the usual side sluice.

The conveyor is 103 ft. long, fitted with a 30-in. belt, and is carried on two 15-in. I-beams. The belt is driven at the upper end by a separate motor. The winches were taken from the L. & J. Gardella dredge; there is one main winch with six drums and one ladder hoist with one drum; the winches are driven by separate motors situated on the forward port side.

The hopper is an interesting feature of this dredge. The design and construction are such that the hopper always contains sufficient material discharged from the buckets to prevent wearing of the hopper bottom, thus making it self-lining; also the angle of repose always is adjusted to the character of the material handled. Sticky material piles up in a much deeper angle than does clean gravel, the result being that the material slides into the revolving screen easily. In the use of the steel chute heretofore, the material passed into the revolving screen at a considerable velocity and might move half-way down the screen before coming to rest.

Utah Copper Company

The quarterly report of the Utah Copper Co., covering the last quarter of 1911, shows that there was produced a total of 26,818,247 lb. of copper. The production by months was as follows: October, 8,660,729 lb.; November, 9,117,961; December, 9,039,557 lb. The total of 26,818,247 lb. compares with the first three quarters of the year as follows: First quarter, 21,296,709 lb.; second quarter, 24,469,812 lb.; third quarter, 25,851,456 lb. The average monthly production for the last quarter was 8,939,416 lb., comparing with, first quarter, 7,098,903 lb.; second quarter, 8,156,604 lb.; third quarter, 8,617,152 lb. The total production for 1911 was 98,436,224 lb., as compared with 89,019,511 lb. for the preceding year; the average monthly production for 1911 was 8,203,019 lb., compared with 7,418,293 lb. for 1910.

The total quantity of ore treated at both plants for the last quarter was 1,365,910 tons, as compared with 1,273,373 tons for the previous quarter. Of this tonnage the Magna plant handled about 76%, and the Arthur plant about 24%. The average assay of the ore treated during the last quarter is stated as 1.418% copper, as compared with 1.483% for the previous quarter. It is further stated that the low grade of the ore treated during the fourth quarter is due to the fact that the shovels on some of the intermediate stripping levels encountered ores that were more or less mixed with capping, some of which was unavoidably included in the ore. This difficulty is expected to be experienced for some months to come, or until it is possible to remove all of the capping from a considerable portion of the orebody on some of these intermediate levels. About 73% of the total ore treated during the quarter was mined by steam shovels, and about 27% came from underground mining operations.

After making allowances for smeltery deductions, and without crediting miscellaneous income, the average cost per pound of net copper produced during the fourth quarter is stated as 7.85c., as compared with 7.56c. for the third quarter of 1911. It is stated that this increase in cost per pound is accounted for by the decrease in the average assay value of the ore, and the increased cost of operations during the winter months. The financial results of the last quarter's operations are given as follows: Net profits from milling operations, $1,475,680; additional income from rent and miscellaneous sources in Utah, $86,896; income from Nevada Consolidated Copper Co.'s dividends, $375,187; income from Bingham & Garfield Ry. Co.'s dividends, $220,000; total net profit for quarter, $2,157,764; dividends paid, $1,177,011; leaving $980,752 as net surplus for the quarter. It is stated that these earnings are computed on the basis of 13.642c. per lb. for copper. At the end of the quarter no copper due for delivery from the refinery remained unsold. The $220,000 income from the Bingham & Garfield Ry. Co.'s dividends does not represent the earnings of the railway company merely during the quarter, but includes trackage rentals for the year.

SEVENTH SECTION OF ARTHUR MILL STARTED

The entire Magna plant was operated throughout the quarter, but its capacity was reduced considerably below the normal of 12,000 tons per day during November and December, because of winter-weather conditions, which were especially severe. In the latter part of October, the sixth remodeled section of the Arthur plant was placed in commission, and since then the six sections have been in full operation. About the middle of January, the seventh section was completed and placed in operation. It is stated that the operations of the Arthur plant indicate that when all the 13 sections have been remodeled, the capacity of the plant will be at least 8000 tons per day. During the last quarter a total of 1,520,058 cu.yd. of capping was removed from both the Utah and Boston groups, as compared with 1,595,095 cu.yd. for the third quarter. This decrease was also due to winter-weather conditions.

The Bingham & Garfield Ry. is stated to have done a profitable business during the quarter and no difficulties were experienced in its operation. An average of 7275 tons of ore per day was hauled from the mines to the mills, and this was done with only two road engines and 120 cars in service. Additional equipment was purchased for the increase in business on this railway during 1912. Orders were placed for a third Mallet compound locomotive, two switching locomotives and 130 additional ore cars. When these have been received, there will be three Mallet compound locomotives, four switching locomotives and 250 ore cars in the total equipment.

Pig Iron Production in 1911

The completed statement of the American Iron & Steel Association shows that the total production of pig iron in the United States in 1911 was 23,649,344 long tons; a decrease from 1910 of 3,654,223 tons, or 13.3 per cent. The production for the second half of the year was 11,982,348 tons, being 315,352 tons more than in the first half. In 1910 there were 14,978,738 tons made in the first half and 12,324,829 tons in the second half of the year.

CLASSIFICATION OF IRON

The classification according to uses for which the iron was intended is as follows:

	1910		1911	
	Tons	PerCt.	Tons	PerCt.
Foundry & forge	6,352,379	23.3	5,256,815	22.2
Bessemer pig....	11,245,642	41.2	9,409,107	39.8
Basic pig........	9,084,608	33.2	8,520,029	35.0
Charcoal.........	396,507	1.5	278,676	1.2
Spiegel and ferro	224,431	0.8	184,717	0.8
Total..........	27,303,567	100.0	23,649,344	100.0

Included in the bessemer pig in 1911 is 282,460 tons special low-phosphorus iron. This was 23,383 tons more than in 1910, and was the only increase in any class of iron, except ferromanganese. The make of ferromanganese in 1911 was 74,482 tons, or 3106 tons more than in 1910. Spiegeleisen decreased, however, the production in 1911 being 110,235 tons, or 42,820 tons less than in the previous year. Included in charcoal iron are small quantities of pig iron and of ferrophosphorus, ferrotitanium, ferrovanadium and other alloys made in the electric furnace.

The notable point in the classification is the decrease in the proportion of bessemer pig and the increase in basic iron. The production of bessemer pig showed a decrease of 16.3 per cent., as compared with 1910, but the loss in basic was only 6.2 per cent. The proportion of forge and foundry also decreased, the loss being chiefly in forge iron.

FUELS USED

The production according to fuels used was as follows:

	1910	1911	Changes
Coke..............	26,257,978	23,141,093	D. 3,116,885
Anthracite & coke	628,579	212,548	D. 416,031
Anthracite........	20,503	17,027	D. 3,476
Charcoal.........	396,507	278,676	D. 117,831
Total..........	27,303,567	23,649,344	D. 3,654,223

Raw bituminous coal is used by only two or three small furnaces; they are included under coke. The very large decrease in anthracite iron is due to the fact that the furnaces using that fuel are chiefly merchant stacks in eastern Pennslivania which can compete profitably with the Central West and the South only when prices are at a comparatively high level; and they are, therefore, usually the first to quit in slack times.

NUMBER OF FURNACES

The whole number of furnaces in blast on Dec. 31, 1911, was 231, against 212 on June 30, 1911, and 206 on Dec. 31, 1910. The number of furnaces idle on Dec. 31, 1911, including furnaces being rebuilt, was 235, against 261 on June 30, 1911, and 268 on Dec. 31, 1910. During the last six months of 1911 the number of furnaces actually in blast during a part or the whole of the period was 275, against 297 in the first half of the year. In the last half of 1910 332 were active, against 374 in the first half.

PRODUCTION BY STATES

The production by states for two years has been, in long tons:

	1910	1911
Massachusetts and Connecticut........	16,582	9,649
New York...........	1,938,407	1,562,756
New Jersey..........	264,781	40,663
Pennsylvania........	11,272,323	9,806,834
Maryland............	326,214	255,816
Virginia.............	444,976	293,642
Georgia and Texas....	14,725	1,200
Alabama............	1,939,147	1,712,443
West Virginia	174,661	291,472
Kentucky...........	100,509	95,202
Tennessee...........	397,569	324,648
Ohio................	5,752,112	5,310,310
Illinois..............	2,675,646	2,108,002
Indiana and Michigan.	1,250,103	1,163,932
Wisconsin and Minn...	307,200	276,807
West of the Mississippi	428,612	395,968
Total............	27,303,567	23,649,344

The producing states west of the Mississippi are Missouri, Colorado, Washington and California. In 1911 Pennsylvania remained the leading state, making 41.5 per cent. of the total. It was followed in order by Ohio, Illinois, Alabama and New York.

PRODUCTION FOR TEN YEARS

The make of pig iron in the United States for 10 years has been, in long tons:

1902	17,821,307	1907	25,781,381
1903 .	18,009,259	1908	15,936,108
1904	16,497,003	1909	25,795,471
1905 .	22,992,380	1910	27,303,567
1906 .. .	25,307,191	1911	23,649,344

The production in 1911 was greater than that of any year prior to 1906; but it was exceeded in every year since that, except in the disastrous period of 1908. The consumption of pig iron in 1910 and 1911, however, did not differ widely. While exact figures on this point are not to be had, the closest possible estimate puts the stocks of unsold or unused pig iron in makers' hands at the close of 1910 at 2,100,000 tons, an increase of 1,700,000 tons during that year. In 1911 these stocks were decreased by something like 1,250,000 tons, standing at about 850,000 tons at the end of the year. From the decrease in production, therefore, the decrease in stocks must be subtracted to get at the real diminution in the quantity of iron used.

The Sitka District, Alaska

WASHINGTON CORRESPONDENCE

The U. S. Geological Survey prepared a study of the Sitka mining district, Alaska, by Adolph Knopf and transmitted it to the House of Representatives where it has been published (H. R. Doc. 183, 62d Congress, 2d session).

The main points with relation to the ore deposits are as follows:

> The known mineral resources of the Sitka mining district are gold and gypsum. To these granite may, perhaps, be added as a possible undeveloped resource. The gold is found in quartz lodes, which commonly occupy shear zones in graywacke. Two properties, both situated at Klag Bay, on the coast of Chichagof Island, have so far been put on a productive basis and give strong promise of a prosperous career. The ores, which range in value from $15 to $90 per ton, are of considerably higher grade than the average ore of southeastern Alaska. A large number of orebodies of the same general character have long been known to occur near Sitka, but owing to the low-grade ores contained in them none have yet been brought to a producing stage.
>
> The orebodies of the region show neither in their mode of occurrence or origin any obvious or immediate relation to contacts of dissimilar rocks, to dikes, or to other igneous rocks. The principal mineral belt appears to lie along the edge of the slate-graywacke formation bordering the band of metamorphic rocks that flank the diorite occurring in the central portion of the islands. The better known ore deposits are found in graywacke, but this is doubtless a fact of no essential significance and should not deter the prospector from searching in other kinds of rocks. . . . That a favorable set of conditions is most likely to be found in the zones that border the long belts of granitic rocks traversing the region is maintained in this report. The indications afforded by present developments point strongly to the conclusion that the entire strip of territory contiguous to the west coast of Chichagof Island offers a more encouraging inducement to the search for new orebodies than any other part of the region.

Portland Cement in 1911

A preliminary estimate of the district production of portland cement in 1911 has been issued by the U. S. Geological Survey. It divides the producers into groups, the basis of which is the trade territory covered by each group. To a certain degree this results in basing the grouping of plants on the raw material used. For instance, plants in northeastern Indiana using marl are grouped with the Michigan plants. The plants in southern Indiana and northern Kentucky using hard limestone are grouped together. All the plants near Chicago, whether in Illinois or Indiana, are put together because of their nearly equal freight rates. The southeastern States, in which the plants use mostly Appalachian limestone, are grouped together and Texas has been transferred to the group of Great Plains states with which it logically belongs.

By territories the production is given as follows: Eastern Pennsylvania and New Jersey (Lehigh district), 25,924,516 barrels; New York, 3,314,217; Ohio and western Pennsylvania, 6,675,249; Michigan and northeastern Indiana, 4,570,033; Kentucky and southern Indiana, 2,818,820; Illinois and northwestern Indiana, 8,617,341; southeastern States, 4,500,001; Iowa and Missouri, 6,060,261; Great Plains states, 6,904,468; the Mountain states, 2,117,930; Pacific Coast, 6,860,400; a total of 77,877,236 bbl. This, as may be seen, is only a small increase over the 1910 figures, and indeed the Survey states that when the absolute returns are in for 1911 it may be that they will show a slight falling off from the 1910 figures.

Aluminum Dust Explosions

The question of explosions of aluminum dust has been investigated extensively. According to R. J. Zink (*Chem. Zeit.*, 1911, p. 1370; abstr. in *Journ.* Soc. Chem. Ind., Jan. 15, 1912, p. 30), aluminum dust alone is not explosive, but becomes so in presence of a quantity of an inflammable gas, corresponding to about one-third of the lower limit of inflammability of the gas. In the case of explosions in aluminum-bronze factories, the presence of the inflammable gas was attributed to the decomposition of water by the aluminum powder or by electrical discharges produced in the machinery. The ignition of the mixture of dust and gas was attributed to electrical sparks produced in the machinery. The author states, however, that even if the aluminum powder be carefully dried, explosions cannot be entirely prevented, and he considers that a more probable source of inflammable gas is the presence of a small quantity of aluminum carbide in the aluminum powder; this might escape complete decomposition in the preliminary working up of the metal, owing to a protective film of alumina, but the latter would be gradually removed in the polishing mill. From 10 kg. of aluminum containing 0.1 per cent. of aluminum carbide and only about 0.15 per cent. of moisture, 4.8 liters of methane would be produced, or sufficient to form 160 liters of an inflammable mixture of dust and gas. Since, at present, it appears impossible to prevent electrical phenomena in the machinery, it is necessary to provide means to minimize the danger arising from the explosions, and the author suggests that in addition to the rules formulated by the *Suddeutsch. Edel- und Unedelmetall-Berufsgenossenschaft für die Herstellung von Aluminium in Pulver* the mill should be closed dust tight by a plate of a material (plaster, earthenware, etc.) permeable to gases, but not opposing any considerable resistance to an explosion. By this means the explosion would be propagated, as in the firing of a cannon, mainly in one direction, i.e., into the open air, and risk of injury to workpeople and to other machinery considerably lessened.

Link-Belt Elevators

BY BENEDICT SHUBART*

The subject of conveying and elevating machinery is of importance in milling operations but is not always given the consideration it deserves when a mill is being designed. Too often the time-honored rubber-belt elevator is installed without regard to conditions, in the mistaken belief that long usage has established this form as the best to be had.

After 15 years' experience in designing, constructing and handling elevators, I am convinced that in nine cases out of ten more economical operation and more satisfactory service can be obtained from other types of elevators.

In the selection of an elevator several points should be considered: the character of the ore to be handled, whether dry, wet, sticky or freely discharged; size of the product; capacity and length of service desired. Naturally no one type of elevator will serve all these different conditions. I shall confine this article to a description of an elevator for handling dry ore crushed to 5 in. or less.

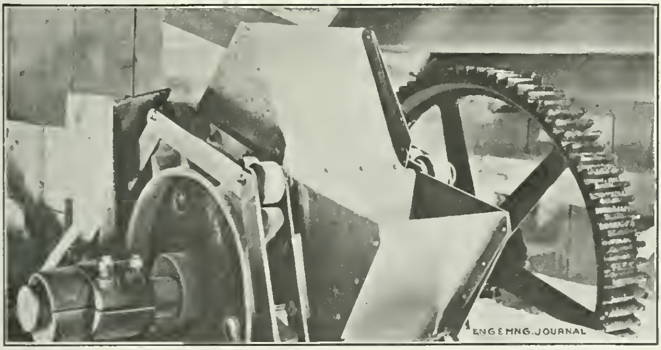
LINK-BELT ELEVATOR AT STRATTON'S INDEPENDENCE

After unsatisfactory experience with various types of elevators for handling abrasive material, the engineer who designed the United States Portland Cement Co.'s plant at Concrete, Colo., decided to take a radical step and in connection with the engineers of the Link-Belt Co., developed a continuous bucket elevator mounted on two strands of heavy bushed steel roller chain. These elevators were massive and slow moving, running only about 60 ft. per min., and were set as near vertical as possible. In point of reliability and low maintenance costs, the results were so thoroughly good that when Philip Argall designed the plant of Stratton's Independence, Ltd., he decided to install four Link-Belt Co. continuous-bucket, slow-moving elevators of the following specifications: 18x18x12-in. buckets mounted on two strands of ⅜x3x18-in. bushed steel chain with 5-in inclosed oiling rollers at the articulation; speed, 60-ft. per min.; no boot used, the feed spouting directly into the buckets; head gearing of the Link-Belt equalizing gear type.

---

*Boston Building, Denver, Colo.

These elevators have been in use for four years and the supplies so far purchased consist of eight head sprockets, a pair for each of the four elevators, at a total cost of approximately $150. So far as known, the elevators have never broken down and have been substantially free from any operating trouble. A similar elevator was subsequently installed at the Portland mill, replacing a different type of elevator.



Discharge of Link-belt Elevator, Stratton's Independence Mill

In designing an elevator of this type, the first consideration is absolute rigidity between the buckets and the chain. The chains must be heavy enough and the buckets made of sufficiently heavy material so that there can be no weaving of the various parts constituting the bucket line. The elevator must move slowly, not over 100 ft. per min. The rollers at the articulations must be large and must be so designed that the oiling is certain. The sprockets at the head end should be of the flint-rim type and equalizing gears should be used to prevent the pulsation due to the operation of a long-pitch chain. The elevators should be set vertically or as near so as possible. There should be no boot but the feed should go directly into the buckets, feeding in at a height about two buckets above the center of the footshaft. The discharge spout should be at an angle of not less than 45 deg., should clear the buckets about one inch, and should be set at a point six inches below a point established by striking a 45 deg. line through the center of the headshaft.

The capacity of the above elevators at a speed of 100 ft. per min., is 150 tons of rock per hour. The power consumption based on 50-ft. centers is not in excess of 15 hp. In comparison with a properly designed belt elevator of the same capacity, the cost is but little more. A 50-ft. elevator complete with chain line, head and foot gearing, and steel guards, will cost approximately $850 at the works. The design of this elevator and its appearance after four years' service are plainly shown in the accompanying cuts which were taken at Stratton's Independence.

Giroux Consolidated

At the Giroux shaft, water is being hoisted by bailers to the 1200-ft. station sump and thence to surface by the 1200-gal. pump. The submerged station pump at the 1400-ft. level was started with air but is working inefficiently. This is believed to be due to worn packing and to exhausting under a head of from 50 to 75 ft. of water in the shaft. On surface at the Morris shaft excavating is in progress for a railroad spur, which will run close to the shaft but at an elevation about 30 ft. lower. This difference in elevation will be utilized by constructing large orebins with the top at the elevation of the shaft collar. About 60 days will probably be required to finish the excavating.

Dispatches from Duluth state that the directors were reëlected at the annual meeting, Feb. 6. The annual report shows a balance of $180,000 in cash and bonds. A 5-year contract has been made with the Steptoe smeltery, at McGill, Nev., effective May 1, which provides for minimum shipments of 900 and maximum of 1200 tons per day. It is stated that over 4,000,000 tons of 2.14% porphyry ore are fully developed in the Bunker Hill mine. There is also said to be an estimated tonnage of 10,291,000 tons of 2% and 6,600,000 tons of 1.65% copper ore fully and partially developed. The Alpha shaft is said to have enough ore in sight to meet all cost of equipment and machinery for this shaft. It is stated that the company expects to produce copper for 9½c. per pound.

The Flameless Combustion of Gas

The article published under the above caption in the Journal, Jan. 20, 1912, was taken, almost without excision, from Prof. Bone's lecture, delivered at the annual convention of the American Gas Institute at St. Louis, Mo. The introductory paragraphs, in which a brief review of the work of other investigators, as well as the theoretical aspects of "surface combustion" were stated, were omitted purposely to emphasize the fact that Prof. Bone had made his initial practical application of the results of his investigations.

In these introductory paragraphs, Prof. Bone says:

> The influence of hot surfaces upon combustion at low temperatures seems to have occupied the attention of several chemists (Dulong and Thénard, and, independently, Döbereiner in France, Sir Humphrey Davy, William Henry, Thomas Graham, Faraday and de la Rive in England) during the first third of the last century, but no one of these distinguished men succeeded in evolving a satisfactory theory of the phenomenon, nor, with the exception of the famous "Döbereiner Lamp," was there any practical outcome of their efforts. In 1836, after a long and abortive controversy between Faraday and de la Rive, interest in the subject dropped and was not revived again until recent years.

Having said in a previous paragraph that Frederick Siemens believed that hot surfaces, by promoting dissociation, must necessarily hinder combustion, Prof. Bone goes on to say how he became interested in surface combustion and how he finally became convinced, through his own investigations, that Siemens was wrong and that hot surfaces really accelerated combustion to a marked degree. The rest of the paper elucidates this theory, then passes on to the experiments in applying practically the principles that had been worked out in the laboratory. He laid no claim to having made a new discovery, other than disproving Siemens' hypothesis.

An editorial comment of Bone's work in the *Journal of Industrial and Engineering Chemistry* for February, calls attention to experiments in burning explosive mixtures of gas, made by C. E. Lucke, at Columbia University, in 1900, the results of which were published in a paper entitled "The Heat-Engine Problem," presented to the American Society of Mechanical Engineers, in December, 1901, and which formed part of his "Doctor's Dissertation." Two patents were taken out by Lucke, and in the illustrations apparatus practically identical with that designed by Bone is shown. The only notable difference is that Bone also used a diaphragm of porous material, as well as broken refractory substances.

Whether or not Lucke's work antedated Bone's, or whether Bone was cognizant of his contemporary's work, does not in the least detract from the credit due him. It may be only one of many instances where two investigators have quite independently arrived at the same results. In this day and generation, it is not sufficient to enunciate a scientific principle, no matter how widely it may be published. The investigator is expected to follow up the principle, and develop from it something that can be of use to the world. He should go still farther and make the world want and use it. Prof. Bone has already made the first practical application of the principle, and is now at work solving the many difficult problems that always arise when the results of scientific investigation are put into commercial form. For this he is justly entitled to all the rewards of his labors that he can get.

Mining Explosives Used in Great Britain

The accompanying tables[1] show the explosives used in Great Britain in the year 1910.

TABLE I. PERMITTED EXPLOSIVES

Name of Explosives	Quantity Used, Lb.	Name of Explosives	Quantity Used, Lb.
Bobbinite...	1,128,926	Swalite.....	117,561
Samsonite..	1,071,143	Permonite..	116,277
Monobel powder...	706,295	Negro powder......	90,958
Arkite.....	687,393		
Ammonite..	621,801	St. Helens powder...	90,017
Rippite.....	540,354	Celtite	78,274
Westfalite..	461,330	Stomonal ..	63,277
Bellite	448,952	Oaklite. ..	50,389
Roburite...	446,120	Fracturite..	48,624
Carbonite...	322,910	Steelite....	44,032
Ammonal...	257,776	Amvis.....	29,616
Stowite....	214,222	Dominite...	27,246
		Tutol	25,142
Faversham powder...	177,949	Kolax......	22,865
Excellite. .	177,582	Minite.....	18,586
Rexite.. ..	173,095	Normanite..	10,576
Abbcite. ..	169,575	All others...	21,064
Cornish powder	147,955	Total....	8,607,882

TABLE II. ALL EXPLOSIVES

Name of Explosive	Quantity Used, Lb.
Permitted explosives, as in Table I	8,607,882
Gunpowder	17,661,483
Gelignite	3,039,256
Gelignite dynamite	491,560
Blasting gelatin	257,756
Blastine	165,456
Cheddite	123,584
Saxonite	118,886
All others	66,258
Total	30,538,121

---

[1] Mines and Quarries Report for 1910, Part II.

The Experiment Station Bill

The text of the bill introduced in Congress by Mr. Martin, of South Dakota, proposing the establishment of mining experiment stations, is published herewith substantially in full. It is diverting reading, and a glance through it will immediately call to mind a multiplicity of problems the government will have to face when it starts to deal with its citizens' individual commercial problems.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that there be . . . established in each of the states and territories which are known to contain natural deposits of the precious metals in commercial quantities, when in the judgment of the Secretary of the Interior it will subserve and promote the development of the mineral resources of the United States and will tend to carry out the purposes and objects of this act, a mining experiment station. The said mining experiment stations and the supervision, management, and control thereof shall be under the direction of the Secretary of the Interior.

Sec. 2. That the Secretary of the Interior be authorized . . . to appoint at each mining-experiment station . . . one expert geologist, at a salary of $3000 per annum; also one competent and experienced chemist, at a salary of $2000 per annum. And the Secretary of the Interior is hereby authorized to expend a sum not to exceed $5000 in establishing, equipping and maintaining each of said experiment stations.

Sec. 3. That it shall be the duty of such geologist and chemist appointed under this act to receive for assay or analysis all rock, cement, clay, or other mineral-bearing substance that may be deposited with them by any citizen of the United States and make a proper classification or assay of each sample . . . for the purpose of ascertaining the exact amount of gold, cinnabar, silver, copper, wolfram, tin, or any other mineral known for its value in the arts and sciences or used in commercial transactions, and to furnish, at a nominal charge, to be regulated by the Secretary of the Interior, to each depositor of rock, cement, clay, or other mineral-bearing substance, a full assay or analysis, showing the quantity and quality of each and every mineral found in said rock, cement, clay, or other mineral-bearing substance so examined by them.

That the person depositing such sample shall at the time of making such deposit make oath before any person authorized by law to administer oaths, stating the place from which such sample was taken and by whom taken, and in addition said chemist and geologist shall be each of them authorized and empowered to administer such oath; and the making of any false oath as to the facts set forth in said affidavit shall constitute perjury. . . .

Sec. 4. That the said geologist and chemist at each station shall keep an accurate record of each and every mineral found in said rock, cement, clay, or other mineral-bearing substance, the name of the party depositing the same, with his postoffice address, and also the particular place where such rock, cement, clay, or other mineral-bearing substance was found; and they shall keep this information secret from all persons except the depositor for a period of 15 days after the delivery to such depositor of the assay or analysis of rock, cement, clay, or other mineral-bearing substance so deposited by them. Each office shall have a public bulletin board therein, on which shall be posted, at the end of the 15 days hereinbefore mentioned, a full description of their assay or analysis of the rock, cement, clay, or other mineral-bearing substance hereinbefore mentioned, and the names of depositors of each lot of rock, cement, clay, or other mineral-bearing substance, and the location in which it was found.

Sec. 5. That at the end of each calendar month each geologist and chemist shall send a full report to the Department of the Interior, to be used for the benefit of the public.

Sec. 6. That the said geologist, when not necessarily engaged in his office duties as herein provided, shall personally explore and carefully examine the mineral regions within his jurisdiction, and especially at points of new and recent discovery, and make full and careful report of such explorations and examinations at such times and in such manner as may be required and directed by the Secretary of the Interior, and he shall be allowed his actual and necessary expenses while so engaged.

Diamonds in the Belgian Congo

In Sydney H. Ball's article, "Diamonds in the Belgian Congo," in the JOURNAL of Feb. 3, 1912, the subhead inserted to summarize the geologic formation in the Congo basin read: "Jura-triassic Sandstones Cut by Basic Pre-cambrian Intrusions." The word "Pre-cambrian" should have been omitted, the heading not having been submitted to Mr. Ball, and the obvious geologic anachronism having escaped editorial scrutiny. The facts are that the Jura-triassic sandstone was laid down on a basement of micaceous schists, quartzite, and granitic and basic igneous gneisses, intruded by granites, diabases and gabbros. This basement, presumably of Pre-cambrian age, had been planed down to an almost level surface, from which a few low ridges protruded, when the Jura-triassic sandstone was deposited. To quote Mr. Ball, the diamonds found along the Kasai River "may possibly have originated from one of the basic igneous rocks of the Pre-cambrian-like series, or they may have once formed pebbles in the flat-lying sandstones. It is believed more probable, however, that they will be found in basic intrusive masses which cut the Jura-triassic sandstone."

Mining in Great Britain in 1911

The copper-ore output of Great Britain in 1911 was about 4500 tons. Mr. Skewes writes that owing to a clerical error, the production was given as 46,500 tons in the article, "Mining in Great Britain in 1911," published in the JOURNAL of Jan 13, 1912.

Stratton's Independence Mill

By T. C. Linderfelt
and James K. Stewart*

Concentration followed by cyanidation is employed in treating the low-grade dump material. The product of rolls and chilean mills is classified and treated as sand and slime.

The mill of Stratton's Independence Ltd. in the Cripple Creek district, was designed and constructed in 1907 by Philip Argall. The old ore-house dump was extensively sampled by a series of small shafts sunk through the dump to the surface of the ground. It was found to run from $2.70 to $3 in gold. The mill was then built to handle this dump and the ore from the mine, but after the construction of the mill, the ore reserves in the mine were found to be less extensive than at first supposed. The mill was at first equipped with an Edwards duplex roaster and five grinding and amalgamating pans, but these were discarded as unnecessary for the treatment of the low-grade dump material.

The crushers are in a separate building, which is situated to the west of the main building. The rest of the plant is in two working units, the concentration and the cyanidation departments. The cyanidation department for some reason is situated above the concentration department. This is probably due to the fact that experiments proving that concentration was more efficient than roasting, the roasting department was discarded and the concentration department erected.

The foundations and retaining walls are of reinforced concrete; the framework is of wood, 10x10-in. and 12-x 12-in. timbers being used; all splices are butt joints, secured by 2-in. planking and 1-in. bolts. The frame-work is housed with 1-in. sheeting, covered with rubberoid building paper.

Two Gates Crushers Used

The dump ore is handled by a Thew electric shovel, with a capacity of 1 cu.ft. which loads the rock into two four-ton cars, drawn up an inclined double track by an electric hoist. The ore is delivered directly to a 7½ D Gates gyratory crusher, which cuts to a 4-in. product. From here it passes over grizzlies to a 24-in., 6-ply, belt conveyor, 20 ft. between centers, and is fed to a 5 K Gates gyratory crusher, which cuts to a 2½-in. product. The machinery in the crusher department is driven by a 100-hp. motor. The entire product from the second crusher and the grizzlies is carried by an 18-in. belt conveyor, 250 ft. between centers, driven by a 20-hp. motor, to a cone-bottomed, steel storage tank with a capacity of 150 tons.

The ore is fed by an automatic disk feed to an 18-in. all-steel, bucket elevator 30 ft. between centers, and is delivered to a set of 16x36-in. Allis-Chalmers rolls, which cuts to a 1-in. product. It is then conveyed up an incline by a 16-in. belt conveyor, 25 ft. between centers, to a similar set of rolls, and is cut to a ¼-in. product. It is then dropped to a 16-in. belt conveyor, 60 ft. between centers. An all-steel bucket elevator, 60 ft. between centers, delivers it to a belt distributor, 35 ft. each way from the elevator, which feeds four 25-ton steel hoppers. This machinery is all driven by a 50-hp. motor.

A reciprocating feed delivers the ore to four Akron 6-ft. chilean mills, driven by two 100-hp. motors. These mils grind to about 12 mesh. The screen analysis of the chilean mill product is as follows: On 30 mesh, 5%; on 50, 14%; on 100, 19%; on 150, 4%; through 150, 58 per cent.

The product from the chilean mills goes to two triplex screw classifiers, 15-in.x15-ft., driven at the rate of 9 r.p.m. by the same power as the chilean mills. The screen analyses of the classifiers follow: Sand—on 30, 60%; on 50, 10%; on 100, 6%; on 150, 4%; through 150, 20%. Slime—on 30, 0%; on 50, 4%; on 100, 12%; in 150, 8%; through 150, 76 per cent.

Concentration Department

In the concentration department, there are 21 Card tables, 4 Frue vanners, 13 No. 3 Deister slime tables and 1 No. 2 Deister sand table. The sand from the classifiers below the chilean mills is fed to 20 Card tables. The tailing from these tables goes directly to a sump and is pumped through a 6-in. feed line to the cyanide department. The first-grade concentrate, assaying between 5 and 6 oz. in gold, is taken directly to the ore bin, from which it is loaded into railroad cars. The second-grade concentrate flows to a 2-in. centrifugal pump and is fed to Nos. 1, 2 and 14 Deister tables, No. 1 vanner and No. 10 Card table. The tailing from these five tables goes to a 2-in. centrifugal pump and is thrown to a duplex screw classifier. This classifier receives its power from the chilean mill motor.

The screen analyses of the products of this classifier are: Sand,—on 30, 42%; on 50, 12%; on 100, 18%; on 150, 8%; through 150, 20%. Slime,—on 30, 0%; on 50, 4%; on 100, 6%; on 150, 14%; through 150, 76 %. Slime from this classifier goes to Callow tanks, while the sand feeds a 5x15-ft. spiral-feed tube mill, making 30 r.p.m. and driven by a 25-hp. motor. The screen analysis of the tube-mill feed is: on 30, 18%; on 50, 21%; on 100, 20%; on 150, 4%; through 150, 37%. The tube-mill discharge analysis: on 30, 0%; on 50, 0%; on 100, 8%; on 150, 4%; through 150, 88%. The feed has 60% of solids.

The discharge from the tube mill is fed to Nos. 3 and 4 Deister tables. The slime from the chilean-mill classifier is delivered to the 16 Callow tanks. The settlings go with the sand from the chilean mill classifier to 20 Card tables, while the decanted slime flows to a cylindrical distributor which feeds the vanners and Deisters. The tailing from the slime tables goes to a 4-in. centrifugal pump, driven by a 25-hp. motor and is elevated to the cyanide department. All the tables in this department are run by a 30-hp. motor on the chilean mill floor.

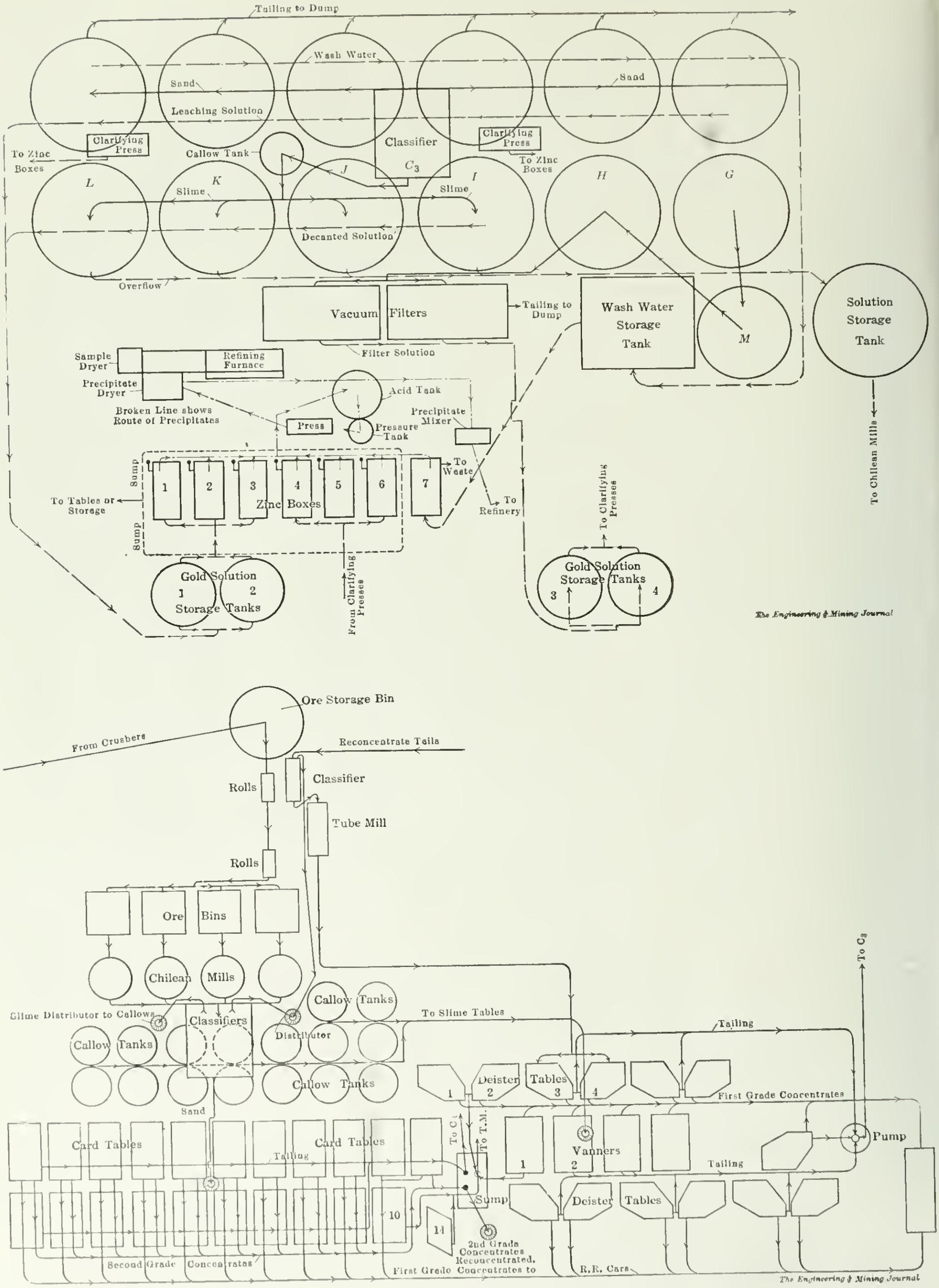
Cyanide Department

In the cyanide department there are: 6 wooden leaching tanks, 6 cone-bottomed settling tanks, 1 Pachuca tank, 2 clarifying presses, a "dope" room, 2 vacuum filters of Butters type and 7 zinc boxes. The table tailings are delivered to two sets of Argall classifiers 15 in.x15 ft. The screen analyses of the products of these classifiers are: Sand,—on 30, 70%; on 50, 4%; on 100, 6%; on 150, 14%; through 150, 6%. Slime,—on 30, 0%; on 50, 4%; on 100, 4%; on 150 12%; through 150, 80%. The sand from these classifiers is delivered directly to a 16-in reciprocating conveyor, 125 ft. long, driven by a 25-hp. motor. The sand is deposited into the six leaching tanks, equipped with four Argall discharge gates. These tanks have a capacity of 175 tons of water or 325 tons of sand each.

The leaching extends over a period of 120 hours. The tanks are filled with leaching solution intermittently every three hours. This solution is drained off at the end of this time and goes directly to zinc boxes Nos. 1, 2 and 3. The washing requires 24 hours, the tanks being filled intermittently every three hours; the wash water going to a discarded Argall filter used as a storage tank, which feeds No. 7 zinc box. The dis-

---

*Mining engineers, Box 148, Victor, Colo.



Plan and Flow Sheet of Concentrating Mill and Cyanide Plant, Stratton's Independence, Ltd.

charge from this zinc box is allowed to go to waste.

SLIME TREATMENT

The slime is fed continually from the cyanide-department classifier to a Callow tank. The settlings from this Callow tank flow through a 2-in. line to the classifier which feeds the tube mill. The slime overflow goes to four cone-bottomed settling tanks, I, J, K, L, which have a capacity of 226 tons of solution each. The overflow from these tanks runs clear for about three hours after a charge has been pumped, the remainder of the charge time it runs about a 20 to 1 slime, to a storage tank of 300 tons capacity on the east side of the building. The thickened pulp from these cone tanks, which has a specific gravity of 1.275, is pumped by a 4-in. centrifugal pump, driven by a 20 hp. motor, into an agitating tank, G.

About 3 ft. of the slime from each of the cone settlers is pumped into this tank once every 12 hours. Seventy-five lb. of NaCN are added every 24 hours at this point and the tank is kept in agitation by means of air from the mill compressor. From this tank, the slime is pumped to a modified Pachuca tank, M, 15x40 ft. which has a capacity of 230 tons.

The slime is agitated for eight hours with air, the bromocyanide solution is added, and the pulp agitated for two hours by pumping in a closed circuit. The pump is then shut down and agitation is renewed with air for the remaining two hours of treatment. The charge is then pumped to a cone-bottomed tank, H, having a capacity of 226 tons, which feeds the filters. The time of charging and treatment is 12 hours.

The bromocyanide mixture, known as "dope," is prepared in a tank of about one-ton capacity, and is mechanically agitated by power received from the sand-conveyor motor. This tank is filled with 36 in. of water and 45 lb. of commercial H_2SO_4, 25 lb. of NaCN and 45 lb. of "mining salts" ($2KBr + KBrO_3$). The reaction is: $4KBr + 2KBrO_3 + 6H_2SO_4 + 6\,NaCN = 6BrCN + 3K_2SO_4 + 3Na_2SO_4 + 6\,H_2O$. Four hours after this solution is added to the pulp all the bromocyanide is consumed. It is necessary to agitate with the pump for two hours and then with air for two hours, for if the air were used first, it would carry out all the bromine, break up the bromocyanide and cause a large loss of cyanogen. The use of bromine requires experience and skill, otherwise the loss of cyanogen is large and poor results follow. The reason for this is that the bromocyanide will oxidize into certain impure compounds and cyanogen is set free more rapidly than the gold will combine with it.

VACUUM FILTERS USED

The filters used are of the Butters type, having 56 leaves and a filtering surface of 678,088 sq.in. per filter. They are connected to a dry-vacuum system which has a U standpipe of 25 ft. A 12-ft. vacuum is furnished by a 16x12-in. Blake vacuum pump, making 100 r.p.m., driven by a 15-hp. motor. A cycle of four hours is required for each filter charge: 2 hrs. being required to form a 1-in. cake; 30 min. to pump back excess slime; 20 min. to fill with wash water; 30 min. to wash; 20 min. to discharge the filter cake, and 20 min. to refill. The filters are fed from the storage tank by gravity until the slime has reached the cone; after this the pump must be used. The pump is an 8-in. centrifugal, driven by a 30-hp. motor.

The vacuum pump delivers the filtered solution to a 3-in. Worthington centrifugal, direct connected to a 10-hp. motor, which is situated in an uncovered sump 8 ft. square and 6 ft. deep, directly under the filters. This pump throws the solution to two gold storage tanks, which have a capacity of 50 tons each. A Deming triplex pump with 5-in. plungers, forces the solution up to the tank floor through two Johnson filter presses, 4x4x-12 ft. In the launders at the presses the solution is strengthened with 100 lb. of NaCN every 24 hours, and flows to zinc boxes Nos. 4, 5, and 6 by gravity.

ZINC SHAVINGS PRECIPITATION

There are six steel, 5-compartment zinc boxes and one wooden 5-compartment zinc box, 4x3x12 ft. The barren solution flows from the foot of the zinc boxes to two concrete sumps situated under the zinc boxes. The solutions from these sumps are pumped either to a storage tank of about 300 tons capacity, situated in the concentration building which furnishes solution for the chilean mills and the concentrating tables, or to a storage tank of 300 tons capacity, situated on the west side of the building, near the discarded roaster stack. Three compartments in each zinc box are loaded with 300 lb. of zinc per compartment.

The precipitate is elevated by means of block, tackle and bucket to a lead-lined acid tank, which has a capacity of 15 tons, and acid treated. The precipitate is then dropped into a steel pressure tank, 3x5 ft. and is forced by compressed air into a filter press, 30x30 in. x 8 ft. The product is dried in a furnace used for that purpose alone. From the dryer the precipitate is delivered to a cylindrical revolving drum, driven by an 8-hp. motor and mixed for 12 hours. The precipitate is then removed from the drum, sampled, weighed and boxed for shipment to Omaha, where it is refined.

ELECTRIC POWER USED

The electric power is furnished by the Pueblo & Suburban Power & Traction Co. It is stepped down from 22,000 volts to 460 volts by three Western Electric Co., 400-kw. transformers. All motors and compensators were manufactured by the General Electric Co. There are no main-line switches in any of the departments, and when the power goes off, the operators are forced to shut off the individual compensators before the power returns.

Air is furnished by a 14x14x18 Blaisdell compressor, driven by a 30-hp. motor. The company cuts all its zinc in a lathe which receives its power from the same motor that drives the precipitate mixer. In addition, there are: an air hoist, used for elevating the chemicals to the "dope" room; a Deming triplex pump, and a Worthington 3-in. centrifugal pump, which are connected to a second 12-ft. dry-vacuum system, held in reserve. A Mine Supply Co. compressor is held in reserve in case of a breakdown of the other compressor. There are two dryers in the cyanide department, one for samples, and the other for the precipitate; and a 4-crucible refining furnace, which is not in use at present. The mill is heated by steam from a boiler in the east end of the concentrating department.

The losses in the tailings are large. A series of assays showed that the heads from the leaching tanks average $0.60 per ton in gold, while the tails average $0.20 per ton. The tailings from the filters show the largest loss, running from $1.20 to $1.60 per ton. An extensive series of experiments made by us showed that this loss is in the form of fine tellurides. In our tests, these were readily caught on canvas tables of the form commonly known as "rag plants." The extraction was from 90 to 95%. One thousand square feet of canvas table would be sufficient to handle the daily output of 150 tons of tailings from the filters. Other losses are: the consumption of power in pumping the table tailings from the concentrating department to the cyanide department; and the leakage of enriched solution from pumps the launders. The mill staff is composed of Philip Argall & Sons, consulting engineers and general managers; A. R. Minner, superintendent; Milo Hahnenkrat, master mechanic; Neil Twyman, chief electrician.

Alluvial gold deposits have been discovered in South Sumatra, close to the Palembang boundary. They are said to be so situated that they can be readily worked by dredging. The government of the Netherlands East Indies has granted to a company organized at Batavia, a license to prospect and work a large area.

Zinc Smelting at Trollhattan

An account of the smelting of 537 tons of ore in electric furnaces, with a statement of the results, including cost and extraction of metals, and reference to the condensation of zinc as powder as the weak point of the process.

During the last five or six years electric zinc smelting, inaugurated under the De Laval patents, has been conducted at Trollhattan, in Sweden, and at Sarpsborg, in Norway. It was attempted at first to smelt ore, but for a long time this was not commercially successful, the product being chiefly zinc powder, which had to be subjected to a resmelting, giving an impure spelter, which finally had to be refined. The works were continued in operation in a more or less irregular way, and spelter from them came on the market, but this was understood to be chiefly the product of smelting dross, scrap and other secondary products rather than ore. Some progress in ore smelting was, however, made, and during 1911 the works were studied by F. W. Harbord, in behalf of the Norse Power & Smelting Syndicate, organized to take them over and enlarge them. The following is a summary of Mr. Harbord's report, especially from the metallurgical standpoint.

The Trollhattan works has a furnace building about 300x52 ft., equipped with 11 smelting furnaces of the new resistance type, six on one side of the building and five on the other, two refining furnaces and several of the old type of arc furnaces, which at present are not working and are to be replaced by the new resistance type. The furnaces are arranged in two rows, one on each side of the building, the condenser sides of the furnaces facing each other.

THE FURNACES

The furnaces of the resistance type are of 350 hp. each, having one large vertical electrode passing through the roof, the other electrode being a carbon block bedded in the bottom of the furnace. The ore is charged through the roof. In the more recently erected furnaces the charge opening is on one side of the electrode only. A furnace is being erected with a continuous side-feed, which it is anticipated will give improved results. Two electrodes are fastened together to form the vertical electrode, which then measures 0.218 sq.m. in cross-section and 3 m. in length, its weight being 680 kg. The capacity of each furnace is approximately three metric tons, and the actual smelting is about 2.8 tons of ore per 24 hours.

Current is supplied to the works by a high-tension three-phase system at 9640 volts and is transformed by single-phase transformers to low-tension single-phase current, the nominal ratio of transformation being 10,000: 110. The transformers are of the open type, air-cooled by forced draft from two fans, the average loss of energy across the transformers being 2.5% of the energy at the furnace. The transformers are situated in a tunnel under the furnace room, each transformer being placed as near as possible and immediately below the furnace to which it is connected.

THE SMELTING PROCESS

The smelting process consists in charging the ore, with suitable additions of flux and reducing material (such as anthracite or coke) into the furnace, where most of the zinc and some of the lead are volatilized and condensed, partly as metal and partly as blue powder and oxide, containing about 54 per cent. of zinc and 20 per cent. of lead. This powder is then mixed with fresh ore and recharged, when a much larger percentage of the metal volatilized is recovered as metal. The first operation of smelting ore alone may be regarded mainly as a concentrating process for the production of a rich oxide, which is reduced to the metallic state by subsequent treatment.

The other portion of the lead, carrying a considerable proportion of the silver, is mainly reduced to metal in the smelting hearth and is tapped out with the slag. Some of the lead, zinc and silver passes into the matte and some into the slag.

In the test conducted by Mr. Harbord and assistants, the following were the charges first used, four furnaces working on ore-powder mixture and three furnaces on ore mixture: Ore-powder mixture; Broken Hill slime (roasted), 100 kg.; powder, 200 kg.; coke dust, 25 kg.; lime, 5 kg. Ore mixture: Broken Hill slime, 300 kg.; calamine, 10 kg.; coke, 75 kg. At the end of the second day the ore furnaces were making sufficient powder to supply the powder furnaces (powder had previously been taken from the works stock in order to start the test) and from this time until the end of the run no further powder was taken from stock. The furnaces were tapped every four hours for crude zinc and powder, and the slag, matte and lead were tapped about every eight hours. During the run a good deal of trouble was experienced from break-outs of lead near the bottom of the furnace, due evidently to the furnace bottom becoming saturated with lead.

During the early part of the run the slags were far from clean, containing large quantities of zinc and lead, chiefly due to imperfect separation of the matte, which in turn was due to imperfect mixing of the charge and to the slags being too basic, owing to improper proportions of flux and reducing agent. Later on the slags improved considerably, although not infrequently two furnaces working side by side on the same mixture would give totally different slags, showing clearly that this was due to some outside cause, like irregular mixing.

Another serious trouble was the removal of electrodes, which caused very considerable delay, due to a great extent to the defective mechanical appliances for removing and replacing the parts. The average time for changing an electrode was 150 min., whereas it should easily be done in 30 min. with proper appliances. Although there were various minor troubles, there was no serious stoppage caused by failure of the furnaces.

INPUT AND OUTPUT

During 27.58 days of the experimental run, the furnaces smelted 518 metric tons of Broken Hill slime (roasted) 19 tons of calamine and 22.5 tons of blue powder (from stock); and produced 160.8 tons of crude zinc and 36 tons of powder. The powder produced by the different furnaces was recharged with fresh ore, a portion each time being reduced to metal, and the final result at the end of the run was 13.4 tons more powder on hand than at the beginning. The crude metal obtained from this smelting averaged about 79% zinc, 20% lead and 0.6% iron. This was afterward refined, with a production of 112.4 tons of spelter (assaying 99.9% zinc) and 24.7 tons of lead. The lead tapped with the slag was remelted, in order to remove the slag. This yielded 41 tons of marketable bullion, containing 141 oz. of silver per ton. In addition to this there was obtained 17 tons of leak-lead, assaying 27 oz. silver per ton. There were also nearly nine tons of skimmings containing zinc, lead and silver. The total input of metals was 204.04 tons of zinc, 128.35 tons of lead and 15,750 oz. of silver. The extraction in the form of metals was 130.46 tons of zinc, 94.94 tons of lead and 7230 oz. of silver, showing a yield of 64%, 73.99% and 45.9% respectively. If the metals in the powder be included, the percentage yields are 73.4 zinc, 79.3 lead and 49.5 silver. Mr. Harbord considered that the losses of lead and silver were unduly large because of the retention of some of those metals in the masonry of the furnaces.

Powder Condensation the Weak Point

Mr. Harbord was of the opinion that the method of charging through the roof leaves much to be desired and anticipates much better results from side charging. Very considerable quantities of valuable fine dust were lost, owing to inadequate arrangements for its collection. A modern bag house, or its equivalent, would lead to an increased recovery of dust. He says furthermore: "The weak point of the process is the large amount of metallic powder produced in proportion to the metals. The recovery of a large percentage of metals as metals is admittedly a very difficult problem, but that the present practice can be very greatly improved upon, I have not the least doubt, leading to decreased consumption of energy and reduction of labor costs. * * * * One detail, which is a great improvement on the early practice, is the better separation of the crude zinc from the powder by a mechanical stirrer, which was only tried just before we commenced our investigation."

Electrothermic Refining

At Trollhattan practically the whole of the crude zinc made during the experimental run was afterward refined. Out of 111,794 kg. of crude zinc there was obtained 78,136 kg. of fine zinc, 17,179 kg. of lead and 11,209 kg. of powder (corresponding to 10,088 kg. of metals). Consequently, there was a loss (unaccounted for) of 5.7%. This loss was distinctly higher than the average, as shown by the records of the works over a considerable period, and probably is explained by the new brick work continuing to absorb some of the metal. In the refining of commercial spelter at Sarpsborg the average practice has been as follows: Fine zinc, 83.9%; powder, 9.8% (corresponding to 8.8% metals); residues (lead, etc.), 2.20%; charge in furnaces, 1.1%; impregnation in brickwork of furnaces and condensers, 0.5%; unaccounted for, 3.5%; total, 100%.

Smelting at Sarpsborg

Mr. Harbord also conducted an experimental run at Sarpsborg. The works at that place have three smelting furnaces of the old arc type and four refiners. During 20 days he smelted 133 metric tons of Broken Hill roasted slimes and three tons of calamine. For the first day, to enable two out of the three furnaces to be put on powder mixture, about 3.5 tons of powder were borrowed from the works stock, but after the first 24 hours sufficient powder to supply two furnaces was made, the third being kept on ore charge alone until within about 36 hours of the finish of the run, when powder was charged with the ore to use up some of the excess stock made during the run. The furnaces worked very well and gave no serious trouble, but the slags were far too basic and contained very large percentages of both zinc and lead, and at no time during the trial run was any matte obtained separate from the slag, the latter being really a mixture of slag and matte. During the run 43 tons of crude zinc and 12 tons of tap lead, containing 191 oz. silver per ton, were obtained. No leakage lead from the furnace bottoms was obtained. The crude spelter contained 74.74% zinc, 24.57% lead, and 0.7% iron.

Arc Furnace vs. Resistance Furnace

The consumption of electric current in the experimental run at Trollhattan averaged 2078 kilowatt-hours per ton of ore smelted. The cost of power at Trollhattan is at present 30s. 3d. per horsepower-year, or 41s. 3d. per kilowatt-year.

The arc furnace, so far as the process of actual smelting is concerned, was found to give just as good results as the resistance furnace, but the consumption of energy was over 70% more. The method of hand feeding the electrode was slow and unreliable, especially as regards keeping the arc in the center of the furnaces. The consumption of electrodes also was materially higher than in the case of the resistance furnaces. At Trollhattan the average consumption of electrodes was 31.51 kg. per 1000 kg. of ore smelted; at Sarpsborg it was 40.57 kg. per ton of ore. If it be decided to continue smelting at Sarpsborg, the old type of arc furnace will have to be replaced by resistance furnaces.

Rules for Coal Storage

Messrs. Porter and Ovitz, of the Bureau of Mines, have been investigating the deterioration of stored coal and the liability of it to spontaneous combustion.[1] If coal be stored under water there is no deterioration, and no difference can be found in the preservative action of salt and fresh water. However, the advantages of storage under water are questionable, as the water absorbed and entrained by the coal must all be evaporated, with corresponding loss of heat units. It was found that after coal which had begun to heat was rehandled and turned over, that reheating rarely began.

The following suggestions were offered for dry storage, where their use does not involve unreasonable expense: Do not pile over 12 ft. deep nor so that any point in the interior will be over 10 ft. from an air-cooled surface. If possible, store only lump; keep dust out as much as possible; therefore reduce handling to a minimum. Pile so that lump and fine are distributed as evenly as possible; not as is often done, allowing lumps to roll down from a peak and form air passages at the bottom. Rehandle and screen after two months. Keep away external sources of heat even though moderate in degree. Allow six weeks' seasoning after mining before storing. Avoid alternate wetting and drying. Avoid admission of air to interior of pile through interstices around foreign objects, such as timbers or irregular brickwork; also through porous bottoms, such as coarse cinders. Do not try to ventilate by pipes as more harm is often done than good.

Republic Iron and Steel Company

The semiannual report of the Republic Iron & Steel Co., is of special interest, since it was the action of this company which started the break in prices which ultimately brought about the increased buying of the closing months of the year. The statement covers the half-year ended Dec. 31:

	1910	1911	Changes
Gross profits....	$2,673,041	$2,208,314	D. $464,727
Main. and repairs	$ 680,630	$ 737,501	I. $ 56,129
Other charges....	424,393	491,346	I. 66,953
Depreciation.....	300,168	180,694	D. 119,474
Total	$1,405,191	$1,409,541	I. $ 4,350
Net profit..	$1,267,850	$ 798,773	D. $469,077

Other charges in 1911 included $369,338 interest and $112,008 charge for exhaustion of minerals. The net earnings in 1911 were $76,227 less than the half-year's dividends on preferred stock. The unfilled orders on the books for finished material and for pig iron were as follows at the dates given below:

	Finished	Pig Iron
Dec. 31, 1911..................	414,431	158,392
June 30, 1911..................	481,425	102,077
Dec. 31, 1910..................	293,734	76,378
June 30, 1910..................	341,887	82,906

The gross volume of business for the six months compares favorably with best previous periods when greater market activity ruled, but the average prices for shipments made are the lowest in the history of the company. The shrinkage in values is the natural result of the restricted demand, incident to disturbed conditions of general business. The increase in the gross volume of business obtained is due entirely to additions to capacity and to greater diversity of products manufactured.

Substantial reductions in costs were generally effected, but the net profits show reductions as compared with 1910, as a result of low prices naturally incident to conditions above stated. While full maintenance charges have been made, some reduction in depreciation charges was thought proper in view of previous liberal allowances on this account. All provisional funds, however, have been fully maintained. In December, the new 90-in. plate mill and the 14-16-in. continuous merchant mill were put in operation.

---

[1] "Power," Jan. 2, 1912.

Righting Overturned Gold Dredges

By Lewis H. Eddy*

Two gold dredges were accidentally sunk in California in 1911, one on Nov. 27, the other on Dec. 22. Both accidents occurred in the Oroville field of the Feather River district. One dredge has been raised; the other is being raised. The dredge that has been raised is commonly known as a Perry dredge, or Pacific No. 1; the other is El Oro No. 1.

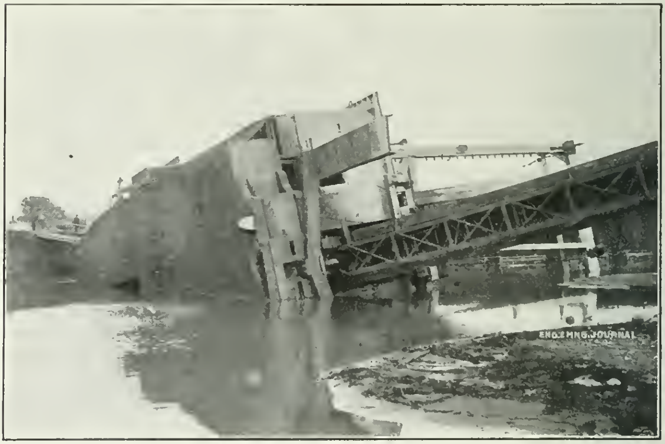
The raised dredge was initially installed by the Pacific Gold Dredging Co., in May, 1906, and is now one of the fleet under management of O. C. Perry. It is a 7½-cu.ft., close-connected, bucket-elevator type, equipped with Bucyrus machinery; the digging ladder and tailings conveyor are of lattice-girder construction; the screens are the flat end-shaking type, and are retained in the reinstallation, as the clayey character of the ground is said to be more economically handled by the flat than by the revolving screen. In the initial installation the dredge was equipped with modified Holmes gold-saving tables; these have been displaced by the cross-system type of tables, with distributing pans.

Another and important economical change made in the reinstallation of this dredge is in the electrical apparatus. After being floated the boat was rewired, and a change in voltage was made, 440-volt apparatus being substituted for the former 2000-volt machines. The motor equipment has a rated capacity of 300 hp., distributed as follows: One 50-hp. motor, connected to a 10-in. pump, and one 25-hp., connected to an 8-in. pump, to supply water to the screen and tables: one 15-hp. motor, connected to a 4-in. pump, to supply water to the spray hopper; one 20-hp. motor to drive the shaking screen; one 20-hp. for tailings conveyor; one 20-hp. winch motor; one 50-hp. sand-pump motor; one 100-hp. bucket-drive motor. Besides the repairs necessary to be made in the hull, the only other essential repair work was on the conveyor frame, which was damaged by being swung over as the boat sank, and was badly twisted; it was necessary to take out the frame and rebuild the lower end.

The hull of the dredge is 95 ft. long, 38 ft. 6 in. wide, 8 ft. 3 in. deep, and draws 5 ft. 9 in. It sank in 26 ft. of water, listed to the port side at an angle of 42 deg. from the water line. The sinking was caused by a leak aft of the well-hole through a hole 6 in. wide and 12 in. long; this hole was made by the spill from the buckets sliding down back of the well and under the protecting plate which, from a cause unknown, had bulged away from the well-hole planking. Divers were sent under water and first nailed all the hatches down, and repaired the leak, thus making the hull water tight. An 8-in. electrically driven pump was installed on the port pontoon, which was the most submerged part of the boat, the divers cutting a hole in the deck and making a water-tight entrance. Also a 6-in. pump was installed in the center compartment to keep down the water in that part of the hull as an aid to the larger pump.

Method of Righting Dredge

Double triple-blocks were rigged to the bow gantry, the upper-tumbler gantry and the stern gantry. A 1½-in. hawser was employed in making connection with the upper tumbler, which is in the center of the boat and the place where it was desired to make the strongest pull. Because of the sinking of the dredge on the port side, the auxiliary winch on the main deck was out of water, and was employed in pulling. Lines were attached to the top of the structure, so as to assist in righting the dredge. A heavy strain was taken on all the lines fastened to the gantries before starting the pumps, and then both pumps were put in action, and steady pulls were taken on all the lines fastened to the top structure, pulling them as evenly as possible. It was demonstrated that the lines were of sufficient strength and leverage to raise the dredge out of the pond, before the pumps were started, the operator recognizing that the tendency of the hull would be to settle further over as it was relieved of the weight of the water within. It required only an hour and a half to float the dredge after the pumps were started. The dredge was raised on Dec. 7, just 10¼ days after it sank.



El Oro Dredge No. 1 Overturned Dec. 22, 1911

The progress of the work was necessarily slow, owing to much rigging of pumps, motors and transformers, and for the necessary hoisting pulls. There were many unforeseen difficulties encountered, peculiar to the conditions, as is the case in each individual job of this kind; so that after holding a *post mortem*, the operators were able to see how the work might have been done more expeditously. The reinstallation of the dredge was delayed about 10 days by the changes made in the gold-saving tables and the electrical apparatus. Otherwise the boat would have been in commission within three weeks from the date of the sinking; the damage to the conveyor frame also caused delay. The actual work of raising the boat was done with moderate ease and expedition.

El Oro Dredge Top Heavy

El Oro No. 1 dredge was installed in December, 1903, by the El Oro Dredging Co., with head office in Mills Building, San Francisco; J. Hellman is local manager. This is a 5-cu.ft., close-connected, bucket-elevator type, electrically driven, and equipped with plate-girder digging ladder, end-shaking flat screens, and Holmes gold-saving tables. The hull is 90 ft. long, 45 ft. wide, 7½ ft. deep, 6-ft. draft. The structure is top heavy, and will require correction of the flotation, as the sinking was due primarily to such irregularity of construction. This boat was not wholly submerged, but went down in 19 ft. of water with the bow entirely submerged, while the stern is above water, the boat standing at an angle of 7 deg. 30 min. from the horizontal of the water line. The submersion reaches to just below the upper tumbler. Practically the same methods are employed in raising this as in raising the Perry dredge. No costly damage was done to the boat or machinery, the resultant expense being covered by the cost of raising the dredge and correcting the flotation, and loss of time.

---

*2218 Peralta St., Oakland, Calif.

Goldfield Consolidated Report

During 1911, 330,549 tons of ore were produced, averaging $32.55 per ton. Net realization was $7,526,846 or $22.77 per ton. Important additions have been made to the mill, resulting in increased capacity. Reserves are estimated at 600,000 tons, equal to a 2-years' supply for the mill.

The annual report of the Goldfield Consolidated Mines Co., for the year ending Oct. 31, 1911, states that the fiscal year closing on that date was the company's banner year, both with respect to tonnage handled, amount of earnings, and ease of operation, combined with freedom from adverse circumstances. During the year there were produced 330,549 tons of ore of an average value of $32.55 per ton, a total of $10,760,198. Metallurgical losses amounted to $1.81 per ton, a total of $597,071, leaving total amount realized from the year's production, $10,163,127, an average of $30.74 per ton.

Expenses and Profits

Gross expenses, including mining, milling, transportation, general, all construction, local, state and Federal taxation, amounted to $2,636,281, leaving a net operating realization of $7,526,846, an increase of $179,154 over the previous year, notwithstanding that the metallic contents realized were $110,806 less than the previous year. At the end of the year the company had no debts; there was a cash balance of $1,369,177 and $451.306 outstanding in bullion and concentrate settlements. It is stated that additional milling facilities are being provided at an approximated estimated cost of $70,000, whereby large economies are anticipated in the treatment of the concentrate residues over the past cost of shipment.

It is stated further that the results of this construction will narrow the company's output to bullion alone, all by-products being handled locally at maximum economy.

Depreciation of plant and equipment has been written off to the extent of $147,194, and during the year a total of 46,739 ft. of development work was done on the properties.

President Wingfield states that the company purchased the Bulldog Fraction at a cost of $13,000, the Jumbo Fraction for $2500, and a one-half interest in the Vinegerone claim at a cost of $195,000. He further states that the company's policy of distributing net realizations as they accrue, to stockholders, in dividends, and retaining a cash reserve of not less than $1,000,000 will be maintained.

General Superintendent's Report

Supt. J. F. Thorn states that the stoping cost for the year was $2.29 per ton of ore mined; development cost, $1.06; total mining cost, $3.35 per ton. Development work, amounting to 46,739 ft. was performed at a cost of $7.51 per ft. The total cost of mining and milling, including concentrate treatment, was $5.62 per ton, or 66c. per ton less than the previous year. Other expenses, including marketing, income and bullion taxes, but not including construction, bring the cost to $7.55 per ton. During the year the assay building, electrical building, storage-battery plant, and Laguna headframe were completed. Improvements at the mill were also undertaken.

BALANCE SHEET, GOLDFIELD CONSOLIDATED, OCT. 31, 1911

Assets	
Mine properties	$31,500,196
Amount computed as representing exhaustion of ore deposits to date	15,145,090
	$16,355,106
Organization expenses	4,079,970
Mine buildings, machinery and equipment	122,941
Office building and furniture	18,475
Compressor plant	38,694
Power station and pole line	11,497
Miscellaneous real estate, buildings and equipment	54,450
Stocks owned	1,660,290
Unexpired insurance	696
Accounts receivable	105,208
Supplies on hand	63,404
Cash in bank and on hand	989,187
Distributed as dividends	18,144,430
	$41,644,354
Liabilities	
Capital stock authorized	$50,000,000
unissued	14,408,520
	$35,591,480
Reserves:	
Bullion tax	$34,388
Property tax	1,794
	$36,182
Accounts payable	$85,950
Net amount realized from operations	21,075,832
Amount computed as representing exhaustion of ore deposits to date	15,145,090
	$5,930,742
Total	$41,644,354

BALANCE SHEET, GOLDFIELD CONSOLIDATED MILLING & TRANSPORTATION CO., OCT. 31, 1911

Assets	
Stamp mill and addition	$361,938
Railroad and equipment	25,126
Water plants, reservoirs and pipe lines	5,000
Absorption	227,800
Mill supplies on hand	120,960
Concentrate residues on hand	74,195
Bullion and concentrate settlements outstanding	451,306
Accounts receivable	615
Cash in bank	379,989
	$1,646,932
Liabilities	
Capital stock	$400,000
Accounts payable	50,823
Reserves:	
Income tax	$21,812
Property tax	4,192
	$26,004
Undivided profits	$1,170,103
	$1,646,932

Combination Mine

In the Combination mine 6201 ft. of development work were done which, together with the sill floors, produced 2376 tons of ore worth $17.78 per ton, a total of $42,243. The principal new orebody in this mine is the 136 stope on the second level, which has produced 6877 tons, worth $88.64 per ton, a total of $609,601. The indications are stated to be that this section will be productive during the coming year. At the Mohawk mine 14,717 ft. of development work were done, and, together with the sill floors, produced 13,203 tons of ore worth $17.74 per ton, a total of $234,193. Two important new orebodies were exposed during the year, as follows: The 260 stope on the 350 level, which produced 7836 tons of ore worth $306,396; the 354 stope on the 450 level, which produced 24,566 tons worth $707,152. The latter orebody has not been found on the 350-ft. level, but it has been found on the 600-ft. level of the Clermont, and in an intermediate drift between the 450- and 600-ft. levels, which is said to assure the downward continuation to a depth of 600 ft. The downward extension of the 403 orebody was found on the 450 level of the Mohawk. Several smaller productive orebodies were found in various places; also orebodies known to exist in some of the caved leased workings were uncovered and have added to the production of the mine. It is said that there still remains in the mine a large area partly developed, which will undoubtedly be productive.

Clermont Mine

The Clermont mine, in which 14,511 ft. of development work were done, produced 9366 tons of ore worth $40.41 per ton, a total of $378,489. Some good discoveries were made in this mine, the most important being the westerly extension of the 408 orebody, between the 600- and 750-ft. levels. A promising orebody is stated to have been uncovered recently, above the back of the famous 401 stope on the 750 level. Practically all developments were stopped below the 1000-ft. level, because of interference with the sinking of the Grizzly Bear shaft, which is being sunk to the 1400-ft. level. When this shaft reaches this level development work on the 1200-ft. level will be resumed. Only a small block of territory at this level has been prospected.

Red Top, Laguna and Jumbo Mines

In the Red Top mine, the downward extension of the Red Top vein is being worked from the lower levels of the Mohawk, the 600 level of the Clermont and the 450 and 600 levels of the Laguna; no new ore has been credited to this mine below the 330-ft. level. The orebodies on the upper levels have been considerably extended and have added some to the reserves. This mine produced 6341 tons of ore worth $15.05 per ton, a total of $95,486, and 4339 ft. of development were done. The Laguna produced 3752 tons of ore worth $10.06 per ton, a total of $37,765 and a total of 6725 ft. of development was done. The downward extensions of some of the Red Top orebodies were found on the 450-ft. level of this mine, and a large tonnage is expected to be mined during 1912. The Hazel shaft was unwatered, and will be sunk to the 900-ft. level, from which point a crosscut will be run and a raise driven to connect with the bottom of the Laguna shaft. The old Jumbo mine, formerly worked by lessees, has been reopened, and found to contain a large tonnage of about $15 ore. During the three months it was in operation, it produced 3377 tons of ore worth $67,685. Owing to the fact that the mine was honeycombed by leases, it is stated to be almost impossible to estimate the tonnage, but that it is practically assured that the mine will produce a considerable tonnage during the coming year.

Ore Reserves

Superintendent Thorn states that considering the past performances of the property, the present exposures and possible extensions of the orebodies now being worked justify an estimate of ore in reserve amounting to 600,000 tons, a sufficient tonnage to keep the present mill running at full capacity for practically two years. He states, however, that owing to the fact that some of the high-grade orebodies have been exhausted, the value of the ore will be somewhat lower. It is further stated that owing to the facts that the cost of production has been considerably reduced and a larger tonnage is being milled, it will be possible to maintain a high rate of production from the lower grade of ore.

The prospects for developing ore, in addition to reserves estimated, are stated to be promising. In the Jumbo, practically no ore has been mined, and only 500 ft. of the 4000 ft. of prospective ground along the strike of the vein have been explored below the 1000-ft. level; the chances of finding ore at greater depth, it is believed, have not been nearly exhausted. The possibilities of finding new orebodies above the 1000-ft. level are stated to be good. During 1911, the 354, one of the largest orebodies ever discovered in the property, was found on the 150-ft. level of the Mohawk. Other important discoveries were made on the 150- and 350-ft. levels, and an important discovery was also made on the 130-ft. level of the Combination mine. It is stated that it is reasonable, therefore, to expect that the large, partially developed area above the 1000-ft. level will produce a large tonnage of new ore during the coming year.

Mill Developments

J. W. Hutchinson, mill superintendent, states that the new refinery was completed and in operation on Jan. 1, 1911, and that it has fulfilled every expectation.

The cost of refining the bullion has been reduced to 7c. per ton, as compared with 19c. per ton the two previous years. The total saving to the company on this account is expected to be in excess of $60,000 per year. During the year a new plate room was built in order to localize the work of amalgamation. A small testing plant and laboratory were also added. Minor changes have been made, causing the plant to handle a larger tonnage than previously, and it is expected that the plant will average 950 tons per day during the coming year.

PRODUCTION AND EXPENSES, GOLDFIELD CONSOLIDATED, YEAR ENDED OCT. 31, 1911

PRODUCTION

	Tons	Total Value	Value, per Ton
Milled	330,062	$10,586,936	$32 08
Shipped	487	173,262	355 77
Total	330,549	$10,760,198	$32 55
Loss in tailings		597,071	1 81
Realized		$10,163,127	$30 74

EXPENSES

	Total	Per Ton of Ore
Stoping . . .	$758,472	$2 29
Development	350,985	1 06
Transportation	30,628	0 09
Milling . . .	626,293	1 89
Concentrate treatment	124,315	0 38
Marketing concentrate residues and by-products	244,583	0 74
Marketing bullion.	49,141	0.15
Marketing ore shipped	17,103	0 05
General expenses, including office, legal, corporation and administration	181,334	0 55
Bullion tax . .	126,319	0 38
Income tax .	27,001	0 08
Total operating expenses .	2,536,180	7 66
Miscellaneous earnings	37,730	0 11
Net operating expenses	2,498,450	7.55
Realization from operations . .	7,664,677	23 19
Construction.	137,831	0 42
Net realization from operations .	7,526,846	22.77
Depreciation of plant and equipment and accounts charged off	147,194	
Depreciation of mine property at $16.36 per ton. . .	5,407,781	
Net profits	$1,971,869	.

Work is now in progress on the construction of a plant to treat the residues of the present concentrate treatment process. Two Edwards duplex roasting furnaces, with 112x13-ft. available hearth area, and one Baker cooler, will be housed in a steel building erected for the purpose.

One 5x18-ft. tube mill, together with tanks, agitators, etc., will be housed in an extension to the present concentrate treatment plant, together with the necessary dust chambers, storage bins, etc. This plant will cost approximately $73,000, and is expected to effect a saving to the company of practically $80,000 per year. It is stated that during the year the mill ran 96.37% of the total time, and averaged 9.39 tons per stamp, actual running time.

Depreciation

In one of the accompanying tables it will be noticed that a certain amount has been written off for depreciation, at the rate of $16.36 per ton. The report of A. H. Howe, secretary and treasurer, contains some information bearing on this. In this connection Mr. Howe states:

> Under the Act of Congress, approved Aug. 5, 1909, and popularly known as the Federal Corporation Income Tax Law, depreciations in the value of property are made available as a deduction against gross income; but the Internal Revenue Bureau of the Treasury Department, having in charge the administration of that law, requires all depreciations so claimed, to be shown on the books of account and balance sheets of the Corporations claiming the benefit thereof. The methods described for ascertaining such depreciation make necessary the adoption of an estimated unit of depreciation, ascertained by reference to the cost of the property, subject to the depreciations in question. A complete account of the computations made necessary in the case of the Goldfield Consolidated Mines Co., could only be accomplished by such extended explanation as would exhaust the reader's patience. Avoiding, therefore, unnecessary detail, it may be briefly stated that the unit employed by this company for that purpose, in obedience to the requirements of the Treasury Department, is $16.36 per ton, being the estimated average cost per ton to the company of its whole estimated commercial tonnage.
>
> The theory upon which these depreciations for exhaustions of ore are based is the well known economic principle, which has in numerous cases received judicial recognition and approval, and which should always be borne in mind by investors in mining property, namely, that unlike most other business projects, the earnings of a mine distributed in dividends are chiefly derived from exhaustions of the mine property in which the capital has been invested Therefore, no matter how profitable the investment may prove to be, the dividends should not be regarded as profit in the ordinary acceptation of that term, until the net amount realized shall have equaled the capital investment in the mine property. Readers of the report will observe that by reason of the adoption of a depreciating unit, as required by the United States Treasury Department, it necessarially results that the net realizations in any year from the company's operations may be derived in part from the exhaustion of assets, and in part from apparent profits flowing from a net recovery per ton in excess of the estimated cost per ton.

Depreciation of Gas and Oil Fields

WASHINGTON CORRESPONDENCE

The Commissioner of Internal Revenue has issued a circular relative to the deductions which may be made by natural-gas and oil companies from income for depletion of their property resources. Such deductions they are allowed to make in computing the amount liable to the corporation tax.

NATURAL-GAS COMPANIES

The following methods for estimating depreciation are recommended: "That the producing gas area of said company be laid off in squares not exceeding 1 square mile, and that three months prior to Sept. 30 of each year, one or more representative wells be shut in in each square or territory, and that as of Sept. 30 an accurate gage be taken of the rock pressure of said wells, and the decline in the average rock pressure from year to year shall be considered as the base of determining the exhaustion of deposit. For instance, a corporation may have 80 square miles of territory, and the average rock pressure Sept. 30, 1909, may have been 600 lb. per sq.in. On Sept. 30, 1910, the average rock pressure may have been 540 lb., or a decline of 10 per cent., and this percentage is to be applied as a basis of depreciation for the year 1910 on the cost of the field and main-line divisions, less depreciation charged off prior to that date, and any salvage value that may remain in the property.

"If, by reason of lack of area, or for any other good and sufficient reason, any corporation engaged in the production of gas shall prefer the volume basis as more accurately reflecting the rate of exhaustion of deposits, the amount of capital invested to be returned out of the income of any given year may be determined on that basis. In case the volume basis is adopted, the volume of each well must be taken with instruments generally recognized as reliable for determining the daily volume produced by each well at stated periods each year, and the percentage of loss in daily production shall determine the percentage of capital investment which shall be returnable out of gross income and the proper deduction to be made each year in the return of annual net income as return of capital invested.

"Any unreturned cash investment remaining when wells or territory have to be abandoned or lines taken up because of failure of the supply of gas, less salvage, may be deducted as part of the reasonable depreciation for the year in which such territory is abandoned unless such values shall have been returned in the reduction made because of loss of volume or decrease in rock pressure, which in such case would be considered as having reached the vanishing point."

PETROLEUM COMPANIES

In all producing oil fields an average value per barrel of the settled daily production shall be adopted as the guide in determining the value of the property, and the following method in depreciating said values is recommended:

"Each corporation will fix this valuation per barrel as of Jan. 1, 1909, or upon the date of commencement of production, if after that date, for ascertaining the deductions for depreciation on the basis of depletion of deposits. This valuation per barrel should be based on the cost of the property to the corporation, plus the cost of the development thereof with a proper deduction from that valuation for the number of years the property has been in operation, and the resulting proportioned decrease in daily production of oil. With this basis per barrel fixed as of Jan. 1, 1909, or at the date of commencement of production, if after Jan. 1, 1909, the value of the property as a whole is to be determined by applying this unit value per barrel to the daily average production for the month of December, or other representative month, in the year for which the return is made. The representative month chosen shall be the same in each year. This unit valuation per barrel is to be retained in arriving at all future depreciation deductions, except where an additional production is secured by drilling or an additional production is required by purchases, in which cases a new average rate per barrel, based upon the actual cash invested in such development, or in the new properties and their development, may be adopted.

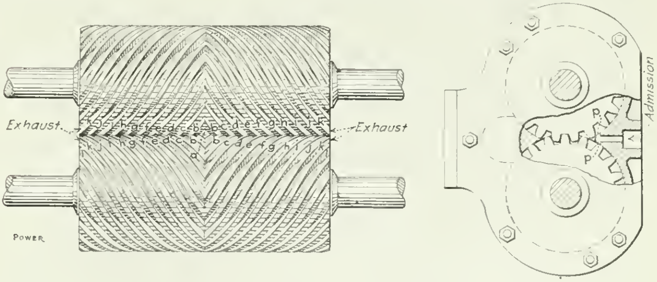
The amount of income each year to be applied to the return of the cash investment shall be ascertained by multiplying the unit valuation ascertained as required above, by the difference between the daily average production in barrels during the representative month of each year. The product of such multiplication will be the amount deductible from gross income on account of cash investment based upon the rate of depletion of deposits.

"The cost of drilling and equipping new producing wells shall be considered additions to capital investment account; the expense of drilling dry holes may be charged to profit and loss.

"The amount of petroleum produced and sold during the year, or the price received for the same will not, so far as the application of this regulation to determine depreciation is concerned, affect the value of the property at the end of the year, which value is based only on the comparative rate of decrease in production in accordance with the standard unit value ascertained, as stated above."

The Buffalo Spiro Turbine

A new form of steam-driven prime mover, to be known as the Spiro, is being put on the market by the Buffalo Forge Co. While the inventor, John H. Van Deventer, is insistent that it be called a turbine, it seems to fall more in the category of a pressure engine, as it works by expansion and not by reducing the velocity of moving steam.



Power

FIG. 2. SHOWING THE INCREASED VOLUME FOR EXPANDING STEAM

If a pair of spiral or herringbone gears are held together, there will be found to be a lozenge-shaped pocket in the center, as at *a* in the accompanying illustration. If the gear is revolved, this space is extended, and as the teeth inclosing it advance to the respective positions, the volume will be increased to that shown at *b*, *c*, *d*, *e* and *f*.

A fluid under pressure admitted to the space *a*, and acting upon the receding surfaces, would drive the gears, the energy being equal to the product of the pressure and the volume generated. If the driving fluid were expansible and were cut off at any point, it would expand into the increasing volume, and the advantages and economies of expansion be realized just as in a cut-off engine working with a regular piston. When the ends of the grooves in which the action occurs pass the line of contact, so that they are no longer closed by the teeth of the opposite gear, the fluid would be exhausted, as indicated at the end of the gear in the illustration. It is upon this principle that

---

Note—Abstract of article in "Power" Feb. 6, 1912.

the Spiro acts. One of the great advantages of the Spiro is the small size of the units for the power developed. It can be shown mathematically that a pair of gear wheels 8 in. in diameter, by 24 in. long, with teeth 1 in. deep, and rotating at 2000 r.p.m., will develop the same power as a piston 13¾ in. in diameter running at 600 ft. per min., and using steam at the same pressure. Consequently great capacity can be obtained with small weight. For instance, a 40- to 60-hp. machine, steam at 100 lb. initial pressure, weighs 1600 pounds.

A test on two small units gave results as follows: No. 1, boiler pressure, gage, 120 lb.; initial pressure, 101.5 lb.; horsepower, 25.3; speed, 2450 r.p.m.; water per brake horsepower, 53.2 lb. No. 2, boiler pressure, gage, 130 lb.; initial pressure, 115 lb.; horsepower, 151; speed, r.p.m., 2710; water per brake horsepower, 31.8 lb. A small hand motor, the rotors of which lie in the palm of the hand, will run a ¼-in. drill into hard cast iron at a rate of one inch per 12 sec., while an illustration shows a 5-hp. unit being operated by the ¼-lb. pressure of a tea kettle, this pressure being sufficient to start the engine and keep it running. One of these engines has been in use by the Buffalo Forge Co. for about three years, with great satisfaction.

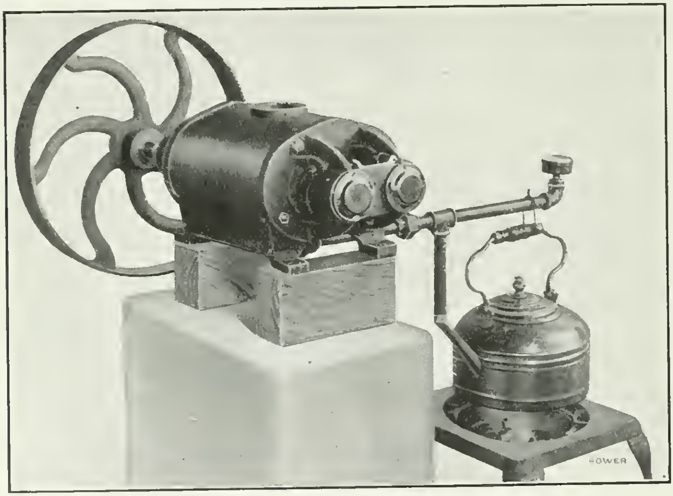


Fig. 3. A 5-hp. Spiro Run by a Tea Kettle

The Chatelet gold mines in France in the fiscal year 1910-11, mined and treated 29,451 metric tons of ore, which yielded 524 kg. fine gold, or $11.82 per ton. The ore is chiefly an arsenical pyrite. The extraction was between 88 and 90 per cent. The profits for the year were $63,815. At the close of the year there were 6968 tons of ore at the surface, and 33,500 tons blocked out underground.

Roller Bearings on Mine Cars

An interesting test was made by a large manufacturer of mine cars to ascertain the relative merits of two forms of roller bearings, the flexible steel spiral and the solid steel roller, with special reference to durability. A roller bearing of each of these two types was fitted in journal boxes on a 2½-in. lineshaft. Between these bearings was placed a babbitted journal 10 in. long and at the ends of the shaft just outside of each of the roller bearings was placed the same type of journal box making three babbitted journal boxes bearing the same load as the two roller bearings.

Across the top of the two roller-bearing boxes were placed heavy I-beam levers, one end of each being attached to the floor and the other end supporting a 400-lb. cast-iron weight. The weight on each of the roller bearings was 2720 lb., which would make the weight sustained by each plain bearing about 1800 lb. The shaft was then rotated at a speed of 185 r.p.m., equal to 10½ miles per hour with 18-in. car wheels.

At the end of a two-hour run or about 21 miles under this load and speed, it is reported that the 7-in. babbitt bearings melted out, although they were kept well oiled. These were then replaced by 2¼x7-in. brass car journals. The condition of the solid roller bearings at various times during the test is reported as follows: At the end of 8 hours the spacing ring had cut ridges in the rollers; 46 hours, the rollers showed small pox marks on their surface, the metal in the rollers seeming to fall out in small granulations; 103 hours, the linings in the bearings likewise commenced to granulate and roughen; 255 hours, the rollers were bent, the axle was cut and ringed by the ends of the rollers and reduced 1/32-in. in diameter and the linings of the box were granulated; 459 hours, apparently could last but a short time. On the other hand, the Hyatt bearing at the end of the run is said to have shown no ill effects.

As an additional test, the oil in the box was mixed with fine coal dust and a run of 8½ hours made. The Hyatt bearings were again reported undamaged as the rollers ground the dust to powder, mixed it with the oil and took it up in the hollows of the rollers. The solid roller bearing ejected the coal dust from the box without further damage to the bearings; but the bearings ran much harder. The brass car bearings became hot, the oil in the brass journals reaching boiling point.

In a third test, the speed was increased to 380 r.p.m. and the weight reduced to 1200 lb.; at frequent intervals the bearings being sledged on top with 16-lb. sledges, and the load jostled up and down and sidewise to represent the conditions affecting the life of bearings on a mine car in actual operations. The following results are reported: At this speed and weight the brass car bearings could not be kept cool enough to run and the shaft was cut and practically ruined. It is claimed that none of these tests seemed to work any damage to the Hyatt bearings.

Prevention of Blue Powder Formation in Zinc Smelting

A recent invention for the prevention of the formation of blue powder in zinc distillation is the use of the vapor of an alkaline haloid (Fr. pat. No. 423,912). It has been proposed before to mix sodium chloride with the retort charge, but this is disadvantageous if the ore carries lead or silver, owing to the volatilization of these metals after chlorination. In the practice of this invention, for a charge of about 100 kg., 112 grams of salt are placed either in the front of the retort, separated by a bed of coke cinders from the charge, or in the back of the condenser, in a small pocket which the present invention proposes to place there. The sodium chloride, or other alkaline haloid, is volatilized, and mixes with the zinc vapors.

It is claimed that the yield of zinc is better, as the yield of blue powder is less and condensation quicker, the furnace man can more easily watch his retorts, and the lead carried over has a tendency to separate from the zinc and deposit separately. If the fumes from the condenser are burned the flame is a brilliant yellow and constitutes a useful source of light.

First Aid to Mining Machinery—VII

By Henry M. Lane*

Large or heavy castings, such as lead kettles, the making of which is described in this article, are cast in loam molds, the supporting structure being brickwork. Instead of the usual patterns, revolvable sweeps are used to shape the loam mold.

There are many heavy castings which can be made without the use of patterns or with the use of part patterns only by employing loam molding. This method also does away with the necessity of building large and heavy flasks.

The principles involved are well illustrated in the making of the lead kettle shown in Fig. 1. It will be noticed that this kettle is 5 ft. in diameter on the inside and 2 ft. 6 in. deep. If this kettle is molded in the position it will occupy when in use it will have the soundest and best metal at the bottom and any blow-holes or defects will be in the rim. This method will not make a good looking kettle, as any defects will appear in the rim, but will insure a longer life than if molded in an inverted position. The molding is simplified by turning the kettle wrong side up; but as this is accomplished only at a sacrifice in the quality, the molding in the position it will occupy while in use will be considered first. The reason this method of molding gives a better kettle is that the metal at the bottom will be under compression and hence more dense; then, too, as already stated, the dirt will rise to the rim.

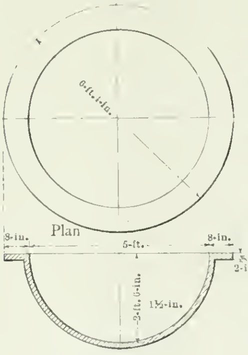
Molding a Lead Kettle by Sweeps

The general method of procedure in the making of the lower or drag portion of the mold is shown in Fig. 2. Where a large drying oven is available, this portion of the mold is usually made on a large cast-iron plate known in the foundry as a loam plate, and after it is completed the mold is picked up, placed on the mold-oven truck and run into the mold oven for drying. It will be assumed, however, in this article that the foundry is not equipped with a mold oven sufficiently large to contain the entire mold, and hence it is necessary to dry it on the floor or at least to dry it sufficiently so that it can be cast.

The special rigging necessary to carry on this work consists of an arbor or spindle stool as shown at *A*, Fig 2. This is a casting having a tapered hole in the center for supporting the lower end of the spindle that carries the sweeps. For making the first portion of the mold the arbor seat is placed in position, leveled and the spindle erected in it. In order to prevent any dirt from working into the bottom of the spindle hole it is common practice to crowd a little waste down through the hole in the seat and into a small pocket left in the sand under the seat. A piece of waste should also be placed around the spindle on top of the stool to keep dirt from working into the joint around the spindle. The top of the spindle *B* can be supported by extending timbers from the wall or suitable supports outside of the mold so that they will carry a top bearing for the spindle. This is not shown in the illustration.

A sweep, as shown at *C*, is provided to sweep out or shape the inside of the kettle. This is secured to the spindle by suitable clamp blocks as shown. In the case under consideration in which no loam plate is used as a foundation, a level bed of sand would be struck off around the spindle. This sand should be rammed hard so that it will not settle during subsequent operations. Upon this sand, brick are laid, the brick being joined by loam mortar. This material is soft mud made from loamy earth. It should be worked up to the consistency of ordinary plasterers' mortar.

More rapid work, however, can be accomplished in most cases by handling the mud with the hands instead of with the trowel. The brick are built up layer by layer as shown, leaving at least an inch between the brick and the edge of the sweep. In work of this kind it is necessary to make ample provision for venting, particularly as the mold is not to be dried in an oven. For this reason sifted coal ashes should be placed in the longitudinal cracks between the brick in every third or fourth course, forming horizontal vent passages between the inside and outside of the mold. These ashes are obtained by taking ordinary boiler-room ashes and sifting out the coarse cinders by passing the material through a ½-in. riddle or, if no riddle of this class is at hand, a No. 4 or ¼-in. riddle may be used. If soft coal or any similar material forming a good ash is not used at the plant, that is, if the boilers are fired with oil or wood, it is necessary to use some other material for opening up the joints and furnishing vent, and this may be accomplished by placing sawdust in some of the vents. These vent passages formed by ashes or sawdust should occur in at least every second row of brick vertically, and should not be separated by a space of more than one foot horizontally.



Center Section

Fig. 1

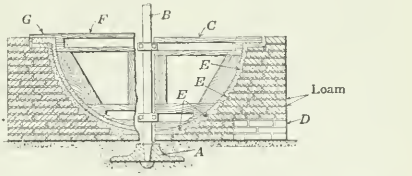


Fig. 2

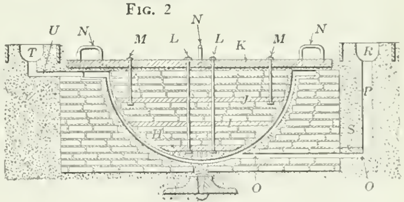


Fig. 3 The Engineering & Mining Journal

Lead Kettle and Loam Mold for Casting It

Provisions for Drying the Mold

Where a large mass of brick like that shown is to be built up, some small pockets of such a length that they can be bridged by two brick placed end to end, each projecting half a length, should be formed around the outside at intervals. These pockets should be eight inches wide and they should be eight inches to a foot high. They can be made to extend into the brickwork as shown at *D*, Fig. 2. The object of these pockets is to afford an opportunity to build small fires in the brickwork to assist in drying the loam between the bricks. In order to indicate the opening *D*, the rest of the brickwork has been lightly cross-sectioned. After the mold is dried out these pockets or openings are filled with sand which is tamped in lightly with a rammer. This sand should be moistened to about the consistency used for ordinary green-sand work, and should not be rammed in so hard that it will interfere seriously with the vent. Some foundrymen prefer to shovel ashes into an opening of this kind and ram them in lightly, which undoubtedly affords a freer vent.

---

*Editor, Castings, Caxton Building, Cleveland, Ohio.

Ordinarily a loam mold of this kind is made in a pit so that the entire mass of brickwork will be below the foundry floor. This makes it possible to back up the brickwork by ramming sand behind it so as to prevent run-outs or metal leaking through the mold. After the brickwork has been built up so as to clear the sweep, a coating of loam is swept on to the inside of the bricks as shown at *EE*, Fig. 2. This forms the face of the mold proper.

In order to make the cope portion of the mold it is necessary to sweep a thickness of loamy sand on top of the surface *EE*, to form a mass equal in thickness to the kettle, and this sand really becomes the pattern. To accomplish this the brickwork should first be partially dried. This is effected by taking out the spindle and sweep and hanging an iron basket or box made of sheet iron in the mold and maintaining a charcoal fire in it long enough to partially dry the loam facing. This surface is then covered with damp newspaper to form a parting, and a thickness of heavy loam sand is swept on to form the pattern. The sweep for accomplishing this is shown at *F*, Fig. 2. It differs from the sweep shown at *C*, in that the diameter of each portion of the edge is sufficiently less than that at *C* so that it will leave a body of sand 1½ in. thick.

The point *G* of the sweep is also arranged so that it will sweep off the top of the flange of the kettle even with the parting of the mold. After the loam sand has been swept on the inside of the kettle by the sweep *F* the sweep and spindle are removed, waste is placed in the hole in the step or support *A*, and the hole through which the spindle fits is patched up with sand even with the inside of the bottom of the kettle.

Forming the Cope of a Kettle Mold

The mold is now ready for the forming of the cope. In order to accomplish this, however, a number of pieces of rigging must be arranged. A general view of a section of a mold showing the completed cope in place is shown in Fig. 3. To make the cope it is necessary to make what is known as a pricker plate, as shown at *H*, two loam plates at *I* and *J* and a covered loam plate as shown at *K*. These four plates are made in open sand and the operation of making them will be described before making the mold.

The pricker plate *H* is shown in detail in Fig. 4. This should be from 1¼ to 2 in. thick and is made by preparing a level bed of sand and then striking out a circle 2 ft. 2 in. diameter and beveled on the lower corner as shown at the edge of the plate. Several vent openings should be formed through the plate by means of cores, as indicated in the drawing. To make these a simple core box is made and a number of cores about 4 in. in length and 1 to 1½ in. thick are made. These cores should be about 2½ in. high, so that they will project above the top of the plate slightly when the mold is poured. After the impression for the plate has been struck out in the sand the cores are placed in position and fastened down with nails. It is also well to weight them by placing some iron bars across the top and then by piling iron on top of the bars. It is also necessary to make provision for the bolt holes which pass through the plate. These holes are 1¼ in. diameter and should be formed by 1¼-in. round cores set on the sand bed and secured in position by weighting.

Sometimes these cores are set in tapered prints formed in the bed by pressing a tapered print-block into the bed, but in any case they should be weighted to keep them from floating when the metal is poured around them. In order to form the prickers which serve to keep the loam in position a stick, usually a dowel stick from ⅝ to ¾ in. diameter, is sharpened at one end. This is then thrust into the sand to the desired depth to form the prickers. To limit the depth to which the stick is thrust into the sand a washer is sometimes fitted around it and as longer prickers are wanted the stick is whittled away and the washer forced farther up. Another way is to cut notches in the stick and thrust it in until it comes to the different notches.

Making of the Loam Plates

At the same time that the pricker plate shown in Fig. 4 is made the two loam plates *I* and *J* shown in Figs. 5 and 6 should be made. These should be about 1½ in. thick and about the form shown in the illustration. They can be struck out of a level bed of sand prepared on the foundry floor. The venting slots and bolt holes are formed by cores weighted in place as already described. The cover plate *K*, Fig. 3, is made as shown in Fig. 7. In this illustration the cover plate as shown is provided with four 1-in. lifting irons. These are bent into a U-shape, and are fastened on the bed by means of nails thrust across the lower end of the U and are generally kept in an upright position by laying a bar or iron across the mold and tying the U-shaped handles to it with wire. The slots for vents and the bolt holes are formed in the manner described in connection with the bolts *H*, *I* and *J*. The under surface of this upper plate is generally covered with prickers throughout its entire area, though it is only necessary to have the prickers around the upper portion of the area where the plate projects beyond the brick body of the core; in Fig. 3 this is shown.

After the plates shown in Fig. 4, 5, 6 and 7 have been made the mold is made as shown in Fig. 3. Dampened newspaper is spread over the inside of the sand which has been struck in to form the pattern. A quantity of loam is then put in the lower part of the mold and the plate *H* lowered upon it. The four bolts shown at *LL* are placed in position when the loam plate is lowered into the mold. Brickwork is then started on the plate *H* and carried up for several courses, the space between the ends of the brick and the paper covering the sand pattern being filled with loam. After several courses of brick have been placed in position the plate *I* is lowered over the bolts *LL* and several more courses of brick introduced. Next the plate *J* is lowered into position and with this are introduced the bolts *MM*, of which there should be at least six. In the plate *K*, shown in detail in Fig. 7, provision has been made for eight bolts in the ring indicated by *MM*. The brickwork with loam filling is continued up to the top of the mold.

Venting a Loam Mold

As each of the plates is placed in position upon a bed of loam, all of the vent holes in the plate should be filled with ashes or a loam mixture rich in sawdust so as to facilitate the escape of gases from the interior of the mold. This large amount of venting in a loam mold is provided mainly to assist in drying the mold rapidly, for if it were not thoroughly vented it would take a long while to drive the water out of the interior of the mass.

After the brickwork has been built up to the top of the kettle a bed of loam is spread over the top of the mold and the plate *K* lowered into position. This plate is allowed to rest upon the mold until the loam beneath it has stiffened considerably by the absorption of moisture taken up by the brick. After this the nuts on the bolts *LL* and *MM* are run down to a bearing. After several hours the inner part of the mold is lifted by means of the lifting lugs *NN*. After the interior of the kettle which forms the cope has been lifted off, its under surface is gone over carefully with the trowel and any rough spots repaired. It is then set up on four or five supports surrounded with sheet iron and a charcoal or coke fire started under it to dry it. The drying should not be forced rapidly but should proceed slowly and in a mold of this size it will probably take 16 to 20 hours to dry it out thoroughly. As drying progresses it may be necessary to tighten up the bolts a little, but if the loam was of the right consistency there should not be much shrinkage. If there is much shrinkage it will distort the kettle, making it too thick at the bottom, and this will show that the loam mixture was not right and that it was applied too wet.

Ordinarily the bricks are dry enough to take up the excess moisture in the mixture and dry it down to approximately the volume it will occupy in its final form. Before the upper part of the mold has been lifted out, marks should be arranged on the lower or drag portion which will enable the foundryman to return the upper or cope portion into exactly the position it occupied during molding. After the cope part has been lifted off and set away to dry, the hole at the bottom of the mold should be cleaned out, the spindle returned and the sand which was struck on to form the pattern, swept out. Some foundrymen, however do not return the spindle, but depend on the paper parting to enable them to remove the sand pattern completely. If the work was done carefully this will save one setting of the spindle.

DRYING THE MOLD

After the sand pattern has been removed, the surface of the mold should be blacked and a charcoal-fire basket made of sheet iron introduced into the interior to dry the mold from the inside. At the same time several small wood fires should be started in the pockets left in the brickwork, and after these have burnt a short time charcoal should be added to them. The pit in which the mold stands can be covered with sheet-iron plates so that the pit becomes a mold-drying oven.

For gating the loam mold, provision should be made during the building up of the wall for two sets of horizontal pouring gates. Fig. 3 shows the gating arrangement. The gate *O* leads to a point near the bottom of the kettle and this should be at least 1¾x3 in. The down gate *P* should be provided with a pouring basin *R*, the top of which should be built up several inches above the mold. To form the horizontal portion of the gate, a gate stick should be introduced into the mold during the building up of the brick and this should be drawn out after the sand pattern has been cleaned away from the interior of the mold. The gate stick must be covered with heavy oil to prevent the loam from sticking to it. The horizontal portion of the gate *O* which projects beyond the brickwork can be formed by means of a dry-sand cover core *S*, which is placed over the gate passage. The vertical portion of the gate *P* can be formed by a gate stick in green sand, or it can be made of pipe-shaped, dry-sand cores. In some foundries ordinary clay drain tile is used for this purpose.

The first iron introduced into the mold should be poured in through the pouring basin *R* and this should be allowed to flow in until the mold is filled to about one-third of its height. After this, metal should be introduced through the pouring basin *T* which connects with the flange by a number of gates *U*. The pouring basin *T* should be fairly long, extending for several feet along one side of the kettle and in many cases two such gates are used on opposite sides of the kettle, so that with the pouring basin *R* they divide the circumference of the kettle into about three equal parts. Pouring should continue through the gates *R* and *T* until the mold is full.

At least two risers should be put on the rim connected through gates similar to that shown at *U*, and when the metal in these rises to a point four or five inches above the flange the pouring should be stopped. The gates *U* should be large so that the metal in the heads *T* will feed down into the rim to follow up the natural shrinkage as the metal sets. During the pouring the plate *K* should be weighted in place with a pile of pig iron or any other suitable heavy weights or it can be bolted down to iron plates placed beneath the brickwork in the drag portion of the mold.

In some shops where kettles are cast they make it a rule to lift out the cope portion of the mold as soon as the metal is set. The object of this is to cause the metal to cool rapidly from the inside, which tends to give a more dense casting. In most cases, however, the metal is left in the mold to cool for several days. In the case of complicated work cast in loam it should never be stripped too quickly unless there are parts which would be cracked by the contraction if not shaken out promptly. In the case of a kettle like that shown in these illustrations it will be necessary to ease off or partly raise the cope soon after casting in order to prevent the plates *I* and *J* from exerting undue pressure on the inside of the casting. It is for this reason that these plates should be kept at least 1½ to 2 in. clear of the face of the casting and generally this amount of loam will be sufficient to prevent injury to the work. It must be remembered that when the plates *I* and *J* are introduced into the mold they are cold. As the casting cools it imparts heat to these plates which tends to expand them. At the same time the casting is losing heat and shrinking, so that the two effects in opposite directions tend to aggravate the difficulty, due to shrinkage.

A loam mixture is essentially a sticky mud which will dry without shrinking. To have this property it must contain sufficient silica in the form of good sharp sand to act as the framework of the final mixture. It must contain consider-

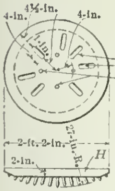


FIG. 4

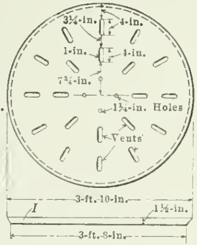


FIG. 5

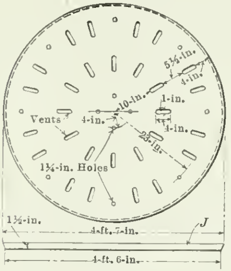
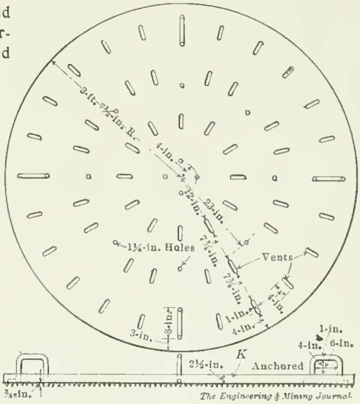


FIG. 6



The Engineering & Mining Journal

FIG. 7

PRICKER PLATES AND SUPPORTS FOR THE CORE OR COPE OF A LEAD-KETTLE MOLD able clay, and generally some other adhesive.

Loam Mixtures

In almost every region sand that will make good loam mixtures can be found. Usually a heavy molding sand high in clay is taken as the base of the mixture, and to it are added sharp sand, chopped straw, sawdust, or horse manure, and glutrin water or molasses water. Clay wash is also frequently used in wetting down a loam mixture.

The following may be given for the composition of loam mixtures in various regions: Where there is available a fairly heavy molding sand and a good sharp silica sand such as a clean lake or river sand, the following mixture could be used: Molding sand, 9 parts; sharp sand, 11 parts; finely sifted fireclay, 1 part; chopped straw, 3 parts; seacoal, 1 part. The straw should be chopped fine and sifted through a ¼-in. riddle. The fireclay should be sifted through a ⅛-in. riddle. If no regular seacoal is available, any good, high-grade bituminous coal may be ground to a fine powder and used.

Any loam mixture requires thorough mixing and hence it is best to mix it in a clay-pan which operates similarly to a chilean mill. Where no machine of this kind is available a fair mixture can be made by treading it with the feet and shoveling it over and over, or by placing a large sheet of boiler iron on a bench about three feet high and shoveling a layer of stiff loam about three inches thick on top of this. Then take a ⅜- or ½-in. rod and beat the mixture, striking hard enough to drive the rod through to the plate every time and beating long enough to work the mixture over several times. Fair results can be obtained in an ordinary mortar-box with a hoe, if a man will stick to it, for the longer the loam is worked the better it will be. It is also good practice to soak loam over night.

Chopped straw or sifted horse manure has been used in loam from so far back in the history of foundry work that no one knows when the mixture was first introduced, but it is only within the last few years that we have learned to appreciate the significance of the horse manure or chopped straw. It seems that chopped straw or any similar vegetable compound contains a considerable amount of what the chemist calls colloidal matter, which has the property of deflocculating and increasing the plasticity of clay. After the loam is dry the fibrous material in it serves as a venting agent.

Other mixtures are as follows: Where loam work is being done regularly the old loam sand can be worked into the mixture in the following proportions: old loam sand, one part; sharp sand, two parts; molding sand, two parts. Wet down with a strong clay wash made with glutrin or molasses water. Not over a half pint to a pint of glutrin should be used to a bucket of water and clay should be stirred in to the consistency of a thin cream.

Another good mix is composed of sharp sand, four parts; molding sand, one part; clay, one part; and pine sawdust, one part. This should be wet down with a thin clay wash. The addition of the clay in this case serves as a bond for the large amount of sharp sand. Slaked lime may be mixed with loam in the proportion of 2 or 3% of lime, but it is not often used as it hurts the men's hands. For the rough or backing coats coarse molding sand containing large pebbles may be used; for the finishing coats finer sand should be used.

Blacking Loam Molds

All loam molds require blacking, and the blacking is best applied when the surface of the mold is air-dried to some extent before it is put in the core oven. The blacking should be made by taking a good plumbago or coke blacking and first mixing it with sufficient water to make a paste. Then glutrin water or molasses water is added and the entire mass stirred thoroughly. It is best to mix blacking several hours before it is to be used and some foundrymen prefer to mix it the day before it is to be used. After the face of the mold has been gone over with the wet blacking it will dry rapidly and when it becomes sufficiently stiff, tools may be used for slicking.

Some foundrymen prefer to shake powdered plumbago or "silver lead," as they call it, from a bag over the damp surface of the mold after applying the blacking and then finish it with trowels or slicks. In some cases loam molds are blacked after they are dried and while they are still hot. In this case the blacking dries rapidly and will have to be strong to prevent its cracking or peeling off.

Magnesite in 1911

The American supply of magnesite continued to come almost entirely from Austria and Greece in 1911. A small shipment was received from the Island of Margarita belonging to Venezuela, and American interests took option on other deposits there during the year. A deposit in Quebec was under option to Americans during the summer, but no exploitation was undertaken. The California deposits are operated on a small scale to supply local demand, but toward the close of the year, plans for a larger utilization of California magnesite were made. The demand for calcined magnesite in the eastern United States was good and at the close of 1911 this market showed a decided upward tendency.

The Payne Electrostatic Separator

In a recent patent issued to Clarence Q. Payne (U. S. pat. 994,870), the inventor calls the attention to the fact that mechanical interference does much to make the present styles of electromagnetic and electrostatic apparatus inefficient. That is, large pieces of electrified material may form "bridges" which will retain small fragments of unelectrified material, and *vice versa*. To prevent this he has previously (U. S. pat. 791,494) attempted to make the field a unipolar field, that is, the lines of force do not at any time return upon themselves. This was accomplished by having the separation take place in the air gap between two opposite poles.

In the present invention, cleaner separations are sought by close sizing of the material to be treated, followed by treatment in an electrostatic or electromagnetic machine, in which the one pole consists of a cylinder, made up of conducting disks of width varying directly as the size of the material to be treated, which are separated from each other by insulating disks similarly proportioned.

New Electric Hoist at West Rand Consolidated Mines

London Correspondence

The British Westinghouse Electric & Manufacturing Co. has supplied the West Rand Consolidated mines with an electric hoist for a seven-compartment shaft, 3000 ft. deep, dipping at an angle of 50°. The No. 1 hoist has a capacity of 12,000 lb. of ore. The skip weighs 7500 and the rope 8500 lb. The No. 2 hoist has a capacity of 6000 lb. of ore. The skip weighs 5500 and the rope 6000 lb. The hoists are intended to be operated at a speed of 2000 ft. per minute.

The Victoria Falls company will supply the power. Each motor-generator set comprises a 2000-volt, three-phase, 50-cycle, slip ring, induction motor directly coupled to a direct-current generator and an exciter. The two drums are 10 ft. in diameter and measure 3 ft. 9 in. across the face between flanges. They run loose on the drum shaft and are driven by multi-tooth clutches that slide on hexagonal sections of the shaft.

The Ward Leonard system of control is used. There is a device on each hoist to prevent overwinding, overloading, failure of power supply, air supply, exciting current, etc. The hoists are housed in a substantially built brick structure, a novelty on the Rand.

Cripple Creek Drainage

By W. Weston*

At this time when the renewed activities in driving the deep-drainage tunnel in the Cripple Creek district, Colorado, are having such marked effect in the unwatering of the lowest workings of the large mines, a short review of the underground water system of the Cripple Creek volcanic area and its drainage, may be interesting, more especially as it is unique in the mining world today; though in former years much has been written on the subject by various engineers, there are many readers of the Journal to whom these articles have not been available, or, if read, have perhaps passed out of mind, and at this time a short, uptodate review may not be amiss.

Water Contained in Granite-rimmed Basin

At the commencement of mining operations the underground water surface of the area stood at about 9500 ft., in what might be described as a basin about two miles in diameter and filled with volcanic tuffs, breccia and islands and broken masses of granite, caused by a violent eruption which threw up the rocks and then allowed them to settle back again into the basin or plug thus formed, and which had for its rim a country of hard impervious granite which prevents the escape of the contained water. This is illustrated in a simple manner by Waldemar Lindgren, of the U. S. Geological Survey, who describes it[1] as "suggestive of a watersoaked sponge set in a glass cup." This water is stored water that came from the rain and snow that fell upon the surface, and not from underground sources.

In the cooling of the volcanic area, shrinkage cracks extending across it were formed, and later dikes of phonolite and of basalt broke through the basin, and still later, probably, steam, gases and thermal waters having gold, tellurium and other minerals in solution, ascended these shrinkage cracks and walls of the dikes and permeated and were precipitated in the inclosing rocks, making the ore, which, since 1901, has added about $200,000,000 to the world's supply of gold. That the face of nature must have been terribly disfigured, is shown by the fact that in some of the veins the remains of trees were found, and in a mine drift near Anaconda, I saw a tree trunk, 6 in. in diameter, that laid across the tunnel and was simply charred, the grain and knots being clearly discernible. The tree was 268 ft. below the surface. In the million years, more or less, that have elapsed since matters quieted down, rain, wind, frost, snow, ice and running water have cracked the surface and made loose rock on top; its disintegration and dust storms made soil, trees and grass grow again, and in 1891 it was a grazing ground for cattle.

Clue Given by Blue Bell Tunnel

The cue to the possible drainage of the basin by tunnels crossing the main course of the vein fissures, was first given by the Blue Bell tunnel, owned by a company, of whose leases I was in charge. This tunnel was a 200-ft. crosscut from the gulch in the town of Anaconda and was driven to intersect a vein 50 ft. below the surface and at 9335 ft. elevation. The fissure on one wall of the vein was open, and about 6 in. wide, its sides being lined with quartz crystals, and the flow of water encountered was 200 gal. per min. Its effect, though slight, was clearly demonstrated in adjacent mine shafts. Then came the Ophelia, or as it was first known, the "Moffat-Bush" tunnel into Gold Hill, at 9268 ft. elevation with a discharge in 1896 of 2000 gal. per min. Then came the Standard tunnel at 9027 ft. elevation, from Gold Run west of Beacon Hill, with a maximum flow in 1899, of from 12,000 to 18,000 gal. per min. with a total length of 2800 ft. In 1903 came the El Paso tunnel, at 8930 ft. elevation, with a maximum flow in May, 1904, of 6848 gal. per min., and this was connected with the El Paso shaft in September, 1903. This, for the time, established the water level of the district.

The Present Tunnel Started Seven Years Ago

Recently came the tunnel of the Cripple Creek Drainage & Tunnel Co., composed of the chief mining companies of the district, which in the last seven years has been driven three miles and is now in the phonolite plug of Beacon Hill; it has drained the 700-, 800- and 1000-ft. levels of the El Paso mine in an ore horizon approximately 500 ft. lower than ore has been opened in any other part of the district, and is correspondingly benefiting the deep mines of nearly the entire Cripple Creek area. This point was the most available for an economical tunnel project, as Beacon Hill is farther down Cripple Creek than any other and is consequently at the lowest altitude. The El Paso mine, being in Beacon Hill, was the first to be benefited by it.

The flow from the portal of the tunnel at present is about 10,000 gal. per min., the breast being in hard granite and not encountering any water courses. The present flow, however, comes mainly from a crosscut to the C. K. & N. vein, and it has been clearly established by the result of this and the two previous tunnels, that though Beacon Hill is a plug or island of phonolite, in the granite area, its vein fissures have some connection with the main watersoaked, volcanic or breccia basin from which the tunnel head is still about 2000 ft. distant, for the recession in the large mines, in the west side of the district, is now about 30 in. per week. When the tunnel emerges from the impervious granite walls into the basin itself, the flow of water will probably be much greater, the recession much more rapid, and the mineralized area more equally benefited. The main line of the tunnel is now headed for a point within about a hundred feet of the Elkton shaft; it is 1420 ft. below the surface, and the total length from portal to breast is 16,400 feet.

---

*965 Gas & Electric Building, Denver, Colo.

[1] Professional Paper No. 54.

Duty on Zinc from Imported Ores

Washington Correspondence

Secretary McVeagh has sent an important letter to the surveyor of customs at Kansas City as follows: "The Department is in receipt of your letter of Jan. 13, in which, referring to the transportation to Philadelphia of spelter produced in bonded smelters in your district, you express the opinion that as only 90 per cent. of the spelter as shown by assay is forwarded to Philadelphia, duty should be collected at your port on the remaining 10 per cent. for the reason that the spelter forwarded to Philadelphia is withdrawn for consumption at that port.

"In reply, I have to state that, while the regulations upon this particular phase of the question are not very explicit, you will observe by reference to article 551 of the 'Customs Regulations' of 1908, that credit for the full amount of the duties charged on the imported ores used in the production of the bullion withdrawn for shipment to another port, should be given on the warehouse bond. It has been the practice at the various ports for years to construe this article as providing that where the products of a smelting or refining establishment are withdrawn for transportation to another port, the withdrawal for transportation shall show the total weight of the metal that was in the ore when imported; that is, if 90,000 lb. of metal were forwarded to another port, this quantity should be shown on the withdrawal for transportation, but duty should be extended upon 100,000 lb. and the warehouse bond canceled upon notice from the collector at the port to which the merchandise is forwarded that it has been received. If upon its arrival it is desired to withdraw the metal for consumption, a rewarehouse and withdrawal for consumption should be made at the port of destination, say Philadelphia, and duty collected at the appropriate rate upon 100,000 lb. The practice as outlined above is approved by the Department, and, therefore, no duty should be collected by you upon spelter which is withdrawn from a bonded warehouse for transportation to another port, as duty is only collected upon merchandise withdrawn for consumption."

Record of Imported Ores Used

In another letter addressed to the collector of customs at New York City, Secretary McVeagh says:

"Drawback is hereby allowed under section 25 of the tariff act of Aug. 5, 1909, and the regulations promulgated thereunder (T. D. 31695 of June 16, 1911) on spelter manufactured by the New Jersey Zinc Co. from imported oxide zinc ores. A manufacturing record shall be kept showing the lots or runs; date of manufacture; quantity and value of the imported ore consumed; dutiable metallic content, lead and zinc, as determined by Government assay; the quantity of domestic ores consumed, where the spelter is not produced entirely from imported ore, giving the lead and zinc content; the total lead and zinc content stated separately of all the ores used; the brand of spelter produced: the quantity; the zinc and lead content stated separately; the quantity of by-products or valuable waste, the zinc and lead content of such waste and the value thereof, and the loss or worthless waste, both as to zinc and lead. A sworn abstract from this record shall be filed with each drawback entry.

"In liquidation, the quantity of imported ore which may be taken as the basis for the estimation of the drawback may equal the quantity used as shown in the sworn abstract from the manufacturing record, an allowance being made for wastage depending upon the value of such waste. Where domestic ores are used in combination with imported ores the loss, valuable waste, and the zinc and lead content of the spelter shall be apportioned to such imported and domestic ores in accordance with the respective quantities of the several ores used and the respective zinc and lead contents thereof."

Cooling Pyrites Burner Gases

A recent patent (Fr. pat. 431,067) provides for the cooling of pyrites-burner gases by a circular tower built in sections, surrounded by an annular space for cooling water which connects with hollow vertical partitions crossing each section, the whole being built of lead and supported over a circular trough in which it is sealed by sulphuric acid.[1] The gases from the burners enter from the top and leave at the bottom, while the cooling water passes in the opposite direction through the cylindrical jacket and the hollow partitions. The burner gases, it is claimed, can be cooled from 500° C. to the ordinary temperature, and all the sulphuric-acid fog they contain separated as liquid. The lid of the apparatus is removable, and easy access is thus offorded for cleaning, which, however, is only necessary at long intervals.

New Kink in Iodide Copper Assays

The iodide method of copper determination has been considered by many chemists more accurate than the cyanide, but nevertheless rejected in favor of the latter, owing to its being somewhat shorter and requiring less manipulation. A modification is offered by E. C. Kendall[1] which he believes puts the two methods on a parity so far as ease is concerned.

The copper is supposed to have been brought into solution by means of nitric acid, and the innovation consists in the destruction of the residual nitrous acid by means of sodium hypochlorite, instead of by evaporation to dryness, or by bromine. The sodium hypochlorite reacts

$$NaClO + HNO_3 = NaNO_3 + HClO$$

$$2HClO + N_2O_3 + H_2O \text{ (or } 2HNO_2) = 2HCl + 2HNO_3$$

$$HClO + HCl = H_2O + Cl_2$$

with the free nitric acid in the solution to form sodium nitrate and hypochlorous acid. Hypochlorous acid and nitrous acid give nitric acid and hydrochloric acid. The hydrochloric acid formed reacts with the excess of hypochlorous acid to form water and free chlorine.

The free chlorine must also be removed, which is done with phenol. If the phenol be added drop by drop, colored oxidation compounds are formed which prevent a successful titration. The presence of a large amount of nitric acid also interferes, by formation of nitrophenol. Consequently the great excess of nitric acid should be neutralized first with caustic soda or potash, and then the phenol added quickly, preferably by forcing it with the breath through a pipette from which the tip has been removed. Under these conditions the chlorine forms an addition product. This is all preferably carried on in a flask, after which the gas above the solution is blown out, the flask washed down, and the solution immediately neutralized to prevent any possibility of nitrophenol formation.

Standard Solutions

The sodium hypochlorite solution is made by boiling 112 grams of calcium hypochlorite and 100 grams of anhydrous sodium carbonate in 1200 c.c. of water. Filter The solution can then be made so that 1 c.c.=0.1 N sodium thiosulphate by adding 5 c.c. of the NaClO solution to 100 c.c. water, adding 5 c.c. KI solution, a few c.c. of dilute HCl, titrating with 0.1 N $Na_2S_2O_3$ and adjusting according to the results of this titration.

The other solutions are: 5% colorless solution of phenol; 20% caustic soda; 50% acetic acid; 30% potassium iodide; a 0.5% solution of Kahlbaum's soluble starch; and standard thiosulphate.

[The author recommends two $Na_2S_2O_3$ solutions, one in which 1 c.c. = 6 mg.Cu.; the other for finishing, in which 1 c.c. = 1 mg.Cu. The advisability of this for fast technical work is by no means clear.—Editor.]

The solution, before adding sodium hypochlorite should measure about 50 or 60 c.c.; the acidity be equal to 4 or 5 c.c. HNO_3 and the temperature about 75° F. Five c.c. of hypochlorite solution are added, and well mixed. The change of the color of the solution from clear blue to greenish, and the liberation of chlorine are indications that enough hypochlorite has been added. The reaction is somewhat slow and it is best to allow to stand two minutes before adding the phenol, which *must* be introduced as quickly as possible. Use 10 c.c. of the phenol solution. Blow out the flask, and wash down the sides, then add sodium hydrate until a white precipitate forms. Dissolve the precipitate with a few drops of acetic acid, add 10 c.c. of KI solution and titrate as usual.

Hudson River Tunnel Holed Through

The Hudson River tunnel at Storm King for the Catskill aqueduct, the deepest water-supply tunnel in the world, was "holed through," on Jan. 30, 1912. This tunnel forms a part of the long aqueduct from the Ashokan reservoir in the Catskill Mountains to the City of New York, and has been given much study on account of the great depth necessary in order to drive the tunnel in solid rock.

A contract for driving the tunnel between the shafts was let last spring to the T. A. Gillespie Co. On Jan. 30, a party of New York officials was lowered to the bottom of the east shaft, where Mayor Gaynor closed a switch, firing the final blast at the junction of the headings.

The tunnel, which is nearly 1200 ft. below the surface of the river, is remarkably free from water, and the rock through which it is driven is solid and free from seams. Less than a hundred feet of bench remains to be removed to complete the tunnel excavation, and the lining of the tunnel with concrete will then be started. The tunnel is of great importance to New York as it will bring water from the Catskills to replenish the Croton supply, now dangerously overtaxed.

---

[1] Journ. Soc. Chem. Ind., Dec. 15, 1911.

[1] Journ. Am. Chem. Soc., Dec., 1911.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

T. Lane Carter, of Chicago, is examining mines in Chihuahua, Mexico.

Frederick G. Clapp, of Pittsburg, is making examinations in the oil fields of Louisiana.

Pentecost Mitchell, vice-president of the Oliver Iron Mining Co., has been visiting the Mesabi Range.

Frank H. Probert has been in New York in consultation with the Ray Central and Proprietary Mines companies.

James Rutherford, of Victoria, B. C., sailed from New York, Feb. 1, for London, where he expects to stay about two months.

Henry D. Boddington, of El Paso, Tex., has gone to London on professional business, and will be there about three months.

F. M. Simonds, of Simonds & Burns, New York, is on his way to Colorado to visit the Rawley mine, at Bonanza, Saguache County.

W. L. Bowron has resigned as superintendent of the Gold Hill & Iowa Mines Co., at Quartzburg, Idaho, and has gone to California for a vacation.

A. L. Queneau, who has been in Europe on professional business for several months, expects to arrive home about the middle of February.

Charles J. Coll has resigned as general manager of the Acadia Coal Co., at Stellarton, N. S. He has been in charge of the mines for a number of years.

W. J. Loring, of Bewick, Moreing & Co., is expected to visit California in February or March when the Plymouth mine development in Amador County is under way.

W. T. Shepard, treasurer, and Hugh Kennedy, general manager, of the Rogers Brown Iron Co., are at Hibbing, Minn., to inspect the company's operations on the Mesabi Range.

W. J. Watson, of Ladysmith, Vancouver Island, has been appointed manager of the Tyee Copper Co., in British Columbia, in succession to W. H. Trewartha-James, who recently resigned.

E. V. Bray, of San Francisco, is in New York, on his way to the Dutch East Indies, where he will take charge of the installation and operation of an all-sliming mill for the Exploratie en Exploitatie Maatschappij Bolang Goudon.

Charles Whiting Baker, editor of *Engineering News*, last week completed 25 years of service on the staff of that journal. His friends and associates hope that the *News* may continue for many years to profit by Mr. Baker's energy, ability and capacity for work.

Norval J. Welsh, of San Antonio, Tex., has assumed the general management of the Mexican Mines Development Co., operating in the Santa Eulalia district, of Chihuahua, Mexico, and has established an office at 229 Avenida Independencia, in the city of Chihuahua.

M. C. Morris, general manager of the Horn Silver Mining Co., retired Feb. 1, on which date B. B. Lawrence, of New York, assumed charge as consulting engineer of all the company's property in Utah. Mr. Lawrence has appointed William H. Hendrickson under him as manager resident.

Dr. John C. Branner, vice-president of Leland Stanford, Jr., University, and head of the department of geology and mining, has been presented by the Philadelphia Academy of Natural Science with the Hayden Medal for the year 1912. This medal is conferred every three years on the man who, in the estimation of the academy, has done the most for the advancement of the geology and palæontology in that period. Dr. Branner is the fourth American to receive the medal, which was awarded first in 1888.

OBITUARY

John D. McKennan died at Pittsburg, Penn., Feb. 2, aged 58 years. He was born at Washington, Penn., and after graduating from college studied law and in 1877 opened an office in Pittsburg, where he became prominent as a corporation lawyer. He had been chief attorney for the Jones & Laughlin Steel Co. for almost 25 years, and prior to that time had represented the National Tube Co. He had also many years ago given legal advice to various coal and gas companies.

W. A. Stevens shot and killed himself at Oakland, Calif., Jan. 22. He was well known as a mining engineer in Idaho and Washington. He was a pioneer of the Cœur d'Alenes and later was general manager for Charles Sweeny in his extensive operations in the Buffalo Hump, Idaho, district. For a number of years he and his family resided at Spokane. From Buffalo Hump he went to Nevada and California, where he got control of valuable properties. About a year ago, in conjunction with Dan Greenwalt, he started a boom in the Steamboat Mountain camp in southern British Columbia.

Benjamin F. Pearson died at Halifax, N.S., Jan. 31, aged 57 years. He was born at Colchester, N. S., and was a leading promoter of industrial enterprises. In 1893, in conjunction with H. M. Whitney, of Boston and others, he organized the Dominion Coal Co. Six years later he took a prominent part in establishing the Dominion Iron & Steel Co. He promoted the Halifax Electric Tramway Co. and assisted in the organization of numerous traction and power companies in Mexico, South America and the West Indies. Mr. Pearson entered political life in 1901 and was a member of the Nova Scotia government until a year ago. He was the proprietor of the *Halifax Chronicle*.

Charles Gilbert Wheeler died at Chicago, Jan. 30, aged 75 years. He was born at London, Ont., graduated from Harvard in 1858, a bachelor of science, and studied in German universities. He was assistant state geologist of Missouri from 1859 to 1861; was United States Consul at Nuremburg from 1862 to 1867; traveled in Europe and North Africa in 1867-8; and became professor of chemistry in the University of Chicago and the Chicago Medical College in 1868. Prof. Wheeler made frequent visits to Mexico and Central America, examining mines for American capitalists, between 1868 and 1900. He was a scientific expert for the Bell Telephone Co. and other companies in litigation. As he read 11 modern languages and spoke seven, he was state commissioner from Illinois to the Vienna Exposition in 1873. He was geologist and interpreter on the commission to examine the route for the Nicaragua canal in 1899.

Societies and Technical Schools

Canadian Mining Institute—The officers elected by the Cobalt branch of the institute for the coming year were: Norman Fisher, chairman; A. A. Cole, secretary; Messrs. Reinhardt, Neilly and McVichie, committee.

American Society of Mechanical Engineers—The monthly meeting will be held at the Engineering Building, New York, Feb. 13. A paper on the "California Gold Dredge" will be read by Robert E. Cranston. Several members of the Institute of Mining Engineers will join in discussing the paper.

Minnesota Alumni Association of the Michigan College of Mines—This association will hold its annual banquet on Feb. 22, at Hibbing, Minn. All graduates of the College of Mines will be welcome at the banquet, and should send notice that they intend to be present to A. L. Gerry, secretary, at Hibbing.

American Institute of Mining Engineers—The institute will hold its midwinter meeting in the United Engineering Building, New York, on Feb. 19, 20 and 21. This meeting was formerly only a business meeting, but it is the intention this year to enlarge its scope by reading and discussion of papers, and also the promoting of social intercourse among the members. On the evening of Feb. 19 there will be a general reception in the institute rooms. On Feb. 20 and 21 there will be morning and afternoon sessions. On the evening of Feb. 20 there will be a dinner at the Plaza Hotel to members and their guests.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Feb. 1—The second severe storm of the winter, threatening the mining districts of California with a shortage of water for power purposes, occurred from Jan. 23 to 26. In the higher elevations the ditches had scarcely been cleared from the December snow and freeze when the second heavy snowfall came suddenly. But it was of short duration, and in a portion of the northern end of the state the precipitation was in the form of rain.

The report is current that the Hill railroad interests are looking for a rail outlet from Oregon into northern California, through Feather River Cañon. The line is said to have been surveyed from the mouth of Butte Creek into the Big Meadows and thence into Lassen County, and that construction will extend south from Alturas, Modoc County, into Lassen, and on further south. This would give a direct outlet for the cattle and mining sections of Modoc County, to San Francisco. The completion of the extension of the Nevada-California-Oregon R.R. through northeastern Modoc County to Lakeview, Ore., means the opening up of what is believed to be a high-grade prospective gold camp northwest of Fort Bidwell and extending to New Pine Creek on the southern edge of Oregon. In the last year there has been a large amount of prospecting and development in that section in what has long been known as the Hoag district. The immediate neighborhood has been the base of considerable energy by Colorado and Utah mining investors, though attracting little attention of California mining men except at Los Angeles. All reports from the new camp, which has been named Highgrade, have it that there has been some good ore disclosed and that much of it is of high grade. Many of the reports have been apparently exaggerated; and there have been instances of effort on the part of speculators to induce investments on the bare chance of finding something of value. But this feature, of course, is common in the opening of new camps. The favorable indication in the present prospect of opening a valuable camp is in the fact that a good deal of development was done in the latter half of the year without causing any undue excitement. Just now there is enough snow in that region to discourage any rush; but the prospect of an early season is good, and the first two or three months of the season will doubtless decide whether there is merit in the new camp.

Denver

Feb. 2—In the Camp Bird mine, at Ouray, some good ore has just been opened, and is being mined, in one of the old Gertrude shoots on the main vein. This shoot appears to carry its rich ore deeper than the other ones, which gave out at approximately the same depth, and this one also had begun to narrow in the same way, but unexpectedly opened out again. No new vein has been found, reports to the contrary notwithstanding. The workings in this great mine are approximately two miles in length. The Gertrude shoots are east of the original crosscut tunnel, and in that direction the limit of pay ground in the company's holdings is sharply defined by a vein called the Hancock & Tuscola, which crosses the company's ground in a northwest-southeast direction, and beyond which no pay ore has been found.

The largely increased tonnage of Cripple Creek gold ore handled at the various mills during January may, in all probability, be properly attributed to the unwatering of the deep levels of several of the largest mines by the drainage tunnel. The gross amount treated was 69,726 tons with a gross value of $1,285,971. The whole camp is in excellent condition and unusually lively. The success of the drainage tunnel started everyone digging again, and new discoveries began to be made. On the Pride of Cripple Creek, on Iron Clad Hill, after nine years of work, and when about to pull out his machines, Fred Johnson, lessee, opened a flat vein, 6 ft. thick, of 5-oz. gold ore, and has a 6-months' supply of ore in sight already; on Tenderfoot Hill, Peter Timmons, lessee in the Emma Abbott, has opened 6 in. of ore that shows by assay $500 per ton. The most sensational strike, however, is reported from the Mary McKinney mine, of 6 in. of sylvanite that runs from 5 to 20 oz. gold per ton. This was found on the 800 level.

The net profit of the Vindicator Gold Mining Co. for the last year, according to the annual report, was $238,804, and a total of $2,452,500 in dividends has been distributed among the stockholders. In the Cripple Creek district in January, a total of 30,233 tons was shipped, with a gross value of $830,322.

The demands of the Colorado Mining and Metallurgical Association, of which State Treasurer Roady Kenehan is president, for a government ore-testing plant, has resulted in a telegram from Congressman A. W. Rucker, calling for succinct data as to the grounds on which this association has petitioned the government to establish an experimental ore-testing station at Silverton, in the southwest corner of the state. According to the opinions of the most prominent and experienced mining engineers of the state, it will be exceedingly difficult to show the government valid reason for the demand.

An advance in the price of cement in Colorado is now expected, due to the formation of a $25,000,000 merger of 15 of the principal companies doing business in Kansas. The price war in Kansas forced the Colorado concerns to meet the low prices made in the former state, and cement has been selling here for about $1.25 per bbl. However, the main point is that when cement was up to $2.60 per bbl. a few years ago, it did not check building, and a reasonable advance in price now will not have any effect on the active building movement going on in Denver.

Butte

Jan. 31—When the present lease on the Basin Reduction Works, held by the Butte & Superior company, expires June 1, it now seems assured that the new concentrator under construction at the Butte & Superior mine will be completed and ready for successful operation, for the work is going along rapidly. Construction of the ore-crushing house is well under way, and the crusher and motor to drive it are in place below the orebins at the shaft collar. The receiving tank is also finished; this tank is constructed of steel and holds 300 tons of ore; the latter will be conveyed from the crusher, at the shaft, by a belt conveyor. The main concentrator building will be completely inclosed within three weeks, and the three chilean mills are being installed. These mills receive the ore after it has passed through the rolls, which are in turn supplied from the crushed-ore bins, having a holding capacity of 2000 tons. Three cars of machinery have arrived and this will be installed as fast as the portions of the concentrator containing them are completed. There are 300 men employed in the construction work. At present there are about 2,000,000 tons of ore blocked out in the mine, which carry an average of 23% zinc and some gold and silver, and with the saving in treatment charges which is expected to be made through the new mill by reason of the doing away with transportation costs, and the use of the latest improved machinery and methods for handling zinc ore, it is figured that the company will earn the equivalent of its par value, $10, on every share of stock. Capt. A. B. Wolvin, president of the company, is in Butte inspecting the property, and expects to be joined soon by several of the directors and by a member of the firm of Hayden, Stone & Co., of Boston.

Ground has been broken for the construction of the 200-ton concentrator at the Ophir mine of the Butte Central Copper Co., and it is expected that the first unit of the plant will be in commission by July 1. The cost of the mill will be about $100,000, which has been advanced by the syndicate of Canadian bankers that advanced the company $200,000, more than a year ago, on the strength of an examination by their engineers, and in consideration of obtaining a substantial stock interest; most of this money has been used since then in developing the property to its present state.

Salt Lake City

Feb. 1—Increased production was made by Utah during 1911 in all metals except zinc. The amount of zinc ores mined, however, was not greatly different from that of the year preceding. The Park City mines produced an increased tonnage of silver-lead ores from which zinc is obtained as a byproduct; the Scranton mine, in north Tintic, increased its output of zinc ores, while more ore containing zinc was mined in Bingham than during 1910. The apparent decrease in the production of this metal was not because there was appreciably less zinc ore mined, but because there was less of it marketed. There has been an accumulation of zinc ore and concentrates by some Park City properties, which did not reach the market, and consequently did not show in the output for the last year, as previously noted.

The case of the Conkling Mining Co., against the Silver King Coalition Mines Co., involving an accounting for ore taken from the Elephant stope in the Conkling claim, owned jointly, came up for trial in the Federal court before Judge Marshall, Jan. 29. The complaint filed some time ago charges the extraction of ore worth more than $700,000 from the Conkling lode claim, in which the plaintiff company has a three-fourths interest. The Silver King Coalition Co., claims to have been entirely within its rights in entering the Conkling claim, the contention being based on two principal points at issue: First, that the Coalition has the apex of the fissure vein, which produced the ore in the Elephant stope; the second point at issue is the question as to the position of the westerly endline of the claim, which according to the defendant is situated 135 ft. east of where it is claimed to be by the plaintiff. Practically all of the ore in the Elephant stope occurs under the disputed portion of the claim. The defendant company is presenting its side of the case first.

At a meeting held by the mining committee of the Commercial Club, steps were taken to get in touch with the Utah delegation in Congress, on the matter of the tariff reduction on lead and zinc. Members of this committee, together with the Utah Development League and others, telegraphed to Senators Smoot and Sutherland and to Representative Howell, protesting against the reduction of the tariff on zinc and lead, and urging them to use their best efforts against the passage of the legislation now pending in this matter. The Underwood bill provides that zinc ores shall enter the United States free of duty, while the schedule on pig lead is to be reduced to 25 per cent., ad valorem. This bill has been approved by the House and will soon be sent to the Senate for consideration. During 1911, Utah lead mines produced approximately 117,593,855 lb. of lead valued at $5,197,648, while the production of zinc was approximately 10,541,198 lb., valued at $601,902. The reduction of the tariff on these metals would mean a reduction in the market price, and the necessity of competing with lead from Mexico.

Negaunee, Mich.

Feb. 2—The Breitung-Kaufman mining companies and the Cleveland-Cliffs Iron Co. have paid their taxes at Ishpeming and Negaunee under protest, but the Oliver Iron Mining Co. and the Jones & Laughlin companies have paid without protest. The tax of the Cleveland-Cliffs Iron Co., in Ishpeming and Negaunee, which does not include their mines in the Gwinn district, is over $250,000. The protests deny the validity of the taxes and the method of assessment upon which they are based which was the result of the valuation of the mines by J. R. Finlay, under instruction from the Michigan Tax Commission. It is claimed that property in the district other than the mines is assessed at not exceeding one-third of its actual value. The officials of the companies charge that the Tax Commission over-assessed the mines with the full knowledge that such assessment was excessive.

Wallace, Ida.

Jan. 30—The Chicago & Northwestern Ry. has completed plans whereby it is to have a through line to the north Pacific coast. The road controls the Pittsburg & Gilmore R.R., which will take the C. & N. W. Ry. to Salmon City. From there the line will be built down the Salmon River to Lewiston and thence to Portland, Ore. This line will open the great lead deposits which are known to exist north of Salmon City. One property in that district has made a profit of $50,000 in spite of the fact that the ore was hauled 85 miles by team. The property was a lead mine.

Another of the plans of the Northwestern is to go south along the middle fork of the Salmon River to its headwaters, thence through the Sawtooth Mountains to the Payette River. This line will terminate at Coos Bay. R. N. Bell, the Idaho state mine inspector, recently made a favorable report on this region.

Toronto

Feb. 3—It is understood that as a result of the strong pressure recently brought to bear on the Canadian Government by the iron and steel interests, the bounty on pig iron abolished by the late administration, will be renewed as a temporary measure of relief, pending investigation by the Tariff Commission, soon to be appointed, into the whole question of protection for the iron and steel industry. The bounty in operation in 1910 was 90c. per ton on pig iron manufactured from Canadian ore and 40c. per ton on the output from foreign ore. It is now proposed to increase this to $1.50 on pig iron made from native and $1 on that produced from foreign ore.

The establishment of a large steel plant at Port Arthur by Mackenzie & Mann, of the Canadian Northern Ry., in conjunction with other large Canadian and American interests, is under consideration and it is announced that the project depends upon the course of the government as regards the bounties.

Porcupine

Feb. 1—Interest in Porcupine during the week has centered around the report on the Hollinger by Manager Robbins. This report has been expected for some time, and is the first important statement of its kind from any of the larger properties. While the report may be a disappointment to the brokers and speculative element, it is a gratifying surprise to the majority of mining men. The grade of the ore is higher than was generally anticipated, averaging, as it does, $22 per ton.

The proposed insurrection by the Temiskaming shareholders against the Cartwright control, appears unlikely to amount to anything. The dissatisfied shareholders in the United States sent delegates to examine and report on the Temiskaming property in Cobalt, and the North Dome in Porcupine, the purchase of which has caused all the trouble. The delegates made an examination of the properties, and expressed themselves as being entirely in accord with the actions of the Temiskaming management.

The Mining News

The Current History of Mining

Arizona

Gila County

Miami—Churn drilling has just been started near No. 3 shaft about 1500 ft. northeast of the present orebody. This shaft is 460 ft. deep and is reported to be bottomed in chalcocite ore averaging about 2% copper.

Inspiration—No announcement has yet been made as to when the construction of the 7500-ton mill by the Inspiration Consolidated Copper Co. will begin. Work is progressing on the water-supply dam and J. M. Callow is still trying out the proposed flowsheet in the experimental mill. Underground development has not been started.

Live Oak—Development of the mine in a small way continues. A 15x20, double-drum hoist has been purchased from the Old Dominion company and will be erected at No. 2 shaft, which will be enlarged to three compartments. According to present intentions of the management, future increase of ore reserves will be accomplished by underground work rather than by churn drilling. Aggressive development appears to be waiting on the result of the recent examination by W. H. Aldridge and Dr. L. D. Ricketts.

Southwestern Miami—Churn-drill hole No. 2 is over 550 ft. deep.

Barney—Drilling continues steadily on this group, under option to the Lewisohns. A hole was recently started at the bottom of the 400-ft. shaft, about 3000 ft. west of the Live Oak west end-line. The hole is in schist.

New State—Six men are employed in the development of this group of 33 claims, on lower Pinto Creek, 15 miles west of Globe. On the Republic claim, a trench was started on the Duquesne vein and is reported to have disclosed, near the surface, from 1 to 3 ft. of shipping ore, carrying gold, silver and copper. The ore occurs in limestone. There are 20 tons of ore on the dump and preparations are being made to ship.

Duquesne—Smeltery returns on a car of ore recently shipped to the El Paso smeltery from this mine, 15 miles west of Globe, gave credit for 39 tons of ore assaying 0.76 oz. gold, 13.6% lead, 17.8% iron and 33% insoluble. The net returns above freight and smeltery charges amounted to about $18 per ton. John Shaw is in charge of the property.

Copper & Silver Zone—A car of lead-silver ore has just been shipped to the El Paso smeltery from this group of claims two miles east of Globe, which is owned by H. W. Clark and associates, and is being worked by several parties of lessees.

Superior & Boston—The crosscut north, from the McGaw shaft on the 12th level, has cut a vein reported to be 4 ft. wide and to carry copper ore of a good smelting grade. Specimens of the ore show the copper to occur as chalcopyrite, associated with pyrite and considerable hematite.

Five Points—Seven men are employed at the mine which is being developed by the Manitou Copper Co., under the management of A. T. Hammons, of Globe. The Cracker Jim shaft has been unwatered and a 25-hp. gasoline hoist has been erected. The shaft is 125 ft. deep and sinking will be resumed soon. It is proposed to crosscut to the Maverick vein at 200 ft. from which some high-grade copper ore has been extracted.

Pinal County

Ray Consolidated—There are rumors that this company is considering the purchase of the property of the Ray Central, which adjoins it.

California

Amador County

Bunker Hill—In the six months ended Dec. 31, 1911, the 40-stamp mill crushed 35,526 tons of ore and operating expenses were $108,000. The ore was average grade.

Keystone—Repairing the shaft is progressing with three full shifts. Difficulty of getting timbers has delayed the work, the timber supply having been exhausted when the mine was closed. C. R. Downs is superintendent.

Plymouth Consolidated—Installation of the electric pump will be completed and pumping will begin about Feb. 15. J. F. Parks, Plymouth, is superintendent.

South Jackson—A pipe-line is being laid for supplying water to the mine. The concrete foundation for the new hoist will be constructed soon.

Daphne—This gravel mine near Plymouth has been leased to R. C. Brown, of Jackson. It is said the royalty agreed on is 20% of the gross output.

Rose—Grading for the foundation for a new 20-stamp mill has been completed at this mine, sometimes called the Poundstone, near Sutter Creek. Thirty men are employed. Development underground has shown good results. L. R. Poundstone is manager.

Butte County

Leggett Gold Mining Co.—A decree of foreclosure has been rendered in the Superior court, in favor of the Bank of Rideout, Smith & Co., on a mortgage of $3000 on a dredge in operation.

Oro Electric Co.—The survey for a line of towers between Oroville and Marysville has been discontinued and the surveyors sent to Magalia to begin a new route across the valley to Willows in Glen County. H. H. Dewell has superseded S. M. Fisher as engineer in charge.

Calaveras County

Petticoat—The machinery of the Illinois mine is being removed to this mine at Railroad Flat, which will be reopened by a new company. Joseph King is superintendent.

Comet—A vein of good ore is being developed and milled at the mine at Railroad Flat. Mr. Harrington is superintendent.

Gwin—Negotiations are reported to be underway for building a spur from Valley Springs to this mine.

Eldorado County

Stony Bar—Uncovering of rich gravel in this mine near Chili bar 21 miles from Placerville bridge has induced work preparatory to the installation of an hydraulic elevator. John and George Luse, and James and William Ober are working the mine.

Inyo County

Santa Rosa—This mine is now a regular shipper of smelting ore. It is wagon-hauled to the railroad at Keeler. A new 3-ft. vein was disclosed in December. J. J. Gunn, of Independence, and other men of Tonopah, Nev., are owners.

Bullion—A good orebody has been opened at the 325-ft. level. The ore is being milled at the Southern Belle mill. Five new stamps are being installed, making a total of 10. The mine is being operated by L. W. Thompson, of Los Angeles.

Arondo—Sixteen miners and carmen are said to have been added recently to the force at the mine, and an increase in the mill and cyanide plant is contemplated.

Skidoo—During December 1654 tons of ore were crushed, producing total receipts of $14,336. Development costs were $7784; operation, $7478; net profits, $6073. On Dec. 1, the cyanide plant closed for the winter.

SHASTA COUNTY

Balaklava—Contrary to reports, it is officially stated that operations at the plants at Coram will not be resumed soon. An appeal to the courts is being considered, asking for the appointment of an arbitration committee to investigate alleged damages from the Selby smeltery fumes.

Bully Hill—It is believed locally that the property will operate again this spring, with the electric zinc recovery process, which is reported to have passed the experimental stage.

Yuba—This property, in December, is stated to have broken the record for low cost in placer mining. One of its 12 dredges cost $327,000; in December it handled 320,000 cu.yd. of gravel at a reported cost of 1.85c. per yard.

YUBA COUNTY

Tarr Mining Co.—F. W. Tarr, vice-president and general manager, has announced his resignation. He has been managing director of the company for several years. The dry-land dredging plant and the 35-mile ditch from Grass Valley were constructed under his engineering supervision. The mine is an old hydraulic operation at Smartville. Pres. J. Thompson states that operations will begin soon. there have been various announcements of the installation and beginning of work at the new plant, which is an engineering experiment.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

American Sisters—This old mine on Columbian Mountain is the scene of an important strike; in sinking the Headlight shaft 100 ft. from the 285-ft. level a vein of gray copper ore has been followed, and by the first test shipment shows 1000 oz. silver, 3.50 oz. gold and 28% lead per ton. Stoping has commenced and the shaft will be sunk another lift. As there are large bodies of mill ore in the upper levels, the 50-ton concentrator will be repaired and put in commission when water is available. Four months ago this property was leased for five years by the Mollie B. Mining Company.

Columbia—In the Central City district Steven Laner is operating a paying lease in this vein on the eastern slope of Quartz Hill. The ore is mined 200 ft. below the tunnel level. It is low-grade ore, but the crevice is a wide one and the ore is easily broken, which gives the lessees a fair margin of profit.

Baker—The crevice is about 3½ ft. wide and has been opened for nearly 1000 ft. on this property on Quartz Hill. It is being operated as a paying lease by Simmons & Roberts.

CRIPPLE CREEK DISTRICT

In the main heading of the drainage tunnel, water is shooting into the tunnel for several feet with a high pressure, and every round of shots brings more. It is difficult to make headway.

Isabella—A bitter fight for the control is being waged between James F. Burns, of the Portland, and A. C. Gardner, which will be decided at the general meeting at Cheyenne, Wyo., on Feb. 5. Circular letters are being sent out and charges and counter charges as to the efficiency of the management made by both sides. The royalties paid the company in January were $3500; $7000 being the total revenue.

Wild Horse—It is reported that this mill on Bull Hill is handling 1500 tons per month, with a 90% extraction by straight cyanidation, and also that the profits from the mill are paying the cost of developing the mine.

Gold Sovereign—About a car per day is being sent out by the Union Leasing Co. from the recent strike in this mine on Bull Hill; the ore runs from $15 to $50 per ton.

Trilby—This company will sink its shaft on Bull Hill, from 960 ft. to 1100 ft., and laterals will then be run to get into the oreshoots which have been producing in levels above this depth for two years.

Moose—Two cars of good ore have been shipped by Dwight Babcock from his lease on the fourth level of this mine on Raven Hill.

Stratton's Independence—During December, production totaled 2085 tons, averaging $24.72 per ton. Low-grade mine and mill ore, amounting to 5200 tons, was treated. Net profit from mine and mill was $16,150, and $1400 were expended on special development. The mill was shut down for 10 days during the month.

LAKE COUNTY—LEADVILLE

Great Hope—The discovery, recently mentioned, of a new body of ore in this mine on the north side of Breece Hill, Big Evans Gulch, is reported now to have developed into a good body of ore running about 4 oz. gold per ton, average value. This ore, found by Thomas Gilroy, lessee, is about 150 ft. deeper than that mined in the upper plane, 17 years ago, and quite possibly is the same oreshoot.

Jolly—In addition to the lead ore found in the raise put up by the lessees at this mine at the head of East 5th Street, a fine body of iron ore carrying silver has been found.

OURAY COUNTY

Wanakah—Another important strike is chronicled in this company's property in the sandstone and quartzite cliffs below the town, and was made on the Diamond claim. In this section the ore has been found in a succession of caves caused by the oxidation of the auriferous pyrite. The total thickness of the sedimentaries is about 1000 ft. here and they are intersected by a strong diorite dike which is supposed to be responsible for the gold in the horizontal deposits.

Barstow—This mine is in the Red Mountain district near Ironton and it is reported that the shaft recently sunk 160 ft. shows 5 ft. of ore for the entire distance; milling will resume when the present severe winter-weather conditions become more favorable.

Idaho

COEUR D'ALENE DISTRICT

Gold Hunter—A rich strike was made in this mine recently, in a crosscut from the 200-ft. level, below No. 6 tunnel. The length of the new orebody has not yet been determined. About 30% of the width of the vein is clean shipping ore and the samples taken show that the entire 12 ft. will run 45% lead and 67 oz. of silver. The mill is again running at full capacity. The continued cold caused a shortage of water but since the thaw the water supply has been normal. This property is situated east of Mullan and has been a steady producer for many years, but has always been worked on a small scale.

Beartop-Orofino—The ore now being taken from this mine in the north side section is sufficient to run the mill 24 hours per day. The concentrates are being shipped regularly. A new tunnel has been started to open up a new level. While the development is going on, the upper levels are being stoped. This new level will open up the Orofino orebody as well as that of the Beartop. The consolidation of these two properties insures each against the litigation, which would probably have arisen, had the properties remained under two separate managements. Both orebodies are unusually rich and if they do not diminish greatly with depth the mine should be a large producer.

Lucky Calumet—This company has installed its new compressor and will soon start work on the long tunnel. The property's end lines adjoin those of the Snowshoe, in which some excellent copper ore was found.

Kansas

Diplomat—This mine at Galena hoisted 1031 cans of dirt, 165 ft. in a 9-hr. shift. An electric hoist was used. This is $114^{5}/_{9}$ cans per hour.

S. H. & S.—The mill of this company, at Peacock, burned to the ground entailing a loss of $20,000. The mill will be rebuilt. O. W. Sparks, of Galena, is manager.

Michigan

COPPER

Calumet & Hecla—The company is reported to have awarded a contract to the Allis-Chalmers Co. for a 10,000-kw. turbine engine, to cost about $250,000, and for use at the mills at Lake Linden. It is said that this is the largest mixed-pressure turbine engine ever ordered in the United States. The engine will supply approximately 13,333 hp., 3000 of which will be used to operate the concentrating machinery in the new regrinding plant. It is stated that the new turbine will operate on exhaust steam from the stamps.

Hussey-Howe—This company has been organized under Michigan laws, with 100,000 shares, par $25. Of these, 54,000 will be issued full-paid and nonassessable, 45,000 of which will go to the property owners. It is reported that the remaining 9000 issued shares will be sold publicly at $10 per share. The property comprises 320 acres of land near the Indiana and Bohemia tracts. The directors are all Pittsburg men, except C. A. Senecal, who is a resident of Lake Linden. No work has been done on the property.

Ojibway—The test mill run, extending over several months, was completed Jan. 31, and it is reported that the rock stamped has averaged about 15.8 lb. copper per ton, exclusive of mass and barrel work. This is expected to bring the yield to 18 lb. per ton.

Franklin—The mine, after several years of underground development and surface additions, resumed shipping recently at the rate of about 1200 tons per day. Mining is being done on the Pewabic lode, and on the levels below the 20th and extending to the bottom or 33d level. Many improvements have been made to the rockhouse and mill, a new hoist installed, and costs are expected in the future to be more in keeping with the best Lake practice.

Mayflower—It is reported that a consolidation is being planned to include this and the Old Colony. The properties adjoin and could be advantageously worked as one mine. W. J. Uren, former general superintendent of the Bigelow Syndicate mines, has been mentioned as general manager of the proposed merger.

Winona—Working forces are being increased preparatory to doubling the output. The second stamphead is expected to start soon. The first unit of the mill is treating about 600 tons per day, from which an extraction of about 70% is said to be made. Tailing losses are still reported as high.

Isle Royale—It is reported that the directors have come to no final conclusion as regards plans for expansion. Enlargement of stamping facilities is believed to be under consideration.

IRON

The work of installing the electrical machinery at the new Carp River power plant, near Marquette, by the Allis-Chalmers Co., has been delayed by the burning out of the three transformers, which were being dried in preparation for starting the plant. The power house will furnish power to the mines of the Cleveland-Cliffs Iron Co. The concrete dam, four miles up the river, is practically completed and most of the men have been released.

Peninsula Power Co.—This company, which is completing a new power house and dam, at Twin Falls, near Iron Mountain, has begun work at Iron River on the site of the proposed substation, to be situated there for furnishing power to the mines. The property lies between the Sheridan mine siding and the main line of the Chicago & Northwestern Ry. tracks, and is part of the MacKinnon lands.

Norman—Two diamond drills are being operated at this property, seven miles northwest of Republic. The Cole & McDonald Exploration Co. is doing the work for the Jones & Laughlin company, which has an option from the Norman Iron Company.

American—This hard-ore mine of M. A. Hanna & Co., situated on the Marquette Range, is installing a system of efficiency engineering in its underground work, under the direction of W. C. Hart and Stanley Mahon.

Rogers—The Munro Iron Mining Co. has let a contract to Worden, Allen & Co., of Milwaukee, to erect extensive mine buildings and a shafthouse at this mine, near Iron River. The shafthouse, which will include a crusher house and orebin, will be of steel, and 140 ft. in height. The buildings will be of steel and brick, of the following dimensions: Boiler house, 48x66 ft.; engine house, 48x128 ft.; machine-blacksmith-wood shop, 48x160 ft.; warehouse, 40x96 ft.; dry, 40x96 ft. The work of erection will be started about Mar. 1, and will be completed about June 1.

Minnesota

MESABI RANGE

Wilrichfern—At this mine, at Buhl, operated by E. Richards, of Virginia, and J. Redfern, of Hibbing, Minn., work is being pushed rapidly. Drifting has been commenced in the ore, which is of good grade.

Lincoln—This mine, operated by the Jones & Laughlin Steel Co., is working about to capacity. Activity is commencing at other properties in the Virginia district, and forces are being increased.

Buffalo & Susquehanna—The Rogers Brown Ore Co. has started test-pitting at this property. The pits are being put down in 100-ft. squares, and are sampled every 5 ft. in depth.

Petit—This mine, at Gilbert, will be opened soon, and will be one of the large shippers this season.

Schley-Minethey—The mine, situated at Gilbert, is taking on more men and will have a crew of 400 men by Feb. 1. Both this and the Petit mine are operated by the Republic Iron & Steel Company.

Leetonia—The new vertical shaft is down to the orebody, and will be in operation early this season; it will increase this property's output considerably.

Missouri

Davy Crockett—This mine near Carthage is to be reopened under the management of John Durby.

Independence—The Panama mill, at Central City, is being moved to this mine in Gordon Hollow. G. M. Burke, of Joplin, is manager.

Hecma—This company, at Joplin, is sinking an air shaft.

Wilcox Mines Co.—This company, operating the John Jackson mine at Chitwood, has gone into bankruptcy.

Montana

BUTTE DISTRICT

Ophir—The south vein on the 500-ft. level was cut recently and drifted on for 30 ft., opening an average of 6 ft. of commercial ore, similar to that on the 300-ft. level. The 500-ft. level is the lowest being worked at present, and like the 200-, 300- and 400-ft. levels, contains principally silver and gold ore of a concentrating grade; however, at the 1050-ft. level, the bottom of the shaft, there is good silver ore, and the copper content increases at that depth, which leads the management to hope that eventually the lower levels will be found to contain commercial copper, for which metal mining was instigated there originally. Meanwhile production will come from the four upper levels in the immediate future, and will consist of silver and gold ore.

Davis-Daly—Since the cutting down of high-salaried officials and officers of the company and enlisting the efficient services of W. B. Fisher, the present manager, the company's affairs are beginning to look more prosperous than formerly, and it appears probable that the mine will soon be on a paying basis. During December about $15,000 worth of ore was shipped to the smeltery and the amount for January will probably be as great or larger. Work is being carried on energetically and although no large veins have as yet been discovered, several small bodies of rich ore have been encountered.

Laurium-Montana—This company, owning nine claims about 3.5 miles south of Butte, is pushing development work on the property. Several veins, traceable through the property, have been prospected by opencuts and shallow shafts, and on the Montana claim a shaft has been sunk on the vein; this has shown up good gold ore, and the company is at present driving a crosscut tunnel to intersect this vein at depth. This tunnel has been driven nearly 200 ft. and is expected to strike the vein soon. The veins appear to be true fissure veins in a country rock of hard granite, similar or identical to that in the Butte district; also the strike of the veins is in a general east and west direction, with a south dip similar to the Butte vein system.

Jefferson County

Elkhorn & Duluth Development Co.—The first car of silicious silver ore from the C. & D. mine has been shipped to the smeltery. This marks an epoch in development in this camp as the ores from the old workings were an oxidized iron-gold-lead ore. Development on this silver lode promises well, the lode being a fissure standing almost vertical and cutting the dolomite and lime formations indifferently.

Union—A lease and bond has been given on this silver-lead property. It was worked a number of years ago, and produced a shipping ore of $30 grade. Smelting rates now favor the operation of this class of ore by about $3 per ton, while available electric power and advances in milling methods and facilities add materially to the net profit in operation.

Elkhorn Silver Mining Co.—This company continues the employment of about 150 men. The company is also developing the Sophia claim, sinking a new shaft below the old workings. The orebody lies well in the foot wall.

Dolcoath—A lease and bond has been given by the owners on this claim near the town limits of Elkhorn and work will be started soon.

Nevada

Comstock Lode

Mexican—A cleanup was made recently on the run for January and the returns were substantial, although pay ore was not put through the batteries until the last two weeks of the month. The average capacity for the month was 50 tons per day, just half the designed amount, but a larger classifier is being installed, which will bring the plant up to 100 tons per day. It is estimated that about 10 days will be necessary to complete the addition of the larger equipment.

Ophir—The south drift of the 2100-ft. level that has been skirting the early-day stopes of the Hardy vein, has now reached virgin ground and is following a small streak of low-grade ore in place. The ground to the north of the old workings has produced over $1,000,000 in bullion, the last two years, and it is now proposed to open the ground to the south and explore it thoroughly.

United Comstock Pumping Association—At the Ward shaft a flow of water has been tapped on the 2450 level in the Combination shaft connecting drift, and the unexpected result has been to lower the water in the Gold Hill section. At the incline station of the Yellow Jacket the water has receded at the rate of 2 in. per day since it was tapped. Work continues clearing out the old workings on the 2000 level, where the Gold Hill drainage will be attempted through the old bulkhead. The motors for the new pumps at the C. &. C. shaft have arrived in San Francisco and are now being fitted and adjusted to the pumps. The equipment will be shipped to Virginia City soon.

Crown Point—A large tonnage of low-grade ore was stoped from the 1400 level recently, the recovery being more than $3000. The annual report for 1911 shows that 14,176 tons of ore were extracted, giving a bullion yield of $67,777. The average battery assay of the ore was $5.89 per ton, indicating that low-grade ore on the Comstock lode can be handled at a good profit.

Churchill County

Nevada Wonder—The mill is partly closed down owing to lack of power. The company which supplies the power has been hampered by the freezing of part of its supply.

Elko County

Esmeralda—A vein of rich ore was recently opened in this group of claims. The camp is known as Gold Circle and suffers principally from lack of power and transportation facilities.

Esmeralda County

Goldfield-Belmont—President Heller has stated that the company will soon make another shipment of high-grade ore, which was taken out in developing.

Goldfield Consolidated—The estimated January production was 28,870 tons of a gross value of $683,000. Operating expenses were $220,000 and $463,000 are estimated as the total net realization. During the quarter ended Dec. 31, 1911, 88,381 tons were treated, yielding $2,243,596 gross and $1,586,738 net.

Humboldt County

A 15-ft. vein of $12 ore was found recently on the north side of Winnemucca Mountain. The find has caused considerable interest locally and the surrounding country has been thoroughly staked.

Lincoln County

Nevada-Utah—A meeting of creditors of the corporation was held on Feb. 2 at the office of Peter B. Olney, referee in bankruptcy, New York, to prove claims and elect a trustee. Henry Melville, the receiver, was unanimously elected trustee. He said that he had not found any money yet to receive. Robert G. Mead, president of the company, was briefly examined concerning its affairs.

Lyon County

Nevada-Douglas—Production continues at the rate of 300 to 350 tons per day. During December and January, the first two months of production, 7000 tons of 6% copper ore were shipped to the Mason Valley smeltery, at Wabuska. This ore came principally from the Ludwig mine, and 1800 tons came from the Douglas Hill mine. A 1700-ft. surface tram connects the latter mine with the Nevada Copper Belt R.R. Shipments from the Casting Copper mine will start in March. Ten 50-ton cars of gypsum per week are being shipped from the quarry and a crusher and chain bucket elevator are being installed there. The gypsum is in rock form, is snow white and analyzes 94 to 96% gypsum. It is used for plaster and is shipped to the Western Gypsum Co., at Reno.

Nye County

Tonopah ore shipments for the week ended Jan. 25 were: Tonopah Mining, 3100 tons; Tonopah-Belmont, 2350; Montana-Tonopah, 1053; Tonopah Extension, 914; West End, 800; Midway, 50; total, 8267 tons and $206,675 estimated value.

Round Mountain—During the quarter ended Nov. 30, 1911, 15,936 tons of ore were mined and milled at a total cost of $65,710, or $4.12 per ton. The gross value was $90,576, or $5.68 per ton; recovery, $80,558; miscellaneous earnings, $476; total gross earnings, $81,034; net operating profit, $14,848 or 93c. per ton. The operating cost of $4.12 includes a depreciation charge of 27c. per ton. Cash on hand, Nov. 30, totaled $107,566. Since the previous report, a crusher, trommel and conveyor have been ordered and will be installed in the 451 crosscut. This machinery is now at the property. General conditions at the property are reported to be satisfactory. It is the intention to change the fiscal year to end Dec. 31.

White Pine County

Boston Ely—The mine shut down recently but it is stated that development will continue with diamond drills.

New Mexico

New Mexico Oil & Refining Co.—The first merchantable strike of oil in the Seven Lakes district is said to have been made recently by this company, of Gallup, N. M., 200 yards from the original Talle well. The well is 400 ft. deep with a 6-in. casing; there are 265 ft. of oil in the hole, and it will pump steadily from 30 to 35 bbl. per day. This is reported to be the most important development in this field since oil was first discovered there a few months ago. The directors of the company have decided to sell the oil to other companies operating in this field, for fuel. The strike has aroused considerable excitement and seems to point to the possibility of Seven Lakes developing into a larger producer.

Oklahoma

Chapman & Lennan—The two shafts of this company, at Miami, have reached a depth of 250 ft. and probably will soon cut into the ore.

Miami Concentrating Co.—This company has bought the Old Chief tailing mill and is moving it to the King Jack tailing pile.

South Dakota

Hidden Fortune—In the examination of this and the Columbus properties for Wood Brothers, of Montreal, 5-ft. samples are being taken in all workings, and these are being assayed in the office which was rented in Deadwood. The work will include a thorough sampling of present ore faces, and should it be necessary, drifting and crosscutting will be done. A diamond drill is being installed at each of the principal workings, *viz.*, the Hidden Fortune and Columbus shafts, and considerable drilling will be done. The former shaft is 300 ft. deep and the latter 500. At the Hidden Fortune pumps were used to take out the water, and at the Columbus skips are removing it at the rate of 400 gal. per min. The property includes about 1000 acres, adjoining the Homestake on the north and west.

Black Hills Grubstaking Concern—This company has been organized by local men, with the intention of raising a fund of at least $20,000, which it is proposed to spend in grubstaking owners of patented ground, and encouraging development. Should any of the properties show favorably, work will be centered upon them. The promoters will attempt to raise the necessary money locally, but should it not be possible to place all of the stock in the Black Hills, outsiders will be asked to join. The promoters of the company have the coöperation of the Deadwood, Lead and Rapid City commercial clubs.

North Homestake—The work of sinking 400 ft. below the quartzite level, or to a depth of 220 ft., has been completed and a station is now being cut. Crosscuts both east and west from the station will be run to develop some known veins in the schists. A sump 15 ft. deep will be completed soon.

Utah

Juab County

Tintic shipments for the week ended Jan. 26 amounted to 167 cars.

Beck Tunnel—Ore has been followed 400 ft. with a good showing in the face. A drift has been started from the 175-ft. level of the No. 2 shaft to reach the orebody 100 ft. below the present workings.

Yankee Consolidated—The annual report assured stockholders that the property is in the best condition for mining in its history, and that the prospects for encountering ore at depth are encouraging. The shipments of dump ore so far have met development expenses, and the year closed with about $160 cash on hand.

Colorado—The ore recently developed on the 300-ft. level of the No. 2 shaft is being followed and will probably connect with one of the old stopes.

May Day—Regular shipments are being made from the new orebody on the 400-ft. level.

Iron Blossom—The ore opened three weeks ago on the 600-ft. level of the No. 3 shaft has been followed for 300 ft. A good tonnage of shipping ore is being mined from three large stopes. Shipments are normal again, following the recent cold weather and car shortage.

Centennial-Eureka—The large steam-electric plant at this property is still in operation, and will probably be kept running for the remainder of the winter. The mine has a contract with the Knight power company for electric power, but line troubles necessitated the starting of the steam plant at the mouth of the Holden tunnel.

Salt Lake County

Utah Consolidated—Shipments of between 500 and 600 tons of copper ore and from 75 to 100 tons of lead ore per day are being made to the International Smelting & Refining Co. Some difficulty has been experienced in operating the aërial tramway in high wind, but as it has not been run up to capacity there has been no delay in transportation. Low-grade concentrating lead ore is being shipped to the Winnemucca mill over the old tramway, and this plant has been treating lead ores for about six weeks. The concentrates are sent to the International. It is reported that Utah Consolidated engineers have made a survey and examination of the Yampa property.

City Rocks—At a meeting, Jan. 26, stockholders ratified the recent action of the directors turning over the property to the Michigan-Utah company, on a basis of share for share in the stock of the new corporation.

Cardiff—Work is being done in the new 2400-ft. lower tunnel. About 125 tons of shipping ore per month are being mined from the upper workings.

Summit County

Park City shipments for the week ended Jan. 27 amounted to 2,517,760 lb.

Daly West—The damage to the ore house at the mouth of the No. 2 tunnel, by fire recently, has been so far repaired as to allow the resumption of shipments.

Thompson-Quincy—Raising from the main level is being done at the rate of about 8 ft. per day. The raise is being driven for the ore-bearing contact between limestone and quartzite. The company's ground takes in about 2000 ft. on the strike of the contact.

Tooele County

Norma Consolidated—This company has recently been organized to operate the old Helvetia property, at Mercur. The claims are in the West Dip portion of the camp. There is a 600-ft. shaft and low-grade gold ore is reported to have been opened.

Cliff—Ore has been encountered in the Middle tunnel, which is thought to be the same shoot opened in the upper workings. If this is so, there will be 400 ft. of stoping ground. The ore is about 3 ft. thick where cut.

Washington

International Lead & Iron Co.—It is reported that this company will erect two blast furnaces with a daily capacity of 500 tons for the manufacture of pig iron and cast-iron pipe. The plant will be erected within 10 miles of Spokane, and work on the furnaces will begin within three months. The company owns 800 acres of iron-bearing ground about 15 miles south of Salmon, B. C., north of the boundary, and nine miles from a railroad. The extension of the Idaho & Washington Northern R.R. Co.'s line, however, from Trail to the boundary line, will afford a through rail route to Spokane. The deposit is said to be a large body of hematite ore which will be mined with steam shovels.

McKinley—A 50-ton mill and amalgamating plant will be erected at this mine, Ferry County, in the spring. C. F. Wickstrom, Orient, is president.

Wisconsin

New Enterprise Mining Co.—The company has unwatered the Enterprise mine, the pioneer deep jack mine in the Platteville district, and will commence operations.

Wisconsin Zinc Co.—The Grant County property, recently acquired, is showing a good body of zinc ore; a tramway connection and an additional roasting kiln will be installed at the Empire mine to treat the concentrates. The company commenced sinking a new shaft on the old Wicklow lease, near Cuba City.

Canada

Ontario—Cobalt

Cobalt shipments for the week ended Feb. 2 were: La Rose, 226,140 lb.; Coniagas, 204,040; McKinley-Darragh, 146,560; City of Cobalt, 132,680; Trethewey, 84,560; Cobalt Lake, 60,840; Buffalo, 56,240; Crown Reserve, 44,920; Colonial, 40,000; total, 995,980 pounds.

Buffalo—During December the mill treated 4088 tons of ore, the average assay before milling being 40.27 oz. of silver per ton. The amount of silver recovered was 144,440 oz. of silver, worth $78,900, or 87.70% of the quantity shown by the assay.

La Rose—Recent developments on two of the subsidiary properties have been favorable. For 45 ft. of the winze put down from the 60-ft. level of No. 9 vein of the Lawson, the vein was found to average 7 in. wide, of 2000-oz. ore. At the Princess, the main stope is now 225 ft. long and full of ore from the second level to the surface. In a raise from the second level on No. 6 vein, 2 in. of 2000-oz. ore have been encountered, and in the winze below that level 1½ in. of high-grade ore are being developed.

Cobalt Lake—A leak which delayed the work at No. 4 shaft has been repaired by means of a cement bulkhead, and the shaft will be put down another 100 feet.

Nipissing—In drifting west toward the shaft at the 100-ft. level of No. 1 shaft, what appears to be a shoot of rich ore has been struck in a vein 3 to 6 in. wide.

Keeley—The liquidator of the defunct Farmers' Bank, of which this property, in South Lorrain, is an asset, has accepted an offer of the Wetlaufer Mining Co., to take the property over on option, the company agreeing to expend $15,000 per month on development for one year.

Ontario—Porcupine

McIntyre—Rich ore has been encountered on the 100-ft. level of the No. 4 shaft. W. D. Cooper, manager, has announced that the first unit of the mill will be in operation about March 1.

Apex—Work on the property has been stopped until spring, when sufficient water supply will be available to run the plant. P. Kirkegaard is consulting engineer.

Plenaurum—Drifting on the vein has been started from both shafts, at the 200-ft. level. The new electrically driven compressor is in operation with 12 drills.

Rea—The main shaft is being continued to 400 ft. depth. Sinking is being done with small hammer drills, which are being found more economical than the reciprocating drills used at first. On the three levels established at 100, 200 and 300 ft., the main vein has been cut. While on the upper levels the vein ran from 3 to 5 ft. in width, it was about 30 ft. in width at 300-ft., but the gold content was not so large.

Porcupine Gold—It is expected that deliveries of mill machinery will commence about Feb. 15. The mill is being built by the Canada Foundry Co., with a guaranteed capacity of 100 tons per day.

Standard—In putting down a new shaft on this property, rich ore was recently encountered both in quartz and quartz-porphyry. The shaft is being sunk to cut a vein discovered with the diamond drill.

Alexo—This nickel property, situated northeast of the Porcupine gold area, and near Kelso, has been opened and arrangements made for the shipment of ore for testing purposes. A shaft is down to the 30-ft. level. The International Nickel Co. formerly had an option on the property, which they abandoned after diamond drilling. The orebody on which the shaft is sunk is 17 ft. wide, and it is believed that there are other deposits.

Ontario—Sudbury

Dominion Nickel Copper Co.—The company has carried on extensive development work at its Whistle mine, besides drilling many of its claims in the townships of Bowell, Wisner and Falconbridge. Recently the company has increased its drills and it is rumored that a reduction plant will be underway next spring. Improvements in the treatment of the ore will enable this company to handle at a profit the lower-grade ores of the north range.

Mexico

Chihuahua

El Cristo—This property in the Santa Eulalia district recently resumed operations and is in charge of Norval J. Welsh.

Le Fe—Carlos Halter, G. C. Harding and Ross D. McCausland are reported to have taken a lease on this mine in San Sostenes, three kilometers from the San Sostenes station of the Kansas, Mexico & Orient Ry., and owned by Agustin Moye. The ore is low-grade, siliceous copper ore and shipments are expected to be made to the local smeltery at the rate of from 30 to 40 tons per day.

Aguilerena—Reports from the property are satisfactory. About 50 tons per week are being shipped to the smeltery regularly, and the run-of-mine ore is said to average from 1 to 1½ kilos of silver per metric ton.

Maria—High-grade ore has been encountered recently, and enough ore is in sight to last for some months.

Montezuma—It is reported that the company is considering resumption of milling operations at the Santa Barbara plant. The concentrator has been idle for some years, the ore going to the smeltery. J. H. Battle is in charge.

Durango

Inde Gold Mining Co.—While on a recent trip to the United States, R. C. McCart, Jr., manager, is said to have ordered a 260-hp. De la Vergne oil engine, which will be used to replace the present steam plant at the Terrible mill. The new unit is reported to have a guaranteed consumption of one-half pound of crude oil per brake-horsepower, under working conditions and installation is expected to lower the present power costs.

Guadalupe—An Oliver filter is reported to have been installed recently, and a second one will be added soon. The mill is being rearranged and additions made.

Oaxaca

San Juan—This mine is reported to have been sold to an American lawyer in Mexico City.

Navaro—Frank Waterhouse has found some good ore in this group of properties and has been maintaining regular shipments. The Escuadra tunnel is being used at present but shaft sinking on the property is contemplated.

Los Ocotes—This mine is expected to be closed soon.

San Francisco—Work has been prosecuted continuously at this mine, but with a small force of men.

Sonora

Buena Vista—George M. Ryall, of the Pacific Smelting & Mining Co., and other New York men are interested in this mine at Realito. Ore running 114 oz. silver and $4 gold per ton is reported to have been taken from the mine recently.

Empire—Officials are reported to have announced that a 3-unit Pittman mill will be installed at the company's Gold Cross property, about 24 miles southwest of Cananea.

Central America

Costa Rica

Aguacate—During January the mill crushed 1300 tons of ore, averaging $11.80 per ton. The steam plant was completed and placed in commission. Total bullion production exceeded that for December and yielded a profit over all expenses. The excavation for the sand-leaching plant was nearly completed and construction will be rushed.

Africa

Rhodesia

Gold production in December was 51,534 oz., or 703 oz. more than in November. For the full year the total was 609,956 oz. in 1910, and 628,519 oz.—or $12,991,488—in 1911; an increase of 18,563 oz. for the year.

Asia

Chosen

Oriental—Cable advices state that the cleanup for January was $127,500.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Feb. 7—The coal-trade situation has improved in some degree, but there is still much trouble arising from delays in transportation and scarcity of cars. The demand for coal is good, both in the East and the West, and there is apparent a growing disposition among large consumers to stock up ahead. This increases demand, and the mines are generally quite ready to respond, if they can only get the railroads to do their part.

The mining rate conference at Indianapolis has come to an end without results, neither operators nor miners being willing to compromise. Probably another meeting will be called later, but no action for such a meeting has yet been taken. It looks as if the bituminous people were inclined to wait and see what action is taken in the anthracite field.

Bituminous coal shipments to Lake ports for three years past, short tons:

District	1909	1910	1911
Pittsburg	8,687,305	11,911,900	10,611,941
Ohio	3,002,815	4,297,300	4,019,544
West Virginia	3,874,570	6,629,500	7,151,200
Total	15,564,690	22,838,700	21,782,685

In 1909, the proportions furnished by the respective districts were: Pittsburg, 55.8; Ohio, 19.3; West Virginia, 24.9 per cent. In 1910 the percentages were 52.2, 18.8 and 29; in 1911 they were 48.7, 18.5 and 32.8, respectively.

Exports of coal from the United States, with coal furnished to steamships in foreign trade, year ended Dec. 31, long tons:

	1910	1911	Changes
Anthracite	3,021,627	3,553,999	I. 532,372
Bituminous	10,784,239	13,878,754	I. 3,094,515
Total exports	13,805,866	17,432,753	I. 3,626,887
Steamer coal	6,445,593	6,658,648	I. 213,055
Total	20,251,459	24,091,401	I. 3,839,942
Coke	879,123	914,142	I. 35,019

In 1911 Canada took 14,108,567 tons of coal; Cuba, 1,053,703; West Indies, 577,159; Panama, 496,830; Mexico, 470,674 tons. The increase in exports was largely due to the long strike in Canada.

Imports of coal and coke into the United States, year ended Dec. 31, long tons:

	1910	1911	Changes
Anthracite	....	2,159	I. 2,159
Bituminous	1,991,943	1,238,808	D. 753,135
Coke	156,417	69,515	D. 86,902
Total	2,118,360	1,310,182	D. 837,878

Canada furnished in 1911 a total of 980,174 tons of coal and nearly all the coke; Australia, 232,969 tons of coal. Imports were chiefly on the Pacific Coast and in the northwestern border states. The decrease in 1911 was due chiefly to the long strike in Alberta and British Columbia.

Coal tonnage of the Norfolk & Western Ry. for the year 1911 was: Commercial coal, 17,051,221; company coal, 2,392,760; total, 19,443,981 short tons. This was an increase of 2,092,011 tons, or 12.1 per cent. over the previous year.

Shipments of coal from Nova Scotia collieries for the full year were 5,275,907 long tons in 1910, and 5,565,298 in 1911; increase, 289,391 tons, or 5.5 per cent.

IRON TRADE REVIEW

New York, Feb. 7—The iron and steel markets show little change for the week. Business is still below the December spurt, but is nevertheless on a large scale. Rail orders from the larger companies continue to come in but the total placed so far is hardly up to expectations.

Finished material is fairly active, though a little irregular. Structural steel orders placed for the week have been mainly in small lots. Bars have been rather quiet, but plates and sheets are active. The steel shapes for the New York Connecting R.R. contract, which was let to the McClintic-Marshall Construction Co., will be rolled by the Carnegie Steel Co.; the contract will take about 40,000 tons.

Pig iron has sold fairly well, orders for the week including some large ones from pipe foundries. Prices of pig iron, however, are not any stronger, though there seems to be less disposition to make concessions to secure business.

The railroads have reduced the freight rate on pig iron from Birmingham, Ala., to Pacific Coast points by $2.40, to $8.96 per ton. This is taken by some to indicate that other reductions asked by the Alabama people will be granted.

In Pittsburg, Feb. 6, a combination of nearly all the independent tinplate makers filed articles of incorporation under the name of the Association of Sheet and Tin Plate Manufacturers. The organization was formed, it is said, to combine the independent concerns for their own protection, but in a manner that would not conflict with the anti-trust law. No attempt will be made, it is stated, by the new association, to fix the prices of products. Its principal mission will be "the encouragement and protection of trade and commerce." Foreign consumption, transportation, and markets, labor conditions throughout the world, safety devices for the protection of employees, and social intercourse of the members of the association are named in the application as the objects sought.

Export Trade—Articles of incorporation have been filed in Pittsburg for the Jones & Laughlin Steel Products Co. The incorporators are John L. Hames, Thomas Anderson and others, all connected with the Jones & Laughlin Steel Co. The object of the company is to handle and develop the export trade of that company. The formation of this company is taken as an indication that the proposed organization of a joint export company by several of the leading independent steel companies has been abandoned.

Baltimore

Feb. 5—Exports for the week included 5,038,950 lb. steel rails and 436,626 lb. track fastenings to Tampico, Mex.; 2,930,400 lb. steel rails and 59,355 lb. fishplates to Havana, Cuba; 222,500 lb. steel rails and 34,000 lb. fishplates to Liverpool; 3,361,280 lb. steel billets to Liverpool and Glasgow. Imports included 300 tons spiegeleisen, 500 tons ferromanganese and 513 tons manganese ore from Rotterdam; 10,900 tons iron ore from Cuba.

Birmingham

Feb. 5—Considerable pig iron has been sold again by Southern manufacturers for delivery during the first half of the present year, and there are still a number of inquiries in hand which promise to result in business. The quotations for the preduct are strong on a $10.25 per ton basis, No. 2 foundry, with $10.50 asked. Cast-iron pipe interests have been the best customers as to size of orders. The smaller consumers have been placing business right along, and while, in the main, this business is in small lots, the aggregate is considerable. The make in the Southern territory is not being increased; there will be no increased production in this section until the demand grows better and most of the accumulated iron has been removed from the yards. The inventory shows that there has been an appreciable reduction recently in stocks of iron. Some of the companies in this section have disposed of all their accumulated iron. There was a furnace blown in recently, but it only replaces one which went out through accident. The Woodward Iron Co. is getting ready to blow out a furnace in order to rebuild it. The Tennessee Coal, Iron & Railroad Co. may be forced to start another furnace or two to meet demands. In addition to the export business now being delivered on, it is announced that an order for 5000 tons will be gotten out in March. There are several inquiries in hand from across the water.

The cast-iron pipe demand is strong. As soon as the United States Cast Iron Pipe & Foundry Co. gets its North Birmingham plant in operation, it is proposed to make extensions on the Bessemer works of the company. Southern pipe makers have supplied much pipe for work in the Panama Canal zone. A large quantity of pipe has been shipped from this section to California during the past few months.

The steel situation shows no change this week. There is a steady outward movement of steel rail from the Ensley plant, while fabricated steel is in good demand. Charcoal pig iron continues at $22 per ton, with a little business coming in. The scrap-iron business is quiet.

Chicago

Feb. 6—The last week has seen activity in charcoal iron, some 10,000 tons having been sold in this market, at $16@16.50. This is indicative of a wider use of charcoal iron and of a bunching of contracts for it at this time, but the sales have not affected the demand for coke iron, which remains light. Southern No. 2 brings $10@10.50, Birmingham, or $14.35@14.85, Chicago, despite efforts to raise the price to the higher figure as a minimum.

Northern No. 2 sells for $14@14.50, as heretofore, with no strong inclination to buy it in preference to Southern manifested by melters. The average melter is apparently contented to let things drift along on the same policy that has been pursued for several months, that of frequent and small purchases. There probably is a slowly increasing aggregate of foundry tonnage, but a waiting disposition on the part of the buyers.

The market for iron and steel products has little change. Sales of railroad supplies in general are good; structural-material contracts have been made for a few new bridges and buildings, but in general are light, with beams and channels selling at 1.30@1.32c., Chicago delivery. The market for both iron and steel bars is light, soft-steel bars bringing 1.25@1.33c. and iron bars 1.15@1.20c. Plates are in very good demand at 1.30@1.38c., with the market firm. Sheets are quiet, but firm, as are also wire goods. General business conditions are fair to promising. The prospect of tariff changes no doubt is influencing the buying market as a general factor, but few specific indications are to be found. Coke is in fair demand at $4.50@4.65, with a good supply.

Cleveland

Feb. 5—The sensation of the week has been the inquiry for a large tonnage of Lake ore from an Eastern company, which has heretofore used local and imported ores. The placing of the order, it is understood, depends entirely upon the prices which can be made. It seems quite probable at present that no general price on ores will be made this season, and there may be considerable irregularity.

Pig Iron—Sales have been chiefly in small lots, but quite a fair aggregate tonnage has been taken. Quotations, Cleveland delivery, are $15.15 for bessemer; $13@13.15 for basic; $13.25 for No. 2 foundry; $12.50 for forge.

Finished Material—Specifications are coming in fairly well, while new business is irregular. Bars are dull, but sheets are active and prices better maintained. One or two structural contracts have been let, and others are under negotiation.

Philadelphia

Feb. 7—Large sales of low-grade iron for pipe are being closed and additional inquiries just to hand show that consumers are providing for future requirements with unaccustomed promptitude. The most notable feature of the market today is the number of inquiries from large as well as from many smaller consumers for iron for the latter half of the year; also, increased interest in basic for immediate delivery. Southern makers have developed unexpected activity in soliciting business. There is much more talk of an early hardening of prices in consequence of the general improvement in pipe iron. The demand for other grades does not show marked improvement, but the tone of the market nevertheless is much stronger. An interesting feature of the market is that some large Eastern consumers who are provided with all the iron they need are figuring upon deliveries later in the year. Forge iron is more active as stocks are light. Foundries are better supplied but are willing to extend contracts if the December concessions are granted. Malleable is weak and very few sales noted. Basic is strong with negotiations pending for two or three lots, but makers of basic for the open market see no encouragement beyond meeting the requirements now in sight. The undertone of the market is stronger than it has been for some time and rumors of shading are not heard. Average quotations for No. 2 X foundry, $15.25; gray forge, $14.25; basic, $14.25 per ton.

Steel Billets—The market is quiet without sales of moment. Buyers are sufficiently supplied to run some weeks. Openhearth billets are quoted at $23, tidewater.

Bars—There has been a gradual accumulation of business since the opening of the year in the bar mills of this territory but makers are still overanxious for business and are not attempting to push the quotation above 1.27½c., though small orders go in at stronger figures.

Sheets—Sheets are strong and have a good volume of business which steadies prices in negotiations now pending.

Pipes and Tubes—The week's business has been better than for some time. Two or three large concerns have renewed their understanding in regard to spring and early summer deliveries for tubes. Merchant pipe is also sharing in the activity. The cast-iron pipe foundries are independent and business is crowding in on them.

Plates—The steel-plate situation is better than it has been for a long time. It would be a matter of guess work to say just how much business is pending in the shape of inquiries and for work that the shipbuilders know will soon come along.

Structural Material—Very large requirements for shapes are now being figured upon for local and near-by requirements as well as for building work throughout most of the Eastern states. Inquiries have also been received for export material, some of it for Panama. On all small lots for delivery within 60 or 90 days, slight advances have been made and a further hardening of prices for spring delivery is looked for.

Scrap—Sales of scrap are limited to small lots for urgent needs. Quotations on large lots of railroad and yard scrap are beyond the present views of buyers. There are two or three inquiries for old iron rails and for old iron and steel axles. The stock of scrap is more than sufficient for current demand and purchases of large supplies have been made, delivery of which will probably be postponed until buyers' requirements render shipments necessary.

Pittsburg

Feb. 6—The iron and steel market has turned for the worse, chiefly, it appears, because of disappointment that there has not been a definite improvement. In November and December orders and specifications came in freely, being interrupted, and then not very seriously, by the holidays. During the first half of January not much was expected, on account of inventory taking, but when the second half of the month passed without any improvement both producers and consumers began to take serious notice.

The situation as to specifications for finished-steel products is decidedly different with different mills. In a few instances, the specifications received during January were close to capacity, and in the case of one important interest exceeded the actual production, this having been relatively light with all the mills in the Central West, on account of the extremely bad weather. In the case of other steel interests, specifications were poor in the first half of January, but good in the second half, the month making a fair showing at the close, while in the case of still other interests specifications have uniformly been below actual output.

The mills still have enough business actually specified on books to carry them for several weeks, and there is no tendency to decrease production. There has been an increase, as compared with December, but chiefly on the part of the Steel Corporation, and due to the car orders placed so freely toward the close of the old year.

The Jones & Laughlin Steel Co. will start one of its Aliquippa furnaces about the middle of this month, and a second about the beginning of March. At the beginning of this year the steel department at Aliquippa was started for the first time. It was not certain at the time how long the tonnage would be required, and the start was therefore made with pig iron in stock, and iron purchased in the market to the extent of about 50,000 tons, the intention being to produce pig iron in case the steel tonnage would be required for a period of months. This seems to have been the conclusion now reached by the management.

The weakest item in the whole steel list is shafting, which has sold at 68 per cent. off list in exceptional cases. Late last year the market was advanced from 67 to 65 per cent. off list, but the advance did not hold when actual orders were to be competed for. On plates, shapes and bars the market continues quotable at 1.15c., but it is believed the figure could be shaded were attractive orders to be offered.

Pig Iron—It is reported that two merchant furnaces are to be blown in, but there is no evidence in the market that additional iron is required; it has been extremely quiet, with prices held merely because through the long decline they had reached a level below the cost of production as ordinarily figured. We continue to quote: Bessemer, $14@14.25; basic, $13.25@13.50; No. 2 foundry, $13; gray forge, $12.50; malleable, $13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market is extremely quiet, but the price seems to be well held. We quote prompt and forward at $41, Baltimore.

Steel—There is little fresh tonnage being bought, but adjustments have been made for February deliveries on contracts, and these adjustments have involved concessions from the nominal prices, as recently advanced, though as a rule the mills will obtain a little more than they did for December and January steel. We quote bessemer and openhearth billets at $19.50@20 and sheet bars at $20.50@21, Pittsburg; bessemer billets at $19 and bessemer sheet bars at $20, Youngstown.

Sheets—The advanced market as established in November of 1.90c. for black and 2.90c. for galvanized is being freely shaded by several mills by at least $1 a ton, and there are reports that $2 a ton off has been given, making a basis of 1.80c., but if these reports are correct it is probable they refer to exceptional cases. Specifications are good for a number of the specialties, but for common grades it appears some of the mills must search continually for specifications in order to maintain operations. We quote black sheets, 28 gage, at 1.85@1.90c.; galvanized, 2.85@2.90c.; blue annealed, 1.40c. for 10 gage, and corrugated roofing at $1.33@1.35 for painted and $2.47@2.50 for galvanized, 28 gage, per square.

St. Louis

Feb. 6—The pig-iron market is a little slow at present. In Southern foundry there has been practically no buying since the first of the year and stocks in foundry yards are rather large, which taken into consideration with the tonnage contracted for, will, no doubt, hold up any buying movement until the latter part of March. Even at that time, from present indications, no buying will be done except for third-quarter shipments. The average price is $10@10.25 per ton, Birmingham.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for the year ended Dec. 31, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1910	1911	Changes
Exports	$201,271,903	$249,656,411	I. $48,384,508
Imports	38,907,119	28,995,600	D. 9,911,519
Excess, exp.	$162,364,784	$220,660,811	I. $58,296,02

Increase in exports, 24 per cent.; decrease in imports, 25.5 per cent. The leading articles of iron and steel were, in long tons:

	Exports		Imports	
	1910	1911	1910	1911
Pig iron	127,385	120,799	237,233	148,459
Scrap	25,825	77,918	72,764	17,272
Billets, blooms, etc.	58,230	234,767	46,578	29,207
Bars	125,606	141,033	38,231	26,730
Rails	353,180	420,874	. .	.....
Sheets and plates	274,521	372,373	6,152	2,453
Structural steel	146,721	223,493	....	.....
Wire-rods	22,861	22,641	20,378	15,483
Wire	171,928	229,316	.....	.....
Nails and spikes	61,201	77,833	.....	.....
Tinplates	12,445	61,466	66,640	14,099
Pipe and fittings	155,778	197,507	.....	......

Imports of rails and structural steel are not reported separately. Imports of wire are not reported in quantities; values were $1,468,741 in 1910, and $1,270,426 in 1911. Exports of mining machinery were valued at $6,586,044 in 1910, and $6,982,360 in 1911; an increase of $396,316, or 6 per cent.

METAL MARKETS

New York, Feb. 7—The metal markets show little change from the conditions which prevailed a week ago. The copper market seems to be waiting for the publication of the January statement, which will be due in a couple of days.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Dec. 1911	$ 994,677	$ 4,707,330	Exp. $3,712,565
" 1910	1,330,400	4,976,632	Imp. 3,646,232
Year 1911	37,183,074	57,445,184	Imp. 20,262,110
" 1910	58,774,822	59,222,518	Imp. 447,696
Silver:			
Dec. 1911	5,997,360	3,306,727	Exp. 2,690,630
" 1910	6,061,060	4,398,450	Exp. 1,662,610
Year 1911	65,564,646	43,746,571	Exp. 21,918,073
" 1910	57,360,973	45,878,168	Exp. 11,482,805

Exports from the port of New York, week ended Feb. 3: Gold, $265,050, chiefly to South America; silver, $1,034,302, principally to London and Paris. Imports: Gold, $186,720; silver, $569,660, from Central and South America.

Gold—The price of gold on the open market in London remained at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Aside from small amounts taken for India and Egypt, there was little foreign demand. In New York a total of $5,000,000 gold has been taken for shipment to Paris.

Iridium—The price continues unchanged, at $64 per oz. for pure metal.

Platinum—The market has been quiet and prices are unchanged. Dealers ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal, up to 10 per cent. iridium.

Silver—The market continues firm with rising tendency, on Indian Bazaars' buying. The market closes steady at 27$\frac{1}{16}$d., in London.

SILVER AND STERLING EXCHANGE

Feb.	1	2	3	5	6	7
New York	58½	58¼	58½	58⅝	58¾	58⅞
London	26⅞	26$\frac{15}{16}$	26⅞	26$\frac{15}{16}$	27	27$\frac{1}{16}$
Sterling Ex.	4.8730	4.8750	4.8745	4.8735	4.8720	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Jan. 25, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India	£ 589,500	£727,300	I. £137,800
China	116,000	110,000	D. 6,000
Total	£ 705,500	£837,300	D. £131,800

India Council bills in London averaged 16.15d. per rupee for the week.

Coined silver in the United States, Feb. 1, is estimated by the Treasury Department as follows: Dollars, $565,222,367; subsidiary coins, $164,667,449; total, $729,889,816. Of the dollars $484,594,000 are held against silver certificates outstanding.

Copper, Tin, Lead and Zinc

NEW YORK

Feb.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
1	14 @14⅛	13.80 @13.90	42⅝	4.25	4.12½ @4.15	6.35 @6.45	6.20 @6.30
2	14 @14⅛	13.80 @13.90	42⅜	4.25	4.12½ @4.15	6.35 @6.45	6.20 @6.30
3	14 @14⅛	13.80 @13.90	42⅜	4.10	3.97½ @4.00	6.35 @6.45	6.20 @6.30
5	14 @14⅛	13.75 @13.85	42⅝	4.00	3.85 @3.90	6.35 @6.45	6.20 @6.30
6	14 @14⅛	13.75 @13.85	42¾	4.00	3.85 @3.90	6.35 @6.45	6.20 @6.30
7	14 @14⅛	13.75 @13.85	43⅛	4.00	3.85 @3.90	6.35 @6.45	6.20 @6.30

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Feb.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
1	61⅞	62⅝	66	194	192	15 9/16	26⅛
2	61 13/16	62 9/16	66	193¼	191¾	15⅝	26
3	......	......	......	......	......	......	......
5	61 7/16	62 3/16	66¾	194	191½	15¾	26¼
6	61¾	62	66¼	194¼	191½	15¾	26⅝
7	61 15/16	62 11/16	66	195½	192½	15¾	27

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—Although a fair volume of business has been reported, the market upon the whole has been rather listless throughout the week. Consumers the world over are in general pursuing a waiting attitude and it has taken a good deal of pressure to promote business. At the same time, the ruling quotations are not uniformly met by the leading sellers, and thereby the varying opinions as regards the future of the market are reflected. The business that was done was both for European and for domestic account, American manufacturers having become interested by the reduced prices to the extent of taking some fair tonnages of electrolytic copper. In the first half of the week domestic sales were made at 14c., delivered, usual terms, and in the latter half at 13.95c., corresponding respectively to about 13.85c. and 13.80c. cash, New York. Sales to Europe were upon about the same basis. In these transactions several of the important agencies participated. Some copper was reported to have been sold by second hands at 13.75c. The business in Lake copper has been insignificant, although it has been freely offered at 14⅛c. At the close the market does not exhibit any positive trend and is quoted at 13.75@13.85c. for electrolytic copper in cakes, wirebars and ingots, and 14@14⅛c. for Lake copper. Casting copper is quoted nominally at 13½ cents.

The standard market declined in sympathy with refined sorts until Feb. 6. On Feb. 7, a sharp rally took place, occasioned by the expectation of favorable statistics, and the close is firmer at £61 18s. 9d. for spot, and £62 13s. 9d. for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for smaller quantities. Copper wire has been reduced to 15c. base, carload lots at mill.

Copper exports from New York for the week were 7573 long tons. Our special correspondent gives the exports from Baltimore at 1711 tons.

Visible stocks of copper in Europe on Feb. 1 are reported as follows: Great Britain, 40,190; France, 5940; Rotterdam, 4900; Hamburg, 8200; afloat from Chile, 2300; afloat from Australia, 7600; total, 69,130 long tons, an increase of 90 tons over the Jan. 15 report.

Tin—Since Feb. 1, the new contract is in force on the London Metal Exchange. Sellers are now enabled to deliver at certain rebates under such contract brands of tin which have hitherto been barred from the London Metal Exchange. Judging from the small transactions that took place, traders are seemingly not quite accustomed to the new order of things. The market was very steady to firm, and closes strong at £195 10s. for spot, and £192 10s. for three months.

Consumers are not buying very freely in this market. The spot situation has eased somewhat, due to large shipments from abroad, which are expected to arrive within the next few days. February tin is quoted at about 43⅛ cents.

Visible stocks of tin on Feb. 1 are reported as follows: London, 11,303; Holland, 2595; United States, excluding Pacific ports, 2809; total, 16,707 long tons, an increase of 193 tons over Jan. 1, but a decrease of 1909 tons from Feb. 1 last year.

Lead—The leading sellers have again reduced the price, by lowering their schedule on Saturday, Feb. 3, to the basis of 4.10c., New York, which cut was followed by a further reduction to 4c., New York. Their reasons for these actions have excited much gossip and surmise. At the lower level, the demand is increasing, and the close is active at 4c., New York, and 3.85@3.90c., St. Louis.

The London market is firmer, the close being cabled at £15 15s. for Spanish lead, and £15 17s. 6d. for English.

Spelter—There has been a very fair inquiry for March and April shipment and a considerable tonnage has been contracted for, the demand having been freely met by the smelters. The bulk of the business was booked at 6.20@6.25c., St. Louis, a little higher price being realized for February and a little lower for April. Belated customers still have to pay premiums for prompt delivery, but such are realized only upon occasional carloads. The close is steady at 6.35@6.40c., New York, and 6.20@6.30c., St. Louis.

The London market, after declining to £26, shows a better tendency toward the end of the week, owing to short covering of dealers, the close being cabled firm at £27 for good ordinaries, and £27 5s. for specials.

Zinc dust is quoted at 7⅜@7½c. per lb., New York.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business continues quiet and quotations hold at 19@19½c. per lb. for No. 1 ingots, New York. The foreign market is reported firm at about 12c. for ingots.

Antimony—Business has been quiet during the week. The price of Cookson's is 7¼c. per lb. Hallett's is unchanged at 7⅜@7½c., while 6¾@7c. per lb. is still named for Chinese, Hungarian and other outside brands.

Quicksilver—The New York quotation is rather higher at $44 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $43.50 for domestic orders and $41 for export. London prices is £8 5s. per flask, with £8 2s. 6d. quoted from second hands.

Bismuth — The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, fo.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Imports and Exports of Metals

Exports and imports of metals in the United States, year ended Dec. 31, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	363,677	149,378	Exp. 214,299
Copper, 1910....	321,590	153,766	Exp. 167,824
Tin, long tons....	1 010	47,740	Imp. 46,730
Tin, 1910........	621	46,937	Imp. 46,316
Lead, short tons.	101,227	87,319	Exp. 13,908
Lead, 1910......	69,786	105,117	Imp. 35,331
Zinc, short tons..	7,330	1,638	Exp. 5,692
Zinc, 1910	4,037	3,452	Exp. 585
Nickel, lb........	25,099,586	29,545,967	Imp. 4,446,381
Nickel, 1910....	15,244,937	32,050,032	Imp. 16,805,095
Antimony, lb.....	160,844	10,957,844	Imp. 10,797,000
Antimony, 1910.	339,685	9,899,514	Imp. 9,559,829
Platinum, oz.....	181	122,390	Imp. 122,209
Platinum, 1910.	47	120,478	Imp. 120,431
Aluminum, value	$1,158,603	....	Exp. $1,168,603
Aluminum, 1910	949,215	....	Exp. 949,215
Ores, etc.			
Zinc in ore, lb...	21,636,946	38,148,847	Imp. 16,511,901
In ore, 1910....	9,420,984	63,523,140	Imp. 44,102,156
Zinc oxide, lb. ..	29,236,779	....	Exp. 29,236,779
Zinc oxide, '10..	26,333,993	....	Exp. 26,333,993
Zinc dross, lb....	8,492,252	....	Exp. 8,492,252
Zinc dross, '10..	9,457,304	....	Exp. 9,457,304
Chrome ore, l.t..	6	37,529	Imp. 37,524
Chrome ore, '10	30	38,579	Imp. 38,549

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1911 was 57,933 tons; exported, 16,322 tons. Imports of aluminum, July 1 to Dec. 31, 1911, were 4,120,992 lb.; not reported previous to July 1, 1911. The metal exports given above include re-exports of foreign material.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, year ended Dec. 31, figures in long tons, except quicksilver, which is in pounds:

Metals	Imports	Exports	Excess
Copper, long tons	140,785	72,613	Imp. 68,172
Copper, 1910....	132,174	81,267	Imp. 50,907
Tin, long tons....	45,906	45,576	Exp. 330
Tin, 1910........	46,285	43,916	Imp. 2,369
Lead, long tons.	213,704	44,026	Imp. 169,678
Lead, 1910	218,936	46,836	Imp. 172,100
Spelter, l'g tons..	144,338	9,582	Imp. 134,756
Spelter, 1910....	139,285	9,101	Imp. 130,184
Quicksilver, lb...	3,491,016	2,357,916	Imp. 1,133,100
Quicksilver, '10	3,344,699	1,856,169	Imp. 1,488,530
Minor met's, tons	6,195	22,913	Exp. 16,718
Minor, 1910....	6,494	22,212	Exp. 16,718
Ores			
Tin ore and con.	28,837	....	Imp. 28,837
Tin ore, 1910...	26,072	....	Imp. 26,072
Pyrites	849,041	....	Imp. 849,041
Pyrites, 1910..	812,247	....	Imp. 812,247

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Miscellaneous metals include nickel, aluminum and the minor metals and alloys.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 3—The high price of zinc sulphide ore was $49, the base offerings, per ton of 60 per cent. zinc, $42@46. Zinc silicate sold on a base of $23@25 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $42.92. The bulk of the lead reported this week was bought on prices of last week, $58@59 per ton, while the high price this week was $56 and the low $52. The average price, all grades of lead, was $57 per ton.

Despite the increased demand for zinc ore prices were lowered. The shipment is equal to an average week's summer shipment, while every buyer has from three to 10 cars purchased but not loaded. With the western zinc-mine output considerably curtailed, producers are expecting a continued strong demand for the ores of this district.

SHIPMENTS, WEEK ENDED FEB. 3

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	6,692,740	.....	1,234,200	$115,184
Joplin........	2,022,270	......	216,270	51,555
Galena........	775,340	......	222,250	22,780
Alba-Neck....	919,850	......	42,440	22,344
Duenweg.....	763,820	83,450	67,010	19,185
Oronogo......	614,220	......	67,600	14,278
Miami........	272,730	......	151,060	9,055
Jackson......	318,240	......	65,660	9,675
Carl Junction	316,250	......	......	7,590
Spurgeon	131,880	130,000	66,800	6,285
Granby	108,710	198,370	15,320	6,630
Lawton	176,010	......	......	3,870
Aurora.......	68,360	145,710	......	3,530
Springfield..	83,410	......	46,990	3,494
Stott City ...	132,000	......	......	3,438
Quapaw......	143,670	......	2,020	2,802
Badger.......	75,960	......	8,350	1,749
Wentworth...	64,460	......	......	1,353
Totals......	10,679,920	557,530	2,195,970	$302,797
6 weeks...	43,116,220	2,265,930	7,206,360	$1,196,965

Blende val., the week, $232,184; 6 weeks, $955,669
Calamine, the week, 8,017; 6 weeks, 30,032
Lead value, the week, 62,596; 5 weeks, 211,264

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January.....	$41.85	$44.90	$40 55	$43.54	$55.68	$58.92
February....	40.21	.....	39 16	......	54 46	......
March.......	39.85	......	38.45	......	54.57	......
April........	38 88	......	37 47	......	66 37	......
May.........	38.25	......	36 79	......	55 21	. ....
June........	40.50	......	38.18	......	56 49	......
July.........	40.75	......	38 36	......	68 81	......
August	42 50	......	41 28	......	60 74	......
September ..	42 63	......	41 29	......	69 33	......
October.....	42.38	......	40.89	......	54.72	......
November...	45.40	......	43.25	......	67 19	......
December...	44.13	.....	40.76	......	62 03	......
Year.......	$41.45	......	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Feb. 3—The base price paid this week for 60 per cent. zinc ore was $46@46.50. The base price paid for 80 per cent. lead ore dropped to $52 per ton.

SHIPMENTS, WEEK ENDED FEB. 3

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Shullsburg...........	1,167,140	86,700	....
Mineral Point.........	755,250	....	.. ....
Harker................	490,790	....	. ....
Galena................	477,300	....	....
Benton................	477,100	. .....	291,300
Platteville...........	350,100	66,000	....
Hazel Green..........	300,000	....	....
Cuba City.............	120,420	69,820	....
Montfort..............	83,000	......	. ....
Linden	......	....	50,000
Total......... ..	4,221,100	212,520	341,300
Year to date..........	15,759,060	535,080	1,217,000

Shipped during week to separating plants, 2,479,560 lb. zinc ore. The year's totals for lead and sulphur ore correct errors in totals as reported for week of Jan. 27 in previous letter.

Other Ore Markets

Manganese Ore—The price for domestic ores, as fixed by large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent., or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess phosphorus and silica.

These prices are put at a high level to encourage exploration for manganese deposits in the United States. Most of the manganese ore used here is imported—from India, Brazil and Russia—and is bought abroad on the open market, usually at prices below those quoted.

The latest quotations in Great Britain are: Indian or Brazilian ore, 50 per cent. manganese, 19@19½c. per unit; 45 per cent., 17½@18c. Caucasian, 50 per cent., 16@16½c.; 48 per cent., 15½@16c. per unit.

Chemicals

New York, Feb. 7—The firm of Mortimer & Wisner having been dissolved as of Feb. 1 by mutual consent, Wm. T. Wisner announces that he will continue the brokerage business in chemicals, fertilizers and dye stuffs as heretofore. Mr. Wisner has associated with him Paul H. Stetson, under the firm name of Wisner & Stetson, at 11-21 William street, New York.

Copper Sulphate—Business continues fair and prices are unchanged. Current quotations are $4.90 per 100 lb. for carload lots, and $5.15 per 100 lb. for smaller orders.

Nitrate of Soda—Business remains about the same and prices are rather firm at last figures. Spot nitrate is 2.20c. per lb.; while 2.20c. is asked also for futures up to July 1, and 2.17½c. for deliveries after that date.

Arsenic—Demand continues fair and prices are unchanged, $2.50@2.75 per 100 lb. being asked for white arsenic.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, year ended Dec. 31:

	Imports	Exports	Excess
Copper sulph. lb.	....	7,421,439	E. 7,421,439
Copper sul., '10	....	....	....
Bleach, lb.......	82,895,472	17,804	I. 82,877,668
Bleach, 1910....	101,029,345	496	I. 101,028,849
Potash salts, lb..	672,639,582	2,731,762	I. 669,907,820
Potash salts, '10	510,191,652	2,187,797	I. 608,003,855
Soda salts, lb....	22,202,469	611,922	I. 21,590,547
Soda salts, 1910	39,183,586	533,417	I. 38,650,169
Acetate lime, lb.	....	72,663,243	E. 72,663,243
Acetate, 1910...	....	64,116,074	E. 64,116,074
Nit. of soda, tons	544,878	6,787	I. 538,091
Nitrate, 1910...	529,172	5,784	I. 523,388
Phosphates, tons	....	1,246,577	E. 1,246,577
Phosphates, '10	....	1,083,037	E. 1,083,037
Sulphur, tons....	24,250	28,103	E. 3,853
Sulphur, 1910..	28,647	30,742	E. 2,095
Pyrites, tons.....	1,001,453	....	I. 1,001,453
Pyrites, 1910...	806,590	....	I. 806,590
Magnesite, lb....	244,840,369	2,169,935	I. 242,670,434
Magnesite, 1910	286,904,705	3,496,662	I. 283,408,043
Sul. ammonia, lb.	189,265,797	....	I. 189,265,797
Sul. am'nia, '10	184,686,534	1,205,998	I. 183,480,536
Arsenic, lb.......	5,404,263	3,684	I. 5,400,579
Arsenic, 1910...	8,257,474	6,098	I. 8,251,376

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 424,831 tons. Exports of copper sulphate in 1910 were not reported.

Chemicals and Minerals

CURRENT WHOLESALE PRICES

Ammonium sulphate . . . . . cwt.	3.10@3.15
Arsenic, white . . . . lb.	0.02½@0.02¾
Barytes, ground . . . . . . sh. ton	12.00@13.00
floated . . . . . . sh. ton	16.00@18.00
Calcium acetate, gray . . . . . cwt.	2.25@2.30
carbide, ton lots f.o.b. Niagara Falls, sh. ton	70.00
Carbons, good drill quality . . carat	50.00@75.00
Cement, Port., Am. 400-lb. bbl.	1 33
Chrome brick, f.o.b., Pittsburg . M	175.00
ore, 50%, ex-ship, N. Y., lg. ton	14.00@16.00
Copperas, bulk . . . . cwt.	0.55
bbl. . . . . cwt.	0.65@0.85
Copper sulphate . . . . cwt.	4.90@5.15
Fluorspar, lump, f.o.b. Pittsburg, ton	8.00@9.00
Magnesite, crude, 95% . . . . lg. ton	7.50@8.50
calcined, powdered . . .	30.00@35.00
brick, dom., f.o.h. Pittsburg . . . . . . M	160@200
Paints, litharge, Am. powd . . lb.	0.05½@0 06
red lead, American . . . lb.	0 06½@0.07
white lead, Am., dry . . lb.	0.05¼@0.05¾
zinc white, Am., dry . . lb.	0.05⅛@0.06¼
Phosphates, acid:	
*Fla., hard rock 77%	5.75@6.25
land pebble 68%	3.70@3.80
†Tenn., 78@80%	5.00@5.50
75%	4.75@5.00
68@72%	4.25@4.50
‡So. Car. land rock 60%	3.50@3.75
Potassium cyanide, 98@99@ . . lb.	0.19½@0.21
Pyrite:	
Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit	0.12@0.12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines	0.11@0.12
Imported, non-arsenical, furnace size, ex-ship, per unit . .	0.13@0 13¼
Imported, arsenical, furnace nace size, ex-ship, per unit . .	0.12½@0.13
Imported, fines, arsenical, ex-ship	0.11½@0 12
Imported, fines non-arsenical, ex-ship, per unit	0 12@0 12½

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

Sodium cyanide, 120 to 130% KCN . . . . lb.	0 19½@0 21
nitrate 95% spot . . . . cwt.	2 20
95% future . . cwt.	2 20
Sulphur, Louisiana prime, N. Y., lg. ton	22 00 up
roll . . . . cwt.	1 85@2 15
flour . . . . cwt.	2.00@2 40
flowers, sublimed . . cwt. .	2 20@2 60
pow. com., bags . . . cwt.	1.50
Sicilian, crude brimstone . . . . . . lg. ton	22 50
Zinc chloride, granular . . . . lb.	0.04½@0 04¾

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.

Petroleum

The monthly report of the *Oil City Derrick* for January gives the number of producing wells completed during the month in New York, Pennsylvania and West Virginia, 271; Lima-Indiana district, 23; Kentucky, 13; Illinois, 81; Kansas and Oklahoma, 207; Texas and Louisiana, 42; total, 637, with an aggregate daily production of 32,968 bbl.

MINING STOCKS

New York, Feb. 7—On Feb. 1 the Exchange was rather weak at the opening. Steel common was heavy. At the close, however, there was a general advance. The Curb was active in spots. Ray Central and Butte Coalition led among the coppers. Nipissing advanced, and there was a demand for Tonopah.

Feb. 2 trading on the Exchange was slow and there was little movement in prices. One sale of Homestake was recorded at $90 per share. On the Curb business in Butte Coalition fell off, but there was a demand for Inspiration rights. Nipissing sold fairly and there was some dealing in Porcupine.

Feb. 3 there was little difference on the Exchange, and trading was light. The Curb was dull and uninteresting, with small sales, on narrow demand.

On Feb. 5 the Exchange was dull, with light trading and few changes in price. The Curb was more active. Cobalt and Porcupine shares found a fair market. Copper stocks were quiet except for Ray Central and Inspiration. The Standard Oil Co., of Indiana, issued a call for a special meeting to vote on increasing the capital stock from $1,000,000 to $30,000,000, and it is reported that part of the new stock will be issued as a stock dividend or bonus to present stockholders.

On Feb. 6 there was more activity and some sharp rises in quotations on the Exchange. The anthracite stocks were especially in demand. On the Curb dealing was not quite so active, but there was a fair demand for copper and Cobalt stocks, and prices were firm. On Feb. 7, conditions were about the same on both Curb and Exchange.

Boston, Feb. 6—An irregular tone accompanies the local share market, while prices have been shaded from those of a week ago. This market has fallen into a rut which will require considerable effort to drag it out. Business has fallen off.

There is lessened interest in both Mayflower and Old Colony stocks and present prices are materially lower than the recent high records. An effort is afoot to consolidate these mines, but it meets with opposition from the managements. North Butte came in for considerable activity and a $3.50 advance to $26 on talk of a share for share exchange with Anaconda. Consolidation talk is heard in other directions, but nothing definite can be given at present.

An advance in Isle Royale stock is accompanied by reports that the company is planning for future extension and improved earning power. Superior & Boston received a little impetus upon the announcement that a sale of 20,000 shares of treasury stock had been effected to a local brokerage firm at $5 per share less a commission that brings the net price to about the present market price of just above $4 per share.

Curb trading has been chiefly in the penny stocks and prices are inclined to

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	Nov.	Dec.	Jan.
Alaska shipments.	1,274,655	4,995,008	. . . .
Anaconda	20,850,000	. . . .	26,350,000
Arizona, Ltd.	2,960,000	3,100,000	. . . .
Balaklala	. . . .	. . . .	. . . .
Copper Queen	6,946,775	8,365,265	6,748,264
Calumet & Ariz. . . .	4,390,000	4,486,000	4,544,000
Detroit	1,941,498	1,969,313	1,941,970
East Butte	983,405	. . . .	. . . .
Mammoth	1,793,181	1,721,404	. . . .
Miami	. . . .	2,500,000	. . . .
Nevada Con	5,207,983	4,679,674	. . . .
Old Dominion	2,082,000	2,610,000	. . . .
Ray	2,517,000	2,660,000	. . . .
Shannon	1,256,000	. . . .	1,550,000
South Utah	361,681	267,514	. . . .
United Verde*	2,500,000	2,000,000	. . . .
Utah Copper Co. . . .	9,117,961	9,039,557	. . . .
Lake Superior*	18,600,000	17,500,000	. . . .
Non-rep. mines* . . .	11,483,000	. . . .	. . . .
Total production.	94,265,139	. . . .	. . . .
Imports, bars, etc. .	17,224,725	21,101,256	. . . .
Total blister	111,489,864	. . . .	. . . .
Imp. in ore & matte	4,767,217	5,159,997	. . . .
Total	116,257,081	. . . .	. . . .
Brit. Col. Cos.:			
British Col. Copper	. . . .	. . . .	. . . .
Granby	. . . .	. . . .	. . . .
Mexican Cos.:			
Boleo	. . . .	2,645,640	. . . .
Cananea	. . . .	3,706,000	. . . .
Moctezuma	1,682,768	2,864,464	2,732,867
Other Foreign:			
Cape Cop., S. Africa	857,920	. . . .	. . . .
Kyshtim, Russia . . .	1.170,000	1,570,000	. . . .
Spassky, Russia . . .	685,440	. . . .	. . . .
Famatina, Argen . .	174,720	. . . .	. . . .
Exports from:			
Chile	4,704,000	5,824,000	. . . .
Australia	7,168,000	11,200,000	. . . .
Arrivals in Europe from other count.†	12,064,640	16,331 840	. . . .

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
I, 1911	115,696,591	42,078,557	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911 . .	1,431,938,338	709,611,605	754,902,233
I, 1912	. . . .	. . . .	. . . .

VISIBLE STOCKS

	United States	Europe	Total
II, 1911	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	. . . .	154,851,200	. . . .

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

sag. A small sale of Ahmeek occurred at $245. Rhode Island Coal went off to 20c. per share upon the announcement that a friendly receiver had been appointed.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1 00
Alpha Con., Nev	Feb. 21	Mar. 13	0.05
Alta, Nev	Jan. 26	Feb. 16	0.05
Andes, Nev	Feb. 7	Feb. 28	0.05
Black Jack, Utah	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	......	0.50
Bruns. C. V. M., Nev	Jan. 12	Feb. 2	0.02
Confidence, Nev	Jan. 16	Feb. 6	0 20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev	Feb. 14	Mar. 6	0 05
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0.05
Hancock Con., Mich	Jan. 10	....	1.00
Hancock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
King David, Utah	Feb. 13	Mar. 6	0.005
Ojibway, Mich	Jan. 10	....	1.00
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz	Jan. 15	....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea Con., Utah	Jan. 17	Feb. 8	0.015
Tintic Standard, Utah	Jan. 8	Feb. 5	0 00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	......	23.794	24 081	......
March	51.454	52.745	......	23.690	24.324	......
April	53.221	53.325	......	24.483	24.595	......
May	53.870	53.308	......	24.797	24.583	......
June	53 462	53.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52 912	52.171	......	24.428	24.082	......
September	53 295	52.440	......	24.567	24.209	......
October	55 490	53 340	....	25.596	24.594	......
November	55 635	55.719	....	25.680	25.649	......
December	54 428	54.905	.....	25.160	25.349	......
Year	53 486	53.304	....	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	....	12.611	......	54.974	....
March	12 139	......	12 447	......	54.704	.....
April	12 019	.....	12.275	...	54.034	....
May	11.989	......	12.214	..	54.313	....
June	12.385	......	12 611	..	56 365	....
July	12 463	....	12 720	..	56 673	....
August	12 405	....	12 634		56 266	..
September	12.201	.....	12.508		55 253	......
October	12 189	....	12 370		55 170	.
November	12 616	...	12 769		57 253	.
December	13 552	...	13 768		62 068	.
Year	12.376		12 634		55.973	

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	[illegible]	42 529	July	42 400	...
February	[illegible]	.	August	43 319	.....
March	40 157		September	39 755	.....
April	42 185	....	October	41 185	.....
May	43 115	.. .	November	43 125	.....
June	44 606	.....	December	44 655	..
			Av. Year	42.281	..

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4.435	4 334	4.327	13 009	15.619
February	4 440	......	4 266	......	13 043	.....
March	4.394	......	4 238	......	13 122	.....
April	4 412	......	4 262	......	12.889	......
May	4.373	.....	4.223	......	12 984	......
June	4 435	......	4 292	......	13.260	......
July	4.499	......	4 397	......	13 530	.....
August	4 500	......	4 406	......	14.260	......
September	4 485	.....	4 356	......	14 744	......
October	4.265	.....	4 139	......	15.332	......
November	4.298	......	4.181	......	15.821	.....
December	4.450	......	4.332	......	15.648	......
Year	4.420	......	4 286	......	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	......	5 368	......	23 276	......
March	5 563	......	5 413	......	23 016	......
April	5 399	......	5.249	......	23 743	......
May	5 348	......	5.198	......	24.375	......
June	5 520	.....	5 370	.....	24.612	......
July	5 695	......	5 545	......	25.006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	......	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14 40	$13.32	$14.75	$14.00
February	15 90	......	14 50	......	14 81	......
March	15.90	.....	14 65	......	14.96	......
April	15 90	......	14 65	......	15 00	......
May	15.90	.....	14 30	......	14.72	......
June	15 90	......	14 06	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13.94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Feb. 6

Name of Comp.	Bid.
Acacia	.05¼
Cripple Cr'k Con.	02½
C. K. & N.	15¼
Doctor Jack Pot	.05½
Elkton Con	.62
El Paso	.67⅜
Findlay	.04¼
Gold Dollar	.15¼
Gold Sovereign	.02½
Isabella	.14
Jack Pot	.05½
Jennie Sample	.06
Lexington	.01
Moon Anchor	01¼
Old Gold	.03½
Mary McKinney	.52
Pharmacist	.02
Portland	.94
Vindicator	68
Work	.03

SALT LAKE Feb. 6

Name of Comp.	Bid.
Beck Tunnel	.13
Black Jack	.10½
Carisa	.16
Cedar Talisman	.02½
Colorado Mining	34
Columbus Con	.27½
Daly-Judge	5 50
Grand Central	.83
Iron Blossom	1 10
Little Bell	38
Lower Mammoth	.02¾
Mason Valley	10.50
May Day	15
Nevada Hills	2 25
New York	06¼
Prince Con	1 00
Silver King Coal'n	1 47½
Sioux Con	.12
Uncle Sam	32½
Yankee	‡ 24

TORONTO Feb. 6

Name of Comp.	Bid	Name of Comp.	Bid
Conlagas	6 70	Pearl Lake	18
Hudson Bay	‡70 00	Porcu. Gold	37½
Temiskaming	30	Porcu. Tisdale	02
Wettlaufer-Lor.	81	Preston E. D.	05
Apex	.05½	West Dome	40
Central	‡3 62½	Standard	20
Doble	50	Foley O'Brien	26
Dome Exten.	32	Rea	1 00
Hollinger	12 00	Crown Chartered	13
Imperial	04	Swastika	23

SAN FRANCISCO Feb. 6

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.01	Belmont	8.65
Belcher	45	Jim Butler	36
Best & Belcher	.12	MacNamara	.26
Caledonia	1.40	Midway	.28
Challenge Con	.13	Mont.-Tonopah	1.00
Chollar	.14	North Star	.30
Confidence	.56	West End Con	.78
Con. Virginia	84	Atlanta	.16
Crown Point	.50	Booth	05
Gould & Curry	08	C.O.D. Con	12
Hale & Norcross	.17	Comb. Frac	.15
Mexican	3.75	Jumbo Extension	.20
Occidental	50	Pitts.-Silver Peak	1 20
Ophir	1 42½	Silver Pick	06
Overman	1.25	St. Ives	.34
Potosi	07	Tramp Con	.01
Savage	.15	Argonaut	‡2.50
Sierra Nevada	.37	Bunker Hill	‡3 00
Union Con	1.10	Cent. Eureka	‡.35
Yellow Jacket	.45	So. Eureka	‡6.00

N. Y. EXCH. Feb. 6

Name of Comp.	Clg.
Amalgamated	60⅞
Am. Agri. Chem.	59½
Am. Sm. & Ref., com	69⅝
Am. Sm. & Ref., pf.	103¼
Am. Sm. Sec., pf. B	86
Anaconda	34⅜
Batopilas Min	1⅜
Bethlehem Steel pf	61
Chino	25⅞
Federal M. & S., pf.	38
Goldfield Con.	4⅜
Great Nor., ore ctf.	37½
Homestake	88½
Miami Copper	23½
Nat'nal Lead, com.	53½
National Lead, pf.	107
Nev. Consol	18⅞
Pittsburg Coal, pf.	79½
Ray Con	17
Republic I&S. com.	21⅜
Republic I & S. pf.	77½
Sloss Sheffi'd, com.	38
Sloss Sheffield, pf.	‡108¼
Tennessee Copper	35½
Utah Copper	54⅜
U. S. Steel, com.	61⅛
U. S. Steel, pf.	108¾
Va. Car. Chem	53½

N. Y. CURB Feb. 6

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	.45
Braden Copper	5⅛
B. C. Copper	4¼
Buffalo Mines	1.25
Butte & Vipond	.53
Butte Coalition	22
Cobalt Central	‡.01
Con. Ariz. Sm.	⅝
Davis-Daly	¾
Diam'field-Daisy	12
Ely Con	9/16
Florence	.57
Giroux	4⅜
Gold Hill Con.	‡
Greene Cananea	8¼
Greenwater	08
Guggen. Exp.	180
Inspiration Con.	18½
Internat. S. & R.	‡124
Kerr Lake	2⅞
La Rose	1⅞
McKinley-Dar-Sa.	1¾
Min. Co. of A. new	4
Nev. Utah M. & S.	⅛
Nipissing Mines	7⅝
Ohio Copper	1 1/16
Pacific Sm. & M.	1/16
Porcupine T'nsite	‡ 03½
Precious Metals	‡1⅜
Ray Central	1 13/16
Red Warrior	‡1½
South Utah M. & S.	¾
Standard Oil (Old)	625
Stand'd Oil of N.J.	330
Stand'd Oil Subs.	335
Stewart	1 3/16
Tonopah	7 1/16
Tonopah Ex	1⅛
Tri-Bullion	⅛
Tularosa	‡3 1/16
Yukon Gold	3⅝

LONDON Feb. 7

Name of Com.	Clg.
Camp Bird	£1 13s 1½d
Dolores	1 10 0
El Oro	0 17 6
Esperanza	2 5 7½
Mexico Mines	7 2 6
Oroville	0 6 9
Stratton's Ind.	0 3 1½
Tomboy	1 1 10½

BOSTON EXCH. Feb. 6

Name of Comp.	Clg.
Adventure	6
Algomah	6
Allouez	39
Am. Zinc	25
Ariz. Com., ctfs.	2⅞
Bonanza	‡.46
Boston & Corbin	6¾
Butte & Balak	3¾
Calumet & Ariz	58⅛
Calumet & Hecla	409
Centennial	18¼
Con. Mercur	.05
Copper Range	50½
Daly West	5
East Butte	12¼
Franklin	12¼
Granby	34
Hancock	32½
Hedley Gold	‡15½
Helvetia	1⅜
Indiana	13
Island Cr'k, com.	43½
Island Cr'k, pfd.	86¼
Isle Royale	21½
Keweenaw	1 1/16
Lake	32½
La Salle	4¾
Mass	7⅝
Michigan	2½
Mohawk	52
New Arcadian	3¼
New Idria Quick.	7¾
North Butte	25⅞
North Lake	5½
Ojibway	5
Old Dominion	45
Osceola	106
Quincy	74
Shannon	9⅛
Shattuck-Ariz	17½
Superior	24¾
Superior & Bost.	4
Tamarack	25
Trinity	6
Tuolumne	3¾
U. S. Smelting	34⅛
U. S. Smelt'g. pf.	47¼
Utah Apex	3 1/16
Utah Con	15
Victoria	4½
Winona	5½
Wolverine	‡97½
Wyandot	2

BOSTON CURB Feb. 6

Name of Comp.	Last
Ahmeek	240
Bingham Mines	3½
Boston Ely	1¼
Boswyocolo	.09
Cactus	.14
Calaveras	2
Chief Cons	.90
Corbin	2⅞
Cortez	2¼
Crown Reserve	1⅝
First Nat. Cop.	2¼
Majestic	.43
Mazatan	1
Moneta Porc.	.12
Nevada-Douglas.	3⅛
New Baltic	4
Oneco	2½
Raven Copper	.35
Rhode Island Coal	.28
San Antonio	‡3¼
South Lake	5¼
Trethewey	‡⅜
Union Mines	‡¼
United Verde Ext.	.40
Vulture	‡5¾

‡Last quotation.

The Engineering and Mining Journal

Vol. 93. FEBRUARY 17, 1912. No. 7.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9300 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Editorials:
  Respecting Metallurgical Patents 343
  Cobalt 344
  Laboratory Motion Study 344
Metallics—By the Way 345
Exports of Copper 346
The Steel Tariff Bill 346
Ray Consolidated 346
Correspondence and Discussion:
  The Niter Assay....Use for Vanadium Iron Bearing Sands....Where Should the Primer Go?....The Experiment Station Bill....Geology Applied to Mining....Literary Taste of Miners....Caucasus Copper Co. 347
Details of Practical Mining:
  *Finger-pin Timbering in Swelling Ground....Thawing Frozen Water Pipes....*Rope Idlers for Inclined Shafts....*A Concrete Trench for Pipes....*Reheating Air for Drills....*A Mine Chute Gate....*Stopping Leaks in Air Receivers....Hints on Buying Pumps....*Turning a Large Sheave....*Hoisting Engine Repair Job....Reproducing Mounted Plans....Ejectors for Mine Drainage 350
*Graphic Solution of Evaporating Problems 354
Firebrick at High Temperatures 354
High Duty Gravity Stamps 354
The Heraeus Resistance Thermometer. A. Schramm 355
Exhaust Steam Turbines 356
*Central Compressing Plants at Butte 356
Transvaal Mining Notes 357
Explosives for Coal Mining 358
*The Davis Mine Anemometer 358
Density of Aluminum 358
*The California Gold Dredge—I. Robert E. Cranston 359
Review of Cobalt 363
Secondary Sulphide Enrichment. Horace V. Winchell 364
Cost of Power Installations 367
*An Adjustable Elbow Union 367
*A Gravity Filter Plant C. J. Stone 368
Effect of Sulphur on Firebrick 369
Improvements in Crushing Rolls. C. Q. Payne 370
Mineral Deposits of Bulgaria 371
*History of a Once Famous Arizona Gold Mine 372
New Publications 373
Personal, Obituary and Societies 374
Editorial Correspondence 377
Mining News 379
Markets 385
*Illustrated.

Respecting Metallurgical Patents

We shall stop far from saying, or even implying, that there is nothing new under the sun; that all kinds of physical forces are known and that all possible reactions have been studied; if we should indicate any such ideas some Marconi or Curie would rise promptly to refute us. Confining our thoughts to the single domain of metallurgy, we are nevertheless inspired with the idea that the wealth of practical experience and scientific research has reduced the chances for any new generic discovery to a very small compass; and indeed there is not left any large leeway for ingenious combinations. This does not mean that we are likely to halt in our progress (our idea is quite the contrary), but it does mean that the chances of anyone monopolizing the results of certain steps in advance, or even reaping extraordinary rewards from them, are no longer to be expected as a common thing. In other words, the chances for securing any sweeping metallurgical patents, capable of being sustained, are relatively small.

There are two kinds of ingenuity. One evolves the idea; the other develops the practice. Without doubt there are thousands of useful ideas discarded, and more or less forgotten, because they failed in their first applications, perhaps simply because they anticipated their time, perhaps for some other reason. Inventors may have a good idea and fail utterly to make it work in practice until someone comes along and learns how to do the thing.

Miss Everson's patent, taken out in 1886, for the flotation of sulphide minerals, is an example of the fact that epoch-making periods in metallurgy do not as a rule follow the discoveries of new principles, but rather depend upon the practical application of known reactions; witness, besides the present flotation processes, blast roasting, pyritic smelting, the bessemerizing of copper matte, converting on basic bottoms, the development of the long reverberatory furnace of the present day, the cyanide method for gold and silver ores, the air-agitation of cyanide pulp, the beneficiation of blende-marcasite ores.

Investigators who have displayed ingenuity in these problems have, in most cases, profited more from their superior knowledge and earlier skill in the art than from generic discovery or from any control of the processes themselves, except when they patented a particular form of apparatus that was required for the successful working of a process. There has been some exception to this, especially where an imposing array of legal talent and threats of suit have enabled patentees to "stand up" the metallurgical world, as it were, and take toll of the operating companies. Such cases have been rare in America where popular sentiment is opposed to the payment of royalties on processes, doubtless for the reasons that we have herein outlined. Nevertheless, there has been no hesitation about paying to a patentee a reasonable round sum in lieu of royalties, in many cases not so much as a recognition of his patents as a consideration for his knowledge, it often being cheaper for a buyer to "learn how" in that way than by engagement in independent experimentation. All the way up the ladder of our metallurgical progress the "learning how" to apply previous knowledge has been of more importance than the introduction of new processes of radical invention.

Thus in the beneficiation of blende-marcasite ores in Wisconsin there was an example of gradual development, the cumulative result of individual effort of a number of metallurgists. The practical work in the magnetic separation of these ores was done in recent years and was put upon a stable commercial basis by the simple development of a long known principle. It had been a matter of common knowledge that these two minerals could be separated by magnetic machines after a roasting to make the marcasite magnetic.

and plants were built to utilize this principle, but for many years they were failures, and success was achieved only when it was determined at just what temperature the roasting should be done, in other words, when the operators became more skillful. No attempt was made to patent this superior skill in connection with a process that was long since known. Some of the devices or apparatus, however, were patented. There is a difference between skill and invention, and fortunately skill is not patentable, else the industries of the world would be in the hands of a few persons in each industry.

Cobalt

If the statement frequently heard that "Cobalt has seen its best days" means that the maximum production of high-grade ore has been or is soon to be reached, it is probably true; if it means that the output of refined silver from that camp has reached its height and from now on will decrease, there is ground for argument. It is generally believed, however, that Cobalt's future rests upon its ability to do what many other districts have done, when the "bonanza" ore has petered out—to get down to systematic mining and maintain a large, profitable production from low-grade ore.

Since the discovery by La Rose six years ago, the history of the camp has been marked by exceptionally narrow, high-grade deposits, high costs and shallow depth of workings. The profitable mining and reduction of this high-grade ore has been governed by many favorable conditions, not least among which has been the moderate cost of installation of plants, made possible by the shallow depth of the workings and the small daily tonnage required. A problem that had to be solved early in the life of the district was the profitable treatment of the somewhat refractory ores. The advantages and disadvantages that attend the mining of narrow, high-grade veins, have been enjoyed and endured by Cobalt up to the present and probably will be for some time to come.

There are unfailing signs now that changes are taking place in the physical conditions of the older properties. There are indications that the high-grade ore that has made these properties and the name of Cobalt famous, is becoming depleted without the addition of reserves of equal grade, to offset such loss. Of course, if nothing is developed to replace this high-grade ore, the camp must soon decline. It is the realization of this condition, doubtless, that has caused the feeling that the best days of the camp have already passed. There are at least two factors, however, that should not be lost sight of—the known presence of low-grade ores and the comparative shallowness of the workings. The policy of prospecting at considerable depth is now being pursued at some of the mines, also the profitable treatment of the low-grade ores is being successfully extended. It is to the possibility of treating profitably this class of ore from present or greater depth that Cobalt must look, to maintain its past record as a producer of silver.

Laboratory Motion Study

Quite as striking a thing as the chemists' search for new methods is the average chemist's reluctance to adopt new apparatus. This may be partly due to training; we know of one university which prides itself on forcing the student to rig up primitive apparatus for all purposes, claiming that the manipulative faculty is developed in this way. Even in those schools which do not point with pride to this state of affairs, the student usually makes one determination at a time, and the idea that if he enter a works' laboratory later he may have 50 determinations embracing a dozen elements or radicals all going at once, neither occurs to him, nor is impressed upon his attention. Consequently its logical conclusion, that the art of commercial analysis is in getting determinations to look out for themselves, while the chemist does other work, never intrudes itself upon him. This does not seem true in other engineering lines, where the student is told of automatic apparatus even though he does not use it.

In the great iron laboratories the requirements of speed and capacity seem to have driven even the chemists to machines, and here power-driven grinding apparatus, automatic stirring apparatus, and the like, would satisfy even Mr. Taylor's requirements. But the average chemist seems still to need to have called to his attention that automatic multiple-stirring and -filtering apparatus, automatic funnel-filling devices for filtering large quantities of liquid, burettes and pipettes which must fill to their zero marks, are all things which should be looked into and, usually, adopted. On the side of furnace work in assaying, Doctor Keller's apparatus has reduced everything to multiple handling, and as they are unpatented, these at least can be used without any great expense. Indeed, it will probably pay any employer to consider whether his chemist is keeping pace with his master mechanic in the adoption of machinery, and if not, to find out why.

James J. Hill is one prominent financier who does not agree with Messrs. Gary, Carnegie and Perkins that the Government should undertake to fix maximum and minimum prices. Mr. Hill told the Stanley committee that the principle of competition in business will prevail as long as the law of the survival of the fittest operates, and he predicts that that law will operate forever. Evidently his wrestling with the forces of nature has taught him a profound respect for its immutable laws. In the management of his hippodrome the Hon. Stanley is to be congratulated upon securing so admirable a performer as Mr. Hill, from whom even he may learn something if he pays attention.

The remarkable rise in ocean freight rates which has taken place in the last few months will probably have some effect in reducing the imports of Swedish and Spanish iron ores in this country. It appears to be due to the activity of trade in Europe and the increase in tonnage offered. It is sufficient to add materially to the cost of imported ores, and in some cases to turn the balance in favor of Lake ores. Cuban and Newfoundland ores are not so much affected, since they are carried chiefly in vessels owned by the iron companies or under long charters.

Lake Superior iron-ore prices for the coming season are under discussion, but for reasons easily understood, it is probable that there will be no open agreement this year among the companies having ore to sell. Besides the reluctance to enter into what may be called a combination, it is understood that efforts are being made to sell to Eastern furnaces, and sellers want to be free to make quiet concessions to secure that business. In any event it is probable that buyers will get the benefit of the freight reductions on the Minnesota railroads.

Metallics

In assaying cupel bottoms, the extraction is bettered by exceedingly fine grinding.

When an iron rod is dipped into molten slag and withdrawn, if the slag is siliceous it will drip in long strings; if basic, as drops, and usually, when aluminous, will form thin sheets.

It nearly always will pay to precipitate copper-mine waters, in one known case an effluent containing only 0.08% Cu was treated at a profit. The best method to precipitate is by old tin cans, and not by leaving picks and shovels in the drainage ditch.

In a power plant having a great number of pipes, it is often a good idea to paint each kind with a stripe of a distinctive color, i.e., green for water, blue for air, white for steam, etc. The subdivision can be still further carried out into separate symbolism for high and low pressure.

The following comparative cost figures have been compiled by the Corrigan-McKinney company, in testing acetylene lamps at its mines at Crystal Falls, Mich.: Cost of candles per day per man, 5c.; sunshine, 2½c.; calcium carbide, 1¾c.; the cost of the lamps is not included in these figures.

In many cyanide mills the lime is added dry to the ore, the lime going slowly into solution. Since some ores develop their acidity progressively, the above method is of especial advantage, as the lime becomes available at successive periods in the process. It is preferable that the lime be not coarser than about 40 mesh, otherwise some of the available lime may be discharged with the tailings.

At the Alaska-Treadwell cyanide plant, one 5x22-ft. tube mill grinds 88.75 tons of concentrate per 24 hours. The pulp fed contains 38.5% moisture and grades as follows: On 100 mesh, 48.7%; on 200 mesh, 41.5%; through 200 mesh, 9.8%. The discharge shows: On 100 mesh, 10.1%; on 200 mesh, 26.4%; through 200 mesh, 63.5%. The tube runs at 27 r.p.m. and takes 59 hp. when just half filled with pebbles.

The presence of over 1% of manganese makes steel brittle. The brittleness increases with the addition of more manganese until, when 4 to 5½% is present, the steel can be crushed under a hammer. With further additions of manganese, up to 7% the brittleness does not increase. Upon addition of as much as 7% manganese an entirely new set of properties is acquired by the steel; these new properties are marked at 10% and reach a maximum at 12 or 15% manganese. Steel containing 12 to 15% manganese possesses great hardness and ductility.

By the Way

Dispatches announce the finding, on Feb. 6, of a large piece of fan coral embedded in sandstone, in the Hilson coal mine, in Park County, Montana. The coral is stated to be of a delicate pink color and in perfect condition.

Railroads, probably more than any other corporations, are harassed by inventors. The other day, recounts the Boston *News Bureau*, one walked into the office of a western road with an invention calculated to make the passenger think twice before he complains of dust. It was a patent window sill to catch all dust forced into the car. The inventor said that he had analyzed the dust in trains coming across Nevada and found a high percentage of precious metals, and that if his sills were installed the company would get some $10,000,000 a year out of dust kept off its passengers. Whether the railroads would be allowed under the commodities clause to combine mining with railroading is not obvious. Whether miners would get more out of dusting than digging is equally obscure. But one thing is certain, the colored whiskbroom industry will suffer if ever the value of that Nevada dust is noised abroad.

A mining engineer has forwarded us some generously tinseled twaddle offered by a so called Boston "bond and investment security" house in support of one of the Curb stocks in that city. The property is supposed to consist of about 1600 acres of placer ground besides 17 rich quartz claims, the veins of which "run north 20 deg. east, the same as all the rich veins in the State of Nevada. The direction of these veins is of great importance, as it means that the value will not pinch out and will get richer as they go down, and no man who has ever been there can say different." The company has had "a highly recommended mining expert" visit the property, and the document in question is offered in response to a request for the report of this person, who poses alternately as adviser and stockholder. We surmise that he is a graduate of the Curb Market School of Mines. The report has the following disingenous beginning: "Having visited the mines of the —— —— company, and spent one week looking over the property, I am going to put out a report on same—not for the purpose of raising the price of the stock, as this will take care of itself when the proper time comes. . . . . I have tested the placer ground of this company; I know it is rich. I do not think officers of the company know of this placer ground. . . . . It is estimated that there is in this placer ground from $10,000,000 to $15,000,000 [You may add a few ciphers for yourself, if you like] and with an outlay of $2000 they could start the placer ground and get results right from the start. The gold is course, and there is not any dirt to remove before the pay dirt is struck. . . . . They have found nuggets that went $2000 on this ground and they are common that go from $10 to $20 each." One would think that instead of working State St. and the tight corners of New England, these Curb Market graduates would retire to this Eldorado of Nevada, and once or twice per month gather a cupful of these $20 nuggets that are so common. They are out for fame, however, and as philanthropists are offering these wonderful opportunities to hard-working New England schoolteachers and tradespeople, through the medium of the Boston Curb. Passing over the fact that there are some equally invaluable shares on exchanges in other cities, do you wonder why "mining shares" have the reputation they bear among many laymen, and why, when a man comes East, limited by facts and a real mine, he has difficulty in getting even a hearing.

Our advertising department has always rightly claimed that advertising in the JOURNAL brings business. Here is evidence of it in a letter which a gratified engineer, whose card appears in our professional directory, has forwarded to us.

Mr. Channing J. Parke,
Consulting Mining Engineer,
42 Broadway, New York.

Dear Sir:

Please send your references for abilities and integrity, etc., immediately. I note your ad in Engineering and Mining Journal. I may need your assistance in a very large deal if your capabilities and honor are satisfactory. Are you in close touch with Mr. John Hays Hammond, E. M.?

Yours respectfully,
JOHN SMITH.

This is fame!

Since Jan. 26, the stock of the new Inspiration Consolidated Copper Co. has declined from 21½ to 18, and it is a thing for which everybody is suitably apologetic, says the *Evening Post*. The stock should have gone up; that it went down instead of up is variably explained. One apologist says an insider was in great haste to collect his profits; another says that a lot of traders on the Curb had loaded up and have been selling out; another more adroitly explains that as everybody expected the price to rise, the insiders thought to shake out a lot of weak speculators and get some cheap stock for themselves by allowing the price to decline at first, and that it will, of course, advance later. No copper promotion has recently been launched so enthusiastically. Everybody who is anybody in copper is on the directorate of the new company; it is the most distinguished copper-company directorate ever seen. That is why Wall Street people began to buy the new stock as soon as it was accessible on the Curb.

Exports of Copper

The Copper Producers' Association has issued the following circular in relation to the discrepancies between its statement of export deliveries and the figures given in the reports of the Bureau of Statistics, to which reference has heretofore been made.

THE 1910 EXPORTS

In a statement issued July 14, 1911, by the Copper Producers' Association, with the approval of the Federal Bureau of Statistics, it was stated that omissions had been discovered in the published Government figures for copper exports in 1910 amounting to 13,209,500 lb. In the "Summary" of the Government Bureau of Statistics for December, 1911, recently issued, the total copper export statistics for 1910 have now been corrected by addition of the quantity shown above, and compare with the earlier figures as follows:

	Old Gov. Figures for 1910	Corrected Gov. Figures for 1910
Under "domestic mdse".	695,107,043	708,316,543
Under "foreign mdse."	55,857	55,857
Total	695,162,900	708,372,400

Inasmuch, however, as this substitution of figures has been made in the official publication without any explanation or comment and thus might readily be overlooked, or might cause confusion to those who did notice it, attention may well be called to this correction.

The Government export figures as they now stand compare with corresponding statistics of the Copper Producers Association for the years since that organization has been in existence as follows:

	1909	1910	1911
Government	683,905,254	708,372,400	786,553,408
Copper produc'd	680,942,620	722,431,494	754,902,233
Difference	+2,962,634	—14,059,094	+31,651,175

The total for the three years is: Government figures, 2,178,831,062 lb.; Copper Producers', 2,158,276.347; difference, 20,554.715 lb. excess of Government figures.

CAUSES OF DIFEERENCES

As has been previously pointed out, exact agreement between the two sets of figures is impossible because of overlap in time of reporting. Over a period of years the Government figures should average somewhat higher than those of the Copper Producers', because of inclusion in the former of exports of old copper and scrap, items not embraced in the Copper Producers' reports.

Including the net result of overlap at the beginning of 1909 and at the end of 1911, the Government figures for the three-year period are seen to have been more than 20,000,000 lb. higher than those of the Copper Producers' Association. The Government excess of more than 31,000,000 lb. for 1911 is mainly due to adjustment of an abnormally large opposite overlap difference, known to have been over 27,000,000 lb., that existed at the end of 1910.

The Steel Tariff Bill

WASHINGTON CORRESPONDENCE

Hearings on the House bill revising the steel tariff have been in progress throughout the past week before the Senate Finance Committee. It is planned to continue them up to Mar. 1, and perhaps longer than that. Among those who have appeared during the first few days of the hearings are manufacturers of saws, of steel pens, and of heavy iron products, the chief representative of the latter being Charles M. Schwab. All of the witnesses have taken strong ground against the rates fixed in the bill, alleging that they would be disastrous to the industry, and particularly to those branches of it represented by the speakers. It is probable that within the next week a considerable number of witnesses will lay stress upon the effect of the bill upon the manufacture of heavy iron and steel products.

Mr. Schwab, in his testimony, put the chief stress upon the effect of the measure on the Eastern steel-producing plants, which, he said, would be practically driven into a state of bankruptcy if the bill were to go into operation. He said that he himself would feel like going out of business under such a condition, and asserted that the Bethlehem Steel Co. had made only a small dividend since its organization. Relatively little detailed information about costs were furnished; this being due, doubtless, to the fact that the subject has been so fully covered by the Bureau of Corporations in its recent report. Great stress, however, was laid upon conditions abroad, as to which the Bureau of Corporations had nothing to say, merely alleging that it had not succeeded in getting any information from the books of foreign iron- and steel-producing concerns. It was alleged, as usual, that wages were so much lower in foreign countries that it was wholly impossible for the United States to contend against them. Perhaps the most difficult proposition which Mr. Schwab had to meet in this connection was found in the fact that the report recently issued by the Bureau of Labor concerning conditions at the Bethlehem plant showed the existence of excessively low wages and long hours of labor there. Mr. Schwab met this by simply alleging that the statements made in the report were false. Former Congressman J. T. McCleary, who has appeared for the Lackawanna Steel Co., has told the committee that that plant is able to earn only about 0.25 per cent. on its stock after providing for fixed charges and a reasonable depreciation allowance. Other witnesses take very much the same point of view, and it would appear that quite as much hostility to the rates fixed on the heavy products as to those established on the more highly manufactured articles will be exhibited throughout the hearings.

Ray Consolidated

A recent notice to stockholders of the Ray Consolidated company, states that a special meeting will be held on Feb. 28, for the purpose of voting upon a plan to increase the capital stock to 1,600,000 shares, an increase of 200,000. The purpose of this increase is to acquire a controlling interest in the Ray Central Copper Mining Co. It is stated that the Ray Central orebody has been developed extensively, and that there has been shown to be several million tons of ore of approximately the same grade as that of the Ray Consolidated, and also a smaller body of much higher-grade ore. Prior to this it has been impossible to arrive at acceptable terms. The present situation was precipitated by the recent issue of $1,800.000 worth of first-mortgage, 6% bonds of the Ray Central company, convertible into stock at $2 per share, of which the underwriters were compelled to take and pay for $1,717,000 worth of the par value, the stockholders having subscribed for only $83,000 worth of these bonds. The Ray Consolidated has now received an offer whereby it may acquire the $1,717,000 par value of bonds upon the condition that it shall offer the holders of all the outstanding stock of the Ray Central company, amounting to 1,000,000 shares, the right to exchange eight shares of the Ray Central stock for one share of the Ray Consolidated.

These bonds to be acquired, if converted into stock, will give the Ray Consolidated 858,500 shares of the Ray Central stock, together with that of the stockholders who have already agreed to exchange on this basis. This, it is stated, will insure the Ray Consolidated company a large majority of the shares of Ray Central. It is purposed, after the offer of exchange has been made to the holders of the remaining outstanding shares of the Ray Central company, to acquire by conveyance all the physical property and assets of the Ray Central company.

As the orebodies of the Ray Central company are believed to be easily accessible to the workings connected with the No. 1 shaft of the Ray Consolidated, the consolidation, it is claimed, would make possible the extraction of several million tons of ore, adjacent to the boundary lines of the two properties which are not now available by either company. It is stated that the Ray Consolidated, with its mining, railroad and milling facilities, can mine and treat the Ray Central ores at a lower cost than the Ray Central company could.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Niter Assay

In the JOURNAL of Dec. 20, 1911, p. 1262, there appeared an article on the niter assay, by P. D. Wilson. Some observations on this article and the niter method, made not in a spirit of adverse criticism, may produce a few points unfamiliar to some of your readers.

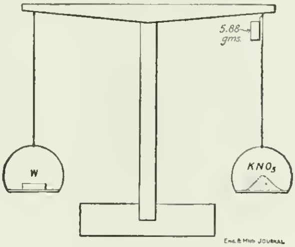
The curve for obtaining required niter from the sulphide content of an ore is of limited use, as the assayer generally has not this information; and when available it is useful only when, as pointed out, the sulphur is combined in a class of sulphides for which the curve has been determined. Of course, the sulphide sulphur must be distinguished from the oxidized compounds. With miscellaneous sulphides we have found the method rather unsatisfactory.

Except where a class of ores is uniform in characteristics, it is next to impossible to estimate the niter required, and it is generally conceded that a preliminary assay is necessary for satisfactory work. Under these conditions the curve for preliminary buttons would be highly useful if it were not for a much simpler method, in which calculations are made by the ordinary balance and no handling of weights is required (ENG. & MIN. JOURN., Oct. 1, 1910, p. 647. "Analytical Methods in the Cananea Laboratory," by F. G. Hawley.) The impression that the niter method is unsatisfactory in charges requiring more than 20 grams of niter is not necessarily true. A highly oxidizing charge which is sufficiently dilute to prevent too violent reaction between the sulphides and the niter will give good results irrespective of the amount of niter used, providing the charge can be fused with sufficient rapidity without overheating.

The following charge, when properly handled, may be depended upon for good results with high sulphide ores, and it is rare that a greater ratio of flux to sulphide is required: Ore, ½ a.t.; Na_2CO_3, ½ a.t.; PbO, 3½ a.t.; borax glass, ⅕ a.t.; silica, ⅙ a.t.; niter, as required.

For the best results it is necessary to introduce the charge into a hot furnace and bring rapidly to fusion, i.e., in from seven to 10 min., with a total time required in furnace of about 30 min. The more sulphide present, the higher the initial temperature required. It is essential that the difference between bringing a charge rapidly to fusion, and carrying it through at an excessively high temperature, be appreciated. If the assay is overheated, low silver results will be obtained. The usual niter charge gives a slag with low surface tension and the oxidized products are not gaseous; therefore, the charge boils little and a rather poor circulation of reduced lead is obtained. For this reason we find it desirable to produce a 25-gram lead button. The preliminary assay for the above charge is: Ore, 1/10 a.t.; Na_2CO_3, ⅓ a.t.; PbO, 2 a.t., observing the above conditions of fusion. The calculation will be $\frac{W \times 5 - 25}{4.25} = X$ grams of niter.

To uses Hawley's method, we have this consideration: ½ a.t. equals 14.583 grams, which, divided by the oxidizing power of niter, 4.25 grams gives 3.43 grams, which is the amount of ore to use for preliminary assay. Make a special weight for this purpose. The calculation then becomes $\frac{W \times 4.25 - 25}{4.25} = X$ grams of niter, which, reduced, equals $W - 5.88$. If, then, we place the preliminary lead button on the left-hand scale pan and suspend a subtracting weight of 5.88 grams from the hook on the opposite side of beam and balance with niter, we shall obtain the requisite amount of this reagent. The statement that niter is less oxidizing in an acid slag is scarcely correct. It is the litharge which loses its efficiency by forming silicates and borates.



NITER BALANCE

E. J. HALL.

New York, Jan. 30, 1912.

Use for Vanadium Bearing Iron Sands

I have established the presence of vanadium in the iron sands of Patea (*cf. Daily Consular and Trade Reports*, No. 187, Aug. 11, 1911) to the extent of 0.15 to 18%, and wish to know whether this percentage of that metal can be turned to commercial account in the United States, either for extraction of vanadium, or as a component in the making of steel. Any reply which is received through the Discussion column of the JOURNAL will be greatly appreciated.

I would ask those who consider these prospective uses to think both of its importation as raw material, or as partly manufactured steel on which the duty is 15c. per cwt., and also whether the completion of the Panama Canal will make any difference in the possibility of the transport of this material from New Zealand to the extreme Eastern seaport points of the United States.

A. D. BANFEILD.

Westport, N. Z., Dec. 27, 1911.

Where Should the Primer Go?

In the interesting article on explosives in the JOURNAL of Feb. 3, under the head of position of primer, Mr. Anderson, engineer with the technical division of the Du Pont company, states: "With . . . . the gelatin dynamites, there is no doubt but that the proper position for the primer is near the bottom of the hole, and the best results will be obtained by pointing the closed end of the cap toward the center of the charge . . . . .because the explosion of the powder starts at the detonator and the force is greatest at that point; the bottom of the hole being the the strongest, it is the part that requires the greatest explosive force."

The du Pont company has just issued a booklet entitled "High Explosives," on p. 43 of which I find this statement: "The effect of a detonator on a charge of high explosive in a bore hole is not infinite, but decreases with distance. It is, therefore, easy to understand the necessity for using detonators sufficiently strong for the effect of the detonator itself to extend throughout the charge. It might be understood from this that the detonator should be located in the center of the charge, and this would be correct, had not numerous tests shown that the greatest effect of the detonator is straight away from its loaded end in a line with its long axis." And on p. 57 this booklet continues: "If the primer is made with fuse and blasting cap, it should be put into the bore hole last; if with an electric fuse, last or next to last."

I grant Mr. Anderson's argument that a stick of powder with a cap in it will do more execution than a similar stick without a cap, and I admit that the inference would be that the bottom of the hole, where the burden is greatest, is the place for the primer, but what about the "numerous tests" of the du Pont company, which have shown that these natural inferences are not always correct? I should appreciate it if Mr. Anderson would elucidate this apparent conflict of authorities within the house of du Pont.

Percy E. Barbour.

Candor, N. C., Feb. 6, 1912.

The Experiment Station Bill

The text of the Martin bill for the experiment stations, as published in the Journal of Feb. 10, 1912, provides that a mining experiment station may be established in each of the states and territories where precious metals occur in commercial quantities. What are commercial quantities? Can Maryland, with a 1911 production of 87 oz. of silver and 1 oz. of gold, have an experiment station, while rock-ribbed Republican Vermont has none to investigate its granite and building stones? Shall Virginia, with a 1910 and 1911 united production of 260 oz. gold and 245 oz. silver, have an experiment station, while Maine gets none to search its pyrite deposits for precious metals? Or, if we exclude Maryland and Virginia from participation in the pie, shall we begin with Illinois, credited with a two-year production of 289 oz. of gold and 6748 oz. of silver? Or shall we let New York, with its Golconda of Adirondack "green gold," go stationless? Here is where the station is really needed. Any assayer can find the Western gold. Patient experiment is needed to find that of the Adirondacks. And New York contains over one-twentieth of the voters.

And what does "$5000 in establishing, equipping and maintaining each of said experiment stations" mean? Is this per annum, per century, or, like Carnegie libraries, is this to start the thing going, and after that the receipts take care of the expenses, except for the salaries of the geologist and the chemist? These are interesting points. What is the use of establishing experiment stations anyway, if the lucky town can't have a public building, and what sort of a public building can be built for $5000, if the furnishings of a chemical laboratory must also be paid for out of this amount.

Why does "an expert geologist" receive $3000 per annum under this bill, while an "expert and competent chemist" gets only $2000? Base favoritism, probably inspired by the Geological Survey! Is not the chemist worthy of his hire? And why should the geologist be expected to travel in his leisure time, and not the chemist? Can't the geologist rest content with his extra $1000 and not also have the benefit of an expense account over the poor but perspiring chemist? Rampant injustice! Here goes for a course in geology.

Chemist.

Perth Amboy, N. J., Feb. 12, 1912.

Geology Applied to Mining

When reading articles on applied geology, such as "Geology Applied to Mining," by Linforth and Milburn, published in the Journal of Apr. 1, 1911, and "Problems on the Dip" and "Problems on the Strike," by Josiah Bond in the issues of Sept. 2, and Nov. 25, 1911, I am always reminded of some of the geological dissertations that I have found in reports and descriptions of mining properties that were offered for sale. I do not refer to the reports made by competent geologists or mining engineers, but to those made by men who are often good miners and know a mine or prospect when they see it, but who are not geologists. Attention is often first drawn to excellent prospects by just such reports.

I have in mind one such report that gave a detailed description of the mine, the work that had been done on it, with maps showing where samples had been taken and assayed. Every statement seemed to have been honestly and intelligently made. The report aroused interest in the prospect and created a favorable impression of the author until the paragraphs on geology were read. There the author "spread himself" and went at length into the origin of ores in general and of this deposit in particular. There was not a single statement founded on facts; only the author's suppositions. The geology was obviously mentioned for effect. Fortunately in this case the rest of the report was so sound that the prospect was examined and proved to be as represented.

This is not an exceptional case, but the rule, as most engineers who have dealt with such reports can testify. And it is by no means the case that such flights of fancy are confined to reports written by men who do not even claim to be mining engineers. Some of the most elaborate geological dissertations that I have ever read were written by men who were excellent engineers, but whose experience had not yet taught them to leave geological matters to the geologists.

This tendency to delve into inconsequential geological theorizing seems to come from the unwarranted assumption that there is a recognized law in the relation of the richness and extent of an ore deposit to the rocks in which it occurs. The tendency has been further fostered by the great number of scientific papers that have been published on the origin of ore deposits. It is a very human trait to inquire into the unknown and formulate hypotheses as to the cause and origin of natural phenomena.

The study of the origin of ore deposits still belongs to the realm of pure science, and to trained and experienced geologists. The hypotheses that have been formulated as to the origin of ores are of interest to the mining geologist, but rarely of value to the mine owner. It is better to leave all such work to the men who make it a life study.

The great objection to this tendency to theorize is that the useful and valuable geological facts are overlooked. The mining engineer and mine owner are interested in the ore as it now is, not in how it got there. It does not matter much what the rock is, in which the ore is found, nor its age, but the condition of the rock is of importance. The effects of faults, fissures, slips, joints, interruption in the continuity of ore, class of rock and its succession by another class, are of great importance and their significance is often unappreciated.

How such geological data are applied to useful purposes in tracing a lost or faulted vein is described by Linforth and Milburn, while Mr. Bond's articles describe how costly it may sometimes be to neglect the geological evidences of the effects of dislocation. In some instances, where the orebody is much broken and faulted, the geological maps may be of as much value as the assay plans.

The value of this sort of geological work is now rapidly becoming more appreciated and as the methods of applying the data become generally known we may expect to find the geological maps taking their proper place second only in importance to the assay plans. It is also to be hoped that a careful description of slips and faults and other such structural geological features that may have an influence on the system of mining the ore, will usurp the place of that worn-out phrase, "favorable formation," and flights of geological fancy in reports of the class hereinbefore mentioned.

J. A. Herdy.

Chicago, Ill., Feb. 7, 1912.

Literary Taste of Miners

I was recently reminded of a statement seen several years ago in the *Bookman*, remarking that "The Connecticut Yankee in King Arthur's Court" was the poorest of Mark Twain's books. In two of the libraries seen recently in this part of the country I have noted that Mark Twain's works were among the most worn, and the "Yankee" was the most used up of the set, apparently by use and not abuse. Is this indicative of poor taste in the miners or is there a virility in this book not perhaps appreciated in the *Bookman*?

K. T. Wheeler.

Bisbee, Ariz., Feb. 3, 1912.

Caucasus Copper Co.

I see that S. F. Shaw, in his data concerning the mines of the world (Eng. and Min. Journ., Jan. 13, 1912), places the Caucasus Copper Co. in Siberia. As its name implies, it is situated in the Caucasus district of the Russian empire.

V. C. Svimonoff.

Pittsburg, Penn., Jan. 23, 1912.

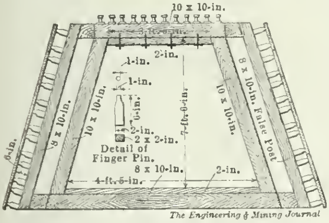
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Finger-pin Timbering in Swelling Ground

The finger-pin method of protecting drift sets in swelling ground was devised on the Comstock lode, and has been in use there several years. In it, as can be seen, in the accompanying drawing, the lagging is held back against the swelling ground by means of finger pins, as they are called, pieces of fir 2 by 2 in. in section, about six inches long and sharpened at their small end to a diameter of about an inch. Two of these pins are put in at each end of a plank, with the larger end against the post as the pressure on that end is less per square inch than that on the small end of the pin. The pin therefore is forced through the lagging as the ground swells, and the lagging is impaled upon the pins. In this way the posts are protected. As soon as the ground has moved in enough so that the lagging is almost against the posts, the ground is eased off, pieces of 2-in. plank are put in to cover the holes, and again the planks are impaled on the pins.



Bridge Sets with Lagging over Finger Pins

The drawback to this simple sprag-pin drift set is that the head timberman and shift-bosses fail to keep close watch of the sets, and before it is discovered the ground is liable to have moved in to the post and broken the timbers. To guard against this the finger-pin method was combined at the Goldfield Consolidated mines with the old method of false sets as is shown in regard to the side lagging in the accompanying drawing. Then, in case the sets are forgotten only the timbers of the false set will be broken.

It is impossible to use these finger pins in supporting the top lagging as owing to unequal weight jack-knifing is sure to occur. Consequently, the procedure is to carry the roof lagging on false caps resting on blocks over the tops of the posts, but where old mine rails are obtainable, they probably make the best lagging for the roof in swelling ground. The rails are used with the bottoms against the caps. Then the ground as it swells will force itself down between the rails and hang down in festoons until it drops off of its own weight. This is the method used at the Copper Queen mines in supporting the roof of drifts in badly swelling ground. Rails are also used for side lagging in the worst ground.

In case that the ground in the bottom of a drift swells, the best thing to do is to keep the bottom covered with several inches of standing water or sand. This keeps the air away from the ground and prevents further oxidation of the decomposing minerals, generally the feldspar.

The oxidation of certain minerals in the rock is, in general, the cause of swelling ground, although in some cases it does seem as though the swelling, especially in talcy ground, is due to real flowage of the rock itself. In holding swelling ground, therefore, the plan is to ease the timbers as little as possible each time so as to try to get a considerable layer of thoroughly oxidized ground exposed to the air so that further oxidation behind the outer layer will be prevented as much as possible.

The Oliver Iron Mining Co.'s ore crusher, at Escanaba, Mich., crushed 200,000 tons of ore in the season of 1911. This is a record amount for the company, although the plant can handle 500,000 tons in a season if necessary. Concentration of crushing operations for the Oliver company's Menominee Range mines is reported to have cheapened the crushing cost materially.

Thawing Frozen Water Pipes

The following method of thawing 150 ft. of ¾-in. pipe is given by J. E. Bates in *Power*. The only current available was that of a railway system supplied from rotary converters at 650 volts. The substation was 14 miles from the main power house, but by shutting down the converters and thawing when few or no cars were running a voltage of 500 was obtained. After rigging up a barrel as a water rheostat one lead was attached to a faucet at the extreme end of the ¾-in. pipe line and the other to a valve on the water main and the upper terminal was lowered into the barrel until the ammeter showed 200 amperes; the voltage dropped to about 200. It took about 1½ hours to thaw out the pipe.

At another time the supply pipe to a dwelling house froze; it was about 50 ft. long and ¾-in. pipe. There was a one-wire feed to the house from the trolley circuit which burned five lamps in series; the return was grounded on the water pipe in the house. It was not known how the current got back to the station; the water mains were all of wood. The trolley voltage was 650, but with the five lamps burning only 600 volts were obtained showing a drop of 50 volts. On the night the pipe froze, the feed wire was connected directly to the faucet of the water pipe and left on all night, leaving the faucet partly open.

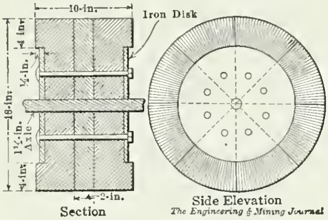
In the morning the water was running. How much current it took was not determined, but it could not have been much because it was not enough to even warm up a No. 14 copper wire.

Success in thawing pipes by electricity, states *Coal Age* in describing the method, will depend in any particular case on at least two essential conditions; namely, (1) sufficient electric current at high amperage and relatively low voltage, depending on the size, length and conductivity of the pipe, which can only be definitely determined by experiment; (2) a sufficient insulation of the pipe line throughout the length of the frozen section to confine the electric current to the pipe without undue loss of power.

The principle is that the resistance develops heat and melts the ice. For alternating currents a special transformer is generally required, as the ordinary type will hardly be capable of giving the required voltage and amperage. This must be ordered to suit the conditions, which should be submitted in detail to a competent electrician.

Rope Idlers for Inclined Shafts

In the conglomerate shafts of the Calumet & Hecla company where, owing to the necessity of not cutting into the foot nor the hanging wall, the shaft must follow the lode in all its changes of dip, the rope idlers or rollers are subjected to severe wear, and some of them have to be replaced once per shift, while the average life of an idler in the whole shaft is not over a week. The idlers are therefore cheaply and simply made. They are maple logs turned down to a diameter of 16 in. and a face of 24 in., in which three grooves are turned along which the cable may run as the idler is shifted in the shaft. Through the center of the idler a 1½-in. hole is bored for the axle. Formerly an iron pipe was inserted in the idlers for a thimble and the idler revolved on a fixed axle. This arrangement is cheaper and good enough for shallow shafts where the hoisting speed is not great, but there is too much friction to use these idlers at high rope-speeds as it is impossible to grease them properly.



Idler for Skip Rope in Shafts

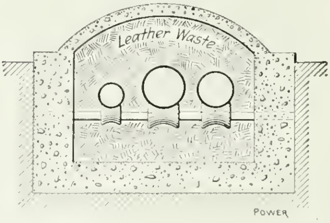
The idlers now generally used have a fixed axle that rests in two bearings on the idler frame which is wedged in place in the shaft between the cedar ties of the skip tracks. These frames are set in the shaft so that the rope passes through the right-hand groove of one idler, the center groove of the next and the left-hand groove of the next. By changing the idlers from one frame to another they may be completely worn out.

This type of idler is used in the amygdaloid mines of the district, except at the shafts of the Osceola Consolidated, where a built-up idler is used. This idler, as the amygdaloid shafts are sunk at a regular dip, does not have to be made so wide to insure the rope staying on the idler, while as the wear is not so great as in the conglomerate shafts, the idler part is built up of segments so that the wear will come end-on instead of sidewise with the fiber of the wood. These built-up idlers are 18 in. diameter and 10 in. wide. There are three layers of octant segments held together by flanges and bolts through the apex of each, as shown in the accompanying sketch. The outer segments are sawed from 4x6-in. maple or beech planks, being cut so that the grain runs approximately lengthwise, while the inside segment, the one that takes the wear, is sawed from a 2x6-in. plank of the same material. It is, therefore, possible to replace the segments without throwing away the whole idler when only a few of the segments in a layer are worn. The outer segments are made with a shoulder ½ in. deep turned in them to receive the flanges so that the bolts that run through the idler will not extend beyond the sides to wear and cut the rope in case it should slip off the idler.

These idlers have been in use several years, they last much longer than do the other types, and as they are lighter, they get up to speed when the rope comes on them quicker than do the others. In the conglomerate mines they cannot be used, because the wear is so great that it does not pay to try to increase the life of the idlers by complicating the design.

A Concrete Trench for Pipes

The trench shown in the accompanying illustration was originally designed for use underground for the purpose of carrying steam pipes without excessive loss of steam through radiation, and to prevent, so far as possible, heating of the drifts through which the pipes pass. The body of the trench is three or four inches thick. The steam pipes are carried on rollers mounted on horizontal cross rods imbedded in the concrete.



Section of Pipe Trench

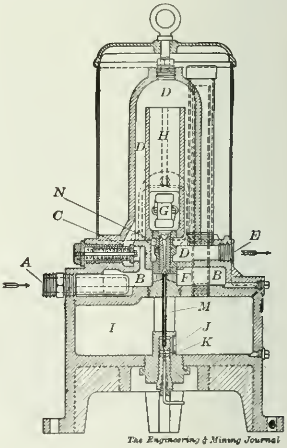
After the pipes are laid, leather waste, sand or other suitable non-conductor of heat is used as a covering. The trench is covered with concrete one inch thick so that the top can readily be broken into when it is necessary to get to the pipes.

Similar trenches can be used to advantage at the surface for protecting water pipes from freezing in cold weather. There are advantages in not burying water pipes at the surface of a mine; it is frequently necessary to reach the pipes, which cannot be so readily done if they are buried deep enough to be below the frost line.

Reheating Air for Drills

A simple portable air reheater intended for use directly at the drill is shown in the accompanying illustration. This air reheater is designed automatically to maintain any predetermined temperature in a compressed-air line, thus expanding the volume, by means of continuous internal combustion of gasoline, benzine or kerosene.

The advantages to be gained and the saving to be made by reheating compressed air may be summarized as follows:—Compressed air for use in rock drills and other air tools may be heated to any desired temperature; the only limit is that temperature that will destroy lubrication. Modern practice establishes this temperature under superheated steam conditions between 500° F. and 600° F. In air tools or air engines, however, the temperature of the air cylinder is considerably less than the temperature of the air used, due to the absorption of heat by the rapidly expanding exhaust air. By using reheated air in rock drills a much greater ratio of expansion is possible before the freezing temperature is reached, consequently in addition to the saving of air consumed, all freezing troubles are eliminated.



Sterling Air Heater

The reheater is, according to *Engineering Contracting*, set in the air line near the machine and automatically maintains any desired temperature, as its operation is controlled by the flow of air. Combustion can only begin when the air passes through the reheater and ceases when the throttle valve of the tool is closed. The machine is always ready for immediate operation in warm or cold weather and the increased temperature desired is absolutely under the control of the operator by simply turning one valve.

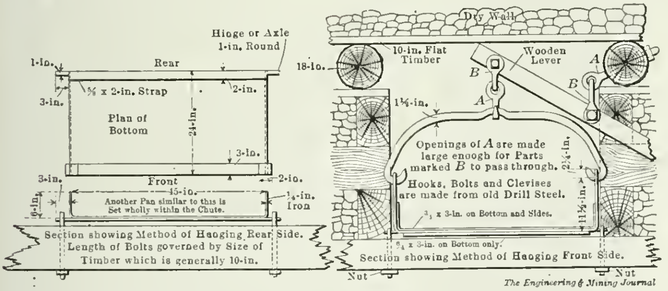
The air is heated by means of continuous ignition of vaporized liquid fuel. It operates equally well on gasoline, kerosene, or any high-grade distillate of crude oil. Perfect combustion is maintained under all conditions, because the combustible mixture of vaporized fuel oil when burned in the combustion chamber is completely surrounded by an abundance of oxygen. Consequently, the heated air in leaving the reheater is absolutely clean and free from any smoke or carbon. The continuous ignition is effected by means of a small electric resistance coil using either 110 or 220 volt alternating or direct current, or, in the absence of an electric current, the ignition is maintained by means of a hot tube.

When the machine is started, air enters the space *B*, of the Sterling reheater shown in the accompanying sketch, and about 98% passes through valve *C* into space *D*. The rest of the air passes through the inspirator opening *F* through the mixing tube *N* and forms a combustible mixture with the fuel oil drawn from tube *M* at the point *F* when the needle valve is open about a quarter of a turn, thus admitting fuel oil through the screen *J* through tube *M* to the point of nozzle at *F*. This combustible mixture is ignited by contact with coil *G* and is burned in the combustion zone at a high temperature; then mixing with the air in *D* and uniformly heating the entire volume to the desired temperature as controlled by the fuel needle valve *K*. The air pressure in *B* and *I*, being maintained the same in these two compartments by means of a balance pipe, as shown, is a fraction of a pound more than in *D*, due to the floating deflector *C*. This difference in pressure raises the fuel oil through *M* to the nozzle. The instant the air passes through the heater, combustion begins and when the tool is shut off combustion ceases. The needle valve *K* is the only adjustable part of the heater. When this valve is once set, the action of the heater is uniform and a constant temperature is maintained by it. The only manual attention required being the renewal of the fuel supply. Approximately 2½ gal. of gasoline or kerosene will heat 100 cu.ft. of free air per min. from 50° to 350° for 10 hours continuous run.

A Mine Chute Gate

By Claude T. Rice

The accompanying sketch shows the gate used in the dry-wall chutes or millholes at the Baltic mine in the Lake Superior copper country. The bolts are put through augur holes in the timbers so that by unscrewing the nut on the ends of the bolts the eye-bolts can be taken out. By taking out the eye-bolts in the front timber or lip piece, that is built into the walls at the millholes, the apron gate can be taken off. Then by taking out the bolts *A* from the clevises *B* that fasten the levers to the wall-piece eye-bolts, the entire gate can be transferred without much trouble to another millhole to be returned again when mining comes back to that part of the stope. The apron gate is always taken off when the millohole is converted into a temporary manway. The lever on the gate is a cedar pole about 10 ft. long bored at the proper points to receive the clevis pins. The gate is held shut by bringing the end of the sweep or lever behind a piece of drill steel or pipe that projects from the dry wall near its bottom. While the car is being loaded, the gate rests on the body of the car.


Hinge or Axle 1-in. Round
1-in.
Rear
3-in.
⅝ x 2-in. Strap
2-in.
Plan of Bottom
24-in.
3-in.
3-in.
Front
2-in.
45-in.
Another Pan similar to this is Set wholly within the Chute.
¼-in. Iron
6-in.
Section showing Method of Hanging Rear Side.
Length of Bolts governed by Size of Timber which is generally 10-in.
18-in.
Dry Wall
10-in. Flat Timber
Wooden Lever
A
B
B
A
1⅛-in.
Openings of A are made large enough for Parts marked B to pass through.
2¼-in.
Hooks, Bolts and Clevises are made from old Drill Steel.
11½-in.
¾ x 3-in. on Bottom and Sides.
¾ x 3-in. on Bottom only.
Section showing Method of Hanging Front Side.
Nut
Nut
The Engineering & Mining Journal

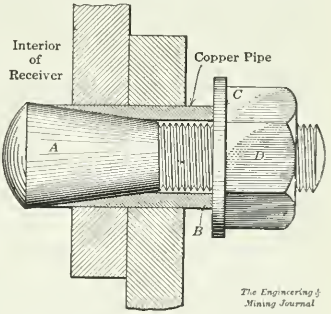
Removable Gates for Chutes in Dry Walls

It was formerly the custom to put a flat piece of sheet iron hinged to the gate in the bottom of the millhole so as to protect the lip timber from wear. This was found unnecessary as in case the lip piece wore so that it would no longer take the strain of the gate, straps could be fastened to the piece of timber in the side of the chute from which the dry walls on the side spring, and the gate secured to these straps. So the pan, as the flat piece is called, is no longer put in the bottom of the millholes at the Baltic and Champion mines. In case the men, in building the chute, make it too wide at its mouth, the fault is remedied by spiking some 2-in. planks to the side timbers of the millhole. Sometimes trouble is experienced from fine rock coming out of the mouth of the millholes when they are about empty and the men are loading into them. This is remedied by building up a temporary grating of old plank and dull drills crisscross around the gate both along the sides as well as in front.

The great advantage of this gate is that it is so easily dismantled. It is simple, effective and inexpensive when its life is considered. The eye-bolts and the pins can be made to serve repeatedly as they always can be taken out of the timbers without much difficulty. The drawing is not intended especially to show the manner of making the mouths of the dry-wall millholes, as this is not the standard form, although sometimes used; so much timber is not typical of the mouths of the millholes.

Stopping Leaks in Air Receivers

A convenient method of stopping leaks around a loose rivet in air receivers or steel water tanks, or even for emergency repair work on boilers, and one which can be made entirely from the outside, is to use a taper bolt with copper sleeve, as illustrated in the accompanying sketch.



Taper Bolt for Stoping Leaks

The head of the faulty rivet is cut off, and the rivet knocked out of the hole or else the rivet may be drilled out. A taper bolt *A*, large enough to pass through the hole, and threaded up to 1½ in. of the large end is inserted in the rivet hole and a piece of copper pipe *B*, of the same internal diameter as the diameter of the bolt, is lipped over the threaded portion of the taper bolt; it should project ¼ to ⅜ in. on each side of the plates. A washer *C* and nut *D* are then put on and the nut screwed up with a long-handle wrench. The bolt can be used for withstanding pressures up to 200 lb. per sq. in. with safety.

The bolt may be used for repairing other small leaks such as may occur in pump columns by drilling out a hole at the point where the leakage occurs. A variety of uses for such a bolt will be suggested by the sketch.

Hints on Buying Pumps

By John S. Leese*

When a prospective purchaser of new equipment of any description is making inquiries of the manufacturers, if he would give a terse account of what he wants he would save much time and lengthy correspondence on the subject of the inquiry. This is not all he would do, however. When the manufacturer knows what the conditions are, under which his machine is expected to operate, he will, by virtue of his long and specialized experience in his own line, be able to supply the most suitable equipment at a reasonable price. The neglect of inquirers to state specifically what they want and what they want it for, is the cause of endless uncertainty and confusion and may result in the undeserved donation of a bad name in a particular place, where a piece of machinery has been installed without the maker having had the opportunity of obtaining full cognizance of the requirements of that case.

If one were considering the purchase of a heavy draught horse, he would, in writing to his dealer, give some information as to the loads and class of work the animal is intended to be put to. He would not write and say, "I want a horse," simply. Why this "horse sense" does not apply more generally to purchasers of mechanical equipment than it does, is a matter of surprise to those who have the doubtfully pleasant task of answering inquiries in the machinery market. I know from experience what a considerable proportion of inquiries come into an engineer's office which are of the "I want a horse" variety, and I am therefore prompted to delineate, in the present article, the most important points to be considered in the selection of a pump.

In the contemplation of the purchase of a pump the following particulars should be stipulated and supplied to each manufacturer along with the letter of inquiry:

(1) The service for which the pump is to be used.

(2) Whether the liquid to be pumped will be hot or cold.

(3) If the liquid is hot, will it be of such a temperature as to evaporate upon the removal of pressure?

(4) If the last answer is in the affirmative, state whether means are available by which the liquid may be arranged to flow by gravity into the pump chamber to submerge the valves.

(5) Whether the liquid to be pumped will be clear or gritty, salt or fresh water, acid or non-corrosive.

(6) The lift through which the liquid is to be raised by the pump suction.

(7) The approximate length, cross-section and conformation of the suction pipe.

(8) The number of tees and elbows in the suction pipe line, and their dimensions.

(9) The source from which the supply of liquid is to be taken by the pump.

(10) What capacity the pump is required for, in gallons of water per hour or per working day.

(11) The head and height against which the liquid is to be forced.

(12) The nature of the head.

(13) The conformation and size of the delivery pipe.

(14) The steam pressure available at the steam end of a steam-driven pump.

(15) In the case of a new installation, give the distance from the boiler to the pump, and the boiler pressure under which the pump is to operate.

(16) The nature of exhaust provided for the steam end of the pump; whether it is to the atmosphere, to a condenser, or against a back pressure.

(17) If the steam is to exhaust into a condenser or against a back pressure, state what the pressure is.

In addition to the important particulars enumerated above there are other requirements and details which it will seldom trouble an intelligent brain to discover. Everything which can be of assistance to the manufacturer should be mentioned. The fulfillment of this condition will tend to go far toward satisfactory operation and a reasonable invoice.

---

*9 South Parade, Deansgate, Manchester, England.

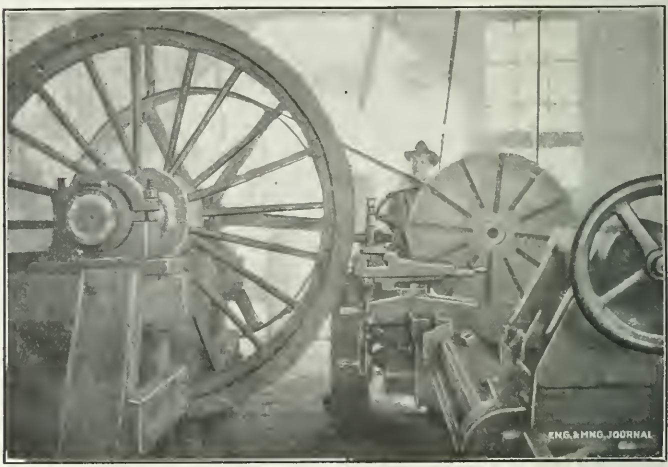
In the Parral camp in Mexico, a fair price for contract work on exploration tunnels for the first 200 m. is 26 pesos per meter, powder and steel being furnished by the company. About a meter per day per shift can be advanced in ordinary rock.

Turning a Large Sheave

By Frederick MacCoy*

Recently at the hoisting shaft of the Esperanza mine at El Oro, Mexico, one of the sheave-wheels that carries a 5-in. flat cable broke, and as it would require about two months to secure a new one from the United States, it was decided to build one locally.

A local foundry was found that would undertake the work of casting the wheel which was to have wrought-iron spokes, but cast-iron hub and rim. As the mine did not have a lathe large enough to finish the hub and rim, the work was done in the following manner: The wheel was bolted down on the floor at one side of a radial-arm drill press. A cast-iron cylinder was then turned down slightly smaller than the hub as cast, and this cylinder was slotted to hold a lathe-cutting tool, which cutter was held in place with a setscrew. The cylinder was tapped out to hold a piece of tool steel that in turn was fitted into the regular drill socket. The arm of the drill press was then run out over the hub, accurately centered and clamped. Then the cylinder carrying the cutter was fed slowly down, boring out the hub to the required diameter as it revolved.



Turning a Large Sheave in a Small Lathe

To turn the rim was the next job, so the sheave was mounted on a piece of shafting as shown in the accompanying illustration; the shafting mounted on horses and a pulley mounted on the shaft. The pulley received its power from the lathe and the tool truck on the lathe was reversed so as to handle the cutter against the sheave face. The work was done entirely by native workmen outside of the molding of the wheel at the foundry.

---

*Chief engineer, Esperanza Mining Co., El Oro, Mexico.

Hoisting Engine Repair Job

At a coal mine in Pennsylvania a 32-by 48-in. first-motion hoisting engine was injured by water entering the cylinders with the steam. This water had accumulated in the pipe line from condensation. The entrance of this water into the cylinders resulted in cracking the engine frames on the under sides of the throat, next to the flange where it was bolted to the cylinder. The engine bed was also broken on one side at the pillow block, either one of the fractures being so severe as to render the engine useless until a new frame could be obtained or repairs made.

The repairs were made as follows and are of special interest as being examples of the emergency casting work that Henry M. Lane has been describing in articles on "First Aid to Mining Machinery." A heavy casting was made to fit on the outside of the engine frame and was flanged to the same size as the frame and the cylinder. Long stud-bolts were used instead of the engine studs, and clearance holes were drilled in the casting to match those in the engine frame. Another set of holes was drilled and tapped in the frame and corresponding holes drilled in the casting. Cap-bolts were then screwed tightly in place. The nuts on the stud-bolts were then screwed up tight. Ribs were made on the casting to strengthen it. A 1½-in. rod was screwed into the base of the engine frame on each side of the cylinder and also pressed through the foot at the head end of the cylinder. These rods were made tight by nuts, as shown in Fig. 1, and the whole served to prevent the cylinder from pulling away from the frame; both cylinders were treated in the same manner.

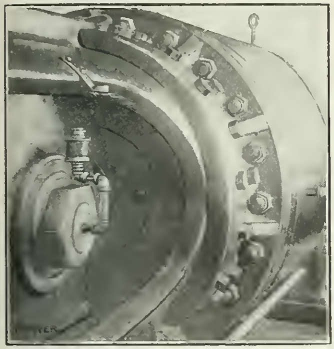


FIG. 1. CASTING FITTED TO FRAME OF ENGINE

Securing the pillow block to the frame was a more difficult job, but it was accomplished by making a new cup for the bearing, having a shoulder cast on the inner end. A special casting was made to butt against this shoulder and to extend out on top of the engine frame, as shown in Fig. 2. The two shoulders were held together by five 1½-in. bolts; the angle casting was secured to the engine bed by eleven 1-in. cap-screws.

On each side of the frame two angle irons were secured by 1-in. bolts and the angle end of each was drilled for a 1¼-in. stay-rod; the inner end of each was screwed into the projecting end of the pillow block of the crank disk. The other end of each rod passed through the hole in the angle iron and was made tight by a nut, as shown.

To make the job more secure, a small casting was made to fit against the outer end of the frame and pillow block. Two holes were drilled in it for two 2-in. rods which were slotted for a key. The other end of each rod was fastened, drilled and secured to the engine frame by a bolt which extended through the engine frame and both eyes of the two bolts, as shown just back of the crank disk in Fig. 2. The bolts drew the frame tight at the bottom and prevented end-play at that point.

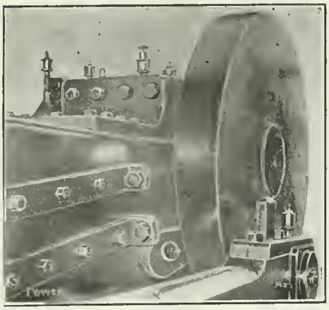


FIG. 2. SPECIAL PILLOW BLOCK CAP FITTED TO FRAME

This completed the job, and the engine has been in use during working hours for a period of about three years, which speaks well for the manner in which the work was done.

Reproducing Mounted Plans

The reproduction of some mounted plans was found to offer considerable difficulties by the West Australia District Survey[1]. Photo-lithography was tried, but it was found that a lithograph required much retouching before it could be used, while sun-printing was out of the question because of the thickness of the paper.

Prints were finally made by placing a sheet of bromide paper in a printing frame, placing the drawing face down over it, and printing by electric light. In this way a paper negative was obtained. The paper used was "Platino-Argentic," and for the subsequent positive, "Nepera gas-light." The light was about 100 c.p., and the exposure 15 sec. for the negative, and 6 min. for the positive. Ferrous oxalate and hydroquinone developers gave the best results.

It was found that a first-class contact between paper and drawing was essential, and for this reason a printing frame fitted with a rubber blanket was used. The frame is provided with hinged flaps which are screwed down on to the edges of the blanket, and the air between the blanket and glass is then exhausted.

---

[1] Survey Journ., Sept. 1, 1911.

Ejectors for Mine Drainage

An interesting application of an ejector for draining drifts in the deep-lead mines of Victoria was recently proposed in the *Australian Mining Standard.* In the deep-lead mines little trouble is experienced from water when driving up the lead as the water flows down the slope to the shaft. In driving down the lead the accumulation of water at the face is a source of delay and annoyance.

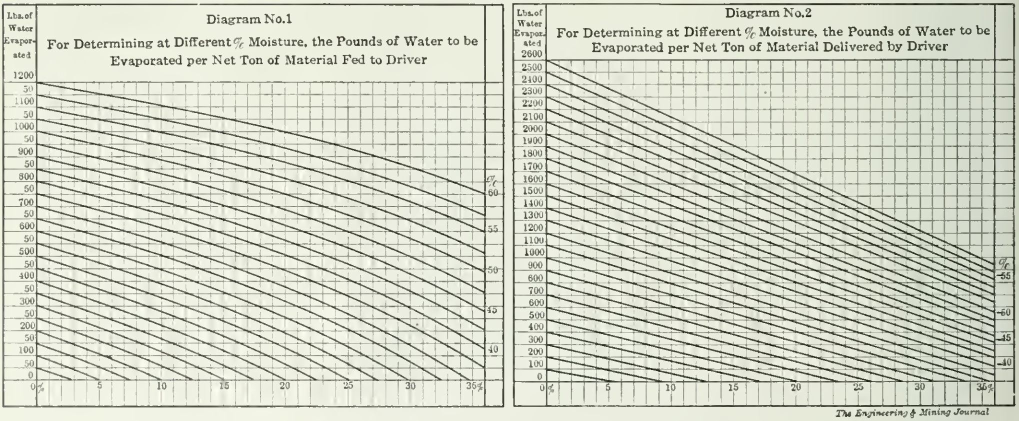
The drifts are usually long and circuitous, so that the installation of a pump and pipe lines is an item of large expense. Baling or removing the water in trucks is convenient where the flow is light, but unsatisfactory if the flow be large.

The proposed method of draining is to utilize the water of the lead itself for drainage. The sedimentaries overlying the lead are usually water bearing, and test holes show that a pressure of 20 lb. is obtained by boring up into this stratum and casing the hole. It is proposed to use 2-in. casing and connect the stream issuing therefrom to operate an ejector, the suction end of which would be placed in the water that accumulates at the face of the drift. This water would be driven up the drift to a sump at the shaft by the ejector. It is thought that such a method would not only effectually and cheaply drain the drift, but would also obviate a burst of water from the overlying water-bearing bed.

This method of draining is novel, insofar as it makes use of the water contained in the upper strata, but it is doubtful if there are many mines outside of the deep leads of Victoria where it could be applied. The ejector has been used in draining mines in the United States, but only with high heads and comparatively low lifts. When applied under such conditions the pressure water can lift up to 11 or 12 times its volume of mine water, depending, of course, upon the ratio of pressure to lift. What the result would be in attempting to use so low a pressure as 20 lb. can only be determined from experience, but it would seem that the proposed method would necessarily be of limited application.

Graphic Solution of Evaporating Problems

Mining, smelting, and refining companies that use driers will find useful the accompanying curves prepared by the engineering staff of the Ruggles-Coles Engineering Co., of 50 Church Street, New York. The use of the curves will be made clear by taking a specific example. Referring to diagram No. 2, assume that it is desired to know the pounds of water to be evaporated per ton of ore delivered by the driver in reducing its moisture from 23 to 3%. Follow the heavy diagonal corresponding to 23 at the right of the curve across until it intersects the ordinate of the point 3. Then follow the horizontal line to the left and the result indicated is 520 lbs., the amount of water to be evaporated per net ton of ore delivered by the driver. In using diagram No. I for determining at different percentages of moisture the pounds of water to be evaporated per net ton of material *fed* to drier, the same method is used. It is evident that there is a considerable time saved by the use of these diagrams.



The Engineering & Mining Journal

THE GRAPHIC SOLUTION OF EVAPORATING PROBLEMS

Firebrick at High Temperatures

It has been noticed that the volume of firebrick permanently increases after heating. According to J. M. Ogan[1] this is due to the formation of an impervious bleb structure in the glassy matrix formed by fusion.

The failure of firebrick at high temperature has also been investigated, by Bleininzer and Brown[2]. At a load of 50 lb. per sq.in., no firebrick can withstand a temperature of 1350° C., if the alkali equivalent be more than 0.225. Silica present in excess of Al_2O_3: $2\ SiO_2$ adds to the fluxing power of the alkali. Thus at 4.4 SiO_2: Al_2O_3, failure under the above conditions ensued at 0.17 R_2O. Experiments showed that most firebrick failed at about 125 lb. per sq.in., and that there is no relation between the crushing strength of a brick at ordinary temperatures and at 1300° Centigrade.

High Duty Gravity Stamps

Several months ago Peter Nissen read a paper before the Chemical, Metallurgical and Mining Society of South Africa, an abstract of which was published in the JOURNAL of Dec. 23, 1911, in which he gave the results of competitive trials between the Nissen single stamp and the modern Rand five-stamp batteries. Commenting upon this paper, H. Stadler, in the *South African Mining Journal* of Dec. 2, 1911, says in part:

> In an appreciation of the undoubted merits of the Nissen stamp it is to be regretted that it has not been given a more thorough test. The summary of the "exhaustive" tests carried out at the City Deep, Ltd., by the Central Mining & Investment Corporation, Ltd., consists of but a few picked tests made under working conditions, which vary just enough to bring confusion into the figures, but not enough to allow a correct conclusion to be drawn as to the effect of these variations. My method of computing crushing efficiency, as practised during the last three years in the experimental work carried out on behalf of the Mines Trials Committee, has been proved to give highly satisfactory and reliable results, and it is, therefore, gratifying to me to have it confirmed by H. S. Ball,[1] who tells us that after careful examination "it was unanimously decided that this method would be applied to all crushing tests of the McGill University." In order to make the data of the summary of Mr. Nissen's paper more legible, the gradings have been replaced (in the accompanying table) by the one representative figure of their mechanical value, and the three factors determining the energy invested in the stamps by the one value of foot-pounds per second.
>
> The mechanical values of the gradings are practically identical for both types of stamps and exactly correspond to those of the curve established for varying coarseness of battery mesh. This confirms the statement made in 1909[2] (referring to lighter stamps) that the gradings of screen pulps are not materially affected by varying working conditions of stamps, but are practically exclusively determined by the mesh aperture, and it shows that the principle also holds good for heavy stamps, at least within the range of the coarse meshes used in the tests. The horsepower consumption has been calculated from the value of the foot-pounds per second, with an allowance of 25% for loss in friction (in an old mill 30% is nearer the truth). By this method the power consumption works out lower, in all tests, for the ordinary stamps, while the table of the Central Mining & Investment Corporation, Ltd., with one exception, gives lower values for the Nissen stamp. Since the mechanical arrangements for lifting the stamps are practically the same in both types, the horsepower (as theoretically established) must be taken as giving more correct relative values than those obtainable by unreliable direct measurements. A possible error made by taking exactly the same height of drop for both cases would be in favor of the Nissen stamp, which, being heavier, might have its lift a little increased in consequence of a greater compression of the rock bed. Until we have been satisfied that all necessary precautions have been taken for exact tonnage measurements, the duties given in the table must be accepted with reserve. In truth they are in some cases not logically related to one another, nor to the conditions of the individual tests. The greatest drawbacks for such tonnage measurements are the continuous fluctuations in the proportion of "fines" contained in the feed.
>
> The greater efficiency of the Nissen stamp, or the relative loss of energy in the old stamps, may be explained as follows:

---

[1] Trans. American Ceramic Society, 1911, p. 602.

[2] Ibid, p. 210

[1] "The Economics of Tube Milling." Bull. Institution of Mining and Metallurgy, Aug. 30, 1911.

[2] Second report of the subcommittee. Mines Trials Committee.

(1) The roundish shape of the particles leaving a five-stamp battery proves that a certain amount of the reduction work is done by attrition and abrasion during the shifting and knocking about of the particles in the mortar box. In the one-unit Nissen stamp the particles are less subject to this action and less energy is lost by useless water churning.

(2) The radial arrangement of the screen allows an immediate rejection of the already finished product, leaving behind a clean material, which, since an ample percentage of its apparent volume is free interstices, is not subject to cushioning.

(3) The accumulated energy at the moment of the impact of a falling stamp is not only distributed over the surface area of the shoe, but it is also transmitted in depth. With a too thick or uneven rock bed, the amount of energy absorbed in packing the material, before crushing by compression can take place, may be so great that the crushing work done by direct impact becomes almost nil. The maintenance of an even surface of shoes and dies and the facility of weighting up the shoes as they wear are far-reaching advantages in the Nissen stamp, as they eliminate factors of inefficiency hitherto beyond our control.

(4) The blows of a one-unit Nissen stamp are bound to be harder and shorter, as the mass of the anvil formed by the thick and heavy bottom of the mortar box, placed in the center of the foundation, is certainly more solid and rigid than in the ordinary five-stamp mortar boxes, where rocking may take place. The vibrations due to the shocks being shorter, less energy is lost in shaking the building and surroundings.

COMPARISON OF SINGLE- AND FIVE-STAMP BATTERIES

	1 Tyler T.C. 9 mesh, 0.205 by 0.536 in.		2		5 9 mesh, 0.277 in. square		3 ⅜ in. sq. mesh, 0.375 in.		6	
	Nissen	City Deep	Nissen	City Deep	Nissen	City Deep	Nissen	City Deep	Nissen	City Deep
Foot-pound-seconds per stamp..........	23.49	21.99	23.43	21.94	24.23	20.95	28.11	22.54	24.21	20.92
Power, consumption per stamp,* hp..........	5.34	5.0	5.33	4.98	5.51	4.76	6.39	5.12	5.50	4.75
Duty per 24 hours per stamp, tons........	24.47	18.26	23.73	19.90	29.81	20.95	36.69	22.72	37.74	24.34
Duty (theoretical).....	(24.5)	(23.0)	(24.5)	(23.0)	(24.5)	(21.0)	..	(24.0)	(26.0)	(22.5)
Mechanical value of pulp, energy units...	17.25	17.44	17.31	17.52	16.97	16.88	16.88	16.57	16.28	16.31
Relative mechanical efficiency per hp.†...	79.0	63.69	90.0	70.0	91.8	74.3	108.4	73.5	111.7	83.6
Increase in efficiency...	24.4%		28.6%		23.5%		47.5%		33.6%	

$$* \frac{\text{Ft.-lb.-sec.} + 25\%}{550} = \text{hp.}$$

$$\dagger \text{Relative Mechanical Efficiency} = \frac{\text{Duty (Tons per 24 hr.)} \times \text{mechanical value}}{\text{hp.}}$$

The lower efficiency shown by the ordinary stamps is partly due to energy lost in deformation within the limits of elasticity, or permanent deformation before reaching the breaking point. To some extent, however, the loss of efficiency is only apparent, as the lower duty is to a certain extent balanced by a larger amount of crushing work performed in the very finest grades as a consequence of the attrition and abrasive action. By taking for the mechanical value of the —200 grade a standard value of 28 e.u. (energy units), the work done in producing ultra fine slime is not accounted for, but this is quite justified as, for Rand ore, grinding finer than to 200 mesh is mere waste of energy. From these premises we may make the deduction that the superiority of the Nissen stamp would be still more pronounced when crushing through finer mesh. The policy of ultra fine grinding by wholesale tube milling, just now in fashion in the metallurgical department controlling the "Rand Mines," has been, unfortunately, no inducement to them to extend their "exhaustive" tests in this direction, and the Nissen stamp has, therefore, not been given the chance of demonstrating its great possibilities as a fine grinder.

The departures are based on sound and theoretically correct principles, and the details of the mechanical arrangements are practical and handy. We have this confirmed by the best judges of new inventions in this connection—by the shiftmen, the men who have to work with it. The calculations of comparative working costs and capital expenditure may be open to criticism, but, compared with the other great advantages claimed and proved, the differences are too small to squabble about. Allowing for all uncertainties the Nissen stamp shows a decidedly higher efficiency than ordinary stamps.

The Heraeus Resistance Thermometer

By A. Schramm

The Heraeus thermometer is a new instrument for the measurement of temperatures, which is based on the increase in electric resistance of a metallic wire, as the metal is heated. In pure metals this increase is about 0.4% per deg. C., with alloys usually a little less. The "bulb" of the Heraeus thermometer consists of a thin quartz-glass tube, about which is wound a spiral of chemically pure platinum wire. This combination is covered with a thin layer of quartz glass, which protects the resistance coil against the influence of injurious gases and vapors, as well as against damage by breakage. Owing to the small coefficient of expansion of quartz glass the thermometer may be exposed to the greatest fluctuations of temperature.

An advantageous feature of the new thermometer is the standardizing of the resistance coil within 0.04%, so that in case of damage it may be replaced by another, without changing the measuring attachments. The standard instrument for industrial purposes has a resistance of 50 ohms, and is 6 cm. long and 3 to 4 mm. thick. The length of the leads is practically unlimited, and their material is either gold, silver or steel, as adapted to the application of the thermometer.

To make the Heraeus resistance thermometer more suitable for handling in factories, it is encased in protection tubes. These tubes may be either steel, lead, or, in the case of acid fumes, silica. The air space between the thermometer bulb and the protection tube is filled out with iron wire, laid around the bulb, thus giving a metal conductor from the protector to the resistance coil. The thermometers have a working range of about —200° C. to +900° C., and are permanent, owing to embedding the resistance coil in quartz.

The Physikalisch-Technische Reichanstalt, of Charlottenburg, Germany, is using these thermometers for calorimetric measurements. To obtain the correct average temperature throughout the entire length of the calorimeters, thermometers with a resistance coil 25 cm. long are used. For the determination of molecular weights, boiling and melting points, thermometers with a stem 2 cm. long are supplied. These thermometers, in connection with the potentiometer as temperature indicator, allow the measuring of 0.001° C., without any difficulty.

For factories, and in such cases where an accuracy of 0.1° C. is sufficient, the Wheatstone bridge is used, in connection with a Deprez-d'Arsonval galvanometer as indicator, but the arrangement used only requires two manipulations for checking the bridge, against three or more movements in older types. The small current consumption of this apparatus makes frequent controlling of the voltage unnecessary. As all the thermometers are calibrated within 0.04%, more than one thermometer can be connected with the same bridge arrangement.

The Heraeus resistance thermometer is used in Germany in chemical, mining, steel and iron industries; also in breweries, schools, hospitals or wherever temperature measurements of less than 900° C. have to be taken. In this country these instruments are distributed by the firm of Charles Engelhard, 30 Church St., New York.

Exhaust Steam Turbines

In a paper read by P. Barrett Coulston before the Manchester Geological and Mining Society on the use of exhaust steam, reference was made to a mine where noncondensing engines of 1200 hp. were installed. An exhaust-steam turbine, taking about 36,000 lb. of steam, with an electric generator and condensing plant, was then installed, with the following result:.

The exhaust steam from the engine which drives the turbine plant gives 1000 kw. or, say, 1500 i.hp.; the 36,000 lb. of steam which must still be generated now yield 2700 instead of the original 1200 i.hp.; and the additional power obtained from the electrical set is being used for different purposes throughout the mine.

Increased efficiency is the chief advantage of the exhaust-steam turbine, due to either excess power for the same quantity of coal expended, or the same power for less coal. There are three points worthy of noting: (1) The capital expended in the installation of the exhaust-steam turbine is low, being only that of the turbine set and its condenser. (2) The space is so small that the plant can almost invariably be installed in the existing engine room. (3) The pipe connections are very simple.

By the introduction of what is termed a "regenerative thermo-accumulator" it is a simple matter to supply steam to the turbine continuously, although the supply of steam from the engine to the accumulator is of an intermittent nature.

The type of accumulator most generally used is a large vessel or container filled with water or other material having heat-storing properties. The exhaust steam from the engine is led into this receptacle, and then supplied to the turbine. When the engine is running and supplying more steam than can be used by the turbine for the time being, the surplus is condensed in the accumulator at about atmospheric pressure, and the temperature and the pressure of the water rise gradually as more steam is condensed. When the engine stops, a drop in pressure at once occurs. As the steam is being constantly used by the turbine, recuperation takes place, and sufficient steam is supplied to the turbine to bridge the gap between the time of starting and stopping the engine.

When the stoppage of operations is of too long duration to be bridged by an accumulator of normal size, it is only necessary to fit a reducing valve, by which means live steam from the boilers can be automatically supplied to the turbine when the pressure in the accumulator falls below a predetermined figure.

Central Compressing Plants at Butte

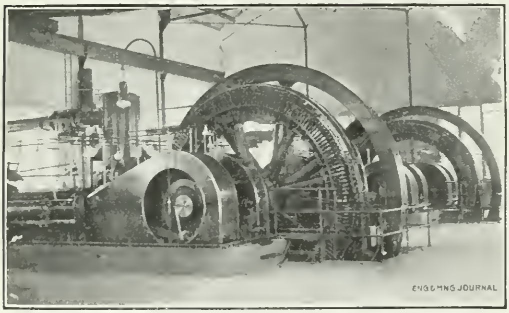
The Amalgamated Copper Co. has adopted the policy of building large electrically driven central compressor plants at its Butte mines. Instead of each mine running its own compressors, there are now four large compressor stations: The Neversweat, the Leonard, the Bell and the new Central plant adjacent to the substation of the Great Falls Power Company.

The plant of the Neversweat mine is the oldest. At this point are installed three 300-hp. and one 800-hp. induction motors driving air compressors. The Leonard, the next oldest, is equipped with two 550-hp. and two 660-hp. induction motors. The third plant, that at the Bell, has four 600-hp. motors. Rope drive is used in the three plants named.

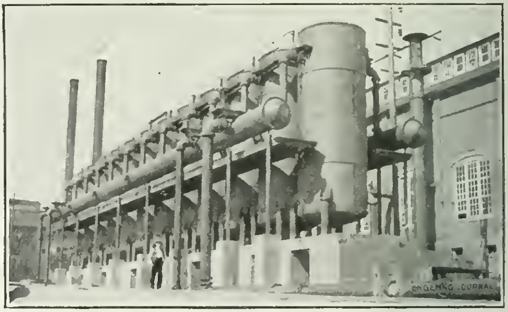
Synchronous Motors Used

For the last plant, known as the Central compressor plant, it was decided to increase the size of the unit over anything attempted previously, to use direct-connected drive, and to install synchronous motors. Accordingly, at this plant are installed three 1200-hp., three-phase, 2400-volt, 60-cycle engine-type synchronous motors built on the shafts of the air compressors. They have an overload capacity permitting continuous operation at 25% overload and 50% overload for one hour. Practically, therefore, they are 1500-hp. motors. On account of the slow speed required, due to their being direct connected to large compressors, they have 96 poles, giving a speed of 75 r.p.m. They were built by the Westinghouse Electric & Manufacturing Co. The dimensions are probably larger than any other synchronous motors ever built for this class of service. Two of these motors are shown in the accompanying engraving. A fourth 1200-hp. motor is ordered and two more of the same size are to be ordered at a later date, making the ultimate capacity of the plant 7200 horsepower.

The economies of electrification are apparent when it is considered that the cost of one horsepower per year generated in the Butte district by steam varies from $80 to $125, while for isolated electrical installations the cost per horsepower year was reduced to from $35 to $60. By centralizing the plants and using large direct-connected synchronous motors further economies were obtained so that in this new central compressor plant the cost will be in the neighborhood of $25 per horsepower year.



Two 1200-hp. Synchronous Motors Driving Compressors at Butte



The Air Tanks at the Central Compressor Plant, Butte, Mont.

The compressors were built by the Nordberg Manufacturing Co. They pump into a large receiver system, consisting of a number of steel tanks; some of these are shown in the accompanying cut. Constant pressure is maintained hydraulically, a huge water tank being situated on a hill some distance above the receivers. The various machines in which the air is used draw upon these receivers. By this arrangement the individual compressors operate continuously at full load and maximum efficiency, large variations in load being taken care of by starting or shutting down an entire compressor unit.

Compressors Started by Air

A novel method is used in starting the synchronous motors. The valve gear on the compressors is arranged with a link motion, somewhat similar in purpose to that used on a locomotive, but different in design. By means of this link motion, the valve motion may be reversed and by introducing compressed air from the receiver system, the compressor may be actuated as an air engine. In this way a compressor may start its synchronous motor and bring it up to the proper speed for synchronizing it with the power supply line. A refinement has been added to the switchboard equipment furnished at this plant, by means of which the motor may be automatically connected to the supply line when it reaches the proper speed, thus eliminating the necessity of synchronizing by hand. This refinement consists of an automatic synchronizer so arranged that, by means of solenoids, it operates the main switches between the bus bar and each motor. While this automatic feature is not always used it acts as an extra safeguard to render the station more reliable.

A still further safeguard is provided by having the motors designed so that they may be started by supplying current directly to the armature. The field is provided with a cage-type winding, which permits the motors to act as induction motors at starting. This method of starting is used only in case of emergency, when no other means of starting are available. The feature has, however, the great advantage that the plant can still be started from a complete standstill even if there is no air in the storage system.

A considerable quantity of the compressed air from this central compressor plant is used to operate the large hoisting engines at the various shafts in its immediate vicinity. The rest is used to operate the drills used underground.

Since the early part of 1910, when the first synchronous motor was put into operation, it is reported that not a single failure of any sort has occurred, and although the power supply during this time has often been unsteady, with large variations in both voltage and load, none of the motors have ever fallen out of step nor has there been any disposition on their part to "hunt." For this reason it has been recently decided to double the capacity of the original installation.

The electrical energy used is generated on the Missouri River by the Great Falls Power Co. and transmitted approximately 100 miles under a pressure of 110,000 volts to the point at which these motors are installed.

A recent patent for the production of aluminum without the use of a cryolite bath is as follows: Aluminum oxide is reduced with a proper amount of carbon to aluminum carbide (U. S. pat. No. 961,913). The aluminum carbide is then used as a reducing agent for aluminum oxide the electric furnace.

Transvaal Mining Notes

Johannesburg Correspondence

The new government mining regulations came into effect at the beginning of the year and they are now as complete and stringent as any in the world. The most important section of the new regulations is that referring to working hours. No person, white or colored, is to be employed underground for a longer period than eight hours. This regulation is interpreted by the mining companies to mean an eight-hour face-to-face shift. The miners are expected to make trouble to obtain an eight-hour bank-to-bank shift. The usual length of shift has been nine hours and had the regulation not included natives the change would not have been so important. As a compromise might have been affected by hoisting the miners at lunch time. The mines have given a month's notice of reduction of wages. The custom in the past was to pay 1½ shifts for Saturday's nine-hour shift. This is to be discontinued. This regulation, I think, threatens to cause trouble and to add to mining costs which are already rising. The white miners' work is mostly supervision and in tramming and shoveling more work can, I think, be obtained from a native in nine than in eight hours.

The labor outlook continues unsatisfactory as the Minister of lands intends to close certain agricultural districts to recruiting. The Rhodesian native labor bureau actively competes in Central Africa, while Nyassaland has been closed altogether to outside recruiting. Better success is attending the efforts made to reduce the terrible death rate of natives imported from tropical Africa. The Chamber of Mines invited Dr. Almroth Wright to visit Johannesburg and it is said that his efforts to procure a serum to inoculate against pneumonia are being successful.

East Rand Proprietary Controversy Continues

The controversy over the East Rand Proprietary fiasco between Doctor Caldecott and the manager Mr. Penlerick continues. Doctor Caldecott adheres to his statement that there was no real shortage and that tonnages were overestimated. Sir George Farrar failed to come to terms with the Corner House regarding the control of the mines and the conflict will be continued until the meeting at the end of February. The underlying cause of the fiasco was that the mine failed to produce the estimated tonnage of ore of a grade of 3 dwt. per ton, which it was reported as being in a position to produce. If it had done so, the directors and managers could have covered up their irregularities easily enough. I am waiting to see when the impatient shareholders will realize this elementary fact and ask pertinent questions.

One is now in a position to judge what the year 1911 has meant in the history of Rand mining. It seems that the best of the profitable ore on the Rand is exhausted and that the mining industry will have reached its maximum output in a few years and has already nearly reached the maximum of profit, if it has not already passed it. A few years will see many well-known outcrop producers exhausted, such as the Jubilee, Salisbury and the Champ d'Or which failed this year. The easily won ore left in the hanging and foot walls of old stopes has been heavily drawn upon during the last three years and the exhaustion of this ore of itself largely accounts for the rise in costs and decline in profits and dividends.

De Beers Company Wins Suit

The De Beers Consolidated Diamond Co. has won its action in the Privy Council against the Rhodesian Chartered Co., and can now lay claim to all diamonds discovered in Rhodesia. The fear of overproduction in the diamond industry has now pretty well been allayed and diamonds are rising in price. Owing to the failure in the grade of the ground and in the quality of the diamonds produced by the Premier Diamond Co., De Beers Consolidated has pretty well resumed control. The policy in the diamond field has been to reduce production to enhance value.

O'okiep Copper Mine Nearly Exhausted

The copper production of South Africa remains about the same. The famous mines of the Cape Copper Co. near O'okiep on the Atlantic Coast of Cape Colony near the Orange River are approaching exhaustion. The famous O'okiep mine which was one of the largest bonanzas of high-grade copper ore known, is soon to be abandoned. The company has another mine in the northern Transvaal which should at least take its place as a producer. This is the Messina mine, north of Pietersburg near the Limpopo River. Here copper glance exists in shear zones in granite. About 12,500 ft. of length of ancient workings show on the surface, about 2000 ft. has been partially explored to the eighth level and a continuous production has been kept up since 1903.

The distance of this mine from rail communication has hampered progress, but a railway is expected to reach the mines by the end of 1912. Coal suitable for reverberatory smelting has been discovered within 20 miles. Mine development has been most favorable. The main lode where cut at the 800-ft. level was 27 ft. wide and the ore assayed 17% copper; 1500 ft. has been driven on profitable ore on the fourth level and one stope 50 ft. long and 25 ft. wide averages 22% copper. The ore actually blocked out amounts to 102,000 tons assaying 10% copper and the probable ore above the 800-ft. level to 430,000 tons assaying 10% copper. The estimated profit will be £600,000 with copper at £55 per ton. There is a small concentrating plant at the mines and the picked ore and concentrate exported assay from 40 to 50% copper while there is an accumulation of some 13,000 tons of middlings assaying 12% copper.

The alluvial tin ore produced during 1911 in Swaziland amounted to 476 tons and was valued at £42,250. The gold production chiefly from the Piggs Peak mine was 13,534 oz. valued at £57,530.

Explosives for Coal Mining

The investigation of various explosives forms one of the matters engaging the attention of the Bureau of Mines at the present time. In explosives for use in open air, for example, in quarrying or railroad excavation, strength and efficiency are the qualities which are most important, and usually the only ones that need consideration Explosives used in tunneling must not only possess strength and efficiency, but must not give off large quantities of poisonous or offensive gases. In explosives intended for use in coal mines, in addition to these two properties, it is important that the explosives should be of such nature as not readily to ignite explosive mixtures of gas or coal dust.

Although it has been found that every known explosive if fired in a sufficiently large charge, will cause the ignition of an explosive gas mixture, the different explosives have been found to differ widely in regard to the amount which can be fired without causing such ignition. For example, ordinary black powder will cause the ignition of explosive gas charges readily, as little as 25 grams serving to bring about this result. Some of the permissible explosives under exactly similar conditions invariably fail to cause ignition of the explosive gas mixture even in quantities as great as 1000 grams.

Those explosives which satisfactorily pass such tests as show that they can be fired in considerable quantities in explosive gas mixtures without causing an ignition, and in addition possess such qualities of stability, etc., as to make them reasonably safe to handle and transport are termed "permissible explosives," and only such explosives are suitable for use in coal mines in which dangerous quantities of firedamp or inflammable coal dust are likely to be met. Although certain explosives may be branded permissible or nonpermissible by the U. S. Bureau of Mines, nevertheless, the government does not compel nor prevent the use of any explosive nor prescribe the conditions of use. It can only advise the public as to the character of the explosives and as to the manner in which they should be used. The authority controlling the use of the explosives lies with the legislatures of the several states and the regulations in different states have been far from uniform.

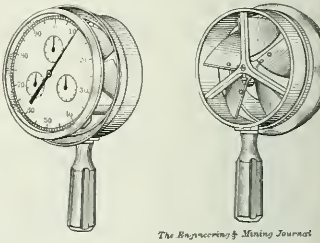
Since an inflammable gas mixture can be ignited either by a high temperature acting for a short interval, or by a lower temperature acting through a longer time, the problem of preparing a safe explosive is that of making a mixture which shall produce a low temperature of short duration and shall nevertheless produce a sufficient quantity of gas to perform by its expansion the work for which the explosive is intended.

In general, the manufacturers of explosives in the United States have coöperated promptly and cordially with the work of the Bureau of Mines, and by Jan. 1, 1910, there had been received at the Pittsburg testing station 51 applications for the testing of 134 explosives. During that year 64 of the explosives submitted were tested and 36 of these passed the test required to place them on the list of permissible explosives. The methods of testing are fully described in Bull. 15 of the U. S. Bureau of Mines.

The Davis Mine Anemometer

A new form of portable anemometer for use in mines has been recently introduced by the English firm of John Davis & Son, Ltd., of Derby. This is illustrated in the accompanying illustrations and is constructed on the principle of the revolving fan invented by Benjamin Biram. It offers several advantages over other forms which have preceded it. The air enters as usual from the back of the instrument, but instead of passing through the protecting ring in a straight line it is deflected outward by a cone through port holes. It would at first be thought that this deflection would introduce a certain amount of air friction, but as a matter of fact the effect of this upon the accurate registration of the instrument is practically *nil*, and it has the distinct advantage that this form of construction enables the instrument to be brought close to the body of the operator without making the readings inaccurate, provided of course, that the bulk of the operator himself does not present so much surface resistance to the draft in a narrow airway as to upset the normal conditions of draft in that portion of the workings.

Another advantage will be noted in the distinct dial face covering the whole circumference of the protecting ring. The instrument has four dials, the large one 13 in. in diameter, including three smaller. The central hand, reading on the largest dial, gives 100 ft. in one revolution, while the three smaller ones give respectively 1,000, 10,000 and 100,000 ft. A handle is provided which screws into the ring of the instrument, and through this handle a plunger passes so that the operator can hold the anemometer, and connect or disconnect the revolving fan from the train of wheels with one hand. The instrument is delicately poised and is strongly protected. From tests which have been taken at the National Physical Laboratory of Great Britain, it has been found that the curve showing the percentage to be added or deducted at various velocities is extremely level throughout the chart, from about 100 ft. to over 3,000 ft. per minute. The dials can be run to zero, and as the instrument records up to 100,000 ft., it can be run in the dark for any reasonable period and then brought into a good light to read. Its small size and portability is a great advantage. It only measures 1½ in. from back to front and its total weight is 12 oz. For purposes of checking mine ventilation, therefore, it is an instrument which deserves a considerable amount of attention.


The Engineering & Mining Journal

Davis Mine Anemometer

Density of Aluminum

Owing to the high purity of the present commercial aluminum, as compared with that on the market several years ago, when the density and co-efficient of linear expansion were determined for the metal, determinations were recently made by Dr. F. J. Brislee, who reported his results at the sixty-first general meeting of the Faraday Society. The metal used carried 99½% Al, and about ¼% each of Si and Fe. For cast metal the density was 2.708, and for hard-drawn rod, 2.705. Remelted aluminum had a density of 2.68, perhaps due to absorbed nitrogen, as suggested by Dr. R. Seligman. The co-efficient of linear expansion for hard-drawn aluminum is:

$$l_t = L\,(1 + 0.00002432\,t)\,;$$

for annealed aluminum:

$$L_t = L\,(1 + 0.00002454\,t).$$

The above figures for density are greatly in excess of those currently given, as is also Doctor Seligman's of 2.727 for the density of rolled aluminum sheets.

The California Gold Dredge—I

By Robert E. Cranston*

The mechanical features of the California-type dredge, which was evolved from the New Zealand and other types, are critically considered. In this article the design of buckets and tumblers is discussed; buckets are usually made with cast-steel base, pressed-steel hood and manganese-steel lip.

This paper deals only with that branch of gold dredging which comes directly within the province of mechanical engineering, and the designs described are those commonly used in California. No attempt is made to cover the whole field, and I have recorded only my personal observations of the more important mechanical features.

Factors Governing Dredge Design

In designing a gold dredge the first essentials to be determined are the quantity of material to be handled and the depth to which it will be necessary to dig. To a lesser degree, the size and quantity of boulders, quantity of clay, nature and contour of bed rock, contour of the surface, whether the dredge is to be operated in a river or in an inland pond, how high above the water line it will be necessary to maintain the bank, the nature and consistency of the gravel, distance from a railroad or other cheap transportation, costs of lumber, labor, electric power, supplies, etc., condition of wagon roads, distance and transportation facilities to a first-class machine shop, climate, distance to nearest public power line, and possibilities of developing electric power on or near the property, are important. If electric power is not available, then the costs of the various fuels for generating steam or running gas engines must be considered, and if the dredge is to be operated inland, how much water is available, and any other data peculiar to the property. All the above information is requisite for the proper design of a dredge to do the most efficient work.

Beginning with the capacity required, the dimensions of the bucket bases, pins, lips, etc., and the horsepower of the digging motor are determined. The depth of ground determines the length of ladder, which is modified by the height to which it is desired to elevate in order to wash and dispose of the gravel properly. The screen pumps and stacker are designed according to the quantity and quality of coarse material and the height to which it is to be stacked. The other machinery is designed to suit the local conditions, and the hull is planned to support the machinery properly, its dimensions varying greatly from the small capacity shallow diggers, to the 16-ft. dredges excavating 60 or 70 ft. below the water line.

The mechanical equipment of the California gold dredge as it is today has in it much to be desired in the way of correct dimensions and the relative strengths of its component parts. Many of these parts should be made stronger, likewise there is much waste material which could just as well be done away with. Notwithstanding these admitted faults the California gold dredge has during the last few years shown vast improvement over the earlier attempts, and with all its frailties has many good points in its make-up which might be profitably studied by engineers called upon to design similar pieces of machinery.

New Zealand Type Dredge

The first successful gold dredges in California were patterned after the New Zealand type. A brief description of one of these, built in 1897 and 1898, will not perhaps be out of place. The hull was built of wood of a rectangular cross-section, having an opening or well extending along the center line part way back from the bow. Near the after end of this well was built an elevated framed structure or main gantry which served to support one end of the digging ladder, the other end being suspended by wire-rope blocks from a head frame or "bow gantry" spanning the well. This ladder was a plate girder upon which were mounted rollers to carry the bucket line. The bucket line was composed of alternate links and buckets pinned together to form an endless chain. The buckets passed over a four-sided flanged tumbler keyed to a shaft and driven by a spur gear mounted on the main gantry. At the lower end of the ladder another tumbler served as an idler.

In going over the upper tumbler the buckets dumped into a hopper leading into an inclined revolving screen with ⅜-in. to ⅝-in. perforations. A spray pipe ran lengthways through the screen, throwing jets of water upon the gravel and washing the finer particles and gold through the screen holes upon gold-saving tables. These tables were covered with cocoanut matting held in place by expanded metal and were arranged so as first to distribute the fine material over a considerable area and then discharge it at the stern; the oversize went to a bucket elevator and was stacked some distance aft of the dredge. The dredge was held up to its work by a head line which could be reeled in by means of a drum on the dredge. Side movement was secured by lines, two at the bow and two at the stern, each running to a separate drum. The motive power for these dredges was steam, which was soon replaced by electricity.

Double-lift Dredge in Montana

Three years before this type of dredge was introduced in California, one of the type known as the double-lift was built near Bannock, Mont. The main gantry was much lower than in the New Zealand type. A revolving screen was used, but the holes were much larger, so that rocks 4 to 6 in. in diameter would pass through. The oversize was dumped at the side of the dredge, and the undersize allowed to collect in a sump from whence it was elevated by means of a centrifugal pump into a sluice running aft from near the throat of the well. At the stern was a pivot connection with another sluice mounted on an auxiliary scow. This scow could be moved from side to side, one end of its sluice being pivoted at the stern of the dredge and the other moving in the arc of a circle, thus distributing the gravel over a considerable area. Instead of a head line, spuds were used to hold the dredge up to its work, the end of the digging ladder moving in the arc of a circle with the spud as its center. About this time several dipper dredges were built, but although some were more or less successful they did not prove to be as efficient as the endless-chain type and were soon abandoned.

In 1899 a double-lift dredge was built at Oroville, and soon after a similar dredge was built on the American River, the latter, however, being of the single-lift type, using close-connected buckets with spuds, no stacker, but having its main gantry high, the buckets dumping into a revolving screen with large holes. This screen was raised high enough so that the finer material fell directly into a fore-and-aft sluice; the oversize dumped into stone chutes discharging on both sides of the dredge.

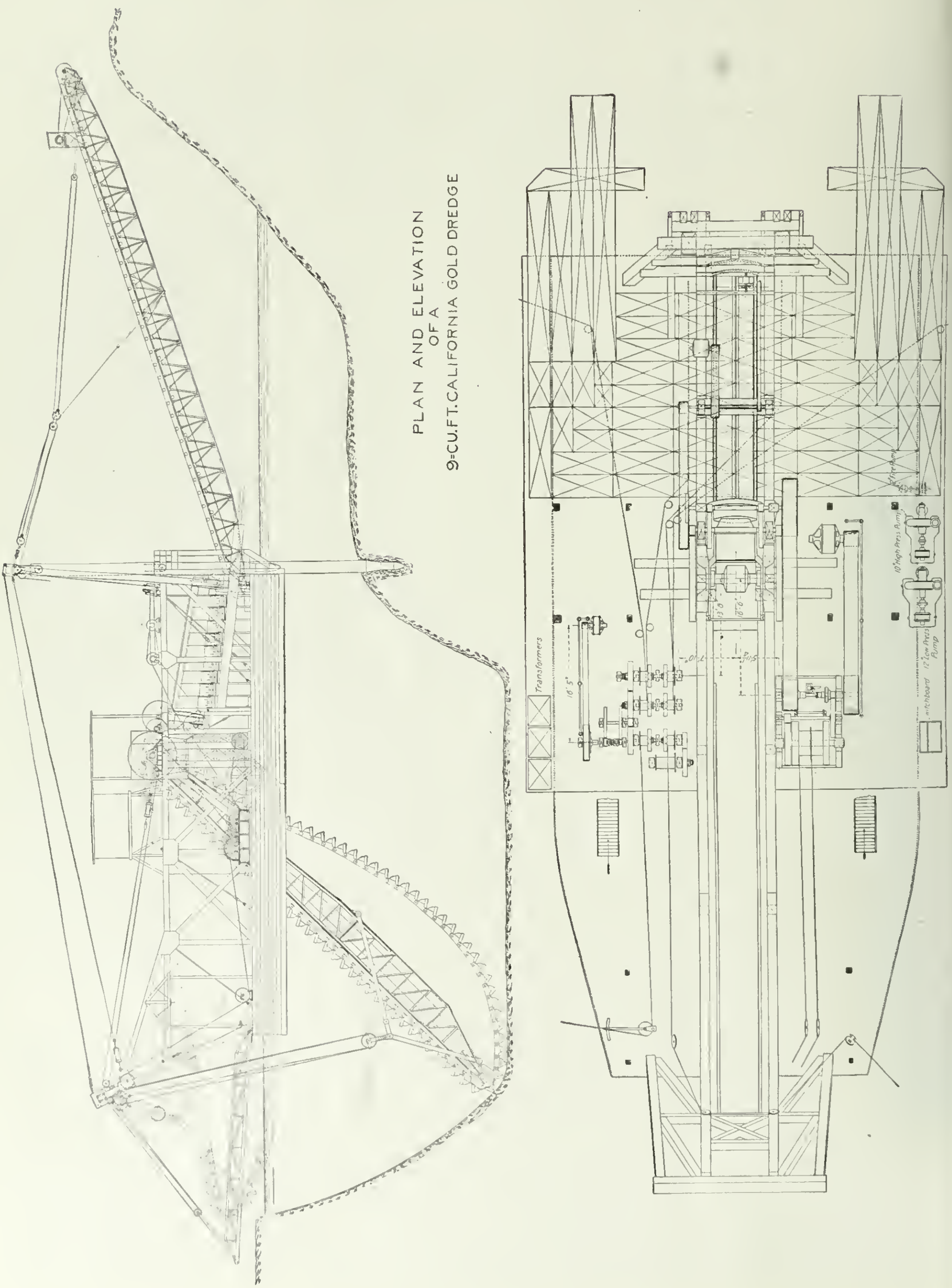
California Type Evolved

A judicious combination of the best features of the New Zealand and the double- and single-lift types described above, together with several new ideas not used in any of the earlier dredges, resulted in a dredge being built some time in 1901, near Oroville, Calif., equipped with a shaking instead of a revolving screen, the holes in which were small, the fine material going to gold-saving tables as in the New Zealand type, but with Hungarian riffles replacing the cocoanut matting and expanded metal. The oversize was stacked at the stern by means of

---

Note—An article entitled "The Design and Mechanical Features of the California Gold Dredge," published in Journ. A. S. M. E., February, 1912.

*Mining engineer, Sacramento, Calif.



PLAN AND ELEVATION OF A 9-CU. FT. CALIFORNIA GOLD DREDGE a belt conveyor instead of a bucket elevator. Spuds and close-connected buckets were used as in the single-lift type. This general arrangement became known as the California type, and with its later modifications is the one to receive the most attention in this paper, and unless otherwise stated the descriptions are for this type of dredge. A plan and elevation of this type are shown in the accompanying full-page illustration.

The original New Zealand type slightly modified is still sometimes used for the smaller, shallower and richer areas, where it is said to do good work. It is cheaper to build and under certain conditions may prove a better investment than the more expensive California type.

The earlier dredges used buckets holding 3 cu.ft., then the 5-ft. size became numerous, and later the 7-, 8- and 9-ft. sizes were much used. Many went back to the revolving screen, noticeably in localities where much clay existed. In 1905 a 13½-ft. dredge was built near Folsom, Calif., and since that time several with 13½-ft. buckets have been put in operation. Having gained a general idea of the development of this type of gold dredge, its different component parts will be taken up in detail.

Bucket Consists of Three Parts

The bucket proper is made up of base, hood and lip. The base is made of cast steel, many grades being used. It should be hard so as to stand wear, tough so as to stand the strain of digging, and should not be too expensive, since it has constantly to be replaced when worn or broken. All dredge costs are figured on a basis of cents per cubic yard of gravel handled, so that the first cost is not vital so long as it will handle the requisite number of cubic yards before giving out.

The most common form of base has one hub or back eye fitting between the two front eyes of the bucket behind it. Some use two back and three front eyes. The advantage of the three-eye bucket is that a smaller diameter pin may be used, there being four planes of shear instead of two; the disadvantage is that the cost of machining is greater and there seems to be a tendency to crack these buckets between the two back eyes, owing probably to a prying action under hard digging conditions, particularly after the pins are partly worn.

Besides the ordinary high-carbon open-hearth steel, chrome nickel and manganese steels are used. One essential is that the bucket casting should be thoroughly annealed before it is machined. It is my opinion that many breaks in bucket bases have been caused solely by improper annealing.

A template having long guiding bushed holes is useful in drilling for the hood so that the rivet holes will be accurately spaced both inside and out. This is essential in order that there may be no lost time in making replacements. In machining the base the holes in the eyes should be carefully bored so as to be exactly parallel with the hole in the hub. In order to do this the bucket may be fitted with its bushing, a shaft put through the hub, the bucket brought tightly against it, and then the eyes bored parallel to this shaft.

Hoods of Pressed or Cast Steel

The bucket hood is made either of pressed steel or cast steel. There are also buckets used which have the hood cast as an integral part of the base. The pressed-steel hoods are made in either one or three pieces. The thickness depends on the size of bucket and the nature of the digging, and varies from ¼ in. to ½ in. It is sometimes reinforced at the back where the greatest wear occurs. The cast-steel hoods are usually made about ¾ in. thick, have a stiffening rib running up the middle, and sometimes shoulders for the lip to rest on and a shoulder for the base to fit into.

The advantages of pressed- over cast-steel hoods are their cheapness, lightness, and ease of repair if bent or broken. A disadvantage is that the strength cannot always be put where wanted except at extra cost.

A standard drilled base may be used as a template for drilling the hood. I consider the one-piece preferable to the three-piece hood because (*a*) it will stay water-tight; and (*b*) there are fewer rivets to work loose and replace. The disadvantage is the difficulty of pressing a single piece into the proper shape, making the cost slightly greater than if three pieces were used.

Lips Generally of Manganese Steel

Bucket lips are now nearly all made of cast manganese steel. At one time I used an exceedingly hard high-carbon nickel-steel forging, its only advantage being that it could be shaped on the ground to fit several different hoods and bases which it was desired to use up. A record was kept of about 100 of these lips and it was found that for cost and life they were close to the manganese steel. For use in out-of-the-way places and in emergencies they do very well. Their greatest disadvantage is that they cannot be readily forged into the more intricate shapes now commonly used.

The lips in use vary considerably in design according to the nature of the ground and the fancy or judgment of the designer. In the first place, a lip must be made sturdy enough to perform its work without bending or breaking, even up to the time it is ready to be replaced. If it is bent or broken before this time, damage is done the hood, with the resultant extra cost of repairing the hood as well as replacing the lip. The thickness of the lip is determined by the above conditions, but its width is a matter of judgment, since if made too wide the capacity of the bucket is materially reduced by the time it is worn out; if too narrow, it must be replaced often and a large loss made in each replacement both in time and unusual metal.

Some engineers prefer a highly arched digging face, others a rather flat face with sharply rounded corners. Those favoring the arched face contend with good reason that it is a stronger shape, and those favoring the flat face and rounded corners think that this shape is a better digger. The shape of the digging edge is another matter in which designers differ; some make it perfectly straight, others prefer corner extensions at the points where the wear indicates most of the digging is done. I am in favor of the corner extensions, since I believe they dig better and the lip is more completely worn out when it is ready to be replaced.

The fewer rivets used the smaller will be the cost of reassembling, but care must be taken to have enough rivets to do the work without shearing or pulling out. On many of the lip designs a shoulder is cast so that the hood edge fits against it, thus taking much of the strain off the rivets.

Pins, Bushings and Insert Plates

There have been many attempts to improve the design of bucket pins, those ordinarily used being rather expensive to make. It is a round shaft with a flat lug or "L" at one end. The L fits into a slot machined in the bucket base and prevents the pin turning in the eyes. Dowel pins, keys, squared and slotted ends, tee shapes and many other devices have been tried, but so far as I am aware none of them has proved as satisfactory as the old L design.

The pins are made of various kinds of steel, the object being to use an exceedingly hard material which is also tough and not too expensive. A high-carbon steel, low in sulphur and phosphorus, forged, machined, and then oil tempered, is most common. Various forms of nickel, chrome and manganese steel are also used, but so far have not become general practice.

The bushings are made in pairs, half round, and fit a recess in the bucket hub, placed at such an angle that the wear will be evenly distributed. They should be a snug fit, but [illegible] in. to ½ in. short on the ends to allow for the flow of the metal. In using manganese steel this tendency to flow must always be taken into consideration and suitable provision made for it in the dimensions.

During the last few years manganese-steel insert plates have come into general use in order to protect the bottom of the bucket base near the hub, at which point excessive wear occurs on account of the slip on the upper tumbler. Often buckets are found to be worn out at this point but perfectly good everywhere else. The manganese plates are of such a shape that after they are put in place and the softer steel of the base peened over the edges they retain their position without other means of fastening.

Lower Tumbler

At the lower end of the digging ladder the buckets pass over a 6-sided flanged tumbler which revolves between forks attached to the digging ladder. It is cast of open-hearth steel. Wearing plates are used to protect the faces and the flanges. The detail of design varies on different dredges. Some use a tumbler having curved extensions at the corners of the flanges, others have the corners rounded but not extended, and still others use a circular flange. The extended corners require less metal, but are likely to be broken off, and the circular flange may interfere with the digging. The design in which a side view will show a hexagonal shape with rounded corners is strong and cannot well interfere with the digging. The height of flange is another point of difference and varies from 6 to 13 in. at the corners. It must be made high enough to keep the buckets from running off, but if too high may interfere with the digging. It is also expensive.

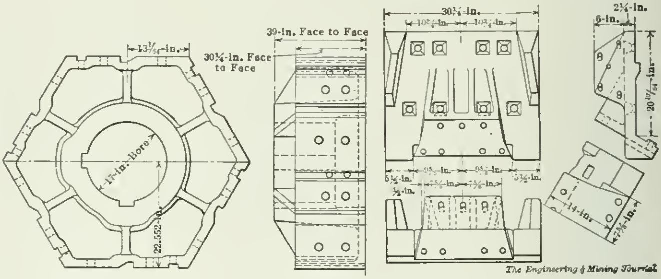
The slope or flare of the flange varies from zero to 1 in 10. It is claimed by some that if the sides are made too straight the buckets are likely to run off and if the flare is too great the eyes of the buckets will wear thin at the bottom. I do not know that any standard of flare has been adopted, but I am inclined to the belief that a straight or nearly straight flange is best, all things considered.

The flanges and tumbler faces are protected by wearing plates made of some hard steel, nickel, chrome and manganese all being used. So far as wearing qualities are concerned the manganese steel gives the best result, but this material is so hard that it cannot be machined and it is difficult to make the plates fit the tumbler accurately; also, since the rivet holes have to be cored they are likely to be a bad fit. Besides these disadvantages the manganese-steel plates are destructive to the bucket line and it is better to wear out tumbler plates than buckets. Several tumblers have recently been made with a manganese-steel disk set into a recess at each corner and held in place by peening over the edges in a manner similar to the bucket insert plates described above. This method is said to have given good results. Some use separate plates for protecting faces and flanges, while others have the wearing plates made so as to protect both faces and flanges. The advantage of the last method is that the plates are strong and not likely to break or work loose.

The lower tumbler shaft is usually made of nickel steel, either oil tempered, annealed, or both, and may be hollow bored or solid. It should be securely keyed to the tumbler, and I have found that four taper keys, two at each side, 90° or 120° apart, have given the best results. Provision should be made for driving the keys out from the inside and the tumbler should be either shrunk or pressed on.

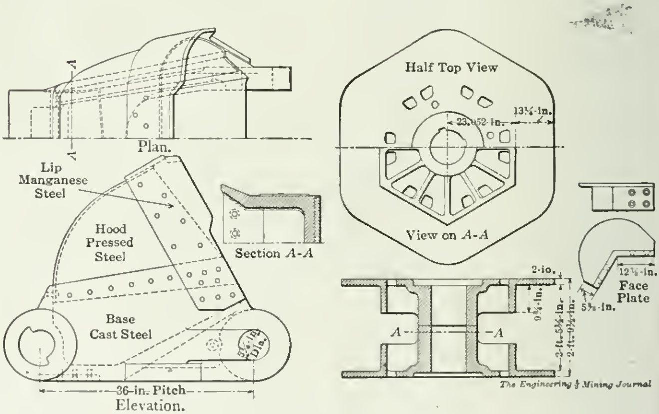
Cast-steel Ladder Rollers

The ladder rollers serve to support the buckets on their way from the lower to the upper tumbler. Cast iron was formerly used, but now cast steel, either high carbon, chrome or manganese, is most in favor. Very hard chilled white iron cast around a soft core has given good results; also manganese steel made in the same way has proved even more efficient so far as wear is concerned. My objection to the manganese roller is that after considerable use the soft core, if made thin, is likely to become loose, and if made thick the difference in expansion of the two metals will cause the outside shell to crack.



The Engineering & Mining Journal

Upper Tumbler and Cushion Plates of a California Dredge



The Engineering & Mining Journal

Bucket and Lower Tumbler of a 9-cu.ft. Dredge

A high-carbon or chrome-steel casting makes a good roller, and can be made just soft enough to machine; it will then wear well and need not have a soft-iron core. I have secured particularly good results with chrome-steel rollers made in this way.

There has always been trouble in keeping shafts tight in the rollers. I use two taper keys at each end, 90° apart, the same plan as for the lower-tumbler shaft. This method of fastening has proved perfectly satisfactory.

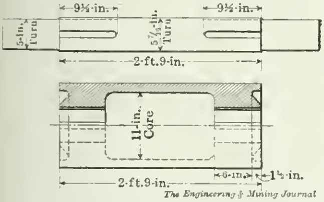
There have been many forms of upper tumbler tried, but now the common practice is to use a 6-sided plain casting, to which is bolted a set of heavy cushion plates with guides cast on the sides.

The cushion plates are made to lap over the corners and fit into transverse slots in the tumbler casting. This is done to prevent them from becoming loose, as was the case before this design was perfected. They are made of cast steel, either high carbon, chrome, nickel or manganese. The cushion plates are bolted to the main tumbler casting by means of large bolts 1½ or 2 in. in diameter with square countersunk heads on the outside.

Wearing plates are used on the cushion plates, both for the faces and the guide flanges on the sides. These plates may be made of any material desired, but the same objection to manganese exists on the upper as on the lower tumbler. I use plates forged from worn-out bucket pins and then give them an oil temper. These have given good results, but care should be taken not to temper them too hard, since they then become brittle and will give poor service. The wearing plates are riveted with countersunk rivets to the cushion plates. Riveting is better than bolting for this purpose.

Strong Upper Tumbler Shaft Needed

It is imperative that the upper-tumbler shaft should be of ample strength and be made of excellent material since it has to bear the brunt of the digging. A factor of safety of not less than 10 is recommended, and it would do no harm to have it even higher. It is customary to use a material of high tensile strength, since if made of low tensile strength material the shaft will have to be so large that it will interfere with the design of the upper tumbler which it carries. Nickel steel, hollow bored, oil tempered and annealed shafts are much used, having a tensile strength of 90,000 lb., elastic limit 60,000, elongation 22%, contraction 50 per cent.



Ladder Roller for 9-cu.ft. Dredge

Excellent results have also been obtained with Krupp crucible-steel shafts, hollow bored, oil tempered and annealed, having a tensile strength of 80,000 lb., elastic limit 43,000, elongation 22%, contraction 45%. Lately I have used a nickel-steel solid shaft which has been thoroughly annealed, but not oil tempered. This has given excellent results and is inexpensive. The physical properties are as follows: Tensile strength, 80,000; elastic limit, 50,000; elongation, 25%; contraction, 45%. A shaft of soft iron or steel, having a low tensile strength, but great toughness, such as Lloyds' test steel, would be the ideal shaft for this purpose were it not for the necessity of making them so large that there is no room left to fasten the cushion plates to the upper tumbler. By using a 7- or 8-sided tumbler this difficulty could be overcome.

(To be continued)

Review of Cobalt

Special Correspondence

Cobalt offers the distinction of being one of the richest and most interesting mining camps in the world today. Silver was first discovered in 1904, and the following year a few tons of rich ore were shipped. Year by year the output has grown until at present the few square miles that comprise the Cobalt mining area, hold third place in the silver producing communities of the world, being exceeded only by Mexico and the United States. In 1910 the production amounted roughly to 30,000,000 oz. of silver, and estimates for 1911, place the output at 32,000,000 ounces.

Veins Narrow and Shallow

The veins are generally narrow, averaging between 2 and 3 in. in width, and they do not extend to any great depth, the greatest part of the ore having been obtained above the 200-ft. level. The grade of the ore is such, however, that these small veins can be worked at a large profit. Production costs for the camp average about 15c. per oz., while the costs for one mine, extending over a period of a year, have been as low as 7c. per ounce. The ore is practically all found in the conglomerate; while some silver has been produced from the diabase and Keewatin formations, over 90% of the total output has come from the conglomerate. There has not been a single mine working solely in the diabase, which has been a commercial success.

When the ore was first discovered it was generally believed that the camp would have a short life. The high-grade portions of the veins were gouged out and but little attention was paid to economical mining methods. When it was seen, however, that the deposits were much more extensive than was at first believed, better methods came into vogue, and while Cobalt mining practice cannot be classed as economical, in general the methods followed are those best adapted to the development of the small but rich veins.

Mill Losses High

Concentration naturally followed and while first attempts were rather crude, a general system applicable to the district has been worked out, and there are now 13 concentrators in the camp, treating the low-grade ores and making excellent recoveries.

It is safe to say, however, that the losses in the majority of the mills are altogether too high. The latest development in the milling practice is the method worked out for the Nipissing ores by Charles Butters, by which, after the coarse ore has been removed by jigs, the rest is cyanided. The original process, consisting of amalgamation and cyaniding, was applied only to the high-grade ores, and it resulted in a material saving over custom treatment. Further work indicated that with some modifications the process could be applied to the low-grade ores, giving an extraction considerably better than was being obtained by the other mills of the district. The Nipissing company is now engaged in the construction of a mill of 200-tons, daily capacity, the practical working of which will be watched with great interest.

Record Production in 1911

While the shipments have been steadily increasing it is probable that the last year will show the record production and that while the output may remain at the same level for a year, there will then come a gradual but steady decrease. While this statement is open to criticism, it is believed that an analysis of the situation will bear out its truth. As stated before, the veins of the district are narrow, and in the majority of cases, have no great depth. With a heavy production these are soon exhausted, and shipments have been maintained by the discovery and working of other new orebodies. In 1909 and 1910 a great many new veins were found, but during 1911 practically no new discoveries of importance were made. The majority of the companies have pretty clearly defined the limits of the mineralized area, most of the available ground has been prospected, and a good idea obtained as to the ore reserves. While the production as a whole has been increasing, the output from many of the smaller companies has been showing a steady decrease, and this has been made up by the increased production of the larger companies. During the last two years, the latter have been increasing their output largely by more extensive development work and by enlarging their mills. It is probable, however, that they have now reached the ultimate productive capacity to which it would be economical to force them, and that while they will maintain a more or less steady output for some time to come, they will no longer be able to supply the deficiency created by the decreased production of the others.

This does not imply that the future life of the camp is short, for although the smaller companies will soon begin to drop out, the larger mines have a long life ahead of them yet, and the Cobalt district is bound to retain its place as an important silver-producing community for many years.

Ferrochrome, ferrosilicon, ferrophosphorus and some other similar alloys are made in Canada in the electric furnace at Sault Ste. Marie and Welland, in Ontario, and at Buckingham, in Quebec. The quantity is not large, the total make last year not exceeding 5000 tons.

Secondary Sulphide Enrichment

By Horace V. Winchell*

Secondary sulphide enrichment the work of surface waters. An "iron hat" containing no sulphides, its invariable concomitant when the enriched veins are profitably large. Instances of secondary enrichment at the surface. Wide field for future study.

Sulphide minerals are found in nearly all veins and ore deposits and are evidently formed by various agencies. Thus, pyrite and chalcopyrite are known to be constituent minerals of deep-seated as well as extrusive eruptive rocks. They are also frequently found under conditions which admit of no other explanation than that of deposition from aqueous solution; in fact, they may be so produced in the laboratory.

Until within about 15 years, geologists never realized that sulphide minerals could be deposited in veins through the agency of surface waters. The fact that these minerals are seldom found in the zone of weathering, and that they are readily destroyed by oxidation within that zone, made it appear that the solutions or vapors or other agencies which deposited them, must in all cases have been derived from some subterranean source.

The Iron Hat Supposed to Mark the Rich Vein

For hundreds of years miners and prospectors have discovered that those veins whose upper portion is decidedly iron stained and weathered are apt to be rich below this zone of weathering. The name given to this zone by the Germans is "iron hat" and the statement is proverbial,—"No vein so good as that which wears an iron hat." Here we have the early recognition and expression of a most important fact, a fact whose explanation has only of late years been determined. Of course, the opposite of this proposition is not always true, nor has it always been kept in mind. Those veins which have no hat at all may be rich, but if they are their wealth must be chiefly due to the character of their primary mineralization.

Secondary Enrichment Defined

By the term secondary enrichment is specifically meant that enrichment which is due to the action of surface waters in taking into solution the sulphate minerals produced from the sulphides by oxidation, carrying these minerals downward into the vein and redepositing them there. Such sulphide enrichment seldom produces ore deposits at great depth below unoxidized and unenriched primary material. There may be more than one period of primary mineralization. The same minerals may in some instances be deposited at great depth through the operation of ascending waters, enriching and enlarging other deposits already formed, but such deposition is by no means as common nor its products so important as that which is accomplished through the work of meteoric or surface waters.

Since ore deposits have been formed at various periods of geologic history and in rocks of all ages, it must be apparent that secondary enrichment has been going on to a greater or less extent through the operation of the agencies of weathering in every deposit of sulphide ores exposed upon the surface of the earth since the time of its formation from the Archean era to the present time. That there were periods of excessive and unusual primary mineralization is unquestioned, and that much of this mineralization has been deposited in comparatively recent geologic time is also admitted. But, in addition to the process of oxidation and of redeposition, there has taken place erosion or wearing down of the surface rocks and minerals; and the extent to which the oxidized products have been preserved within the limits of the vein depends to a considerable degree upon the relative rates of oxidation and erosion.

Copper and silver are the two metals peculiarly susceptible of concentration by secondary sulphide enrichment. Other metals are likewise concentrated through the same general process, and a most important and valuable investigation into the subject of the secondary enrichment of gold ores through the agency of manganese was published about a year ago by Prof. W. H. Emmons. This little monograph already ranks as a classic and is one of the principal guide posts on the road to the why of gold ores. Without going into the chemical reactions involved in this alteration of ores through processes of sub-aërial decay and their downward migration, I wish, for a few moments, to call attention to some of the conditions necessary for such an operation.

Circulating Water the First Requisite

In the first place, it is obvious that as a prerequisite for such enrichment ores must either outcrop at the surface or must be within the zone of circulation of oxygen-bearing waters.

In the second place, as already suggested, the work of these waters must be chemical rather than mechanical. The outcrop of a vein beneath the bed of a rapid stream could hardly be expected to oxidize more rapidly than erosion proceeds, and whatever sulphates are formed under these conditions will be, for the greater part, carried away along with the waters of the stream rather than directly downward into the vein. Conditions of alternating moisture and dryness are, in general, more favorable for rapid oxidation than a condition of permanent saturation. Of course, the amount of oxidation that will take place in a perfectly dry spot is imperceptible. The temperature of the solutions passing over vein minerals has much to do with the rapidity of chemical change. A difference of a few degrees seems to retard oxidation to a marked extent.

Vein Structure Influences Oxidation

The structure of the vein filling, the existence or absence of cavities and of channels through which surface waters may find their way, also govern to a large extent the progress of oxidation and chemical change. Thus, for example, disseminated pyrite, in the gouge of a fault, may be protected from oxidation, although the apparently solid quartz containing sulphide minerals in the vein along side of this gouge may be oxidized to great depth. The character and nature of the combination of the sulphide minerals themselves has a great deal to do with the extent to which chemical change takes place within a given time. Thus, the ordinary sulphide of iron is less susceptible to oxidation than pyrite containing a small admixture of chalcopyrite or other copper sulphides. Where the sulphide minerals are associated with feldspathic minerals, which have been more or less crushed by earth movements in the vicinity of or within a vein, as in Butte, the readiness of these feldspathic minerals to become hydrated seems to facilitate the oxidation of the associated sulphides.

This point is well illustrated by contrasting conditions as observed at Butte with those seen in Sweden and Alaska. In Butte, pyritic material consisting of a mixture of ore and crushed granite, composes many mine dumps. Oxidation proceeds so rapidly even in cold weather that the surface of these dumps is more or less encrusted with the light green and blue sulphates of iron and copper and there is actually enough heat developed by the process of oxidation to melt the snow much more rapidly, especially upon southern exposures, than melts the snow which covers the completely oxidized country rock immediately adjacent and likewise facing south. The tailings from the concentrates of Butte and Anaconda are, of course, finely divided, and therefore present a maximum surface to the action of the weather, and they are so rapidly oxidizing that a profitable business is conducted in pumping the water from central wells, sunk in these tailing piles, and precipitating therefrom the content of copper.

---

*Mining geologist, 505 Palace Building, Minneapolis, Minn.

UNOXIDIZED OUTCROPS IN NORTHERN COUNTRIES

In Alaska, on the other hand, and in Sweden, sulphide ores outcrop almost immediately upon the surface. They have been exposed to the chemical action of the surface waters for hundreds and thousands of years, and yet, in some cases, oxidation has effected almost no visible decomposition. At the Falun mine in Sweden the outcropping massive pyrite, inclosed in crystalline limestone, still bears the marks of glacial striation. It is known from the studies of the Swedish glacial geologists that those glacial markings were carved into the ore more than 3000 years ago. In some places moist glacial till has covered the scarred surface until within a year or two, and yet the pyrite is as fresh to-day as the day the ice retreated, and the adjacent marble is not visibly discolored. To how great an extent this resistance to oxidizing influences has depended upon the composition of the sulphide mineral and its density and how far it has resulted from the low isothermal of a northern latitude, it is impossible to state without careful analysis and examination of the pyritic ore to determine its copper content and its physical structure.

AN INSTANCE OF ALASKAN SECONDARY ENRICHMENT

That oxidation has occurred in Alaska in ages past, there can be no doubt, but its products have been almost entirely removed by glacial erosion and by the rapid wearing down from excessive rains and torrential streams; and still, even in this northern country, I have observed two remarkable examples of secondary sulphide enrichment which are worthy of brief description.

In the Copper River country, copper minerals are particularly abundant in the vicinity of an eruptive rock called the Nicolai greenstone and along its contact with the Chitistone limestone. The copper is native and in various sulphide combinations. Pyrite is fairly abundant and there is occasionally a little blende and galena. The valleys are filled in their higher portions with glaciers, and the water emanating from these glaciers is almost ice cold. The gradients of the rivers and creeks are steep and the current rapid. The creek beds are filled with boulders, which are constantly making their way down stream, frequently with a rumble and a clicking, perfectly audible above the noise of the dashing waters. Just above the bedrock, which is seldom at any great depth, the heavier substances accumulate. Here we find boulders and pebbles of native copper, grains and pebbles of unoxidized sulphide minerals, rounded pieces of heavy spar, and grains and nuggets of gold. There is, of course, some organic matter in these waters, but, as a rule, the water is extremely cold and fresh, and save for the abundance of milky sediment, decidedly palatable.

In prospecting for gold the miners dug numerous test pits and trenches through the gravel in the beds of some of these streams to the underlying rock and in washing the gravel, many copper nuggets remained in the sluice boxes. The larger nuggets are usually coated with green copper carbonate. Inclosed within this green carbonate coating may frequently be seen minute scales of native silver and sometimes flakes of gold. There is nothing remarkable about this, but some of the smaller copper nuggets were found to be completely inclosed within a matrix of secondary copper sulphides consisting of chalcocite and bornite and frequently containing also pebbles of pyrite and nuggets of gold. Many such small copper nuggets were collected.

Here appears to be an instance of secondary sulphide enrichment in cold waters in recent times in the presence of an excess of oxygen and outside of any vein or ore deposit in place. The explanation of the formation of copper glance under these conditions is difficult. It may possibly have been formed through the oxidation of pyrite, the formation of sulphuric and sulphurous acids, the former of which immediately dissolved some of the metallic copper from adjacent nuggets, and the latter of which reduced the cupric sulphate to cuprous sulphate, which was in turn transformed into cuprous sulphide and deposited as copper glance upon the very nugget of copper from which the copper was taken by the sulphuric acid. This occurrence alone is a complete demonstration of the possibility of the formation of sulphide minerals upon the surface of the earth at ordinary temperature and pressure, and nothing more would be needed to refute the statements so common 20 or 25 years ago that sulphide minerals can be formed only through the agency of hot, ascending solutions.

INSTANCES OF ABOVE-GROUND SULPHIDE FORMATION

Other instances of the formation of secondary sulphides under atmospheric conditions can be seen in many places along the Pacific coast of Washington, British Columbia and Alaska. The rocks here are prevailingly crystalline and frequently carry a considerable amount of visible sulphide mineralization. The minerals are pyrrhotite, pyrite, and chalcopyrite. The hillsides are covered with a heavy growth of evergreen forest and the snow lies upon the ground for more than half of the year. During the other months the ground is full of water flowing down through the roots of the trees and over the surface of the glaciated rock beneath the soil.

Where the sulphide minerals are particularly abundant I have seen a superficial plating of ore entirely covering the underlying rock to the depth of from an inch to five inches. In such places the casual observer would conclude that the entire mountain is composed of massive sulphide ore. A sample broken from immediately upon the surface will assay perhaps 7% copper and $1.50 per ton in gold and silver. Careful examination of the material broken from projecting knobs and points will show a layering or banding, and careful sampling discloses a rapid diminution in copper percentage away from the immediate surface. At the depth of six inches the sulphide substance is more or less mingled with rock and the copper content is only about 0.5%. At greater depths the entire blanket rapidly changes into solid rock, carrying no appreciable copper or precious metals. In such localities as this there may be in sheltered depressions some limonite and some copper and iron sulphates showing surface weathering. Usually there is no considerable quantity of these materials and the surface of the rock is dark, bronzy black. Here we have a different problem presented. Why was chalcopyrite formed instead of chalcocite? What are the conditions under which, in a northern clime, immersed in snow water and covered only by soil and the roots of trees, such a blanket could have been formed since the departure of the glacial ice mantle? In more southern countries such a thing would be impossible, except at great elevation, and even there it has never been reported.

These are only curious examples of secondary sulphide enrichment and their only significance and commercial importance is to serve as a warning to the prospector rather than an encouragement. Generally speaking, secondary enrichment is not as abundant and does not extend to such great depth in northern, cold, semi-arctic regions as in the semi-arid districts two thousand miles farther south.

Most Big Copper Camps Due to Secondary Enrichment

The importance of a thorough understanding of secondary sulphide enrichment in connection with the examination and appraisal of copper mines can hardly be overestimated. With the possible exception of Butte, most of the large copper camps of the country owe their importance to secondary enrichment. Without it there would be no Bisbee, no Utah Copper, no Nevada Consolidated, no Ray Consolidated, no Chino, and possibly even Butte would remain to-day still undiscovered.

It was at Butte that the first laboratory experiments were made, demonstrating the possibility of the formation of chalcocite from sulphate solutions, and there can be no doubt that a portion of the rich ore mined in the upper levels of that camp has been produced in that way, through the action of descending meteoric waters. There can be no doubt, upon the other hand, that there is in Butte a large amount of primary chalcocite, and it is a matter of exceeding difficulty to determine what portion of this pure copper mineral is primary and what portion secondary.

Enargite, chalcopyrite and covellite also occur in the veins at Butte, and in many cases are clearly secondary. Indeed, the geologic history of the Butte camp is so complex and there has been such repeated working over of the primary vein material and such transportation and transmigration from one part of a vein to another, that it has thus far been impossible to unravel the threads of its history and to say precisely what was the nature of the genesis of its ores.

Secondary Enrichment Can Occur Only Under an Iron-Oxide Hat

The mining geologist should always bear in mind the fact that secondary sulphide enrichment can occur only where there is for a long period of time an overlying, protecting gossan, or zone of oxidized material, and this "iron hat" is not composed of sulphide materials, either primary or secondary. I was much surprised during the trial of a case recently to have the professor of mining engineering in a state university testify that the general prevalence of an iron hat in the Mount St. Helen's district in Washington was in itself sufficient indication of the existence of enriched ore deposits below. When asked what minerals he observed composing this iron hat, he blandly replied: "Pyrite, chalcopyrite and some other sulphide minerals, together with a certain amount of magnetite and specular hematite." And upon examination of the history of this district, I was amazed to find that about 11,000 ft. of tunnels have been driven by mining companies and individuals in the vain hope of discovering mines underneath this kind of iron hat.

It should also be borne in mind that where the country rock adjacent to the veins is comparatively fresh and shows but little evidence of weathering, there is not likely to be great depth to the secondarily enriched zone in the veins, even though they appear to have an excellent gossan.

Change of Ground Water Level Most Important

One of the most difficult questions, and yet one of considerable practical as well as scientific importance in connection with the study of mining districts, is the question of the alternate rising and lowering of the ground water level. It is a fact well known to miners that in the same district two shafts, a thousand or 1500 ft. deep, one may be dry and the other wet. It is also easy to discover in some mines in desert countries evidences of a former water level hundreds of feet higher than that which prevails to-day. Under these conditions it is readily seen that surface waters may have been able to penetrate to greater depths during some periods than at others, and there may be in some cases a masking or disguising of the evidences of secondary enrichment, or even a double series of such deposits within the same vein.

The latter phenomenon is a possibility in another way, through the agency of faults, which may bring oxidizing solutions directly from the surface down to the lower part of a vein and there produce ore chutes of secondary enrichment which would have been impossible if the surface waters had been compelled to travel for the entire distance along and through the vein minerals.

This theory of secondary enrichment is so attractive and explains so readily many phenomena connected with the universal impoverishment of sulphide ores with depth that it has been eagerly adopted. The Germans, to be sure, hardly seem to realize its true significance, and in their later treatises upon ore deposits give scanty space to a description of this class of deposits, but under the heading of secondary enrichment discuss chiefly secondary oxides and carbonates and chlorides; but the geologist should be upon his guard lest he be tempted to see in a given district indications of important secondary deposition which the facts, rightly interpreted, do not afford. In this connection, I am reminded of recent descriptions of the sandstone copper deposits of Katanga in Africa. These descriptions are written by a German geologist and published in the *Zeitschrift für praktische Geologie.* Although few traces of sulphide minerals have yet been encountered, and although no one else has ever thought of such a thing, this writer states without hesitation that these enormous deposits, a large part of which are admittedly within a sandstone, are the oxidized upper portions of enormous bodies of sulphide ore below, and gives it as his opinion that there will be found bonanzas of copper glance and bornite below the zone of oxidation.

Every geologist should be equipped with an active imagination, but, unless supported by facts, it should not play too large a part in the enunciation of his conclusions.

The Value of The Mine Geologist

The practical value of geological work in the elucidation of the structure of ore deposits is rapidly becoming better appreciated by those engaged in the operation of mines. Only a few years ago the average mine superintendent was extremely skeptical as to the desirability and usefulness of a mining geologist. Knowing nothing of the subject himself, and perhaps for that reason prejudiced against those possessed of technical knowledge, the manager of a mine could soldom be brought to an appreciation of the possibility of deriving real benefit from the detailed mapping of his underground workings. In fact, the opportunity for the geologist to demonstrate the value of his services arose in many districts only after the mines had become nearly exhausted or the grade of the ore had declined almost to the limit of profitable exploitation or until the veins were faulted and lost or until vexatious and expensive mining litigation arose concerning the ownership of extremely valuable deposits of minerals. Once given the opportunity, however, the economic geologist quickly justified his title and profession. The decisions and definitions of the highest courts in the land are based upon the testimony given in hotly contested lawsuits by geologists. Untold millions of wealth have been saved or discovered through the careful, plodding investigations of the mining geologist. Indeed, the life of some of our most important camps has been indefinitely prolonged by the intelligent working out of the problems connected with the origin, structure and location of the ore bodies; and today almost every large mining company not only recognizes the importance and value of such work, but includes upon its staff the services of either a regular or a consulting mining geologist.

UNDETERMINED PROBLEMS OF SECONDARY ENRICHMENT

The most important field of investigation for the economic geologist in the future is that connected with the interpretation of oxidation phenomena and the extent of secondary enrichment. There must be some method of determining from the character of the minerals in the upper zone of a vein or ore deposit and from the study of the associated rock formations whether or not important deposits of ore may be confidently expected below the zone of weathering. It must be possible to distinguish between the chalcocite, bornite, galena, and various other sulphide and arsenide minerals deposited by ascending waters and the same minerals deposited by descending solutions.

Many ore deposits remain today unsuspected and undiscovered simply because there are no surface indications of their existence, intelligible in the light of our present knowledge. Superficial oxidation of the outcrop of a great copper mine may, for example, be carried on in a district where there is no limestone and where the various elements of the minerals which compose the ore bear such a relation to the oxidizing agents that every trace of copper is carried away and there is no discoloration nor any deposition of the oxidized copper minerals remaining, to attract the eye of the prospector and stimulate the efforts of the miner. This was almost literally true of the Butte copper mines, which are known to be the most important that have been discovered. There is scarcely a trace of copper mineralization in the outcrop, nor within the upper hundred feet of the most important copper veins in that camp. If it had not been for the fortuitous association of a later series of silver veins of different structure and composition, whose outcrops furnished placer material and whose secondary ore was deposited near the surface in the form of mixed chlorides, arsenides, sulphides and antimonides, it is entirely probable that the great masses of copper glance which have contributed about two million tons of pure copper for the world's consumption would not yet have been discovered.

How many more such deposits may still lie ready to reward the efforts of the intelligent prospector or the investigations of the uptodate mining geologist, there is no possible method of telling, but it is certainly stimulating to the imagination and suggestive of the importance of the most careful study in the field of the why of secondary enrichment.

ALL BONANZAS NOT YET DISCOVERED

There has been a tendency within the last two or three years upon the part of some of our prominent and most successful mining engineers to discourage the expectation of the discovery of more large mines in this country. Just because those deposits whose existence was obvious to the most casual observer, those mines which flaunted the gaudiest colors and the most imposing outcrops in the face of every passer-by have been, for the greater part, developed and turned into famous producers, there is no reason to give up all hope of the discovery of the more modest-hued and retiring centers of mineralization, whose value may be as great or even greater than that of the more brazen and ostentatious creatures.

I am a thorough believer in the future of this country and in the possibilities for almost unlimited development in the West, and I would hold out every encouragement to the student of mining and geology, particularly in the investigation of the as yet but partially revealed secrets of secondary sulphide enrichment, for, in the language of Job, the oldest authority on prospecting: "Surely there is a vein for the silver, and a place for gold where they fine it."

Cost of Power Installations

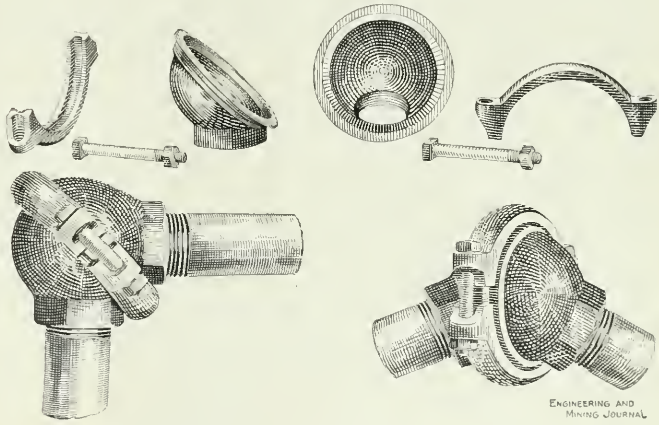
The cost of power installations using a steam prime mover and electric generators is discussed in the *Journal* of the Association of Engineering Societies, Jan., 1912. The figures given for a station of this type having steam turbines, with coal costing $4.25 per ton are as follows:

Size plant, kw.	Cost per kw. of capacity	Power cost per kw.-hr.
1000	$125	1.25c.
2000	110	1.08c.
3000	100	1.00c.
4000	95	0.96c.
5000	90	0.94c.

An Adjustable Elbow Union

The adjustable elbow union shown in the accompanying illustration is a new pipe fitting that is being manufactured by the E. W. & L. K. Peck Co., of Grand Rapids, Mich. The structural details of the fitting are clearly shown in the illustration. The device consists of two hemispheres with tapered flanged edges. A two-piece band that can be drawn together by two bolts and the inner face of which is recessed to receive the flanges, encircles the flanges and binds them together, no gasket being necessary to make a tight joint. The two bolts may be tightened so as to draw the recess of the band down tightly over the flanges, their trapezoidal section or taper bringing the flanges tight together as the band is drawn down.

The median line through the pipe connection makes an angle of 135° to the line normal to the plane of the flange. The two hemispheres are free to revolve in the plane of the flanges so that the piping can be put together at any desired angle by revolving one hemisphere to the desired position before drawing the fitting tightly together with the band bolts.



AN ADJUSTABLE COMBINATION ELBOW AND UNION

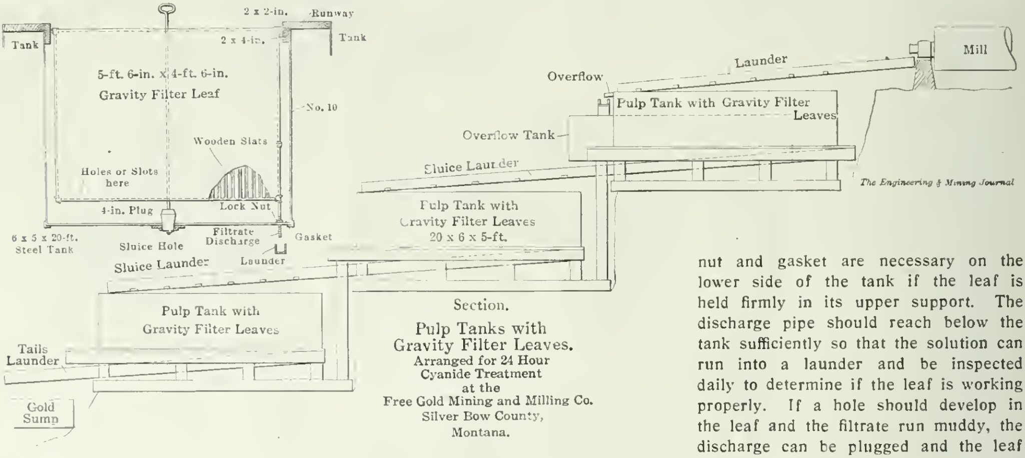
The fitting takes the place of an elbow or bend, a nipple and a union. It has a further advantage in that removal of the band permits drawing the pipes apart at the turn so that there is a free straightaway passage down the pipes in either direction, making it an easy matter to run a rod through either of the pipe legs to remove any obstructions that may exist in them. This feature would appear to make the fitting of particular utility in mills or cyanide plants in such pipe lines as are used for conveying pulp and tailings, thus taking the place of the cross and two plugs, sometimes used instead of an elbow.

A Gravity Filter Plant

By C. J. Stone*

Filter leaves of the Butters type are suspended in slime tanks, the solution passing into the leaves and out through the frames without the aid of vacuum or pressure pumps. A small plant of this type is in operation in Montana at an isolated mine producing low-grade free-gold ore.

The problem of a suitable milling equipment for a gold property under consideration by an engineer, is always a serious one, and one that is beset by many chances for error. Although the fundamental principles of cyaniding are sufficiently understood, the best mechanical method of treating the ore to obtain the maximum extraction with the least cost of equipment and operation is the main problem. For the engineer to develop and recommend an original equipment for each property that might come under his immediate supervision, is out of the question. Manufacturer's literature is full of schemes and methods for handling cyaniding ores and many equipments in detail have come under his own observation. The simplest equipment with the least expenditure possible, which promises results and low operating and maintenance costs should always be advised.



Section.

Pulp Tanks with Gravity Filter Leaves. Arranged for 24 Hour Cyanide Treatment at the Free Gold Mining and Milling Co. Silver Bow County, Montana.

Used at a Montana Mine

On this point, the use of the gravity filter leaf has much to recommend itself to engineers, when better understood. Their use seems especially well adapted to small low-grade free-gold properties, and properties at considerable distance from transportation. The Free Gold Mining & Milling Co., operating in Silver Bow County, Mont., has developed the use of this leaf satisfactorily, and a description of its use and results obtained may be of interest.

The term "gravity filter leaf" is used because the solution filters through it by gravity only, in place of being drawn through or into the leaf by vacuum pumps, or being forced through by pressure pumps, as is the general practice. The filter leaf consists of a rectangular frame of half-inch standard black pipe with the perforations or slots for the filtrate to pass from the filter in the bottom pipe only. The filling consists of slats or strips of wood placed vertically. No cocoa matting is necessary. The frame is placed in a canvas sack covering the whole and the opening is closed and sewed over the top supporting rod. The size of leaf which gives the best results is from five to six feet long by four to five feet deep. A larger leaf can be used but the strain and wear to which it is subjected, makes it shorter lived. An accompanying sketch shows its simple construction and its method of support and discharge.

A steel tank of No. 10 thickness, 20 ft. long, 6 ft. wide, by 5 to 5½ ft. deep gives good results. The discharge gates are 4-in. flange openings in the bottom. They are closed with a soft red-wood plug which has a long handle that reaches about a foot above the top of the tank. No trouble develops in removing the plug when it is desired to sluice the tank. The discharge gates can be two or four feet apart as desired and placed along the center of the tank bottom.

The leaves are suspended in the tank from their top cross bars which rest on both sides on a strip or piece of 2 x 4-in. scantling bolted to the inside of the tank. Half-inch notches are cut into the scantling as often as the leaves are necessary. A 2 x 2-in. strip in short sections should be bolted to the sides directly above to hold the leaves firmly in their notches thus preventing them from floating up when the tank is being filled. The discharge from the leaves through the bottom of the tank is effected through a punched hole for a ½-in.. pipe. The discharge pipe of the leaf is placed through the hole and a lock nut and a soft rubber gasket prevent leakage. No lock nut and gasket are necessary on the lower side of the tank if the leaf is held firmly in its upper support. The discharge pipe should reach below the tank sufficiently so that the solution can run into a launder and be inspected daily to determine if the leaf is working properly. If a hole should develop in the leaf and the filtrate run muddy, the discharge can be plugged and the leaf replaced at the next emptying of the tank.

Number of Leaves Required

The number of leaves necessary per tank will depend upon the character of the ore and the fineness to which it is necessary to be ground to obtain a satisfactory extraction within a given time. On a 24-hr. treatment the above company is using 30-mesh slotted screens in Huntington mills, and 30% of the pulp will pass 200 mesh. The leaves are placed 8-in. between centers, and within 6 hours a tank will leach to 25 to 30% moisture. A pulp with 50 to 60% slime will require 40 to 50 leaves per tank to effect a rapid filtering. Sixty leaves will give 1485 sq.ft. of filtering area.

The tanks are placed on benches with sufficient elevation if possible to obtain

---

*Superintendent, The Butte-Alex. Scott Copper Co., Butte, Mont.

satisfactory gravity sluicing from the upper series to the lower. A sketch shows the arrangement used at this company's mill. Only two decks or series of tanks are used, but tests have shown that a better saving of dissolved gold and of cyanide could be made with a third series. Each Huntington mill serves two tanks, one is being filled while filtering and sluicing are being carried on in the other. In filling a tank, the pulp passes directly from the mill over amalgamating plates and is run into the tank from side gates in a launder passing over the tank.

The ore is ground in a 2-lb. cyanide solution. Lime is added in the feed to the Huntington mill. The use of three pounds of quick lime per ton of ore gives good results. The solution often titrates a little more effective cyanide after passing through the mill and the first series of tanks because of the lime added. Before the tank has its proper charge of pulp, which takes the entire capacity of a 5-ft. Huntington mill for seven or eight hours, the filters will become flooded and an overflow spout or decanting pipe or both carry the excess water and slime to a tank at one side arranged as an overflow tank. This tank can be equipped with filter leaves or not as desired. The overflow when sufficiently clear can be sent direct to the gold-solution sump or pumped up to the battery-feed tank when slimey. The tank should be set sufficiently high so that it can be cleaned by sluicing into the lower series of tanks. No overflow is necessary for the lower series of pulp tanks.

Pulp Sluiced from Tank to Tank

Six to eight hours are necessary for the satisfactory leaching of the upper set of tanks. The sluicing is done by removing the bottom plugs, and by using a long ½-in. pipe, plugged and bored with a ¼-in. hole, for a nozzle. The sluicing can be assisted by a pipe placed along the bottom of the tank with a hole so bored that a jet of water can play on the pulp directly above the discharge gates. An active operator can sluice and clean from 8 to 10 tanks in eight hours. The pulp goes directly to the tank below, just sufficient water being used in the sluicing to fill the tank. This tank in turn when leached down is sluiced into the tank below, when three series of tanks are used in the process. The first sluicing is done with the barren solution from the zinc boxes, the second with clear water or a proportion of clear water and barren solution. Sufficient clear water is added to supply the loss of water used in the system. The last sluicing from the third series of tanks, will be the final tailings discharged and is done with clear water.

During the passage of the pulp through the tanks no cake is formed on the leaves and the mixture of sand and slime is a better filtering medium than might be expected. While sluicing, all clots are broken up and the pulp is thoroughly diluted, agitated and aerated. The above company uses a small amount of wash water in the lower series of tanks by placing the nozzle to the bottom of the tank and thoroughly mixing the pulp. The lower series of tanks leach to 25% moisture before the pulp is discharged. All pulp is under treatment 24 hours.

The extraction and efficiency under the above method is as follows: When the average of the heads is $5 per ton gold, the discharged pulp from the first series of tanks carries approximately $1.50 per ton. The amalgamation in the cyanide solution is unsatisfactory, only about 10% of the total gold being recovered on the plates. The solution hardens the plates and renders them almost of no value for amalgamating after three or four months' run.

The filtrate solution from the first series of tanks carries from 40 to 50c. per ton, and from the last series from 10 to 20c per ton, depending upon the time the sample is taken. The final tails discharged carry from 50 to 60c. per ton, and will titrate a little more than a trace of cyanide. The system requires from 15 to 20 gal. of water per minute for a 100-ton plant. The cyanide consumption amounts to about ½ lb. per ton of ore. The total recovery is from 90 to 92% of the gold content in the ore. The total labor and supply costs, exclusive of power, approximate 47½c. per ton of ore treated.

First Cost Low

The use of the gravity filter leaf here has proven simple and effective. The tank equipment is inexpensive, amounting to about $100 per tank complete. The filter leaves cost to make from $5 to $8 each, depending upon the price of labor and materials available. Their construction is such that they do not become impervious to solutions after several months usage, as is the case with vacuum and pressure filters. The upkeep is reduced to the minimum because of the simple equipment. There are no large capacity sand or slime pumps to maintain or operate, and power costs, no matter where, are always a serious factor to be dealt with in designing a plant.

The quantity of precious opal won in 1911 from the White Cliffs and Lightning Ridge fields in New South Wales was less than in previous years, but some stone of exceptional quality was discovered during the year.

Effect of Sulphur on Firebrick

In the process of building the two new Edwards' roasting furnaces at the Associated mine at Kalgoorlie, states M. W. von Bernewitz, a large number of old bricks from the old furnaces were used, care being exercised in their selection so that only the best were saved. In spite of this, a few, under a dozen, soon showed signs of fretting away. The foreman bricklayer reported that these bad bricks must have come from either the walls in the hot parts of the old furnaces, or from one of the floors. That conclusion was based on the fact that when such bricks were built in, they invariably started to swell and fret away. When this class of brick is stacked outside, and left to the influence of the weather, decomposition is rapid and complete, whole bricks crumbling away to a powder. Bricks from certain parts of the flues also behave in a like manner.

What is the cause of this change? It may be mentioned that bricks laid in lime mortar, fireclay, or ordinary clay are not acted on similarly, so the argument that lime may be partly the cause, will not hold good. The original bricks came from Coolgardie, and were noted for their general hardness, good composition and finish. As these bricks were laid in the hot portion of the furnaces, where most of the sulphur in the ore is eliminated, and the bricks being naturally of a porous nature, the sulphur would gradually tend to saturate them. The iron, alumina and magnesia that exist in the original clay are attacked by the sulphurous acid witn the ultimate formation of sulphates. When the bricks are dampened and laid down with water, these sulphates, being deliquescent, take up water, and this results in the swelling and crumbling away of the brick. The same process takes place when the rain soaks into bricks left in the open.

We have broken several samples which were partly decomposed, there being a fairly hard center left, which gave off the characteristic sulphurous odor. New bricks give a slightly alkaline reaction, while the affected bricks are strongly acid. If many of these old bricks were built in a furnace, the results would be disastrous, as the lifting power during swelling is rather extraordinary. From the old Ropp furnaces, which were at work some years ago, a number of bricks were used in building walls before this action was understood, and two of them have fretted away rather badly, while a third has lifted up the sole plate of a building nearly an inch. Of course, decomposition continues only as long as the bricks get moisture. The foregoing observations may put others on their guard in the use of old furnace bricks, especially those bricks that have been exposed to the weather.

Improvements in Crushing Rolls

By C. Q. Payne*

Much progress has been made in coarse and intermediate crushing by increasing the size of the rolls and by making the framework more massive. Rolls for fine crushing have not yet been so satisfactorily improved.

The art of crushing ores and other materials by means of rolls is one of comparatively recent origin. While the first record of the use of rolls with iron crushing surfaces dates back to the year 1806, when they were employed in Cornwall, their principal development has taken place during the last 30 years.

To Stephen R. Krom belongs the credit of being the pioneer in introducing the belted high-speed roll, which was originated and developed in this country. His notable contribution to the art was in the use of a single bedplate or frame for supporting the roll shafts, and to which levers holding the movable roll bearings were pivoted. He also made use of steel tension rods to support the crushing strains, and of hammered-steel tires for the crushing surfaces. These changes brought the design of crushing rolls to an advanced stage.

Following closely thereon, about 1885, W. R. Eckart conceived the idea of the swivel or ball-and-socket support for the roll shaft bearings. This is an excellent mechanical conception, especially for bearings held against a spring pressure, and while it may not be necessary for all types of rolls, yet it has been quite generally adopted by other designers of rolls and illustrates the refinement which roll construction has now reached.

THE EDISON "GIANT" ROLLS

Other engineers, as for example, Argall, Vezin, Rogers and Sturtevant, to mention only a few among many, have also given the closest attention to the various details of rolls, such as the frame, springs, bearings and shafts, and have developed many novel and original designs. It has remained, however, for the boldness and originality of Thomas Edison to extend the field of crushing rolls in two directions, and to cause them to exercise new functions. In developing crushing machinery for his portland-cement works, Edison constructed "giant" rolls, having a diameter of 6 ft. and a length of 7 ft. With these he was not only able to challenge the long established position of the jaw and the gyratory crushers as primary crushers, but even to leave them well in the rear. By means of projecting knobs on the roll surfaces, he utilized the stored energy of the revolving rolls, and was able to shatter masses of rock of so huge a size that they could not otherwise be made to enter the rolls, thus saving the expense of block-holing and sledging, which is usually charged to quarrying. This work has had successful applications in crushing limestone, and there remain also possibilities of the extension of this new use of rolls to still harder rock.

In going to the other extreme of size reduction, Edison has also utilized rolls in pulverizing cement rock. For this purpose, rolls with sectional, corrugated chilled-iron shells 30 in. diameter by 18 in. face, are provided with shafts 18 in. diameter. The rolls are forced together with a spring pressure of 100 tons. The feed material, which has passed a ¾-in. screen opening, is thus reduced in a single operation, at the rate of 60 tons per hour, to a size of which 94% passes 100-mesh screen. This use of rolls carries the principle of choke crushing to so extreme a limit as to involve practically a new function. It would appear at first sight, however, that there is less margin of profit for rolls in pulverizing than in mass reduction, and only a close comparison of the final products obtained and the respective costs per ton can determine the relative economy of rolls for pulverizing when compared with the tube mill and other types of grinding apparatus.

ROLLS FOR COARSE CRUSHING ARE BEING MADE HEAVIER

Irrespective of the part which rolls may play in the future in their relation to the two extreme limits of size reduction, there is no doubt that they have achieved for themselves a secure position in crushing products of intermediate sizes. This is partly due to their large capacity and low cost of operation. It is also due to the fact of their mechanical simplicity, which involves the principle of the toggle lever in overcoming crushing strains exerted by particles brought within the angle of nip of their surfaces. Since their revolving masses also serve to absorb their own "peak loads" when properly fed, a moderate and fairly uniform application of driving power is able to accomplish a considerable amount of effective work in splitting and shattering rock fragments.

Perhaps the most distinctive advantage of rolls is that their construction permits them to apply the principle of "arrested crushing" to a greater range of sizes than is possible with any other type of crushing apparatus. The crushing pressure exerted by the opposing roll surfaces during the angle of nip is instantly released and ceases when the rock fragments reach the horizontal diameter of the rolls, where the open space between them permits the material to be discharged. Roll crushing thus permits most careful and accurate stage reduction within a wide range of sizes, and avoids pulverizing and sliming an undue amount of the softer minerals of an ore, in crushing it to the size at which they will unlock sufficiently from the inclosing gangue to permit their being concentrated. For those ores, therefore, which require concentration, the use of rolls in preparing them for jigs, shaking tables, or magnetic separators has become almost the universal practice. This applies to many iron, copper, lead and zinc ores. Gold and certain silver ores, both those which require concentration and those which do not, are in a class by themselves.

The modern tendency to reduce milling costs by increasing the mill capacity has demanded a greater duty from rolls than ever before, and in the larger mills rolls are now employed from 36 in. up to 54 in. diameter, and from 15 in. to 28 in. width of face. Such rolls are used mainly for coarse crushing; that is, they take the product from the jaw or the gyratory crusher of 1½- to 2½-in. size, and reduce it to about ½ in. These coarse or No. 1 rolls are then followed by other rolls, set closer together for finer crushing, and possibly by others which recrush certain middlings products obtained in the process of ore treatment, or even tailings, dependent upon the nature of the ore and its association. Rolls of this general character require massive construction and excellent workmanship. Rolled-steel tires can now be obtained up to 54 in. diameter. Special hard steels, such as chrome and manganese steels, are also used for certain ores, either in the form of tires or of plates bolted to a central mandrel. In this way the life of the crushing surfaces has been much prolonged.

Marked progress has thus been made within recent years in the field of coarse crushing by means of rolls, in response to the greater demands of modern mill practice, and this progress has been largely brought about by increasing the dimensions of the rolls and adopting a more massive construction, as well as a better design, combined with a wider choice of steel adapted to different ore requirements than has heretofore been available.

Note—Excerpt from an article entitled "Progress in Roll Crushing," read at the San Francisco meeting of the American Institute of Mining Engineers, October, 1911.

*Mining engineer, 82 Beaver St., New York.

ROLLS FOR FINE GRANULATION NOT YET PERFECTED

On the other hand, it must be admitted that up to the present time rolls designed for fine crushing, where the ore requirements demand a maximum granulating effect and a minimum pulverizing or sliming effect upon the crushed product, have made little progress compared with rolls designed for coarse crushing. In fact, rolls, as heretofore designed, can hardly be said to have held their own; and since little assurance of their satisfactory operation can be had in connection with an ore which must be reduced to pass a 20- or 30-mesh screen while retaining the crushed material in a granular condition, rolls have been assailed on all sides by various types of ball mills and other pulverizing apparatus, which claim to accomplish the function of granulating an ore successfully, but usually by means of some reduction in the time during which the pulverizing effect takes place. While there may be an overlapping territory at the limit of fine granulation where pulverizing apparatus may be so adjusted as to perform the function of approximate granulation with sufficient success to make their use advisable, yet it is clear that a crushing force exerted upon material placed between walls which do not touch when at their minimum distance apart, must produce a distinctly better granulated product than when it is crushed between walls which are brought into physical contact with a grinding pressure.

With the presumption of advantage thus on the side of rolls, even down to the finest sizes, the fact remains that heretofore rolls have proved unsatisfactory and inefficient, from lack of control over the granulating action as the roll faces wear, and also from their small capacity.

In looking more closely into the cause of this inefficiency, it is evident that the effect of the irregular wear of the roll faces becomes a more serious matter in fine crushing than in coarse crushing, for the reason that in the former, since the faces must be brought quite close together, the ratio of the sectional area due to irregular wear to the total areal opening between the rolls is greater than in the latter case. Hence any ridging, grooving, or corrugating of the roll faces permits a considerable proportion of the particles in the feed stream which enter the depressions to pass between the rolls without being crushed. This reduces the capacity of the rolls, measured by the amount of undersize or finished product obtained. Another difficulty arising from irregular wear of the roll faces is due to the fact that when out of parallelism rolls tend to exert a certain component of the crushing pressure at right angles to the diameter of the rolls, or in the direction of the axes of their shafts. This produces an end thrust upon the roll shafts, which, transmitted by means of collars to their bearings, causes them to heat and the shafts to cut, thus absorbing power wastefully, and still further reducing the crushing efficiency as measured by the power consumed to operate the rolls in relation to the amount of finished product obtained.

Rolls used for fine crushing thus show a decreasing efficiency in proportion to the wear of their roll faces until a point is reached where it becomes necessary to stop the crushing operation, and to restore the faces by chipping, grinding, or machining them until their surfaces are parallel. This involves loss of time and of mill capacity, besides expense and a wasteful use of the roll shells.

While a certain amount of choke crushing is usually advisable in fine crushing, in order to offset some loss of capacity, the best results can only be obtained, where the prime object is to granulate an ore, when the roll faces are maintained parallel, and when the feed consists of sized material in order to avoid packing and pulverizing it in passing it between the rolls. It seems clear from the above considerations that further advance in the art of fine granulation by means of rolls can only be expected by means of certain refinements of function whereby the roll faces can be maintained parallel while they undergo wear.

Mineral Deposits of Bulgaria

The mineral deposits of Bulgaria at one time played an important part in the industry of the country, but were afterwards abandoned until within the last few years. Recent investigations have revealed the existence of ancient workings dating back to the time of the Romans, some of them having been reopened by the Saxons during the early part of the fourteenth century. In 1879 the Bulgarian government started a lignite mine at Mochino, 17 miles from Sofia, and worked it until 1891, the total output, being consumed in the capital and by the state railway.

The iron industry was formerly carried on at Samakof, where a large heap of slag, containing up to 53% of iron, and capable of utilization as ore, has been discovered. Magnetite is found in compact masses at Srem, but neither this deposit, which is 25 miles from the railway, nor that at Bogitsa has been investigated. The deposits of red hematite at Kremikovtzki, Breznik and Troyan are better deserving of attention, the ore being rich. Two concessions have just been granted.

Manganese ore occurs at Varna, Sliven and Haskovo, and in the first-named district a number of prospecting licenses have been issued, but the investigations are not yet sufficiently advanced to afford any positive information. The ore occurs in a pure state in some places, and as impregnating clay shales in others. One of the deposits, situated near the sea, a fact which invests it with considerable importance, has furnished samples containing up to 40% of manganese.

Graphite is found near the village of Bistritza (Doubnitza district), in a pure state, but has not been worked. Oil-bearing shales, chiefly paraffiniferous, occur in the districts of Bresnik, Philippopolis and Sliven, but have not been worked. Anthracite is found in the environs of Svogné-Tzaritchina, Tzeretzel, Rebrovo, Svidnya, and Batoulya, all in the district of Iskretz, Department of Sofia, traversed by the Sofia-Varna railway. Several concessions have been granted, according to *Bulletin de la Societe de l'Industrie Minerale*, for the prospecting of these deposits, which occur in greatly disturbed Permo-carboniferous strata, in consequence of which they are difficult to investigate. At the outcrops the anthracite crumbles to dust, and if it is important that further investigations should be made to determine whether a more compact form exists at all. In one case, near Tzaritchina, a concession has been granted to work a seam of anthracite averaging eight feet in thickness.

Coal is found in several places near Sofia, but the most important deposits are met with in the Balkans, at Gabrovo and Trevna where small quantities of coal were raised prior to the Russo-Turkish war, and even down to 1892. The coal was fairly pure and yielded good coke. The deposits are irregular, though typical seams have been identified. One portion of the basin has been reserved by the State, and the rest has been parcelled into a number of prospecting concessions which are being actively investigated.

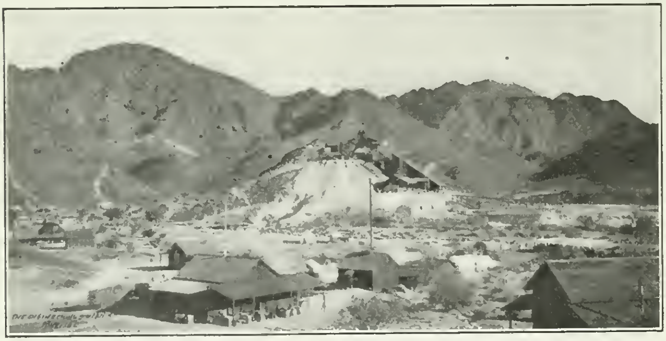
The "Prince Boris" concession at Trevna contains coal in seams and lenticular beds, and the proprietor of the concession has built a narrow-gage railway, 35 miles long, to connect the coal field with the state railway at Tirnovo station. Lignite is found in considerable quantities, the most important deposit being that owned by the State in the Tertiary basin at Pernik-Mochino, covering an area of about 40 square miles. The mine is equipped with modern French appliances for washing, briquetting and electric lighting.

The Ahmeek Mining Company paid its first dividend, of $2 per share, on Nov. 1, 1911. In January, 1912, it paid a second dividend of $3 per share. There are 50,000 shares issued, of $25 par value.

History of a Once Famous Arizona Gold Mine

Special Correspondence

No matter how often the "bottom drops out" of the copper market, it is not customary for the bottom to drop out of a copper mine. The Rio Tinto, of Spain, has been worked for 2000 years and is producing more copper today than it ever did in the past. Mines like the United Verde, the Copper Queen and the Pilares increase their reserves from year to year. But with gold mines business enterprise often becomes a romance. In rare instances, however, does the man who has followed a yellow streak in the hills to fortune have the luck to abandon the game just as the pay streak fails, but such is the history of the Fortuna mine, which leaped into fame, produced its millions making more than one family rich, then vanished from the mining records of the country like snow on a spring day.



The Fortuna Mine and Cyanide Mill at Gila, Ariz., in 1897

The Fortuna mine, was not many years ago, the inspiration to every gold seeker in the Southwest. Its discovery was as romantic as its development, its chambers of virgin gold and its sudden passing. In 1892 the gold-placer fields of California were drawing prospectors and fortune hunters across the arid deserts of Arizona. One of the noted stopping places of the caravans was the camp of Gila, about 30 miles southeast of Yuma, on the Mexican border. One evening there drifted into this camp Billy Holbert and his partner. They turned their pack burros loose, and the animals strayed up on the foothills of the west slope of the Gila mountains. Even before this the fortune seekers had discovered gold on the east slope. The precious metal, however, had never been found on the west slope of the mountains. This did not deter the burros that had wandered away from Holbert from going after the green cactus on the shoulder of the hill. Toward evening, so the story goes, Holbert went after the burros. He picked up a piece of rock to throw at the animals, and was on the point of hurling it at the leader when his trained eye caught the glint of gold in the rock. Investigation showed that the ground was literally spotted with gold-bearing rock. The news spread, but not before Holbert and his partner had staked out the ground and made good their title.

Discoverers Sell Property for $150,000

Holbert did not go to California. He had discovered what proved to be one of the great bonanzas of Arizona. When he and his partner had driven an incline shaft into the rock in the hill only 20 ft. the showing in gold was remarkable. The fame of the new strike came to the ears of Charles D. Lane, who organized the Wild Goose company, at Nome, Alas., and who is now largely interested in the Utica mine, at Angels Camp, Cal. Lane formed the Fortuna Mining Company to take over the property, for which he paid $150,000. A mill was erected at once and began operations in April of 1894. The machinery was freighted from Blaizdell, 16 miles distant. A water plant had to be installed also, at a cost of $40,000, the water being pumped 16 miles to the mill. This mill was claimed to have the heaviest stamps in any mill in the world at that time, the stamps weighing 1450 lb. each. The gold was amalgamated and the bars turned out were 960 to 970 fine.

From the first the mine was a bonanza. The cleanup was made every 30 days, and averaged $40,000. Nuggets too coarse to pass through the screen often accumulated in the batteries. The mine established many records, but the most notable was in the size of a bar of bullion for a 30-day run. This bar was sold to the Selby Smelting and Lead Company, at San Francisco, for $97,000. For the transportation of this gold it was necessary to maintain a mounted guard, which accompanied the bars to the railroad station.

Produced $3,000,000 Before Orebody Failed

The Fortuna continued to produce gold at the rate of a quarter of a million dollars a year for 12 years. The vein was narrow and difficult to follow. And as it was followed to a depth of 2000 ft. it turned over several times, the hanging-wall more than once becoming the footwall. The gold occurred in a schistose formation, which was cut in places by feldspathic dikes. At depth the schist ran into blue syenite, but the dikes continued downward. The irregularities of the orebody made it difficult to follow at all times, but all along Lane's slogan was, "When she doesn't pay, shut her down." He always said that a mine was made to produce metal, and when it ceased doing that it would not bury his fortune, for all its past history and record. He made good his word, for when the orebody was finally lost, he made no effort to locate it, but bade his Ophir farewell, and quit the camp. The camp died with the mine, for notwithstanding the fabulous wealth of the Fortuna, prospecting in the vicinity failed to produce even the semblance of another mine. Today only the remains of the buildings are to be seen. The Fortuna was remarkably free from water so efforts may, at some future time, be made to relocate the orebody.

Separation of Alumina and Ferric Oxide

Barbier describes a new and convenient method for the separation of alumina from ferric oxide (*Bull.* Soc. Chim. de France). The alumina and ferric oxide are separated from other substances in the ordinary way, the precipitate of hydroxides is dissolved in a little acid, and a slight excess of sodium-acetate solution is added, enough to give the solution a red color and to insure absence of free mineral acid. Next a 10 per cent. solution of sodium hydrosulphite is cautiously added until the red color of the ferric compounds has wholly disappeared. The solution is then boiled for a short time, when the whole of the alumina is precipitated as a dense white powder which is easy to filter and wash. The filter paper is moistened with nitric acid and incinerated, and the alumina transferred to the crucible and the whole strongly ignited. In the filtrate the iron can be estimated in any known manner. The author has had occasion to analyze a number of beryls, and he points out that glucinum, when present, is precipitated as hydroxide with the alumina. On prolonged digestion of the precipitate (36 hours) with a cold concentrated solution of ammonium carbonate, the glucina is wholly dissolved. The alumina is then filtered off and the glucina reprecipitated from the filtrate by boiling this for some time.

NEW PUBLICATIONS

The McGraw-Hill Book Co. announces the completion of arrangements for the sales agency of the technical books of the *Railway Age-Gazette, American Engineer* and *Signal Engineer*. This makes the McGraw-Hill Book Co. publishers and distributors of books for the three journals, but it does not affect the publication of the papers themselves in any way. With the addition of these three papers in the railroad field, the McGraw-Hill Book Co. now publishes books for the twelve leading American engineering papers in the fields of mining, civil, mechanical, electrical, metallurgical and chemical engineering, electric and steam railroading and machine tools. The papers now represented are *American Machinist, Engineering News, Electrical World, Railway Age-Gazette, Electric Railway Journal, Power, Engineering Record,* ENGINEERING AND MINING JOURNAL, *Coal Age, Metallurgical and Chemical Engineering, American Engineer* and *Signal Engineer.*

POWER HOUSE DESIGN. By John F. C. Snell. 5¾x9, pp. 448, illus.; $6. Longmans, Green & Co., London, Eng.

THE OFFICIAL YEAR BOOK OF NEW SOUTH WALES, 1909-10. Pp. 634. J. B. Trivett, Government Statistician, New South Wales.

THE USES OF PEAT FOR FUEL AND OTHER PURPOSES. By Charles A. Davis. Pp. 214. Bull. 16, Bureau of Mines, Washington, D. C.

PRACTICAL GEOLOGY AND MINERALOGY. By W. D. Hamman. 5½x7¾, pp. 224, illus.; $2. Way's Pocket Smelter Co., South Pasadena, Calif.

GEOLOGY AND MINERAL RESOURCES OF A PORTION OF FREMONT COUNTY, WYOMING. Pp. 90, illus. C. E. Jamison, State Geologist, Cheyenne.

ANNUAL REPORT OF THE MINING DEPARTMENT OF TENNESSEE FOR 1910. Pp. 155. R. A. Shiflett, Chief Mine Inspector, Nashville, Tenn.

REPORTS ON WIRT, ROANE AND CALHOUN COUNTIES. By Ray V. Hennen. Pp. 573, illus.; $2. West Virginia Geological Survey, Morgantown.

PRELIMINARY REPORT ON THE STRUCTURAL MATERIALS OF OKLAHOMA. Pp. 182, illus. Bull. 5, Oklahoma Geological Survey, Norman, Okla.

MINING LAWS OF AUSTRALIA AND NEW ZEALAND. By Arthur C. Veatch and Walter L. Fisher. Pp. 180. Bull. 505, U. S. Geological Survey, Washington, D. C.

RESUME OF PRODUCER-GAS INVESTIGATIONS, Oct. 1, 1904-June 30, 1910. By R. H. Fernald and C. D. Smith. Pp. 393, illus. Bull. 13, U. S. Bureau of Mines, Washington.

PRODUCTION OF PETROLEUM IN 1910. By David T. Day. Advance Chapter from "Mineral Resources of the United States," 1910. Pp. 136. U. S. Geological Survey, Washington, D. C.

REPORT ON THE GYPSUM DEPOSITS OF THE MARITIME PROVINCES. By William F. Jennison. Pp. 165, paper, illus. with maps. Canadian Department of Mines, Mines Branch, Ottawa.

GEOLOGY OF A PORTION OF FABRE TOWNSHIP, PONTIAC COUNTY, QUEBEC. By Robert Harvie. Pp. 33, illus. Dept. of Colonization, Mines and Fisheries, Mines Branch, Quebec, Canada.

REPORT OF PROCEEDINGS OF THE AMERICAN MINING CONGRESS, 1911. Fourteenth Annual Session, Chicago, Ill., Oct. 24-28. 6x9, pp. 397, paper. Published at the office of the secretary, Denver, Colo.

MEXICO, A GENERAL SKETCH. 6½x9½, pp. 409, illus. Compiled by the Pan-American Union, Washington, D. C., June, 1911.

This book is recommended to anyone who wishes a comprehensive handbook bearing on every side of Mexican progress.

GRAPHICAL SOLUTION OF FAULT PROBLEMS. By C. F. Tolman, Jr. 5½x8, pp. 43, illus.; $1. Mining and Scientific Press, San Francisco, Calif.

Contents: Nomenclature of fault movement; methods of projection; elementary problems in line and plane intersections; fault movements of pure translation—fault plane vertical; fault movement of pure translation—fault plane inclined; fault problems where a rotation about a pole is combined with translatory movement.

REPORT OF THE MOLYBDENUM ORES OF CANADA. By T. L. Walker. 9¾x6½, pp. 64; illus. Canadian Department of Mines, Mines Branch, Government Printing Bureau, Ottawa, 1911.

This report aims to present all the available information regarding molybdenum deposits in Canada, with the view of arousing interest in their economic possibilities. A list of the most promising of these deposits in Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia is given.

MINING WITHOUT TIMBER. By R. B. Brinsmade. 6x9, pp. 309, illus.; $3. McGraw-Hill Book Co., New York.

The scope of this book is adequately indicated by its title. Its subject matter is essentially based upon the contributions to recent periodical technical literature. Although incomplete and imperfect in its treatment, and in no sense analytical and critical, it is nevertheless a useful collection, giving to the reader a good deal of valuable information that otherwise he cannot so conveniently obtain and much that he would be likely to miss.

A MANUAL OF THE AMERICAN MINING LAW. By A. H. Ricketts. 4½x6¾, pp. 500. Scientific Book Publishing Co., San Francisco, Calif.

The body of this book consists of a digest of the federal and state laws applying to the mining business. The headings are: Mining law in the United States; courts; actions; grubstake contracts; mining partnerships; co-tenants; mining leases and licenses; options, deeds, examination of title; possession, abandonment, forfeiture; remedies; miscellaneous definitions; coal lands; lode claims; mill sites; placer claims; timber lands; town sites; tunnel sites; water rights; monuments; discovery; locators and locations; annual expenditure; patents, and taxation. The definitions are simple, and citations full. There is a helpful appendix of forms and methods of proceeding in mining law, and a good index, both by subject and case.

A BRIEF LABORATORY GUIDE FOR QUALITATIVE ANALYSIS. By Arthur E. Hilt. 5½x7, pp. 80. Chemical Publishing Co., Easton, Penn.

We believe there is too much simplicity aimed at in this book. There is no royal road to learning, and ignoring the effects of borates and phosphates does not alter the results when solutions of borates and phosphates are treated. Nor will leaving out consideration of cadmium prevent a beautiful yellow sulphide making trouble for the youthful analyst some day, if he stir at all outside of mixtures made by a thoughtful teacher. Then the student, at considerable effort, will have to put a few pergolas on his knowledge of qualitative analysis. We believe the student will not be seriously damaged by having to think, and that the textbooks on qualitative analysis, even when elementary, should be complete as far as they go. The student can learn as much manipulation, and about as much chemistry, if he learn the first three groups completely, as if he ignore all the troubles chemical flesh is heir to, and learns to detect all the groups, providing no chemical derelict is floating around to wreck him.

COURS DE METALLURGIE DES METAUX AUTRES QUE LE FER. By Eug. Prost. Pu. 888, illus. Ch. Béranger, Paris and Liége.

This elaborate work, the most recent general treatise on metallurgy, we make haste to say is a good one. This was, of course, to be expected as the product of so accomplished a metallurgist as Prof. Prost, who is well known by his work at the University of Liége. In the present treatise he begins with zinc, following with lead, silver, gold, copper and tin. The amount of space devoted to each of these subjects permits of a comprehensive and well-balanced treatise on each. That upon zinc is particularly strong, which, of course, is natural in a book emanating from a historic center of the zinc industry. Prof. Prost's treatment of this subject is competent, illuminating and satisfactory. Moreover, it is distinctly uptodate. The last may be said of the other subjects treated in this book, Prof. Prost being evidently a careful reader of the JOURNAL and thereby keeping abreast of the progress in the art of metallurgy.

A unique and valuable feature of this book is its inclusion of the metallurgy of the less important metals. Thus are to be found sections on cadmium, nickel, cobalt, mercury, antimony, bismuth, aluminum, platinum, manganese, chromium, tungsten, molybdenum, titanium and vanadium. In no case do these chapters appear to be merely perfunctory compilations. It is useful to find them collected in one volume.

Prof. Prost, in his preface, expresses gracefully his recognition of the eminence of American metallurgists, and the great advancement in the art that is due to them. We have pleasure in returning the compliment with praise for the excellent summary of their work that he has given us.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

L. D. Huntoon is directing development work at the Alice Dayton mine, near Wentworth, Missouri.

Edwin S. Berry will leave New York this week for Chile to make an inspection of the Braden Copper Co.'s property.

J. H. Plummer, president of the Dominion Steel Corporation, has sailed for England, where he will remain for two months.

James McNaughton, general manager of the Calumet & Hecla Mining Co., has returned to Calumet, Mich., from a short visit in the East.

Jack S. Wilson, formerly of Marquette, Mich., but now of Porcupine, Ont., has been chosen a director of the Dome Mines Co., of Porcupine.

Charles M. Henrotin, formerly connected with the Kimberley diamond mines, has been put in charge of underground work at the Dome, Porcupine, Ontario.

Robert Livermore has taken charge of the Kerr Lake Mining Co., Cobalt, Ont. He is son of Col. Thomas L. Livermore, formerly vice-president of the Calumet & Hecla.

Dwight E. Woodbridge, of Duluth, is in Birmingham, Ala., and expects to be in the South for some time, on professional business connected with the United States government.

Arthur Scott, formerly superintendent of the Calumet mine, in the Metropolitan district, for Pickands, Mather & Co., has been appointed superintendent, under W. G. Hansen.

W. S. Keith, manager of Frankmont Mining Co., has returned to San Francisco, after a two months' stay at the company's property at Last Chance, in Placer County, California.

J. W. Pender, of El Paso, Tex., has been in Pittsburg several weeks, and has now gone to take charge of development on the Penn-Sonora mine, north of the Altar district, Sonora, Mexico.

Capt H. T. Munn, who has been in charge of operations on the claims of the Porcupine Canada Mining & Development Co., owned in London, has gone to England to report the result of operations.

A. W. Prior, who recently resigned as resident manager of the Rio Plata Mining Co., in Chihuahua, Mexico, is now in Los Angeles, Calif. Alvin R. Kenny, formerly mine superintendent, has succeeded Mr. Prior.

W. H. Foster, until recently assistant manager of the smelting department of the Guggenheim interests in Mexico, has accepted a position in the buying department of the Continental Mexican Rubber Co. Mr. Foster for several years was located at Asarca smeltery.

A. C. Veatch, having returned from a year's examinations and explorations in the Trinidad and Venezuela oil fields, and having resigned from the U. S. Geological Survey, announces that he will practice as a consulting geologist, specializing in oil, with office in Washington.

W. G. Hansen, formerly assistant superintendent of the Verona Mining Co., has been appointed superintendent of the Iron River-Stambaugh district, Menominee Range, for this Pickands-Mather subsidiary, to succeed W. H. Jobe, who resigned to become general manager of the Iron River Steel Co.

Samuel S. Arentz, superintendent of the Nevada Douglas Copper Co. for the past four years, has been appointed general superintendent of the company and of the Nevada Copper Belt R.R., with headquarters at Ludwig, Nev. Archie J. Orem becomes superintendent of the Nevada Douglas company.

OBITUARY

John Herron died at Telluride, Colo., Feb. 3, from injuries caused by a falling timber which struck him as he was climbing a ladder between two levels in his mine. He was 55 years old, and had been for a number of years prominent in mining in Colorado. He was for several years general manager of the Tomboy Gold Mines, Ltd., and at the time of his death was manager of the Telluride Leasing Co., operating on the Smuggler-Union and other mines. He left a widow and three children. His brother, D. A. Herron, is the present manager of the Tomboy.

George Jarvis Brush, professor emeritus at the Sheffield Scientific School, Yale, died at New Haven, Conn., Jan. 6, aged 80 years. Prof. Brush was a mineralogist who had written extensively on many phases of geology, and was a member of most of the great scientific societies of the world. He studied under Yale's famous professor of sciences, Benjamin Silliman. He was graduated from Yale in 1852, and after a year in the University of Virginia and two years' study in Europe he was called to Yale and the newly formed Sheffield Scientific School. He became professor emeritus in 1898. Prof. Brush was born in Brooklyn in 1831, the son of Jarvis Brush. He attended private schools to prepare for college. He was a close friend of Joseph Earl Sheffield, who in 1904 gave a large sum of money to the school bearing his name. Prof. Brush gave to the school recently his collection of minerals, and a fund of $10,000 for its maintenance. At the time of his death he was president of the board of directors of the school. He was married in 1864 to Harriet Silliman Trumbull. Three daughters survive him.

Societies and Technical Schools

Institution of Mining and Metallurgy of Great Britain—This society has awarded gold medals as follows: Gold medal of the institution (two awards): (*a*) to E. P. Mathewson, general manager of the Anaconda Copper Co., in recognition of his services in the advancement of metallurgy generally, and especially in regard to copper; (*b*) to Walter McDermott, in recognition of his services in the equipment of the Bessemer Laboratory of the Royal School of Mines, and to signalize his services in the advancement of metallurgical practice. The Consolidated Gold Fields of South Africa gold medal to Walford R. Dowling, for his paper on "The Amalgamation of Gold in Banket Ore."

Canadian Mining Institute—The provisional program for the annual meeting at Toronto is as follows: Wednesday, Mar. 6, at 10 a.m., business meeting, at which the usual current business will be dispatched, the presidential address delivered, and the mineral statistics for 1911 presented. In the afternoon there will be a meeting for reading and discussion of papers; and in the evening Dr. W. H. Tolman, director of the American Museum of Safety, will deliver an illustrated address on "Accident Prevention." On Mar. 7 there will be morning and afternoon sessions for reading and discussion of papers, and in the evening a smoking concert. On Mar. 8, morning and afternoon sessions for reading and discussion of papers, and for the dispatch of any unfinished business will be held. In the evening the meeting will close with the annual dinner.

American Institute of Mining Engineers—A circular from the committee of arrangements says: "At meetings of the Institute in former years the social side was brought prominently to the front; the dinner for the members and their ladies as guests was one of the most attractive features. In recent years this custom has been neglected and many think it has not been to the advantage of the Institute. It is proposed now that the February meeting each year, which has recently been only a business meeting, shall be made a regular meeting, to include not only the discussion of papers but to enable the members to meet each other informally and promote the social side of the Institute as well. To this end, there will be an informal social meeting and smoker for members only at the Institute rooms on the evening of Feb. 19; to be followed on the evening of Feb. 20 by a subscription dinner, for members and guests, at the Plaza Hotel. The reception will be in the palm room of the Plaza at 6:30 p.m., so that the dinner may begin promptly at 7 o'clock. The price of the tickets for the dinner has been fixed at $5 for each person."

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Feb. 7—Interest in the advancement of mining on the Mother Lode, California, has been so directly centered in Amador County in the present season, that other counties having part in the general movement have been overlooked in the measurement of activity and consideration of the effect upon the future. Calaveras and Tuolumne Counties are adding much to the composite prosperity and have attracted small attention from outside. Although supplied with railway facilities, the chief towns forming the centers of mining advancement in these counties are at the end of the respective lines of road. Jamestown is the terminus of the main line of the Sierra Ry., and Tuolumne and Angels are at the end of the branch roads that form part of the Sierra Ry. system. This situation is a commercial disadvantage to these towns in their relation to other towns beyond the end of the line; but the direct benefit of rail connection with San Francisco and Stockton, the chief commercial centers for these camps, is unquestioned.

Rail transportation has had a noticeable effect upon the development and operation of the mines in providing a market for the concentrates produced by the stamp mills. In 1911 there were shipped from Angels camp 5100 tons of concentrates; 8400 tons were shipped from Jamestown. The latter figure includes shipments from mines other than those immediately adjacent to Jamestown. The grade varies from $30 to $75 per ton. The total value of the shipment of 13,500 tons of concentrates from the two counties is conservatively estimated at $600,000. This output represents the concentrates from approximately 600 stamps. During a part of the last half of 1911 a number of these stamps were hung up for lack of power owing to the freezing of the water supplying the mills at Angels with water and electric power. The figures here given are not assumed to be precise either as to the total value of the concentrates or the number of stamps in continuous operation. The value is probably underestimated, while the stamps may have totaled a smaller figure. But the tonnage is accurate as shown by the railway records.

The prospective future of the camps mentioned is marked by various installations of additional stamps, and other equipment necessary to advanced methods of treatment, and the installation of new machinery to facilitate extraction and the progressive development of orebodies.

In other seasons there has been a disposition to abandon the Mother Lode for fresher fields in Nevada and Arizona. Many of the men who went away in search of opportunities to develop larger mines have returned, and others have joined them. There is, at present, a surer indication of permanency of operation than in the past. The fact that the average milling grade of the Mother Lode ores is low, necessitates improved methods that will guarantee high extraction and the employment of modern and economic methods of treatment. There is a noticeable advancement in milling practice, and the later practice includes the testing of offered improvements in concentrating machinery. Altogether the forward movement of gold mining and milling in Calaveras and Tuolumne Counties is satisfactory.

Butte

Feb. 7—President Thayer, of the Anaconda company, who has been in Butte for several weeks on his semiannual inspection of the company's mines, expressed himself as highly satisfied with the condition of the mining properties in Butte and the prosperous air of the camp. He stated that the mines are being operated on the normal basis of production of about 26,000,000 lb. of copper per month, or 300,000,000 lb. per year, and that production will be maintained at that level without further attempt to increase it. With mining operations carried on in the future at this rate, the reserves in the Butte mines will continue the city's prosperity for many years; also, the electrification of the Butte, Anaconda & Pacific R.R. and the extension of the line into the Georgetown mining district, thus opening the mines of the Southern Cross section, will be of great benefit both to Butte and to Anaconda.

The total production of copper from the Butte district was about 27,500,000 lb. during January; of this amount the output of the Washoe smeltery at Anaconda and the Great Falls smeltery, which includes the production of the Anaconda, North Butte and Tuolumne company's mines, was 26,350,000 lb. About 1,000,000 lb. were produced by the East Butte company, and the remainder consisted of custom ore from the Alex Scott, Butte Central and other small producers. The production of the district during December was about 25,400,000 lb., and in November, 21,850,000 lb., showing the increase in production in the last few months.

According to the report of T. B. Miller, head of the government assay office in Helena, Lewis and Clark County led all others in the production of gold and silver during January, with deposits amounting to $67,931, a great increase over a year ago when the amount for the same month was $20,764. The other counties in the state which made deposits are: Beaverhead, $123; Fergus, $12,896; Granite, $98; Jefferson, $123; Madison, $36,286; Powell, $254, and $762 from Silver Bow.

Denver

Feb. 9—The whole state is worked up over the proposed tariff reduction on zinc, lead and tungsten, and will apparently be backed up by Idaho and other Western states. R. Kenehan, president of the Colorado Mining & Metallurgic Association, requested Senator Guggenheim recently to have the hearing on the metal schedules postponed until after a meeting of the association called for Feb. 13, and the Northwest Mining Commission meeting, at Spokane, Wash., Feb. 15 to 17. It is expected that important action will be taken at these meetings. The Denver Chamber of Commerce has two delegates *en route* to Washington, to argue for a retention of the present duties.

Mining men of Colorado received word recently from the Interstate Commerce Commission that it had approved the proposal of the railroads to increase their freight rate 50c. per ton on Colorado ore shipped to Kansas and Oklahoma points. Some time ago the railroads served notice upon ore shippers that they would raise the rate beginning Feb. 5, and the shippers appealed to the commission for a hearing. Evidently the commission decided that the rate should be advanced without a hearing.

Salt Lake City

Feb. 8—The Utah Apex report for December shows an increase in net earnings. The total receipts were $53,615, from which after deducting smelting and freight charges of $12,436, and mining, milling and development charges of $17,083, left a net profit for the month of $24,095. The last annual report showed net profits for six months averaging $20,616 per month. The output is being increased, and the January production will be in excess of that for December. The present work is opening new tonnage and putting more ore in sight than is being extracted. The limits of the large silver-lead orebody are still undetermined.

The number of furnaces smelting ore in the Salt Lake valley and vicinity at the beginning of February was as follows: The United States Smelting, Refining & Mining Co. at Midvale was running five furnaces on lead ore, and treating its usual tonnage. The wet concentrator is treating between 300 and 350 tons of ore per day, and producing about 45 tons of zinc middlings, which are treated by the Huff electrostatic plant. The American Smelting & Refining Co., at Murray, had five lead furnaces and one furnace on matte concentration in operation. This company is receiving more sulphide ores than there are facilities for roasting under present arrangements, and has stockpiled between 40,000 and 50,000 tons of ore largely unoxidized. The Garfield smeltery of the American Smelting & Refining Co. is running two blast furnaces and five reverberatories, and is smelting about 2200 tons of ore per day.

At the International company's Tooele plant, three reverberatories are treating more than 600 tons of copper ore per day. The greater part of this comes from the Utah Consolidated, from which lead ores also are being received. Copper ores from the South Utah and custom ores are also being treated. The two new lead furnaces are nearly completed, and one of them will probably be ready to begin operations before the end of February, and the other in March. The International has contracted for ore up to the capacity of the lead plant, and is now not so much disposed to get ore under any terms, as formerly.

Duluth

Feb. 9—It is believed here that the opening of navigation in Lake Superior will be the latest in years. The ice in the lake is exceptionally heavy. The average opening of the navigation season is about Apr. 20, but it is believed that the ice problem will delay the free movement of interlake boats until at least May 15.

On the Mesabi range, the long-talked of electric railway seems to be nearer realization that at any previous time. It is reported from Boston that a syndicate headed by Tucker, Anthony & Co. and including Charles D. Barney & Co., of New York, has underwritten securities of the Mesaba Ry. Co., recently organized to build a high-speed, interurban road on the Mesaba range in Minnesota, operating between the towns of Hibbing and Gilbert. The new road will serve six towns which are at present without traction facilities. The company will have an initial issue of $1,000,000 first-mortgage, 5% bonds, $500,000 preferred and $1,500,000 common stock. Construction work on the new line will start soon. Rights-of-way are reported to have been secured at a low figure.

The Cuyuna Range will probably have more shipping mines this season than in 1911, but it is hardly likely that the number of such mines will be as large as many freely predict. While the region adjacent to the towns of Crosby and Ironton still continues to attract attention, more interest than formerly is being taken in the development on the so called south range, particularly in the vicinity of the Adams mine, the latter being a short distance southwest of Deerwood. The Inland Steel Co.'s Thompson mine will probably ship this season and an increased tonnage is expected from the Kennedy mine of the Rogers-Brown Ore Co. The two last-named properties are on the north range.

Negaunee, Mich.

Feb. 9—The Cascade district, situated six miles southeast of Negaunee and classed as part of the Marquette Range, is becoming active. At the New Volunteer mine, owned by T. F. Cole, of Duluth, and associates, about 180 men are employed and a soft, high-grade bessemer ore is being mined. Just southeast of the village of Palmer, a Minneapolis exploring company has begun diamond-drilling. The E. J. Longyear Co. is doing this work under the direction of L. D. Cooper, chief engineer; one drill is in operation and two more are on the ground. The company has options on a considerable tract of land including the holdings of the Pittsburg & Lake Superior Iron Co. In the swamp on Sec. 26, three miles east of Palmer, the Cole & McDonald Exploration Co. is drilling for the Heidelbach interests of New York and the timber is being cut from seven forties held by the Heidelbachs.

The Iron River Steel Co., recently organized in Iron River, has taken over the holdings of the Michigan Iron Mining Co. and the Lennox mine, of the Brule Mining Co. The Michigan Iron Mining Co.'s lands include a 40-acre tract lying just north of the Lennox mine and a 40-acre tract known as the Corry exploration, where the ore formation exists, situated just east of the Berkshire mine of the Brule Mining Co. The Lennox mine, consisting of 40 acres, has a shaft and some underground workings, with 65,000 tons of ore reported blocked out; the Lennox orebody lies between the Dober mine, of the Oliver Iron Mining Co., and the Tully mine, of the Corrigan, McKinney company. The Caspian mine, of the Pickands-Mather company, adjoins it on the southeast. The surface plant and machinery at the Lennox were purchased, and it is reported that ore will be shipped as soon as possible. W. H. Jobe is general manager of the Iron River Steel Company.

Cobalt

Feb. 9—An interesting announcement has been made to the effect that the control of the Kerr Lake mine has passed from the hands of the Lewisohns to the Mines Finance Co. Some time ago this company also obtained the control of the Wettlaufer from the Lewisohns, who are now definitely out of the Ontario mining field.

The La Rose directors are to meet in Montreal soon to decide what is to be done with the $1,600,000 surplus. President McGibbon has promised that something will be done to give the stockholders a larger share of the profits. Personally he favored a plan for redeeming the shares, but was forced to abandon it on account of legal difficulties.

Porcupine

Feb. 9—Particular interest in the Porcupine mining district attaches to the Dome mine. This property is in the most advanced stage of development of any in the camp, and if no unforeseen accident happens, should be in a position to commence operations by Mar. 20. In order to handle the large tonnage above the 45-ft. level, without interfering with the development, an incline is being put down from the crusher station to the level and all the ore can be hauled up on an easy grade. By this means the main shaft can be used for development purposes only, and all the other shafts and raises will be used as ore chutes. The mill is now completely covered and the inside work is progressing rapidly.

Chihuahua

Feb. 5—The movement of ore throughout the state in general is regarded as satisfactory and a tendency toward increased shipments has been noticed. Good business is reported by ore buyers on 3- to 6-months' contracts. The advance in silver and copper metal prices has had a stimulating effect that will probably be felt for some time.

A number of excellent strikes of high-grade ore are reported from the vicinity of Batopilas and these have been reflected in increased activity at a number of nearby inoperative properties. It is believed locally that the ultimate result will be the devoting of more time and money to development and exploratory work. The Cusihuiriachic district is continuing to attract much attention and developments there are reported to be satisfactory. Political troubles are causing some anxiety but it is generally believed among the local mining men that the government will be able to cope successfully with the situation. Up to the present, no effect is noticeable in the mining industry in this district.

The Mining News

The Current History of Mining

Alaska

More recent dispatches regarding the strikes reported some time ago in the vicinity of Sixtymile River, southwest of Dawson, indicate that excitement still continues and claims are being staked rapidly. The gold is said to average $1 per square foot of bedrock, which is about 20 ft. deep. The valley in which the discovery was made is about 20 miles long and 2000 ft. wide.

Copper Mount—R. L. Kilpatrick, representing Duluth, Minn., men who recently purchased this property, is making an examination of the land and will formulate a plan for developing and operating the property.

Londevan—A tunnel that has been driving for several months recently cut the ore at a depth of about 2000 ft. The ore is silver-lead, with copper and gold, and the disclosure in the tunnel indicates a large tonnage above this point. The showing is especially noteworthy, as it suggests the possibility of depth in the Ketchikan district, which has long been doubted.

Redwing—R. W. Dwyer, superintendent of this mine on the west coast of Prince Edward Island, states that the property is showing up well, and that a shipment of ore will be made soon to the Tacoma smeltery. New machinery, including a pump, has been installed, and the coming season is expected to be a profitable one.

Alaska Treadwell—During December, the mills crushed 75,264 tons of ore, yielding $187,904 gross and net $78,629. Operating expenses were $95,201; construction, $14,073; yield per ton, $2.52. Development work amounted to 959 feet.

Arizona

Gila County

Miami—The starting of the sixth unit of the concentrator is still delayed by the nonarrival of the Hardinge mills, which will follow the rolls in that unit. With this exception everything is in readiness for operation. Development on the 570-ft. level is being pushed forward. Where the crosscut from the main shaft cut the orebody, the ore is reported to assay 4.76% copper. One churn drill is at work near the old No. 3 shaft, and has not yet passed through the capping of iron-stained silicified schist.

Inspiration Consolidated—The construction and development plans of the Inspiration Consolidated are still hanging fire. The greatest obstacle to the final settlement of these plans seems to be the inability of the officials of the Arizona Eastern railroad to come to an agreement with property owners along the proposed right-of-way for the extension of the railroad from its present terminus at the town of Miami to the Inspiration and Live Oak mines, a distance of about 1½ miles. In the condemnation proceedings recently instituted in the territorial district court, at Globe, by the railroad company, the court decided that the company must give a bond of $13,500 before it could proceed with construction. This the company declined to do, and rather than take the chance of an excessive award by a jury when the case shall have to come to trial in the new state court, the railroad is now conducting negotiations with the property owners outside of court. W. H. Aldridge, managing director, is now at the mines.

Old Dominion—The output of the smeltery for January was 2,026,000 lb. of fine copper. The company is planning to install skips for hoisting ore. This will include a remodeling of the crushing plant and sampling mill. Some changes will be made in the concentrator, which will increase its capacity to 700 tons per day. At the smeltery a separate dust chamber will be constructed for the converters, and a machine installed for cheap handling of converter slag, all of which will be resmelted. The Gray shaft, of the United Globe, is shut down for retimbering, and the work of concreting the Kingdon shaft is progressing satisfactorily. The company now has about 900 men in its employ.

Copper Reef—At the annual meeting of the shareholders, in Globe, Feb. 5, the board of directors was reëlected, with the exception of J. W. Gillingham, who was succeeded by W. A. Griffith, of Pittsburg, Penn. M. J. Kennedy, of Scottdale, Penn., was reëlected president at a meeting of the directors, and W. A. Griffith was made secretary. Charles Saxman was elected manager, succeeding John W. Gillingham, whose contract expires Mar. 1. The property consists of 80 claims, about 12 miles south of San Carlos, reported to have favorable surface showings of copper.

Live Oak—Excavation is completed for foundations for the new hoist at No. 2 shaft, and preparations are being made to enlarge the shaft to three compartments, after which it will be used for the further development of the orebody. An Ingersoll-Rand compressor, capacity 1300 cu.ft. of free air per min., has been ordered. The eastern end of the orebody is being developed from No. 1 shaft.

Barney—The churn-drill hole is now over 600 ft. deep and is continuing steadily. The hole is in the schist formation and ore has not yet been encountered.

Black Warrior—P. S. Tate and Abraham Lyle are leasing on the 100-ft. level of this mine. The company has sold its teams and store supplies.

Arizona Commercial—The Copper Hill shaft is being retimbered, preparatory to starting development work after the bonds of the old company have been foreclosed and the new company has taken possession.

South Live Oak—This company has been formed to develop the Schulze group of claims, lying a mile southwest of the Live Oak.

Superior & Boston—The crosscut from the McGaw shaft, on the 15th level, is breasted in hard diabase formation after passing through about 15 ft. of badly broken, iron-stained diabase. A stringer of chalcopyrite ore was encountered in this broken formation, and drifting disclosed a width as great as 4 ft. in one place, but the country is so badly fractured and broken up that it is impossible to give an average width and assay for the vein. It is thought that this is the Great Eastern vein and that the drift, which is now in about 20 ft. west from the crosscut, will soon leave the faulted zone and enter the unbroken vein. Assays of some of the ore are reported to run as high as 15% copper.

Southwestern Miami—At the annual meeting in Globe, on Feb. 12, the following officers were elected: George F. Ruez, broker and banker, Ishpeming, Mich., president; R. T. McKeever, president Copper Range R.R., vice-president; Robert H. Gross, president East Butte company, secretary and treasurer. These with the following constitute the board of directors: Thomas S. Dee, of Paine, Webber & Co.; D. T. Kennedy, Boston; G. J. Maas, Negaunee, Mich., and Henry B. Hovland, former president of Live Oak, and now a director of Inspiration Consolidated. The company holds under option 261 acres adjoining Live Oak; the purchase price was about $160,000 upon which $15,000 have been paid. The next payment of $34,000 is due in June, 1913, and the final payment of $58,000 is due July, 1914. The recent sale of stock to Eastern men is said to have placed the property on a better financial basis and increased operations are contemplated, including more extensive drilling and the sinking of a shaft near the Live Oak property.

Graham County

Arizona Copper Co.—The January production was 3,200,000 lb. of copper.

California

Amador County

Keystone—The new electrically driven compressor is ready for installation. The repair timbering in the shaft is extra strong and in heavy places the turbines are 19 ft. long, and 18x18 in. in section.

Alpine—This mine is advertised to be sold at sheriff sale on Feb. 24 to satisfy judgment for a small sum. The matter may be adjusted without dismantling the machinery.

Lincoln—The suit to quiet title to the Stewart claim has been decided in favor of the operating company against the California Consolidated. The Lincoln can now explore the east holdings.

Bunker Hill—On Feb. 7, 68 miners were imprisoned in the shaft for 24 hours, through the breaking of a timber by a falling skip. The hoisting cable parted as the skip was dumping. Food and water were sent down in bullion bags through the 4-in. column pipe, and all were rescued without injury.

Calaveras County

Utica—Extraction of ore from the Cross shaft was resumed Feb. 1, and the 60-stamp Stickels mill started. The shutdown resulted from the freezing of the ditches of the Utica power system. One hundred stamps are now dropping on ores mined by this company, including the Gold Cliff mill. F. J. Martin is manager.

North Star—The 10 additional stamps installed in January are dropping, making a total of 40 stamps crushing ore at this mine which is less than two years old. The inclined shaft is 500 ft. deep, and drifting is in progress on the four levels. The Dolling Gold Mining Co. is the owner and G. S. Berry is superintendent in charge.

Angels—Twenty of the 40 stamps are dropping on good ore. The shaft is 1100 ft. in vertical depth. Extraction is from the 225-ft. winze at the 900-ft. level

Lightner—The Supreme Court has denied the rehearing of this company's suit against the Utica. The plaintiff is the former owner of the Lightner mine. The present owner is the Lightner Gold Mining Company.

Fresno County

Consolidated Lands & Oil Co.—It is reported that this company, which represents the W. P. Hammon interests, has agreed to the payment of $20,000 for further extension of the option on the Lucile Oil Co.'s property.

Modoc County

Modoc—This company is reported to have been successfully financed by William Wrigley, Jr., of Chicago, and work started on the property in the Highgrade district.

Sunshine—This mine, which has produced some high-grade ore, is reported to have been sold to F. Wesendanger, of Los Angeles.

Big Four—Negotiations for the sale of this property are reported as being nearly closed.

San Bernardino County

Death Valley Arcavalda Consolidated—The litigation is reported to have been settled; 40 men are at work and 20 teams of horses and supplies have been sent to the property near Cima. The plant includes a stamp mill, water equipment and electric lighting system.

Shasta County

Noble Electric Steel—The electric smeltery at Heroult made its largest experimental run on Feb. 3, producing 36 tons of pig iron. The furnace was blown in on Jan. 31, and in the 3-days run the total output was nearly 100 tons. The furnace will be operated continuously for two or three weeks for a test run and observations as to cost of operation.

Mammoth—The company is reported to be preparing for an increased production. The orebody opened a year ago is said to have added materially to reserves. Preliminary work has started on the installation of another bank of cooling pipes in the baghouse, making a total of nine. It is expected that this will enable the operation of three instead of two furnaces, as at present. This should increase production considerably.

Sierra County

Kate Hardy—A contract has been let for 150 ft. of tunnel at this mine, near Forest, and work will begin soon.

Rainbow—Machinery for sinking at this mine, at Alleghany, is being brought in and installed. L. P. Woodbury is superintendent.

Sixteen-to-One—At this mine, at Alleghany, sinking will begin as soon as machinery, now on the ground, can be placed in operation. W. I. Smart is superintendent.

Siskiyou County

Siskiyou Mines Co.—It is expected that the flumes and ditches of this company will be in shape by April to begin active operation. G. B. Burbank, of New York, one of the owners, recently inspected the work.

Trinity County

Porphyry Dyke—A cannon-ball mill was installed last autumn and is now in working order for the testing of ore in development, in order to decide upon future equipment. The veins and seams are in a porphyry dike 100 to 400 ft. wide, and of low grade.

Tuolumne County

App—The examination and negotiations respecting the sale of this property include the Moore mine in Amador County as well as the Rawhide in Tuolumne. Captain Nevills states that he is ready to transfer the property, should the prospective purchasers decide to take the mines. The Moore abstracts are now being examined.

Colorado

Cripple Creek District

Rumors are current that a cyanide mill will be put on the Dante in the spring by Edwin Gaylord, one on the Cresson, in Eclipse Gulch, and one on the Elkton, on Raven Hill. The camp is anxious for an official statement of saving and costs on the Clancy mill at the Ajax mine.

South Burns—The January output from this mine on Bull Hill was 13 cars of ore running from $8 to $40. The installation of a new hoist at this shaft has been a boon to the sublessees, most of whom are working in good ore. Charles Crowder is the manager of this property, and also of the Riqua-Savage, where the shaft is being sunk to the 700 level, where a drift will be started.

Trilby—Thirty-two cars of mill ore were shipped in January by the lessees, Oleson and Van Tilborg.

Los Angeles—The January output by Chilson & Polly, lessees, was 14 cars, and it is reported that one car of extra high-grade ore brought $5000. A crosscut is being driven from the end of a drift on the 475-ft. level, and good ore is being mined on the 225-ft. level.

Ajax—The January output was 50 cars of about 1-oz. gold ore. Judge Colburn, president, cancelled four leases for alleged bad mining.

El Paso Extension—The Camilla shaft, on Guyot Hill, has been sunk to a depth of between 900 and 1000 feet.

Lady Campbell—A strike of 2 ft. of rich ore is reported on the Emma Abbott, on Ironclad Hill. Fitzmorris & Bay are the lessees.

Pride of Cripple Creek—Thirty tons have been shipped from the recent strike in one of the Forest Queen flat veins, and it is stated that the grade of the ore was $300 per ton.

Forest Queen—The January output by John Connor, lessee, was about 15 cars, running $40 per ton. It is claimed that he has sufficient ore in sight for a year's production.

Cresson—The January output was 1600 tons of $25 ore. Richard Roelofs is manager.

Christmas Gold Mining Co.—This company, whose mine is on Bull Hill, just above the Golden Cycle, is suing the latter for $2,700,000, the value of the ore which the plaintiff alleges was extracted from its ground, contending that the apex of the vein on which the defendant company is working, and from which it took the ore, apexes within the Christmas company's lines. The Golden Cycle company admits a $75,000 liability, but resists a larger claim. An injunction is also being asked to prevent the Golden Cycle company from further working this vein, its principal and richest one.

Portland—The 18th annual report shows the following: Tons shipped last year, 50,258; gross value, $1,140,054; total production since Apr. 1, 1894, 1,318,261 tons; gross value, $32,827,057; dividends last year, $240,000; total to Jan. 1, 1912, $8,917,080; total development to date, 237,062 ft., or about 45 miles; gross profit for year, $370,913; total income, $380,579; cash balance to 1912 account, $97,023. During the year $11,733 were paid toward the drainage tunnel, making a total of about $60,000 to that fund. It is stated that the Colorado City mill is being changed from chlorination to cyanide at a cost of $100,000. During December, the Victor mill treated 12,285 tons: gross value, $31,432; average, $2.80 per ton; recovery, 80.05%. The cost of treatment was slightly over $1.13 per ton by the Portland process.

SAN MIGUEL COUNTY

Tomboy—During January the mill crushed 8900 tons of ore, yielding $83,500 gross and net $33,500. Expenses were $50,000 and $2828 were spent on permanent improvement.

Michigan

COPPER

Calumet & Hecla—The order recently placed with the Allis-Chalmers Co. calls for a mixed-pressure turbogenerator of 7500-kw. capacity. The exhaust steam of the steam stamps will be used, and it is calculated that about 5500 kw. can be secured from this source. This addition to the electric power plant will give the company about 20,000 hp. in electric power. The proposed new regrinding mill is to be electrically driven and will require about 4000 hp. in motors. The company is also planning on the installation of additional electrically driven mine pumps.

Hancock—The vertical shaft is sinking below a depth of 3300 ft., and is in proximity to the point at which it was estimated that the Pewabic Lode would be reached. Developments are being watched with interest. Nothing is being done on any of the formations encountered in the shaft, but as soon as the shaft reaches its permanent bottom the other lodes will be fully developed.

Houghton Copper Co.—The further extension of the crosscut from the 600-ft. level of this company's shaft shows the lode that was reached recently to be heavily mineralized, and the management is encouraged.

Indiana—The company has started cutting a plat at the 600-ft. level. The shaft is bottomed in the formation, showing an encouraging amount of copper.

Mayflower—It is reported that a change of management is imminent and that those who are opposed to the Fay management are soliciting proxies for the meeting on Mar. 20. It is generally conceded that the St. Marys Mineral Land Co. holds the balance of power through its ownership of 25,000 shares.

Isle Royale—The old hoist at No. 5 shaft is to be replaced with one formerly in use at the Tamarack, Jr., mine. The latter hoist is good for a depth of 2500 feet.

Franklin—The new 10-ton skip went into commission recently, and it is reported to be working satisfactorily. Mill returns are said to be showing improvement since the resumption of active mining operations.

Allouez—The new engine and shaft house are expected to be ready for operation in about two months. No. 1 shaft has reached the 17th level and No. 2 is at the 21st level; the grade of the rock is said to be satisfactory.

IRON

Oliver Iron Mining Co.—A rescue station has been established at Iron Mountain on the Menominee Range. Three oxygen helmets and a pulmotor have been provided, and men are being instructed in rescue work. The Chapin mine, the largest iron ore producer in Michigan, is the chief holding of the Oliver company at Iron Mountain and the Aragon mine, at Norway belonging to the same company is 10 miles distant.

Ladenburg, Thalmann & Co.—These interests, known at Florence, Wis., as the Florence Iron Co., and at Iron River, Mich., as the Bates Iron Co., have taken an option on Sec. 36-T. 44-R. 33, in the Amasa district, and have let a contract for diamond drilling to the Cole & McDonald Exploration Co. Ore formation has been found to the southeast on Sec. 6-T 43-R. 32, and the Hancock, Michigan, and Gibson mines lie to the northwest.

Pickands, Mather & Co.—This company is exploring the Warner property in Sec. 9-T. 44-R. 33 in the Amasa district. The land lies between the Michigan mine of the Oliver company and the Gibson mine of the Rogers-Brown Ore Company.

Champion—This specular hard-ore mine of the Oliver Iron Mining Co., on the western Marquette Range, is practically idle. The Buckeye exploring company, which has been drifting on the 2000-ft. level of the Champion mine, for exploring ground to the west, thus saving the cost of sinking a shaft, has stopped work; only a small lens of ore was cut. The underground operations of the Buckeye company have been directed by Capt. John Thomas, of Ishpeming.

Maas—It is reported that this mine of the Cleveland-Cliffs Iron Co., in Negaunee, will be reopened in the spring. The mine has been closed down since last spring, when the wooden shaft was replaced by a concrete drop shaft, sunk by the Foundation Company.

Minnesota

MESABI RANGE

La Rue—It is reported that this property of the M. A. Hanna company will resume operations on Mar. 1. Two years ago, considerable money was spent in improving the property, installing new machinery, etc., but since then little ore has been shipped. Butler Bros., contractors, are expected to resume stripping operations with one shovel on Mar. 1; when the pit is sufficiently large, a second shovel will probably be installed.

Platt—This mine, according to reports, will begin underground work early this spring. The ore, heretofore, has been hoisted from an open pit, but it is thought that a shaft will be sunk.

Hull-Rust—Trouble, due to encroachment of mining operations upon private property, culminated recently in the cessation of winter mining operations at this and the Burt-Sellers pits. The men have been paid off and it is not known when work will be resumed. These are two of the largest properties on the range.

Mahoning—It is locally reported that this property will be stripped between the present open pit and the viaduct, where there is said to be a body of high-grade ore, which is wanted for mixing with that being taken from the pit.

Scranton—Drifting and raising are in progress and the mine is being put in shape to move the ore rapidly when it is wanted.

Missouri

Cherokee—This mill, at Thoms Station, is nearly completed, and will soon be operated. J. M. Short, of Joplin, is manager.

Hayseed—This mill, near Carthage, has burned to the ground. Thomas Douglas, of Joplin, is manager.

Double D—The ground at this mine, at Carterville, has caved in and may take in the mill.

Minor Heir Sunrise—This company, operating the Sunrise mine, at Spring City, has pumped out the water, repaired the mill and is now producing ore.

Nevada—This zinc smeltery has been remodeled, and is now producing spelter.

Doe Run Lead Co.—This company is floating a 3-year issue of bonds, amounting to $2,200,000, on its 6700 acres, to finance heavy investments made in the acquisition of more property and the enlargement of its plant. It has produced $11,400,000 worth of lead and for years has paid 6% on its stock.

National Lead—The company has taken an option on the Jake Day tract of the Potosi Mines Co., on which a shaft was recently completed. Diamond drills have been moved to the property to test the orebodies. This tract includes 357 acres situated on Big River in the heart of the disseminated lead belt. The property was acquired for about $1000 per acre and is said to be optioned at about double this amount.

Montana

Butte District

Anaconda—The Butte, Anaconda & Pacific Ry. and all its branches are to be electrified. It is expected that the new system will be in operation early in 1913. The electric locomotives are already being constructed. The General Electric Co. has the contract.

East Butte—Mining operations are still confined largely to the orebody on the 800-ft. level, from which about 30,000,000 lb. of copper have been mined by the company under its present management; development work, however, is being carried on extensively on the 1000-ft. level, and within six months the orebody now being mined on the 800-ft. level will be opened on the 1000-ft. level, with what the management has every reason to believe, as good or better results than on the level above. It has been decided to increase the orebin capacity, and to install a mechanical charging system, at the smeltery on the property.

Deer Lodge County

Southern Cross Extension—This and the Early Spring lode claims, adjoining the Southern Cross mine in the Georgetown mining district, have been purchased by John D. Pope, general manager of the North Butte company in Butte. The Southern Cross Extension was deeded from H. C. Bacorn to Mr. Pope, and the Early Spring from B. W. Todd, F. W. Bacorn, and H. C. Bacorn, with the purchase price not given. Mr. Pope and Mr. De Peu, chief clerk of the North Butte company, own several other claims adjoining these two and, with these additions, are possessors of a valuable group of claims adjoining the Southern Cross on the northwest. It is their intention to begin development soon. The advent of the Anaconda company into the district is causing activity there.

Hidden Lake—Regular shipments of ore to the Washoe smeltery are being made from this property in the Georgetown district, and extensive development work is being carried on at a number of the claims, including the sinking of a shaft on the Gold Bug claim. R. R. Robinson, one of the owners, is in charge of operations.

Jefferson County

Sunlight—For the purpose of operating this mine, near Whitehall, the Montana Merger Mines Co. has been incorporated at Virginia City, with a capitalization of $1,500,000. Officers and directors are: Amos C. Hall, president; Jacob Albright, vice-president; L. D. Moritz, secretary and treasurer; Harry E. Hall, F. C. Ball, R. E. McConnell, and S. V. Stewart all of Virginia City; D. A. Morrison, of Whitehall, and R. C. Monahan of Butte.

Madison County

Pittsburg—It is probable that the coming summer will witness the continuation of work on the company's properties, situated about 10 miles from Twin Bridges, near the head of Bear Gulch, and closed two years ago owing to difficulty among the owners. The owners are Bielenberg & Higgins, of Deer Lodge, and Roy, Samuel and George Pritchett, Mr. Bielenberg holding the controlling interest. Considerable good milling ore and some high-grade base ore were blocked out at the time operations were suspended, and the company plans to add new machinery for treating the ore and to drive a 1000-ft. tunnel to develop the property.

Nevada

Comstock Lode

Consolidated Virginia—It is announced that the management will soon start a raise in the rich streak of ore recently cut on the 2550-ft. level in the southwest drift, and will carry it to the 2450-ft. level. This raise will serve the double purpose of making an air connection with the level above, which is open direct with the C. & C. shaft, a downcast, and of prospecting the vein. The ore shows well in the roof of the drift and also in the bottom. This work will be started as soon as the west crosscut has opened the formation to the footwall. An east crosscut has been started on the 2450-ft. level from the main northeast drift to connect with the raise from the 2550 level.

Union Consolidated—The directors have elected C. E. Julihn superintendent of the property, to succeed Whitman Symmes, and the former has taken charge. An east crosscut has been started from the main north drift to explore the vein formation on the hanging-wall side. Mr. Julihn has also been made superintendent of the Sierra Nevada mine.

Ophir—A west crosscut is being driven on the 2100-ft. level from the main south drift, that has been skirting the old stopes of the Hardy vein. The gross assay value of the ore recovered from the mine last week was $11,000. One car of concentrate was shipped to the smeltery.

Crown Point—The last report from the mine shows increasing grade of the ore from the 1400-ft. level, the recovery last week amounting to $4000. The Yellow Jacket mill is operating to capacity on ore from the mine, repairs to the plant having been completed.

Yellow Jacket—The annual report of Superintendent Sturges for 1911 shows that 21,954 tons of ore from the surface dumps were treated at the mill, the assay value of which was more than $57,000. The mill crushed 39,095 tons, of which 17,141 tons were from the Crown Point mine. The Yellow Jacket company will resume active work in the mine as soon as the water is lowered in the deep levels, through drainage from the Ward shaft, now being attempted with good prospects of success.

Mexican—The mill has resumed operations after a shutdown for the monthly cleanup, and for the installation of a larger classifier. Three bars of bullion were shipped to the smeltery as a result of the month's run.

Esmeralda County

Goldfield-Belmont—It is announced that another shipment of high-grade ore has been made recently, amounting to 26 tons and averaging $90 per ton.

Lander County

Some good veins are being opened in the new camp of Carroll, 40 miles south of Austin. Activity is expected to increase with the arrival of spring.

Nye County

Tonopah Extension—The output for January amounted to 4619 lb. of bullion, valued at $50,809, the mill having treated 3760 tons of ore during the month.

Tonopah Belmont—The main shaft is now 1420 ft. deep and has been sunk a depth of 65 ft. in the vein, which at this point is nearly vertical. For 53 ft. the ore was of high milling grade, but is now low grade on the footwall. A winze on the vein 300 ft. east of the shaft is 70 ft. deep, the entire distance in high-grade shipping ore.

Jim Butler—The report for the fiscal year ended Sept. 30 shows: Total receipts, $25,817; disbursements, $23,939; balance, $1877.

White Pine County

Nevada Consolidated—A new steam shovel is reported to have been received for use in the pit at Copper Flat. Seven shovels are now in service and one will be moved to McGill to excavate for the new settling tank at the Steptoe concentrator. The force at the Veteran mine has been increased to 300 men, and this has increased the total payroll of the Ely district to about 3000 names.

Utah

Beaver County

Atlas—It is reported that a lease and bond have been taken by Park City men on this property, southwest of the Moscow. The development includes a 600-ft. tunnel and a 500-ft. incline.

Horn Silver—The showing on the 400-ft. level continues good; the ore has been followed 40 ft. along the strike and is 15 ft. wide. A 10-ft. face of lead ore of good grade has been opened on the 720-ft. level.

Box Elder County

Box Elder Consolidated—Articles of incorporation for this company, organized in Brigham City, have been filed. The capitalization is 500,000 shares, par value 10c. C. M. Peterson is president. A good surface showing is reported.

Juab County

Chief Consolidated—The annual report has been issued. During 1911 there were produced 6703 tons of ore, net profits from which were $13,929. The net value per ton was $15.59, the ore averaging 0.048 oz. gold, 39.584 oz. silver, and 5.277% lead per ton. The development work amounted to 3300 ft., of which 2682 ft. were drifts, 519 ft., raises, and 99 ft., winzes. A small product of fairly good ore has been gained, and the ore has been improving in quality and quantity, with depth. On the north the ore has been found, and is being followed under the town of Eureka, where ore of good grade is being stoped. Drifting has been done to the east and west under the town in an effort to develop other ore zones, and the western drift is within a few hundred feet of neighboring mines, working on independent ore zones.

Tintic Mining & Development—Preparations are being made to work this property, northeast of the Gold Chain and Mammoth. Prospecting will be done through the Sioux-Ajax tunnel. The company is a close corporation. J. W. D. Moodie is manager.

Crown Point—The drift on the 500-ft. level eastward from the shaft has attained a length of 170 feet.

Eureka Hill—In December four cars were marketed, and in January two, some of the ore netting about $1000 per car. The ore comes from ground adjoining the Centennial-Eureka, which is being worked through that property under a lease.

Grutli—This property, consisting of a group of patented claims in the eastern part of the district, is making preparations to sink a winze from the 200-ft. level. The property has not been in operation for some time.

Sioux—Drifting is being done to prospect the ground underneath the cave encountered recently.

Lehi Tintic—A tunnel is being driven to prospect ground under the 400-ft. incline shaft. The tunnel is 1075 ft. long, being about 200 ft. from its objective point. The face shows iron-stained quartz, similar to that found with the ore in the incline.

Santaquin Chief—A tunnel, the face of which is 120 ft. from the surface, is being driven; it is in 150 ft., and there is ore reported for two-thirds of that distance. A cave with ore in the bottom has been broken into, and a winze is being sunk to prospect it at greater depth. Twenty tons of sorted shipping ore are piled in the tunnel, and there are 40 tons on the dump. The ore is lead-silver, averaging $35 per ton. There is also some zinc.

Grand Central—The shaft is being sunk 3½ ft. per day. Shipments are being maintained.

Salt Lake County

Utah Metal—Work on the Tooele-Bingham tunnel is progressing at the rate of about 10 ft. per day. The face is in hard quartzite but the work is being done at an unusually low cost. The Tooele side is in about 6600 ft. and the Bingham side about 400. Two shifts are being used. The work on the Bingham side is in Bingham Central Standard ground.

Alta Consolidated—Settlement for 23 tons of ore recently shipped brought $993. Shipments were suspended some time ago on account of heavy snows, but the roads have been opened again and teams are hauling 80 tons of ore per day. Work on ore is being done in five or six places, and 18 men are employed.

Utah Copper Co.—The eighth section of the Arthur mill is expected to go into commission on Mar. 1, and it is planned to place an additional section in operation each succeeding month until the 25 sections are in full operation, 12 at the Magma and 13 at the Arthur mill; these will handle about 20,000 tons per day.

Summit County

New York Bonanza—This property is reported to have marketed 133 tons the past week, and 114 tons the week preceding. The ore brings about $10 per ton and comes principally from the fourth level.

American Flag—Development at this property is being done chiefly on the 1100-ft. level. The main shaft is 1170 ft. deep. No shipments have been made since last April, but previous to that gold and silver ore was shipped to the American Smelting & Refining Co. About two-thirds of the content of the ore is in silver.

Canada

British Columbia

Large areas of anthracite coal are reported to have been found in the region at the headwaters of the Skeena River, about 150 miles north of Hazelton. It is said that a good-sized party of engineers has spent considerable time in the district recently, and that good seams of coal are said by them to underlie a large expanse of territory.

Yankee Girl—It is reported that a 100-ton mill will be erected at this mine at Ymir, next autumn. Robert Mabry, of Spokane, Wash., is one of the owners.

British Columbia Copper—The report for the year ended Nov. 30, 1911, shows total revenues of $1,968,159, an increase of $501,419 over the previous year. Total assets were $3,826,032, a decrease of $135,870. Total deductions of $1,834,229 left a balance of $133,930 for dividends, resulting in a deficit for the year of $14,001. President Erb states that considering the low price for copper that prevailed and the difficulties incident to the coal strike, the results for the year were favorable and that the prospects for the coming year are satisfactory.

Ontario-Cobalt

Cobalt shipments for the week ended Feb. 10, were: Nipissing, 144,920 lb.; Temiskaming, 133,212; Drummond, 120,650; McKinley - Darragh, 120,452; O'Brien, 71,592; La Rose, 65,339; Kerr Lake, 41,056; total, 697,221 lb. Bullion shipments were: Nipissing, 143,213 oz.; O'Brien, 19,570; Crown Reserve, 15,000; miscellaneous, 7293; total, 188,077 ounces.

Nipissing—January production amounted to 406,826 oz. of silver, of a gross value of $224,903. This compares with 407,114 oz. for December, 403,408 for November and 431,986 for October. Shipments were small and amounted to ore valued at $113,647. This was due to the closing of the high-grade plant for the annual cleanup.

Trethewey—During the last calendar year the mine produced 716,464 oz. of silver, of a gross value of $373,486. Reserves were increased by an almost equal amount.

Beaver—Shaft No. 1 is down 550 ft. and sinking is being continued. A station is being cut and a level established at 530 feet.

Provincial—A vein 1½ in. wide of rich ore, with silver shot through the wall rock for 2 ft. on each side, has been encountered in the conglomerate, 60 ft. from the shaft at the 300-ft. level.

Ontario-Porcupine

Crown Chartered—A new road has been cut from this property to the town of South Porcupine; it will also serve the other miners in that section.

Leighton-Warner—A 10% dividend has been paid on the outstanding capital. The money comes from the sale of properties.

Iroquois—Free gold has been encountered in the shaft at a depth of 40 feet. Machinery has been installed recently.

Little Pet—The 5-stamp mill for this property has been shipped. Foundations for the mill have been started. The drift on the 100-ft. level is in about 12 ft. on a vein of good ore, 3 ft. wide.

Dome Lake—A compressor is to be installed, and diamond drilling is still giving good results.

West Dome—The mine has been partially closed down.

Kelso—This nickel property is to be opened under the direction of the original owners.

Dome Extension—Drilling near the Dome boundary at a vertical depth of 500 ft. showed 20 ft. of gold-bearing vein matter.

Martin—Work has been suspended on the property.

Dobie—Crosscuts have been started at the 60- and 90-ft. levels, respectively, of the two shafts.

Winyah Gold Mining Co.—This recently organized company, has taken over four claims in Mountjoy Township, owned by R. A. Cartwright. Diamond drilling will be started soon. A shaft has been put down to a depth of 56 ft. and some development work done, with good results on the 50-ft. level. A. W. Grierson has been appointed manager.

North Dome—A vein 2 ft. wide carrying free gold has been encountered at 60 ft. in No. 2 shaft.

McEnaay—An orebody 5 ft. wide, carrying good ore has been cut at the 173-ft. level. Coe Carson and Samuel Cohen, president and general manager of the Crown Reserve, recently visited the property.

O'Brien—A rich silver deposit has been struck between two veins at the 150-ft. level of this Gowganda property. There is leaf silver on the wall rock on each side of a calcite vein which carries silver in nuggets.

Porcupine Reserve—A larger plant is to be installed on this property.

Ontario-Sudbury

Mond Nickel Co.—The company has secured about 2400 acres of land at Coniston, as a site for the new smeltery on which it is understood active operations will be begun this spring.

Mexico

Chihuahua

Santa Reyes—Some excitement was caused recently by a strike of bonanza ore at this mine in the Andres del Rio district. Mr. Monge is operating the property, having purchased it about a year ago from Doctor Durand. Development work has been carried on since then.

Alvarado—The order for the new aërial tramway to connect the Presena mine and the mill opposite the Palmilla mine has been placed and construction will begin soon. The ropeway will be 12,500 ft. long between terminals and will be supported by 32 towers. Gravity supplemented by a motor at the discharge terminal will be the power employed. The discharge terminal will be constructed of steel, but the towers will be of wood. The tramway is expected to handle 350 tons per 10-hr. shift, which is more than the present capacity of the mill. New tube mills, however, will increase the capacity of the latter.

San Juanico—The Alvarado company is considering the resumption of active work at this mine. Work in a small way is going on at present with leasers and tributers.

La Cumbre v La Bufa—Two cars of ore were shipped to the Torreon smeltery recently.

El Tajo—The new concentrator is treating about 2000 tons per month. The new pump is giving satisfactory service. H. H. Utley is in charge.

Tepehuan Mexican Syndicate—The new machinery for the mine at Cebollitas has arrived at Parral and will be forwarded soon.

Alfarena—The ore bins have been put in good condition and the new electric hoist is expected to be working in about six weeks. The shaft at this mine is an inclined one and parallels the vein at a distance of about 50 ft. in the footwall. The ground requires little timbering. T. G. Hawkins is in charge.

Jalisco

El Favor—Good orebodies are reported to have been opened recently. Cyanide tests are said to have shown that a good extraction is possible. Reduction equipment for an addition to the present plant has arrived at Magdalena and a contract has been let for transporting it to the mine. The present mill is not large enough to handle the tonnage from this and the Mololoa mines.

Oaxaca

San Juan—Judge L. R. Wilfrey, of Mexico City, recently purchased the interest of C. A. Hamilton, in this mine, at Taviche, for 1,000,000 pesos. The mine was developed by Mr. Hamilton, but became involved in a lawsuit, after which it reverted to Juan Baights, who worked it for three years. It is stated that the smeltery returns for 1911 were 900,000 pesos. A mill will be erected.

Sonora

It is reported that a concentrator will be erected at Tesia, a station on the Mayo River, about five miles from Navajoa on the Alamos branch of the Southern Pacific R.R. It will be of 200 tons capacity.

La Dura—A strike of employees is reported to have occurred recently, in which an increase in wages of 33⅓% was demanded.

Cicero Smith—J. H. Reagen, of Patagonia, is moving the mining machinery from this mine to a point on the Yaqui River where it will be erected and placed in operation.

Muchacho Grande—This company, operating in the Alamos district, is reported to have arranged for building a concentrator at Victoria station on the Alamos branch railroad.

South Sonora Silver Mining Co.—This company, composed of Kansas City and New Orleans men, is operating on a group of claims near the Plata Fino group. It is reported that machinery will be installed soon.

South America

Colombia

Guadaloupe & Porce Mining Co.—This company is composed principally of Denver, Colo., men and has recently acquired extensive placer properties on the Guadaloupe and Porce Rivers. F. L. Norman, engineer for the company, has purchased and shipped a complete hydraulicking plant. This is expected to arrive soon and ditches and flumes are now under construction. The plant includes 2000 ft. of 16-in., and 300 ft. of 12-in. pipe, all of which will be shipped in 3-ft. sections, punched for double riveting. The elevator is of the Evans type and is expected to raise to a height of 50 ft., all the material under 6-in. size that can be washed to it by a 2½-in. giant. The depth of the gravel is from 20 to 35 ft. Numerous tests are said to have indicated a content of about 80c. per yd. Active washing operations will be in charge of James Boger and the company's headquarters are in Denver, Colorado.

Asia

Chosen

Oriental—During December, 26,121 tons of ore were crushed, yielding gross $136,755. The Kuk San Dong mill and dump plant were closed during the entire month due to lack of labor causing a shortage of wood. The Candlestick mill had five stamps hung up all month owing to lack of labor in the mill. Labor conditions are improving.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Feb. 14—Demand is increasing in the coal trade; both in the West and the East. Part of this demand is immediate, arising from weather conditions, and part is prospective, being due to the desire of large consumers to put in stocks to provide against possible shortage in April. The present difficulty in the trade arises from shortage of cars and from slow transportation on the railroads, due to the weather. Operations at mines have been subject to some delay from the severe cold, but all demands could be met if the railroads could only move the coal promptly. They are not doing this and the trade generally is in confusion. Prices are advancing, but there is much trouble about deliveries everywhere.

Anthracite shipments in January are reported at 5,763,696 long tons; which is 351,731 tons less than in December, and 140,421 tons less than in January last year.

Austrian Coal—Coal production of Austria year ended Dec. 31, metric tons:

	1910	1911	Changes
Coal..............	13,773,985	14,861,314	I. 1,087,329
Brown coal.....	25,132,855	25,255,429	I. 122,574
Total mined..	38,906,840	40,116,743	I. 1,209,903
Coke made.....	1,999,106	2,076,978	I. 77,872
Briquets made.	334,218	347,597	I. 13,379

Of the briquets reported in 1911 there were 208,759 tons made of brown coal or lignite.

Iron Trade Review

New York, Feby 14—The iron trade has been moving rather steadily, reports generally showing fuller operation of mills. Specifications on contracts come in quite freely, and new business is not lacking, though there is no resumption of the December rush. Structural steel continues in demand and business in plates and sheets is good. Reports from the wire trade are favorable. As spring approaches there is an increasing demand for bars and smaller material. The reported blowing in of several steel works furnaces indicates an increasing demand for finished steel.

Pig iron has shown some activity, owing to a better demand from foundries, inquiries for large lots of pipe iron, and some call for basic pig. The general report is that stocks have been pretty well cleaned out, and that any further increase in demand will require the blowing in of more merchant furnaces. There has been no material change in prices.

The official estimate for next season's shipment of ore from the Great Northern ore properties, by the Oliver Iron Mining Co., is reported to show an increase of 31.5 per cent. over 1911. Last year shipments were 6,883,000 tons. The estimate recently submitted for this season's shipment from the Hill properties, gives a total of 9.050,000 tons.

Pig-iron Production—The reports of the blast furnaces, as collected and published by the *Iron Age*, show that on Feb. 1 there were 227 coke and anthracite stacks in blast having a total capacity of 71,100 tons of iron daily; an increase of 3500 tons over Jan. 1. Making allowance for the charcoal furnaces, the total make of pig iron in the United States in January is estimated at 2,077,500 long tons.

Steel Corporation Orders—The statement of unfilled orders on the books of the Steel Corporation on Jan. 31 shows a total of 5,379,721 tons of all kinds of material. This is 294,981 tons more than on Dec. 31, and is the largest tonnage reported since March 31, 1910. It is 2,268,802 tons more than on Jan. 31 of last year.

The Steel Corporation showing is favorable, but it must be noted that shipments were somewhat decreased in January as compared with December, on account of the weather, and despite the fact that during the month the corporation made an increase in the capacity nominally in operation. The December increase in unfilled tonnage was 942,806 tons; the January increase was 647,846 tons less, and considering the presumptive decrease in shipments it may be taken that actual bookings decreased 700,000 tons or more from December to January.

Baltimore

Feb. 12—Exports for the week included 129,920 lb. wire and 83,105 lb. nails to Dublin. Imports included 15,915 tons iron ore from Cuba.

Birmingham

Feb. 12—Southern pig-iron manufacturers report a little lagging in the selling but the market is still in a fairly satisfactory condition. The price of pig iron in this section has taken on some strength, a few sales having been made at $10.50 per ton, No. 2 foundry and the inclination is to make that price the basis for all iron that will be sold for delivery during the second quarter of the year. Inquiries are coming in steadily for iron for delivery during the last half of the year and it is believed there will be good business through the year. The make is still off. Alabama during January produced only 146,212 tons of iron against 161,976 tons in December, the month previous. The accumulated stock of iron in the Southern territory is still of considerable size but there is a steady reduction and by the end of four months it will be almost wiped out.

There is still discussion in this section as to reductions in freight rates to Ohio gateway points; the independent manufacturers in the South will shortly present a petition to the Interstate Commerce Commission looking to a lower freight rate, a reduction of at least $1 per ton, to Ohio points.

There is a satisfactory condition, everything considered, in the steel trade in the Southern territory. In fabricated steel there is continued activity. The rail trade is steady, though the Emiley plant is not making its full capacity. Steel-wire goods are moving well..

Chicago

Feb. 12—The iron market is quiet; there has been no important change from the conditions noted last week. Pig iron is in light demand with sales only in small quantities and not extending beyond first-half deliveries as a rule. It seems more than ever a waiting market. Transactions in charcoal pig iron have quieted and the market rests on the small though numerous needs of the coke-iron smelters.

Southern No. 2 coke iron sells for $10@10.50 Birmingham, or $14.35@14.85 local delivery, the lower price obtaining easily on any good-sized order. Northern No. 2 brings $14@14.50 and Lake Superior charcoal iron $16.50@17. There are a few inquiries for lots of more than 1000 tons, but they seem to be put out more to feel the market than to place contracts.

Iron and steel products make a better showing, the local mills being well supplied with orders and sales of the leading lines being satisfactory. Structural material is in increasing demand for bridge and building work in the West and Southwest with scattering sales in local and northwestern territory; beams and channels under 15 in. continue at 1.30@1.38c. Aside from the occasional sales of heavy rails in large quantities of which the local mills get a share, there is a good, steady demand for track fastenings and light rails. Bars are steady, with little if any price cutting reported, bar iron being quoted at 1.15@1.20c., and mild steel bars at 1.25@1.33c. Plates are holding to 1.30c. minimum, with the demand not so active, but still fair. Minor lines show good sales and prospects of new business.

Cleveland

Feb. 12—While no prices for ore are made yet, several contracts for delivery during the season have been made, subject to prices which may prevail later The large inquiry from the East, which was noted last week, has not yet developed into actual business.

Pig Iron—The market is inclined to be slow, though a fair business has been done in small orders. There is some inquiry for basic. Current quotations, Cleveland delivery, are $15.15 for bessemer, $13.25 for No. 2 foundry, $12.50 for forge and $16.50 for Lake Superior charcoal.

Finished Material—Some contracts have been let for structural steel and plates. Wire is active. Prices on bars are rather irregular; also on sheets.

Philadelphia

Feb. 14—The feature of the pig-iron market today is the large number of inquiries, largely from small consumers in widely scattered localities. Furnacemen hope for a permanent advance of 25c. on most of the new business where small orders are placed. The larger consumers are negotiating, but show an unwillingness to close promptly. Low-grade iron for pipe purposes has slightly advanced and on account of the well sold up condition of the furnaces a further permanent advance is regarded as probable. All kinds of iron are decidedly stronger as judged by the statements and attitude of the leading furnace interests of this territory. Makers have declined a few offers for third-quarter delivery, believing that it is not advisable to commit themselves to such remote delivery in the present situation. Forge iron is moving steadily, but as usual in rather small lots. Malleable has regained its former activity and a few contracts have been placed for supplies running to midsummer. Basic has not changed and new business is of small volume. The general tone of the market is decidedly stronger from the makers' point of view, but this conclusion is not accepted by buying interests.

Steel Billets—The heavy buying of material into which steel billets enters has at least strengthened the market, but actual sales at stronger figures cannot be proven. The minimum quotation of billets is not changed.

Bars—Bars have not advanced in a large way, in fact large buyers find no difficulty in securing all the material they want on practically their own terms.

Sheets—Sheets maintain their advantage and new business for the week shows a marked increase over last. Much business for the latter part of the second quarter has been placed.

Pipes and Tubes—All the reports concerning tubes are favorable. Merchant pipe is doing better in orders for spring delivery. The cast pipe interests are all loaded up with business.

Plates—Only a moderate business has been done in plates, although there are enough orders to be placed to satisfy the mill interests. The larger buyers are hesitating for some reason not apparent and the manufacturers are holding their minimum quotations very firmly.

Structural Material—Structural material is quiet, comparatively speaking, the only business closed this week being the acceptance of orders which have been occupying attention for two or three weeks. Much of this material is for construction work in New York and in some New England cities. A few moderately large orders have been placed on account of Philadelphia enterprises and a number are likely to be placed.

Scrap—Very little business has been definitely placed, but consumers are asking for quotations which will lead to business probably by the middle of March. The present quotations do not invite them, but the scrap dealers claim the prospective supply will enable them to maintain their quotations.

Pittsburg

Feb. 13—The finished-steel market has not lost ground in the past few days, but it has not gained. Last week the eagerness of certain mills, particularly in the East, resulted in prices on bars, plates and shapes becoming quotable at 1.10c., Pittsburg, on desirable orders, a decline of $1 a ton from the advanced quotations of December; but it must be observed that the advanced prices were at no time the subject of any general trading. The mills put up their quotations to the 1.15c. level, and in a few cases to a level of 1.20c., simply because they had booked an unusually large amount of tonnage in a few weeks at especially low prices, and were in position to try the effect of advanced prices. The effect might have been altogether favorable if weather conditions had been normal; as it was, the extremely cold weather tended to retard the placing of business and some of the mills became ready to book desirable orders at 1.10c., or $1 below the former asking price, but somewhat above the prices actually obtaining on the material which is being shipped this quarter.

Since this decline the market has not suffered further. There is not a great deal of competition, for the reason that the Steel Corporation and some of the independents are well sold up, on one product or another, so that the competition has been relatively limited.

Pig Iron—The Jones & Laughlin Steel Co. is this week blowing in one of its Aliquippa furnaces, and will blow in a second about Mar. 1. The Carnegie Steel Co. has given orders to blow in its Niles stack, in about a week, and this, with the second Isabella furnace being started, will make 52 of the 59 Carnegie furnaces in operation. The Steel Corporation will not buy any merchant bessemer iron, as was reported last week it might do. The Shenango Furnace Co. blew out one of its stacks, Feb. 4, and will rejacket and reline it. Perry furnace, at Erie, has also gone out, and will be relined. The merchant furnaces now in operation are well sold up, according to their reports, and the local pig-iron market perhaps owes its steadiness to this fact, as current demand furnishes no support, inquiry and actual buying being extremely light. We quote: Bessemer, $14@14.25; basic, $12.25@12.50; No. 2 foundry, $13@13.25; forge, $12.50@12.75; malleable, $13@13.25, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market is very quiet, with the price well maintained at $41, Baltimore, for prompt and forward, freight to Pittsburg being $1.95. The steel interests are much exercised over the feature of the Underwood bill which places the duty on ferromanganese at 15 per cent. *ad valorem,* the same percentage rate as is placed on pig iron. This, at the present level, would make the duty about $5.40 per ton, against $2.50 in the present law and $4 a ton in the old law.

Steel—The Carnegie Steel Co. is oversold on billets and sheet bars and is entirely out of the markets on these products. Some of the mills are ready to book additional orders at less than the asking prices of 30 days ago, though not at as low prices as obtained in November. We continue to quote bessemer and openhearth billets at $19.50@20 and sheet bars at $20.50@21, Pittsburg; bessemer billets at $19 and sheet bars at $20, Youngstown.

Sheets—The market continues irregular, with one mill or another usually ready to shade the openly recognized prices by $1 a ton, and occasionally by a trifle more in the case of black sheets. The leading interest is well sold up, and so are some of the independents. We quote: Black sheets, 28 gage, 1.85@1.90c.; galvanized, 2.85@2.90c.; blue annealed, 1.35@1.40c.; painted corrugated, $1.33@1.35 per square; corrugated, $2.47@2.50 per square.

St. Louis

Feb. 10—There has been nothing to disturb the even tenor of the pig-iron market during the past week. Buying has been light and inquiries few. All sales are of small lots. There will probably be little done for another 30 days, when it is expected that buying for the third quarter will open up. The price on Southern iron remains $10@10.25, Birmingham, or $13.75@14, St. Louis. Not much interest is being shown in Northern iron; $14.25@14.75 is the present quota-

The demand for coke from the foundries is fair and prices are quite stiff at $2.25@2.40, at ovens, or $5.05@5.20, St. Louis, for 72-hour foundry. The high price of coke is more reflection of the general coal and railroad situation than from any heavy demand from founders.

Iron Ore Trade

It is stated that a lot of iron ore from Wabana, Newfoundland, has been contracted for by an Eastern furnace at 7c. per unit, f.o.b. cars at Philadelphia. Some large lots of New York and New Jersey ores have been placed at 7¼@7¾c. per unit, delivered. These prices are slightly under last year.

The Eastern Steel Co. is negotiating for 150,000 tons of Lake Superior ores for Warwick furnaces at Pottstown, Penn. The question to be settled is the price.

Imports and exports of iron ore in the United States for the full year, long tons:

	1910	1911	Changes	
Imports	2,591,031	1,811,732	D	779,299
Exports	748,875	768,386	I.	19,51

Exports are chiefly to Canada. The imports in 1911 included 1,147,879 tons from Cuba; 219,238 from Sweden; 194,965 from Spain; 174,853 from Newfoundland; 50,480 from Canada; 24,317 tons from other countries.

Imports of manganese ore were 242,348 tons in 1910, and 176,852 in 1911; decrease, 65,496 tons.

British Iron-Ore Imports—Imports of iron ore into Great Britain for the year ended Dec. 31, were 7,020,799 long tons in 1910, and 6,328,623 in 1911; decrease, 692,176 tons. Imports of manganese ores were 482,209 tons in 1910, and 358,915 in 1911; decrease, 123,294 tons.

French Iron Ore—The production of iron ore from the Briey Basin in 1911 was 10,427,000 metric tons; which compares with 8,470,000 in 1910, 6,310,000 in 1909 and 4,368,000 in 1908. The increase has been at the rate of about 2,000,000 tons a year.

Foreign Iron Trade

German Iron Production—The German Iron & Steel Union reports the production of pig iron in Germany in December at 1,377,637 metric tons; being 63,741 tons more than in November, and 70,553 tons more than in December, 1911. The total make of pig iron for the year was 14,793,325 tons in 1910, and 15,334,223 tons in 1911; an increase of 540,898 tons, or 3.7 per cent.

METAL MARKETS

New York, Feb. 14—The metal markets continue rather interesting, but with no great changes apparent or completed.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January	110	111	July	112	......
February	115	......	August	117	......
March	112	......	September	111	......
April	114	......	October	112	......
May	118	......	November	111	......
June	115	......	December	110	......

Year 1909, 115; 1910, 115; 1911, 112.

Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold:				
Dec. 1911	$ 994,677	$ 4,707,330	Exp.	$3,712,565
" 1910	1,330,400	4,976,632	Imp.	3,646,232
Year 1911	37.183,074	67,445,184	Imp.	20,262,110
" 1910	58,774,822	59,222,518	Imp.	447,696
Silver:				
Dec. 1911	6,997,360	3,306,727	Exp.	2,690,630
" 1910	6,061,060	4,398,450	Exp.	1,662,618
Year 1911	65,664,646	43,746,571	Exp.	21,918,073
" 1910	67,360,973	45,878,168	Exp.	11,482,805

Exports from the port of New York, week ended Feb. 10: Gold, $8,344,387, chiefly to Paris and Argentina; silver, $891,970, principally to London. Imports: Gold, $632,809, largely from Mexico and South America; silver, $216,101, from Mexico, Central and South America.

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Some gold was taken for India, but otherwise there was no foreign demand. In New York $3,750,000 for Argentina.

Messrs. Samuel Montague & Co., write from London, Feb. 1: "In last week's letter the impression was conveyed that the net imports of gold into India for 1911 would constitute a record. The total for the year was £20,909,442. This heavy total represents considerably over a fifth of the world's output of gold. The large recent withdrawals from London suggest that the imports for the present season will be phenomenal."

Iridium—The price remains about the same, $64 per oz. being asked for pure metal.

Platinum—The market has been quiet and prices rather weaker. Dealers still ask $46, but sales have been made at 50c. less. We quote $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

SILVER AND STERLING EXCHANGE

Feb.	8	9	10	12	13	14
New York	59⅞	60⅛	60⅜	....	60⅝	60
London	27 9/16	27 11/16	27¾	27 13/16	27⅞	27⅝
Sterling Ex.	4.8705	4.8710	4.8730	....	4.8730	4.8710

New York quotations, cents per ounce troy, fine silver: London, pence per ounce, sterling silver, 0.925 fine.

Silver—The market has reached this week the highest point yet attained in the present advance. While fluctuations are in order, those in a position to judge think the metal should maintain a high level, owing to the Eastern conditions.

Exports of silver from London to the East, Jan. 1 to Feb. 1, reported by Messrs. Pixley Abell:

	1911	1912	Changes	
India	£1,091,300	£835,300	D.	£256,000
China	176,000	250,000	I.	74,000
Total	£1,267,300	£1,085,300	D.	£182,000

India Council bills in London averaged 16.15d. per rupee for the week.

Movement of gold and silver through the port of San Francisco, year ended Dec. 31:

	Exports	Imports	Excess	
Gold	$2,671,597	$7,595,052	Imp.	$4,923,455
Gold, 1910	1,989,208	4,373,713	Imp.	2,384,505
Silver	8,865,842	1,502,598	Exp.	7,363,244
Silver, 1910.	7,482 529	1,817,919	Exp.	5,664,610

The exports of silver in 1911 included $219,086 in coin and $8,646,756 in bullion. The imports were $737,545 in coin and $765,983 in bullion.

Gold and silver movement in France 11 months ended Nov. 30:

	Imports	Exports	Excess	
Gold	Fr.243,206,000	Fr.141,288,000	Imp.	Fr.101,918,000
1910	210,988,000	168,684,000	Imp.	42,304,000
Silver	173,037,000	123,939,000	Imp.	49,098,000
1910	152,951,000	190,028,000	Exp.	37,077,000

Imports of copper and nickel coins in 1911, 47,000 fr.; exports, 545,000 francs.

Copper, Tin, Lead and Zinc

NEW YORK

	Copper		Tin	Lead		Zinc	
Feb.	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
8	14⅛ @14¼	13.80 @13.90	43	4.00	3.92½	6.40 @6.55	6.25 @6.40
9	14⅛ @14⅜	13.90 @14 00	43¼	4.00	3.92½	6 40 @6 55	6 25 @6 40
10	14¼ @14⅜	14.00 @14.10	43¼	4.00	3.92½	6 40 @6 55	6 25 @6 40
12	.. ..	......	...	....	....	......	....
13	14 25 @14 45	14.05 @14.10	43⅜	4.00	3.92½	6.40 @6.60	6.25 @6.45
14	14.25 @14 45	14 05 @14 10	43½	4 00	3.92½	6 40 @6 60	6 25 @6 40

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The publication of the statistics, which were unexpectedly favorable, on Feb. 8 aroused a mild interest and that led some sellers to advance their prices to 14⅛c., delivered, but on

LONDON

Feb.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
8	62⅜	63⅛	66½	195¼	192½	15$\frac{11}{16}$	27
9	62$\frac{11}{16}$	63⅝	67	195½	192	15$\frac{11}{16}$	27
10	.....	.....	.....	.....	.....	.....	.....
12	62¼	63½	67	196	192	15$\frac{11}{16}$	26¾
13	62$\frac{7}{16}$	63⅜	66¾	197	192¾	15$\frac{11}{16}$	26¾
14	62⅜	63$\frac{1}{16}$	66¾	197½	192⅞	15¾	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. — £1 = ± 0.21¾c.

that day and the next some large transactions were made at 14c., delivered, usual terms. Later on the price of 14¼c., delivered, became established, with 14⅜c. asked but not paid. The market then became very dull. Some fair size transactions in Lake copper are reported, up to 14.45c. having been realized, while a special brand is said to have fetched 14.50c. Domestic consumers have been reluctant to follow the advance and the activity in the demand from abroad subsided with the decline in the London market. At the close the quotation is more or less nominal at 14.25@14.45c. for Lake and 14.05@14.10c. for electrolytic in cakes, wirebars and ingots. Casting copper is quoted nominally at 13¾@13⅞c. as the average for the week.

The standard market, after rallying sharply on Feb. 8 and 9, has been reacting ever since, and closes at £62 7s. 6d. for spot, and £63 1s. 3d. for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for smaller quantities. Copper wire has been advanced to 15¼c. base, carload lots at mill.

Copper exports from New York for the week were 9555 long tons. Our special correspondent gives the exports from Baltimore at 624 tons.

Tin—The market abroad retains its strength, which finds its main expression in the advance of quotations for spot material. It is reported that the available supplies in the Far East are very much concentrated, and for this reason a scarcity of near-by material in England may develop.

Business here is confined to retail transactions. Spot tin is still at a premium, notwithstanding the very large arrivals in this port. The market closes steady at £197 10s. for spot, and £192 17s. 6d. for three months, and at about 43¼c. for February tin in New York.

Production of the mines in Cornwall and Devonshire, England, in 1911, is estimated at 7602 long tons of black tin; 251 tons less than in the previous year.

Lead—The market is dominated by the leading sellers, who are supplying the demand freely on basis of 4c. New York, and 3.92½c., St. Louis.

The London market is slightly weaker, the close being cabled at £15 15s. for Spanish lead, and £15 17s. 6d. for English.

A recent dispatch from London reports the formation of an international combination of white-lead manufacturers, to include all the prominent American and British concerns. This report, so far as American manufacturers are concerned, is denied by the National Lead Co., the principal maker here.

Spelter—The demand for this metal still taxes the current output to the utmost, and as a result premiums are again prevailing for near-by deliveries. The future months have advanced in sympathy, but business at the higher price is not as active as it has recently been, although a fair tonnage in March and April contracts has been reported. The close is firm at 6.40@6.60c., New York, and 6.25@6.45c., St. Louis.

The London market declined about 5s., closing at £26 15s. for good ordinaries, and £27 for specials.

Zinc dust is quoted at 7⅜c. per lb., New York.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business has been fair and the market is a little stronger. Quotations are 19¼@19¾c. per lb. for No. 1 ingots, New York delivery.

Antimony—Business has been quiet and prices rather weaker. Cookson's is quoted at 7⅛@7¼c. per lb., and Hallett's at 7⅜@7½c.; while 6¾@6⅞c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is strong and prices have advanced. The New York quotation is now $46 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $45 for domestic orders and $42.50 for export. The London price has been advanced to £8 7s. 6d. per flask, while £8 5s. is quoted from second hands.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Spanish Metal Exports

Exports of metals and minerals from Spain, 11 months ended Nov. 30, reported by *Revista Minera*, in metric tons:

Metals	1910	1911	Changes	
Pig and manuf. iron	35,798	35,091	D.	707
Copper	16,176	15,041	D.	135
Copper precipitate..	12,958	12,667	D.	291
Lead................	174,741	156,589	D.	18,152
Zinc................	1,757	2,556	I.	799
Quicksilver.....	1,311	1,484	I.	173
Minerals				
Iron ore.............	7,481,698	8,616,021	D.	865,677
Manganese ore.....	5,328	28,596	I.	23,268
Copper ore..........	863,427	270,086	D.	593,341
Lead ore............	3,100	2,741	D.	359
Zinc ore............	116,978	119,066	D.	2,088
Pyrites...............	1,362,365	2,529,289	I.	1,166,924
Salt.................	472,232	482,986	I.	10,754

In 1910 pyritic ores were classed as copper ore when they carried 1 per cent. or over in copper.

Zinc and Lead Ore Markets

Platteville, Wis., Feb. 10—The base price paid this week for 60 per cent. zinc ore was $45@46; market weaker at close. No sales of lead ore were reported; offerings for 80 per cent. lead ore were $48@$50 per ton.

SHIPMENTS, WEEK ENDED FEB. 10

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point.........	1,075,880	....	....
Shullsburg............	897,950	....	....
Galena...............	818,800	....	....
Platteville	485,100	....	....
Benton...............	412,600	....	121,100
Harker...............	390,700	....	....
Hazel Green..........	240,000	....	....
Cuba City............	76,500	51,000	166,500
Total................	4,397,530	51,000	287,600
Year to date..........	20,156,590	586,080	1,504,600

Shipped during the week to separating plants, 1,503,660 lb. zinc ore.

Joplin, Mo., Feb. 10—The highest price paid for zinc sulphide ore was $49, the base price, per ton of 60 per cent. zinc, $43@46. Zinc silicate sold on a base of $23@26 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $42.38. As high as $53 per ton was reported paid for one bin of lead ore, the general market being close to $52, with some ore selling down to $46 at the week-end. The average price, all grades of lead, was $52 per ton.

The weather was good for mining and milling ore, but in the scattered cases

SHIPMENTS, WEEK ENDED FEB. 10

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,223,820	.....	516,320	$104,233
Joplin........	1,721,210	......	276,260	45,910
Alba-Neck....	687,230	......	......	15,805
Galena.......	575,830	.....	89,020	14,695
Oronogo......	500,120	.....	123,810	14,180
Granby	62,000	670,800	11,430	11,800
Duenweg....	526,290	......	......	11,314
Carl Junction	382,790	.....	......	9,185
Miami.......	170 050	.....	88 100	5,350
Spurgeon . ..	58,630	221,100	35,980	5,255
Wentworth...	191,260	.....	......	4,016
Aurora.......	120,890	66,000	......	3,460
Lawton	87,560	......	40,840	2,955
Cave Springs.	116,900	......	......	2,570
Jackson......	64,010	......	......	1,375
Totals.....	9,488,590	957,900	1,181,760	$252,113

6 weeks..	52 604,810	3,263,830	8,388,120	$1,449,078

Blende val. the week, $206,985; 6 weeks, $1,162,657
Calamine, the week, 14,372; 6 weeks, 44,404
Lead value, the week, 30,753; 6 weeks, 242,017

where hand cleaning is still in vogue, it was too cold for concentrating. Still there was a lull in the production of both minerals, and this apathy is partly attributed to the slump in lead ore. The week should have shown an output of 5500 tons zinc ore, but will scarcely exceed 5000 tons, and may not reach that figure when all returns are in. The shipment of 5223 tons of zinc was a decrease of 306 tons. In lead was the great decrease in shipments, with 591 tons shipped, a decrease of 507 tons.

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	......	39.16	......	54.46	......
March	39.85	......	38.45	......	54.57	......
April	38.88	......	37.47	......	56.37	......
May	38.25	......	36.79	......	55.21	......
June	40.50	......	38.18	......	56.49	......
July	40.75	......	38.36	......	53.81	......
August	42 50	......	41.28	......	60.74	......
September	42 63	......	41 29	......	59 33	......
October	42.38	......	40.89	......	54.72	......
November	45.40	......	43.25	......	57 19	......
December	41.13	......	40.76	......	62 03	......
Year	$41.45	......	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Feb. 14—The general market is beginning to show a moderate degree of improvement, without any marked change.

Copper Sulphate—The market is beginning to show the effect of the usual spring demand, and sales are improving. Prices are firm at last figures, $4.90 per 100 lb. for carload lots, and $5.15 per 100 lb. for smaller orders.

Nitrate of Soda—Business has been inclined to quiet, but there is no change in current prices and futures are a shade firmer. Quotations are 2.20c. per lb. for spot, and 2.20c. for all future positions.

Arsenic—Demand is good and prices are a little firmer, $2.62½@2.87½ per 100 lb. being asked for white arsenic.

Potash Salts—Exports of potash salts from Germany, year ended Dec. 31, metric tons:

	1910	1911	Changes
Kainit, kieserit, etc.	1,181,208	1,154,974	D. 26,234
Potassium chloride	270,237	329,734	I. 59,497
Potassium sulphate	76,285	109,555	I. 33,270
Pot.-magnesium sul.	197,408	282,574	I. 85,166
Total	1,725,138	1,876,837	I. 151,699

Of the exports in 1911 a total of 1,042,558 tons went to the United States.

Petroleum

The production of petroleum in California for the year ended Dec. 31, is reported at 83,744,044 bbl.; deliveries for consumption, 72,933,793 bbl.; surplus added to stocks, 10,810,251 bbl. By districts, the largest production was 21,584,602 bbl. in the Midway field. By months the heaviest production was 7,446,041 bbl. in December.

Mining Stocks

New York, Feb. 14—On Feb. 8 trading on the Exchange was exceedingly dull and price changes small. On the Curb copper shares were active and strong. Nevada gold stocks were in some demand, while Cobalt stocks showed some gains. There were sales of Homestake at $88.25@89 per share.

Feb. 9 the Exchange continued quiet, with no particular changes. On the Curb there was moderate trading in coppers, Butte Coalition, Mason Valley and Ray Central being prominent. There was good buying of Porcupine stocks.

Feb. 10 there were no special changes on either the Curb or the Exchange. Feb. 12 was a holiday.

Feb. 13 the market opened rather weak, but later recovered and there were small advances on moderate trading. The Curb dealt rather freely in copper shares, at fractional advances; but other mining stocks were quiet. Feb. 14 the market remained much the same, with no special tendency and moderate dealings at small advances.

At auction in New York, Feb. 8, a first-mortgage 5 per cent. bond of the West Kentucky Coal Co. for $1000 brought 76 per cent. of par; 5500 shares Royal Tinto Mining & Smelting Co. common stock, $25 for the lot.

Boston, Feb. 13—The appearance of the Copper Producers' statement last week gave the metal-share market quite a lift and considerable animation for that day only. This has been particularly disappointing, for the rank and file believe in higher prices for copper shares and deprecate the lack of initiative on the part of big interests, and the absence of leadership. Some of the Lake Superior issues take on periods of activity and strength at times, but the movements are not sustained, and have the appearance of professional dealings in the main.

Notably in this class has been Franklin, with a $1.25 rise to $13.50, and Winona, which advanced $2.37½ to $7. A quietus has come to the late activity of Old Colony and Mayflower stocks, although drill work continues. Isle Royale continues among the leaders and spurted $2.50 to $24. Among the porphyries Inspiration and Mason Valley hold attention. Local interests state that a consolidation of Ray Consolidated and Ray Central is being perfected.

Curb trading has been quiet. Eagle & Blue Bell was a feature, with an advance to above $1. The Rhode Island Coal Co. will issue receiver's certificates to pay current bills.

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company	Nov.	Dec.	Jan.
Alaska shipments	1,274,655	4,995,008	3,701,010
Anaconda	20,850,000	....	26,350,000
Arizona, Ltd.	2,960,000	3,100,000	3,200,000
Balaklala	....	....	....
Copper Queen	6,946,775	8 365 265	6,748,264
Calumet & Ariz.	4,390,000	4,486 000	4,544,000
Detroit	1,941,498	1,969,313	1,941,970
East Butte	983,405	....	....
Mammoth	1,793,181	1,721,404	....
Mason Valley	... .	....	600,000
Miami	....	2,500,000	. ....
Nevada Con.	5,207,983	4,679,674	....
Old Dominion	2,082,000	2,610,000	2,044,000
Ray	2,517,000	2,660,000	... .
Shannon	1,256,000	....	1,550,000
South Utah	361,681	267,514	189,678
United Verde*	2,500,000	2,000,000	....
Utah Copper Co.	9,117,961	9,039,557	....
Lake Superior*	18,600,000	17,500,000	....
Non-rep. mines*	11,483,000	....	.....
Total production	94,265,139	.... .	....
Imports, bars, etc.	17,224,725	21,101,256	....
Total blister	111,489,864	... .	....
Imp. in ore & matte	4,767,217	5,159,997	....
Total	116,257,081	....	....
Brit. Col. Cos.:			
British Col. Copper	....	....	....
Granby	....	....	....
Mexican Cos.:			
Boleo	....	2,645,640	2,315,040
Cananea	....	3,706,000	3,552,000
Moctezuma	1,682,768	2,864,464	2,732,867
Other Foreign:			
Cape Cop., S. Africa	857,920	....	....
Kyshtim, Russia	1,170,000	1,570,000	.. ..
Spassky, Russia	685,440	721,280	....
Famatina, Argen.	174,720	217,280	....
Exports from:			
Chile	4,704,000	5,824,000	8,064,000
Australia	7,168,000	11,200,000	7,056,000
Arrivals in Europe from other count.†	12,064,640	16,331 840	13.144,320

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
I, 1911	115,696,591	42,078,557	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068 307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119.337 753	62,343,901	89 167 914

VISIBLE STOCKS

	United States	Europe	Total
II, 1911	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89.454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Salt Lake City—At the annual meeting of the Stock & Mining Exchange, the governing board for the year was elected as follows: R. J. Evans, president; W. J. Browning, R. K. Cobb, A. L. Jacobs, J. L. Karr, W. D. Nebeker, C. W. Pratt, E. G. Woolley, Jr. and A. Thomas.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1.00
Alpha Con., Nev	Feb. 21	Mar. 13	0.05
Alta, Nev	Jan. 26	Feb. 16	0.05
Andes, Nev	Feb. 7	Feb. 28	0.05
Black Jack, Utah	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.50
Confidence, Nev	Jan. 16	Feb. 6	0 20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev	Feb. 14	Mar. 6	0.05
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0.05
Hancock Con., Mich	Jan. 10	....	1.00
Hancock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
King David, Utah	Feb. 13	Mar. 6	0.005
Lehi Tintic, Utah	Feb. 29	....	0.01
Ojibway, Mich	Jan. 10	....	1 00
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz	Jan. 15	....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea Con., Utah	Jan. 17	Feb. 8	0.010
Tintic Standard, Utah	Jan. 8	Feb. 5	0 00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0 10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	......	23.794	24.081	......
March	51.454	52.745	......	23.690	24.324	......
April	53.221	53.325	......	24.483	24.595	......
May	53.870	53.308	......	24.797	24.583	......
June	53.462	53.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24.428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53.486	53.304	......	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	......	12.611	......	54.974	......
March	12.139	......	12.447	......	54.704	......
April	12.019	......	12.275	......	54 034	......
May	11.989	......	12.214	......	54.313	......
June	12.385	......	12 611	......	56 365	......
July	12.463	......	12.720	......	56 673	......
August	12 405	......	12 634	......	56 266	......
September	12.201	......	12.508	......	55.253	......
October	12.189	......	12.370	......	55.170	......
November	12 616	......	12.769	......	57 253	......
December	13.552	......	13.768	......	62.068	......
Year	12.376	......	12.634	......	55.973	......

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 520	July	42 400	......
February	41 614	......	August	43 319	......
March	40.157	......	September	39 755	......
April	42 185	......	October	41 185	......
May	43.115	......	November	43 125	......
June	44 606	......	December	44 655	......
			Av. Year	42 281	......

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4.435	4 334	4.327	13.009	15.619
February	4.440	......	4 266	......	13.043	......
March	4.394	......	4 238	......	13 122	......
April	4 412	......	4 262	......	12.889	......
May	4.373	......	4.223	......	12.984	......
June	4 435	......	4 292	......	13.260	......
July	4.499	......	4.397	......	13 530	......
August	4 500	......	4 406	......	14.260	......
September	4.485	......	4 356	......	14 744	......
October	4.265	......	4 139	......	15.332	......
November	4.298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	15.648	......
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	25.642
February	5 518	......	5 368	......	23 276	......
March	5.563	......	5 413	......	23 015	......
April	5 399	......	5 249	......	23 743	......
May	5.348	......	5.198	......	24.375	......
June	5 520	......	5 370	......	24.612	......
July	5 595	......	5.545	......	25.006	......
August	5 953	......	5 803	......	25 801	......
September	5 859	......	5 719	......	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	25.795	......
December	6.301	......	6.151	......	25.849	......
Year	5.758	......	5.508	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14 75	$14.00
February	15 90	......	14 50	......	14 81	......
March	15.90	......	14 65	......	14.96	......
April	15 90	......	14 65	......	15 00	......
May	15.90	......	14 30	......	14.72	......
June	15 90	......	14 05	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13.94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Feb. 13

Name of Comp.	Bid.
Acacia	.05¾
Cripple Cr'k Con.	.02⅜
C. K. & N.	.15
Doctor Jack Pot.	.05⅛
Elkton Con	.52¾
El Paso	.70
Findlay	.05
Gold Dollar	.15
Gold Sovereign	.02⅞
Isabella	.14¼
Jack Pot	.05½
Jennie Sample	.06
Lexington	.01¼
Moon Anchor	01¼
Old Gold	03⅜
Mary McKinney	.53
Pharmacist	.02
Portland	.90
Vindicator	.65
Work	.02½

SALT LAKE Feb. 13

Name of Comp.	Bid.
Beck Tunnel	.13
Black Jack	.12½
Carisa	‡.16
Cedar Talisman	.02½
Colorado Mining	.36½
Columbus Con	.26
Daly-Judge	5.70
Grand Central	.85
Iron Blossom	1 22½
Little Bell	.35
Lower Mammoth	.03
Mason Valley	12.25
May Day	.15
Nevada Hills	2.35
New York	.06¾
Prince Con	1 02½
Silver King Coal'n	1 40
Sioux Con	.10½
Uncle Sam	31½
Yankee	.15

TORONTO Feb. 13

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6 50	Pearl Lake	20½
Hudson Bay	‡70 00	Porcu. Gold	44
Temiskaming	34	Porcu. Tisdale	.03
Wettlaufer-Lor.	77	Preston E. D.	.06
Apex	.07	West Dome	‡ 40
Central	‡3 62½	Standard	.20
Doble	60	Foley O'Brien	.32
Dome Exten.	.42	Rea	1 05
Hollinger	11 54	Crown Chartered	13
Imperial	.04	Swastika	.24

SAN FRANCISCO Feb. 13

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.02	Belmont	8.77½
Belcher	.55	Jim Butler	.36
Best & Belcher	.15	MacNamara	.24
Caledonia	2.40	Midway	.26
Challenge Con	.18	Mont.-Tonopah	1.00
Chollar	.13	North Star	.30
Confidence	.74	West End Con	.79
Con. Virginia	.81	Atlanta	.17
Crown Point	.55	Booth	.05
Gould & Curry	.06	C.O.D. Con	.12
Hale & Norcross	.23	Comb. Frac	.15
Mexican	3.62½	Jumbo Extension	.20
Occidental	.50	Pitts.-Silver Peak	1.22½
Ophir	.42½	Silver Pick	.05
Overman	1.40	St. Ives	.34
Potosi	.09	Tramp Con	‡.01
Savage	.28	Argonaut	‡2.50
Sierra Nevada	.36	Bunker Hill	‡3.00
Union Con	1.07½	Cent. Eureka	.35
Yellow Jacket	.56	So. Eureka	5.50

N. Y. EXCH. Feb. 13

Name of Comp.	Clg.
Amalgamated	63½
Am. Agri. Chem.	59¼
Am.Sm.&Ref.,com	71
Am. Sm.& Ref., pf.	104
Am. Sm. Sec., pf. B	86
Anaconda	35⅝
Batopilas Min	1⅜
Bethlehem Steel pf	59¾
Chino	25⅞
Federal M.& S., pf.	40
Goldfield Con	4⅛
Great Nor., ore ctf.	38¼
Homestake	87
Miami Copper	23¼
Nat'nal Lead, com.	53¾
National Lead, pf.	108
Nev. Consol	18¾
Pittsburg Coal, pf.	76
Ray Con	16¾
Republic I&S, com	20
Republic I & S, pf.	74½
Sloss Sheffi'd, com.	40
Sloss Sheffield, pf.	‡108¼
Tennessee Copper	35¼
Utah Copper	55½
U. S. Steel, com	60½
U. S. Steel, pf.	107¾
Va. Car. Chem	54

N. Y. CURB Feb. 13

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	.48
Braden Copper	5⅛
B. C. Copper	4⅛
Buffalo Mines	1.20
Butte & Vipond	‡ 53
Butte Coalition	22⅜
Cobalt Central	‡.01
Con. Ariz Sm.	⅝
Davis-Daly	11/16
Diam'field-Daisy	10
Ely Con	½
Florence	.60
Giroux	4⅜
Gold Hill Con	1/16
Greene Cananea	8
Greenwater	08
Guggen. Exp.	180
Inspiration Con	18⅝
Internat. S. & R.	‡124
Kerr Lake	2 13/16
La Rose	3⅞
McKinley-Dar-Sa.	1¾
Min. Co. of A. new	4
Nev. Utah M. & S.	1/16
Nipissing Mines	7½
Obie Copper	1 1/16
Pacific Sm. & M.	11/32
Porcupine T'nsite	‡ 03½
Precious Metals	‡1⅜
Ray Central	2
Red Warrior	‡1½
South Utah M. & S.	¾
Standard Oil (Old)	625
Stand'd Oil of N.J.	330
Stand'd Oil Subs.	335
Stewart	1⅛
Tonopah	7⅛
Tonopah Ex	1⅛
Tri-Bullion	⅛
Tularosa	‡31
Yukon Gold	3⅜

LONDON Feb. 14

Name of Com.	Clg.
Camp Bird	£1 12s 0d
Dolores	1 10 0
El Oro	0 17 3
Esperanza	2 2 6
Mexico Mines	7 2 6
Oroville	0 5 9
Stratton's Ind.	0 3 1½
Tomboy	1 2 6

BOSTON EXCH. Feb. 13

Name of Comp.	Clg.
Adventure	5⅝
Algomah	5⅛
Allouez	39½
Am. Zinc	25
Ariz. Com., ctfs.	4
Bonanza	.45
Boston & Corbin	6⅞
Butte & Balak	4½
Calumet & Ariz	60
Calumet & Hecla	414
Centennial	18½
Con. Mercur	.03
Copper Range	52
Daly West	5⅛
East Butte	12¾
Franklin	12¾
Granby	35
Hancock	35
Hedley Gold	18
Helvetia	1⅜
Indiana	13¾
Island Cr'k, com.	43½
Island Cr'k, pfd.	86½
Isle Royale	23¾
Keweenaw	1⅜
Lake	34¼
La Salle	4½
Mass	7¼
Michigan	3
Mohawk	53
New Arcadian	3⅞
New Idria Quick.	‡7¾
North Butte	26
North Lake	5½
Ojibway	5
Old Dominion	45
Osceola	109½
Quincy	74
Shannon	9½
Shattuck-Ariz.	17½
Superior	24½
Superior & Best.	3¾
Tamarack	27
Trinity	5½
Tuolumne	3¾
U. S. Smelting	35¼
U. S. Smelt'g. pf.	47½
Utah Apex	3
Utah Con	15¼
Victoria	4¾
Winona	6½
Wolverine	98
Wyandot	2¼

BOSTON CURB Feb. 13

Name of Comp.	Last
Ahmeek	240
Bingham Mines	3½
Boston Ely	1¼
Boswyocolo	.09
Cactus	12
Calaveras	2 1/16
Chief Cons	85
Corbin	2⅞
Cortez	1 3/16
Crown Reserve	3
First Nat. Cop.	2 3/16
Majestic	43
Mazatan	½
Moneta Porc.	.14
Nevada-Douglas	3½
New Baltic	3¾
Oneco	3
Raven Copper	.32
Rhode Island Coal	.27
San Antonio	‡3½
South Lake	5¾
Trethewey	.70
Union Mines	‡¼
United Verde Ext.	.36
Vulture	‡5¾

‡Last quotation.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines. $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9300 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Editorials:
  Mexico 389
  Settling Mill Slimes 389
  The Steel Rail Question 390
  Manipulation and Methods 390
Metallics—By the Way 391
Adirondack Gold Schemes. D. H. Newland 392
Laboratory to Test Potash Minerals 392
California Oil Dividends 392
Water Power for the Kolar Gold Field 392
Correspondence and Discussion:
  The Basis of Calculating Tonnage Costs....The Slow Speed Chilean Mill....Smoke Investigation....Government Experiment Stations....Improvements in Crushing Rolls 393
Details of Practical Mining:
  *Drill Post with Removable Screw....*Electric Hoist at Negaunee Mine....*Wrench for Removing Stuck Drills....*Timber Framing for Side Pressures....*Cross System Gold Saving Tables....Removal of Paint and Varnish....*A Ball Bearing Turntable....Unwatering with Electric Turbine Pumps....*Lowering the Bottom Plate of a Gyratory Crusher....Melting at the British Mint....Scaffolding for Drills in Wide Stopes....Measuring the Flow of Streams 395
The Jones Step Process 400
American Institute of Mining Engineers 401
Ductility of Zinc 402
Caving of the Bunker Hill Shaft. L. H. Eddy 402
*Amphidization 403
De Beers Consolidated Mines 403
Ray Consolidated Quarterly Report 404
Mt. Morgan Gold Mining Co. 404
Austrian Mineral Production 404
*Ore Dressing in the Joplin District—I James L. Bruce 405
The Electrometallurgy of Tin 410
*Mason Valley Smeltery, Nevada 410
*The Settling of Mill Slimes. D. L. H. Forbes 411
The Missing Zinc at Broken Hill 415
The Longitudinal Railway of Chile 415
*The Wizard Rock Drill 416
*The California Gold Dredge—II. Robert E. Cranston 417
Installations of Girod Electric Furnaces 420
Reduction of Rare Oxides 420
*Prospecting on City Lots. C. L. Edholm 420
Patents 421
Personal, Obituary and Societies 422
Editorial Correspondence 423
Mining News 425
Markets 431
*Illustrated.

The Engineering and Mining Journal

Vol. 93. FEBRUARY 24, 1912. No. 8.

Mexico

Disturbances in Mexico are again plaguing the mining industry of that unhappy country. During the last week or two revolutionists have taken the mining towns of Velardeña, Mapimi and Parral, committing serious outrages, and disorder has prevailed in many other places. The removal of the strong hand of Diaz has let loose selfish ambition and given free rein to the inclination of bandits. Madero undertook a grave task and has not yet had reasonable time to make headway with it. With the collapse of the plot of Reyes it seemed that Madero was going to have a fair chance, but later events have dispelled that hope. It is still two early to pronounce whether Madero is equal or unequal to the problem that confronts him. In his own words, "The difficulties through which the Republic of Mexico have been passing were not of really great importance and have been overcome. There has been no great political principle involved and there has been no notable leader as their sponsor. For all these reasons my government is sufficiently strong to give complete protection to all of the interests." This statement is probably correct as to the absence of any great political principles and notable leadership in the case, but otherwise it is undoubtedly over-optimistic, as the daily outrages reported in the newspapers show clearly.

Americans residing in Mexico are naturally exasperated by the situation, but there is nothing for them to do but to be patient, continue to restrain themselves, and, if possible, take themselves out of harm's way. Any propaganda for American intervention would be like pouring gasoline on the flames. It is highly gratifying that the Americans in Mexico have so far behaved in a quiet and correct manner. They will best conserve their lives and property by continuing to act in that way. The situation in Mexico is particularly vexatious to those who are engaged in the mining industry. There is nothing to be done, however, but to grin and bear it.

Settling Mill Slimes

When leaching was the only means of applying the cyanide process the presence of slime in the material to be treated was particularly objectionable. In those days crushing apparatus was judged largely by its ability to grind the ore with the production of a minimum quantity of slime. The introduction of simple devices for separating sand and slime and efficient means for handling slime caused a reversal of the procedure until now all-sliming is common practice.

With this change the necessity for accurate knowledge of the nature of slime was developed. To such good purpose have certain investigators carried their researches that we are now in possession of a good deal of valuable data on the subject.

Essentially slime is made up of crystalline and colloidal material; an increase in the proportion of the colloids causing a decrease in the settling rate. Since pure water was found to have a decided solvent effect on crystalline minerals, crushing in water would tend to produce an excess of colloids. Crushing in the presence of lime was suggested as one means of preventing this action; a protective coating being formed on the crystals. Lime acts as a coagulant and hastens the settling of slime, but since the settling rate varies inversely as the viscosity of the supporting liquid a large excess of the alkali obviously should be avoided.

While the basic facts in this matter are known among cyanide operators, the laboratory tests carried on for the direction of mill operations often give results which do not work out in practice. To those who have experienced such difficulty the article of D. L. H. Forbes elsewhere in this issue will be particularly welcome. Mr. Forbes sets forth in a concise manner the conditions which should be observed in making tests on the settlement of slime in order to forecast accurately the behavior in large-scale operations. An apparently unique method of applying the information gained by preliminary tests in the design of settling plants is proposed.

The Steel Rail Question

The steel-rail question, which was so actively discussed two or three years ago, has come up again in active form, chiefly because of several recent accidents which are attributed to broken rails. It was supposed to have been settled at the time by the adoption of more careful methods of rolling and discard, and partly by the increased use of openhearth steel for rails; but this seems to have been only a temporary truce between buyers and users. A conference of representatives of the two parties was held recently in New York, at which it is understood that sharp differences of opinion were developed.

The claim of the railroads is that the mills have turned their attention to economy and rapidity of manufacture rather than quality of product; that they have been inclined to haste and carelessness in rolling and have tried to use up the ingots too closely, without discarding a sufficient part of the defective ends. Naturally, these charges are denied, and the mills claim that railroad specifications are made up with a sole regard for wear. They want a hard steel to resist abrasion, with a section giving all possible metal in the head, and cutting down the web and foot to the smallest possible dimensions. These sections, with the hard steel, make a difficult rail to roll, and increase the liability to cracks and eventually breaks in the web. A softer and tougher steel, with a better distribution of metal, would decrease the liability to breakage. Moreover, it is urged that sufficient allowance has not been made for the great increase in the weight of locomotives and cars during recent years. In support of their claim the railroads' representatives say that most of the failures investigated occurred on rails made in 1906 and 1907, when the mills were rushed with orders and production was pushed to its highest possible point.

The dispute rests here until some compromise can be found. Something is to be said in favor of the claims of both parties, though it looks as if the railmakers had rather the better of it so far, from a technical point of view.

Manipulation and Methods

There seems to be an everblooming perennial interest in schemes for quick slag analysis, and the average smelting chemist usually ends in inventing a scheme to cut the corners of the methods in common use. Much of the inventive force thus spent, is, however, wasted energy, which might be more profitably spent in investigating what other chemists have already done. Thus, the use of alcoholic and ethereal hydrochloric acid instead of aqueous, has been described, and there is hardly any stunt of such time-saving value as this, yet it seems comparatively little known. Again, the precipitation of copper and lead by hydrogen sulphide in dilute solution, leaving the silica hydrated, or the instant precipitation of copper and simultaneous reduction of any ferric iron by means of a little test lead, are both good schemes, and deserve more extended use than is given. The gooch crucible and pressure filtration ought to be in every chemist's home. When, with existing methods, it is possible to run Fe, CaO, SiO_2, Cu and Pb in about 22 min., it has become more a question of the man and his manipulation, rather than of methods, for cutting more seconds off this record.

The British Coal Strike

Negotiations for a settlement of differences between the British coal miners and operators have made no progress, and recent advices indicate that the general strike of the miners will begin on March 1. The result will doubtless be a wide spread industrial disturbance. It is understood that options have been taken on considerable quantities of West Virginia coal, to provide against such a contingency. Leaders of the British miners have been negotiating with the Belgian and German unions as to steps to prevent shipments of coal from those countries to England. No European country, however, is in a position to make large exports of coal; in fact many of them import British coal. Latest advices are that the government will intervene and endeavor to bring about a compromise.

Chinese Pig Iron

It is going rather far afield—or looking rather far ahead—to find in possible Chinese competition an argument against the reduction of the duties on iron and steel. The possibilities of foreign competition do not lie in that direction. China has at present one modern steel plant, the Hangyang Works, and is still a large importer of ironwork of all kinds. A rather sensational contract was made a year or two ago by a Seattle corporation for the importation of Chinese pig iron; but we cannot find that any considerable quantity was brought here under that contract, and the Seattle company is now in the hands of a receiver. China has possibilities for iron manufacture in the way of ores and coal, but the time is distant when it may be counted as a competitor for our trade; or for any other foreign trade except that of Japan and its dependencies.

In the testimony offered before the Senate committee on the iron tariff bill several prominent witnesses referred to the lower wages paid in Germany; but we do not see that any of them made mention of the extent to which the German ironmakers profit from the use of byproducts. Possibly they hardly appreciated it themselves; possibly also they did not care to call attention to our own disregard of possible economies. The fact is that while our attention has been given to increasing production and rapidity in handling material, we are far behind the German metallurgists in saving byproducts and the utilization of what we have been in the habit of regarding as waste. A closer attention to possible savings might be enforced by a little foreign competition.

Silver last week went above 60c. per oz. in New York, the first time it has reached that level since the latter part of 1907. It is still very close to 60c., and seems likely to hold up to that point for some time. It is now about 8c. above the price recorded a year ago. The chief causes for the advance are found in the unexpectedly large demand from China and India; and in the strong Indian speculation, which is based on the belief that the government will be forced before long to add largely to its silver coinage.

Metallics

Metals are practically without electric resistance at temperatures near absolute zero.

Immersing zinc shavings in a solution of lead acetate before using in the boxes increases the efficiency of the precipitation, due to the electrolytic action of the lead-zinc couple.

The use of tinned-copper scrap by copper refiners for making cakes is sometimes attended by bad results. The tin seems to segregate, and when the copper is rolled, the plates show small white spots.

An ink for writing on blueprints may be made by dissolving 75 grains of potassium oxalate in an ounce of water, thickened with a little gum arabic. The paper must be washed thoroughly after using the ink.

At the Cia Minera las Dos Estrellas mill, El Oro, Mex., a Trent agitator, installed in a 36x20-ft. tank, is operated with 7½ hp. on pulp containing 6% on 80 mesh, 55% on 120, 2% on 200 and 37% through 200 mesh.

For cutting large glass tubes, wrap a strip of thick paper around the tube where the cut is required, and then make a cut clear around the tube with a file, using the paper as a guide. Take off the paper and run a red-hot, sharp-pointed iron around the tube in the file scratch.

Boiler-feed water should not be heated by the direct exhaust of a steam engine. The cylinder oil is carried into the boiler and in time forms a film on the surface of the water. At times of low water this film of oil will adhere to the boiler plates or tubes, and will not rise when the water level is reëstablished. This thin film of oil is a poor conductor of heat and may prevent the water in the boiler from cooling the plates. The plates may then become overheated and softened so as to bag under normal boiler pressure.

The largest ladder dredge in the world was recently completed by William Simon & Co., of Renfrew, Scotland, for use on the Panama Canal. This new dredge, which is to be known as the "Corozal," will soon be at work on the Pacific end of the canal. The dredge discharges directly into hoppers or barges alongside, and has a steaming speed of 10 knots per hour. It is to be capable of digging to a maximum depth of 55 ft., and is expected to have a digging capacity of 1200 cu.yd. per hour. The dredge is provided with two sets of buckets, one with buckets of 54 cu.ft. capacity each, and the other set with buckets of 34 cu.ft. each. These buckets are made with cast-steel backs, and bodies of pressed plates of mild steel. The lips are of manganese steel, forged to shape, and afterward tempered.

By the Way

John Hays Hammond said at a dinner in New York of a financier who had failed: "No wonder he failed. His methods were inept. He was the sort of man who'd start the promotion of a new gold mine by naming it the Munchausen-Cook."

Wall Street has lately been exercised by rumors of an exchange of Amalgamated for Anaconda shares, on the basis of two of Anaconda for one of Amalgamated, which inspired the *Evening Post* to remark that that would be a singular performance. The Anaconda is a holding company, and the Amalgamated holds it. For the inside holding company to swallow the outside holding company would be a feat impossible physically, though feasible enough, no doubt, financially.

It would seem a pleasant occupation, next summer, to undertake the development of the "Cold-as-Hell" claim, which has just been located in the Georgetown district in Montana; it should be remembered, however, that the Never Sweat mine is one of the hottest in Butte. Speaking of names, the Bunko mine in the Empire district, says the Anaconda *Standard*, made its fortunate owners rich, while the Ophir near Marysville never paid a dividend, its original owner dying of starvation.

Apropos of the "Blue Sky" law to protect Kansans, mention of which was made in these columns recently, the securities of one of those Kansas mining companies has been advertised in a Topeka paper as "a legitimate business proposition backed by a gold bond of the ——— Securities Co., of Los Angeles, Calif." But who guarantees the bond? This sounds like the "cat-rat" farm where the rats eat the carcasses of the cats that live on the rats, etc., the profits of all the "skins" going into the pockets of the promoters.

Since the disintegration of the Standard Oil Company of New Jersey an extraordinary and to most people an unexpected turn of prosperity has overtaken the oil business. Oil prices have been advanced several times. Even the Texas Co., created by the late John W. Gates, says the *Evening Post*, has become suddenly prosperous, to judge from the rise in its securities on the Stock Exchange, where only a few months ago they were desperately weak. Frugal investors holding Standard Oil fractions jeer at their improvident relations who own automobiles and tell them it serves them right. This is a condition strongly at variance with the popular expectations raised in October, 1910, by an official statement from the Standard Oil Co. on the state of the oil business. The statement baldly set it forth that there had been a great overproduction of oil in the world. In three years, 1906 to 1909, the world's production of crude oil had increased 42½%, whereas the world's business in refined oil had increased only 10%, from 48,000,000 to 53,000,000. And at that time, according to the statement, there was held in tanks in the United States alone 115,000,000 bbl., or considerably more than two years' consumption. That was only 16 months ago. Either the production of oil must have enormously decreased or the consumption has run mad.

The expression "wedge rock" is used on the Comstock lode to designate rock that carries some metallic content but not high enough for "pay ore" or "second-class ore"; it usually assays under $5 per ton. The expression came into use in the early days of the Comstock lode and has been in vogue ever since. When a car is placed on the cage to be hoisted from the mine, a wooden wedge is placed on top of the car, indicating to the top carman to what class it belongs. In this manner the term "wedge rock" came to be applied to what is generally termed low-grade ore. Pay ore is tagged as such with special tags, as is the second-class ore. Waste rock is not tagged at all.

For gross wordly wisdom says the Toronto *Globe*, it would be difficult to surpass the "Ten Demandments" hanging in one of the many salmon canneries at Steveston, Western Canada:

(1) Don't lie. It wastes my time and yours. I am sure to catch you in the end, and that is the wrong end.

(2) Watch your work, not the clock. A long day's work makes a long day short; and a short day's work makes my face long.

(3) Give me more than I expect, and I will give you more than you expect. I can afford to increase your pay if you increase my profits.

(4) You owe so much to yourself you cannot afford to owe anybody else. Keep out of debt, or keep out of my shops.

(5) Dishonesty is never an accident. Good men, like good women, never see temptation when they meet it.

(6) Mind your own business, and in time you'll have a business of your own to mind.

(7) Don't do anything here which hurts your self-respect. An employee who is willing to steal for me is willing to steal from me.

(8) It is none of my business what you do at night. But if dissipation affects what you do the next day, and you do half as much as I demand, you'll last half as long as you hoped.

(9) Don't tell me what I'd like to hear but what I ought to hear. I don't want a valet to my vanity, but one for my dollars.

(10) Don't kick if I kick. If you're worth while correcting you're worth while keeping. I don't waste time cutting specks out of rotten apples.

Adirondack Gold Schemes

By D. H. Newland*

For many years the Adirondacks have been the camping ground of process promoters engaged in enlisting public support for their schemes to work the alleged gold-bearing sands of that region. The absolute futility of their enterprise is, no doubt, appreciated by readers of the Engineering and Mining Journal, but in view of the need for bringing the facts to general attention, I hope the opportunity which its columns afford to that end may not be denied.

The methods of procedure in the business are mostly of one pattern. The first essential is a process. After this has been introduced on the scene, usually in some new locality each time, there follows the period of experimental mystification, during which local interest is created and sufficient funds obtained to erect a more or less elaborate plant. Some waste sand lots that can be calculated into the millions of tons and as many more dollars as would make the stockholders all and severally candidates for the plutocratic class, if they should win, are thrown in for a good measure. The sand, however, is a secondary matter—worthless to anybody who has not a share in the process and not less remunerative apparently in one place than another. The advertised recoveries run all the way from $5 to $50 per ton; the cost of extraction a dollar or less. It is evident that with the process in working order, a field is opened that would soon make South Africa a second-rate producer, and in time might overturn our whole financial system. But for some unexplained reason, after the mill is up, the machinery in place, and all made ready for operation, the gold does not materialize—to the stockholder. Then comes his unpleasant awakening from dream to reality, and another abandoned mill marks the progress of the promoter.

It is not necessary to enter upon details of the various undertakings or the several processes on which they have been based, as indeed such particulars have been carefully guarded in the information issued to the public. They all spring from the assumption that the gold exists in a peculiar condition; hence it cannot be recovered by ordinary methods, which fact has been amply demonstrated. "Volatile," "ionized," "combined," and "atomic" are some of the elusive qualities of this gold, well calculated to put an end to scientific discussion.

Credit for the discovery of this field of "enterprise" seems to belong to a man named Bullis, who carried on experiments about 20 years ago, and, in the language of one of the printed circulars, found "that fire assays were entirely unreliable, and that all methods in common use were useless." He was followed by Sutphen, who originated a process and erected plants at Glens Falls and Hadley from the proceeds of stock sales. In the years that have since elapsed, the Keystone and Waverly processes have been brought out and given trials. The Keystone seems to have had the greatest claims as a money maker, for the "tests" showed an average value of $13.97 per ton on Lewis County sands, of which the company owned 30,000,000 tons, and the cost was stated to be not in excess of $0.75 per ton.

It may seem surprising that such schemes should find support among the public, but their vitality is witnessed by the continued interest shown in them, as noted in the press and in the recent reports issued by the State Geological Survey. They appeal, naturally, to those least able to assume the financial loss which they have always entailed.

The actual sums that have been raised by these concerns must amount in all to several hundred thousands of dollars, but there is a much greater economic waste than is represented by the mere capital outlay, as need scarcely be stated. The extent of the craze that may seize upon the people during the height of a boom is well shown in the periodic scrambles for the registration of claims; in one year nearly 4000 were filed with the Secretary of State at Albany. The interest also is not purely local; inquiries in regard to the matter have come from all parts of the country.

No doubt, many engaged in the business are acting in good faith, and there is no intent here to question personal motives. It seems, however, an opportune time to throw some light on a situation which is hardly creditable to the mining industry.

---

*Assistant State Geologist, Albany, N. Y.

Laboratory to Test Potash Minerals

To develop more thoroughly the fertilizer and potash resources of the United States, Secretary Wilson of the Department of Agriculture has established at Reno, Nevada, a laboratory for the examination of natural material thought to contain potash. The laboratory has been organized under a coöperative agreement between the Mackay School of Mines, the Bureau of Soils, and the United States Geological Survey. The laboratory is in charge of Prof. George J. Young, of the Mackay School of Mines, and A. R. Merz, of the Bureau of Soils. Facilities have been provided for the examination and assay of all potash-bearing materials and of saline waters. The laboratory will be at the disposal of the public free of charge.

In speaking of the arrangement, Secretary Wilson said, "All samples should be addressed to: Coöperative Laboratory, Mackay School of Mines, Reno, Nev. Dry samples should at least be one-half pound in weight, should be securely wrapped and tied, and marked with the name and address of the sender. Samples of brines or water should be placed in clean bottles of at least one quart capacity, stoppered with clean corks securely tied in, and should be well packed against breakage. In all cases all transportation charges must be prepaid."

California Oil Dividends

January oil dividends were up to the normal in amount, while falling below those of December, in which month the Buick paid a dividend covering four months' earnings, and the payments by the English capitalists on their purchase of the Imperial, Mountain Girl and Gypsy were made, and partly disbursed by the recipients as dividends. The following is the list:

JANUARY OIL DIVIDENDS

Company	Per Cent.	Amount
Caribou	0.025	$8,070
Central	0.015	15,400
Claremont	0.015	7,500
Columbia	0.01	9,992
Continental	0.01	2,500
Fullerton	0.05	30,000
Globe	0.01	6,000
Home	0.01	7,500
Homestake	0.01	1,000
Mascot	0.01	5,000
Monte Cristo	0.05	25,000
*Mount Diablo	0.01	10,000
New Pennsylvania	0.005	5,000
Olinda Land	0.01	10,000
Paraffine	0.01	3,000
Rice Ranch	0.015	4,500
Record	0.01	10,000
Sauer Dough	0.02	4,000
Section 25	0.25	10,000
*State Consolidated	0.005	5,000
Traders'	0.006	9,000
Union	0.006	183,388
Union Provident	0.006	90,767
United Petroleum	0.006	48,451
Western Union		10,000
W. K.		15,000
Total California Co.'s		$506,068
Mex. Pet., Ltd., pfd	0.002-3	80,000
Grand total		$586,068

*Unlisted.

This table, says the San Francisco *Chronicle*, by no means represents the money paid in dividends on California oil properties, the greater portion, and, excluding the Union, the more valuable, not being listed on the stock market and their dividends not being made public.

Water Power for the Kolar Gold Field

Special Correspondence

The first stage of a scheme for supplying power to the Kolar gold field of India and for providing a canal system for irrigation purposes, has been sanctioned by the durbar of the Mysore state.

A great masonry dam, 4200 ft. in length, will be built across the River Cauvery, at a point eight miles west of Seringapatam, at a cost of $2,700,000. The dam will eventually store 41,500,000,000 cu.ft. of water. The entire project, it is estimated, will cost $76,000,000, and the canal system will irrigate 150,000 acres of land.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Basis of Calculating Tonnage Costs

Regarding the article on this subject in the JOURNAL of Feb. 3, 1912, the reduction of mining costs to the cost-per-ton basis is done, I take it, for two purposes: First, as a means of comparison with other mines, and second, as a means of comparison, weekly, monthly, or yearly, as the case may be, in the same mine.

As to the first comparison, is it not time we acknowledge that there is not, and cannot be, any practical method devised for comparing mining costs between different mines on the cost-per-ton basis, that is not dangerous, misleading, and if without a great deal of supplementary information, absolutely useless?

In the second case, however, we have a real use for the cost per ton as it gives the manager and other directly interested persons a quick and simple mode of comparing and noting variations in the cost of mining at their particular mine, into which they can inquire if they see fit.

As to whether the cost should be based on the ton mined or the ton milled, the one which gives the closest approximation to the truth in each case should, I think, be chosen; but as a matter of fact is it not better to keep the cost of milling entirely separate? In the term ton mined in most cases, to be practical, we must confine ourselves to the tonnage hoisted, and ignore any tonnage that may be hand sorted below, for to try to ascertain this tonnage would from the nature of things be a costly and at best an inaccurate refinement.

While not attempting to question, as it is not a practical solution, the statement that the theoretically true basis for comparison is the volume basis, one is tempted to ask why, and for what good reason are the old, cumbersome fathom and square fathom pushed forward and maintained as units of measurement.

I note in Mr. Hague's article the use of the word "beneficiation." I remembered that such a term was used in mining; but I unblushingly admit that I had to look it up in the dictionary to be sure of its meaning. The Standard Dictionary gives the following: *"Beneficiate* (Rare), mining. (1) To work or improve, as a mine, (2) to reduce, as ores."

It may be simpler and convey more, to speak of "mining and beneficiating" or "beneficiating and milling," as either seems to be correct, than it is to say "mining and milling," but I doubt it. Is it not true that many of our problems in mining are rendered still more difficult and confusing by the use and abuse of unnecessary words and expressions?

JOHN T. FULLER.

Honesdale, Penn., Feb. 12, 1912.

The Slow Speed Chilean Mill

Congratulations are due Messrs. Narváez, Megraw, and other advocates of the slow, heavy chilean mill, on the conversion of a builder of stamp-battery cyanide plants to a recognition of its merits. Two remarkable features attend this conversion, however: the time required to effect it, seeing that Mr. Empson has been building stamp mills at Pachuca and Guanajuato for several years, and must have had ample opportunity to observe and compare results, and the fact that (with the exception of Mr. Megraw) he is the first foreign cyanide metallurgist to publish so decided an approval of the ancient crushing device. The reasons for this tardy appreciation may be found among those enumerated in his paper, quoted in the JOURNAL of Feb. 3, 1912, but I think he is unduly severe, considering his own experience, in hinting at ignorance and prejudice on the part of his *confrères*.

I should attribute the delay rather to a phenomenon which has frequently come under my notice during 16 years of contact with cyanide metallurgists in Mexico, and which, for lack of a better term, I may call "mental reluctivity" on their part toward suggestions and ideas emanating from mining engineers, managers, and others not strictly pertaining to "the profession"; the phenomenon occasionally assumes a pronounced form, especially when the suggestions are from a Mexican source.

SIBERIAN MILLS NOT FINE GRINDERS

The Siberian mills mentioned by Mr. Empson appear to be a compromise between the Pachuca form and the Lane slow-speed mill. Their apparently high efficiency seems to arise from the coarse screen and low discharge used, and if they were called upon to produce pulp approximating that of La Unión or Santa Elena, either in one operation or followed by a tube mill, their efficiency would be greatly lowered. In fact, working alone, it could not be expected that their sliming efficiency would approach that of the Pachuca form, due to the great distance between the rollers; as explained by Mr. Narváez (ENG. AND MIN. JOURN., Nov. 21, 1908), the greater the radius of the circular die the less the rubbing effect or twisting motion upon which sliming principally depends. If tube mills are to be added, for the purpose of producing agitation pulp, a loss of mechanical efficiency and a complication of plant ensue. Taken alone, it does not seem that the Siberian mill can compete with the Pachuca form as a slimer, however efficient it might prove in turning out a granular pulp.

The character of the work done at La Unión is not approached elsewhere, so far as I have been able to ascertain. To take 1½-in. ore, of average hardness, and reduce it to 80% through 200, at a single pass through the chilean, and with an efficiency of 46.13%, or a rate of 1.70 tons per horsepower-day, or 0.59 hp. per ton ground, certainly upsets some of the calculations of the advocates of multi-stage crushing; and when we consider the almost negligible loss of running time, the cheapness of attendance and repairs, and the extraordinary simplicity of plant, it makes a remarkable record. Mr. Megraw's work at Santa Elena shows higher mechanical efficiency; but he was not producing a pulp suitable for agitation without regrinding, as was the case at La Unión.

Mr. Megraw emphasizes the deficiency of the mill as a regrinder. It is evident that at the standard of performance given above, regrinding would rarely be required, but I am of the opinion that if the discharge were led through a Dorr classifier and the plus 200 returned to the mill, the small percentage of oversize would not be found to affect the efficiency of the mill by packing down on the die, and the classifier would act as a safeguard against coarse pulp reaching the treatment tanks. A little consideration will show that this could be arranged in a compact and satisfactory manner.

SUGGESTED IMPROVEMENTS FOR THE PACHUCA MILL

I agree with Mr. Empson that the Pachuca mill is susceptible of improvement, particularly as regards the power transmission and feed. If the crown wheel were given a sliding fit on the vertical spindle, so that it could remain at constant height even if the spindle wore at the step bearing, each mill might be driven by a Morse or Renold chain from a vertical motor, mounted on the main frame, thus suppressing the intermediate gearing. A quarter-turn rope drive might be used, the crown wheel being changed for a rope pulley, and the drive taken from quill clutches on the line-shaft, or, with the improved efficiency of spiral gearing in late years, the mills might be driven directly from spiral pinions mounted on quill clutches on the line-shaft, the latter being driven by motor or other means.

On account of the practically continuous running time, a battery of these mills would be particularly adaptable to group driving by motor. A continuous feed, if practical, should certainly improve efficiency. The other improvements, excepting the Mantey offset already in use, would require practical demonstration. If the modernized mill proposed by Mr. Empson, followed by sufficient tube-mill capacity to regrind oversize, cannot show a higher efficiency than 0.766 hp. per ton ground, its advantages would seem doubtful. There would seem to be no reason why all cast parts of the mill proper should not be made in Mexico; in fact, I think this has already been done in some cases.

A further improvement in adapting the mills to harder rock would be an increase in the diameter and weight of the rollers, the die remaining unchanged. This would give a better bite on large feed, and a greater pressure per unit of die surface. Whether and under what circumstances it would be advisable to increase the width of the tires and die is a matter for investigation; mathematical analysis of the peculiar combination of twisting and rolling might determine this, and would be interesting.

I have long been impressed with the work of mills of the roller type, and have from time to time gathered data on their performances, but until the publication of Stadler's investigations no suitable form for comparing mechanical efficiency had come under my notice. With the exception of La Unión, all the plants that I know of as producing fine pulp are working in conjunction with stamps or rolls, and are followed by tube mills. As stated in the article in the Journal of Aug. 5, 1911, quoted by Mr. Empson, the crucial question is the efficiency of the entire combination of machines required to reduce mill feed to fine pulp, comprising all apparatus between the rock breakers and the treatment tanks. Of course, if all the members of the combination were of high efficiency, the combination would inevitably be efficient; but this is not the case, as we find stamps of approximately 70% efficiency working in connection with tube mills of say 17%, etc.

Now that Stadler's method affords a convenient means of comparing crushing efficiencies, I suggest that the Journal publish, if obtainable, figures from the leading exponents of the various crushing schemes in the United States and Mexico. For instance: Mr. Dorr, at the Mogul, and Mr. Argall, at Stratton's Independence, use rolls, fast (three-roller) chileans, and tube mills; Mr. Hutchinson, at Goldfield, is using stamps, fast chileans, and tube mills; Mr. Pattinson, at El Bote, uses slow chileans—whether followed by tube mills I cannot say; Hugh Rose, at Santa Gertrudis, has a most modern mill, with 1550-lb. stamps, followed by high tube-mill capacity; and if I am not mistaken, El Oro practice is now limited to stamps and tube mills. If these gentlemen can be induced to publish the data, and Messrs. Narváez and Megraw will give their latest results, your readers will be able to form an intelligent comparison of the relative merits of the different methods.

Such data should comprise the following: Class of crushing and grinding machinery, omitting rock breakers, power consumed by each machine in the combination, whether battery, rolls, chilean, classifier, elevators, pump, etc., handling material between the delivery of feed from mill bins and its discharge to treatment tanks; size and hardness of feed, tonnage of feed, screen analysis of discharge (preferably by dimensions of screen aperture); approximate cost of labor and repairs per ton fed; approximate cost of wearing parts per ton fed; time lost. If power is stated as input to motors, their efficiency should be given, so that the net output to the machinery itself may be figured.

Although conditions differ in all the mills mentioned, figures covering such a wide range of practice should throw much light on relative efficiencies of machinery. Metallurgists and managers are interested in knowing how many tons of ore, from a certain feed to a certain discharge, can be put through certain forms of mill, per horsepower expended; or conversely, what horsepower it requires to reduce a ton of ore to pulp, under these circumstances. As to the other points of equal or greater importance—percentage of running time, simplicity, attendance, cost and frequency of repairs, these are quite necessary in passing judgment; so far as heard from, however, the advantage in these particulars seems to be on the side of the Pachuca chilean.

E. H. Webster.
San Antonio, Tex., Feb. 9, 1912.

Smoke Investigation

It may be of interest for you to know that we are entering into a study of the smoke problem in the broadest manner possible. We are taking the following as our chief lines of investigations: the effect of smoke on health, plant life and buildings. We are also considering the increased cost of living due to damage and dirt caused by smoke, and the legal as well as the engineering side of the problem. Each of these investigations will be carried out by one or more men, each a specialist in his line.

It is hoped that by coördinating these various researches it will be possible to obtain some valuable technical as well as scientific data. We will at least be able to establish the status of the problem, as a whole, on a scientific basis. I am writing at this time to see if you will not aid us by making mention of the work we are doing in the columns of the Engineering and Mining Journal. We should like to get in touch with people interested for the purpose of coöperation, information and suggestions.

R. C. Benner.
Pittsburg, Penn., Feb. 15, 1912.

Government Experiment Stations

At a meeting of the Assayers and Metallurgists of San Francisco, held Feb. 5, 1912, the following resolution was unanimously adopted:

Whereas, a bill (H. R. 17,033) has been introduced by Mr. Raker, of California, into Congress and referred to the House Committee on Mines and Mining, providing for the establishment of a government experiment station at Auburn, Placer County, Calif., at which assays, tests, analyses and miscellaneous investigations of minerals and metallurgical problems are to be made gratuitously or for a nominal charge, and

Whereas, there already exist well established private plants where this work is adequately and economically done and which meet the existing conditions along these lines,

Now, therefore, be it resolved, that while cordially approving of well directed efforts on behalf of the government in the advancement of science, we protest against any unnecessary interference with established industry and personal initiative and against this bill in particular, as an unwarranted and unwise incursion into the field of established business.

Be it also resolved, that copies of this resolution be sent to Congress, to the press and to interested technical societies.

EMORY E. SMITH, President.
ABBOT A. HANKS, Secretary.
San Francisco, Calif., Feb. 9, 1912.

Improvements in Crushing Rolls

In the article by C. Q. Payne under the above caption in the Journal of Feb. 17, 1912, it was stated that the Edison corrugated rolls for pulverizing cement rock were provided with shells 30 in. diameter by 18 in. face. This is a typographical error. The width of the face is 8 in. The characteristic of the rolls are their relatively narrow corrugated face, their high peripheral velocity, and the high compression under which they are forced together by springs.

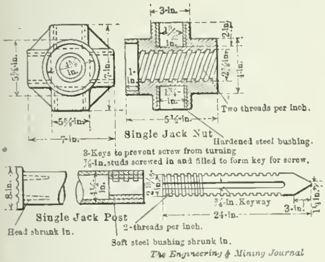
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Drill Post with Removable Screw

In the Copper Range, Hancock and Quincy mines single-screw posts, the jack screws of which are removable, are used whenever a single-screw post is required in making a cross-bar setup with a machine. The details of the screw are shown in the accompanying illustration.



The Engineering & Mining Journal

Details of Drill Column with Removable Screw

The device has even been used in shaft sinking and is said to have proved as satisfactory for that work as an ordinary post, while it possesses the advantage that owing to the fact that the screw feeds ahead instead of the jacking nut, as is the case in the ordinary single-screw post, the screw can be stuck into a hole in the wall, and the bar jacked without any trouble arising from projections from the wall interfering with jacking. The separate screw and nut also possess the advantage that such a single-screw jack can be used with several different lengths of bars.

The nut of the jacking device is octagonal in shape with four steel-bushed holes in its sides for receiving the jacking bar, and one end of the nut is made big enough to go over the end of the post as a collar. The screw has a blunt end that goes against the ground, while in it is a keyway that goes over three lugs in the end of the post so as to keep the screw from twisting with respect to the post as the jacking nut is turned. The post has at one end the ordinary toothed head shrunk on it, while at the other there is a soft-steel bushing or guide shrunk in for the screw. Through this end of the bar three holes are drilled and tapped for ⅞-in. studs. These studs are screwed in tightly and then filed flat to serve as the keys to go into the keyway in the jacking screw, as well as to hold in the guide bushing. The barrel of the post is a piece of ordinary 4-in. gas pipe.

Electric Hoist at Negaunee Mine

By P. B. McDonald*

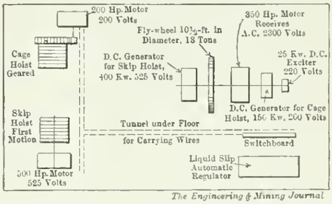
The new electric hoist installed at the Negaunee mine of the Cleveland-Cliffs Iron Co. uses direct-current motors, has a flywheel to eliminate peak loads, and an automatic regulator for varying the speed of the motor-generator.

There are two hoists, a first-motion skip hoist and a geared, cage hoist. The two hoist motors are of different power, the skip hoist 500, the cage hoist, 200 hp. The voltage is so adjusted that both motors have the same ampere capacity; this is done so that in case of a breakdown either motor can be run from either generator. Double-throw switches are provided on the switchboard so that in case of the 200-hp., 200-volt motor being run from the 400-kw., 525-volt generator, additional resistance is inserted in the field of the generator to cut down the voltage to that of the motor. If the 500-hp., 525-volt motor is run from the 150-kw., 200-volt generator it will pull the full load at about half speed so that hoisting need not be entirely stopped, but can take place at a reduced rate.

Alternating current comes to the hoist house at 2300 volts. It is led direct, to a 350-hp. induction motor which is mounted on a line shaft with the two direct-current generators, 13-ton flywheel, and 25-kw. exciter. By means of an automatic, liquid, slip regulator (in which a solution of washing-soda is used in place of the customary salt water) the speed is reduced as the load increases thus allowing the flywheel to give up its energy and so maintain practically a constant load on the transmission line.

Without this slip regulator the flywheel would not be able to give up its energy. The flywheel will run several hours after the current is turned off. It is 10 ft. 6 in. in diameter, 7 in. thick, and is built up of steel plates riveted together; it makes about 700 revolutions per minute.

The hoisting engineer has only two levers to throw. One is for starting and stopping the motor actuating the drum, the other is for controlling the brake engine which is worked by compressed air. There is an automatic safety device which throws these levers in case the engineer does not. To prevent overwinding a wheel is turned slowly by a worm gear as the drum revolves, and engages cams which, through a system of levers, cut off the power to the motor. The brake which is normally held on by a heavy weight is released by compressed air during the hoisting period. Should the drum tend to overwind due to neglect of the engineer, a safety stop opens a valve which releases the air pressure and thus causes the brake to be applied.


200 Hp. Motor 200 Volts
350 Hp. Motor Receives A.C. 2300 Volts
Fly-wheel 10½-ft. in Diameter, 13 Tons
Cage Hoist Geared
D.C. Generator for Skip Hoist, 400 Kw. 525 Volts
25 Kw. D.C. Exciter 220 Volts
D.C. Generator for Cage Hoist, 150 Kw. 200 Volts
Skip Hoist First Motion
Tunnel under Floor
for Carrying Wires
Switchboard
Liquid Slip Automatic Regulator
500 Hp. Motor 525 Volts

The Engineering & Mining Journal

Layout of Negaunee Electric Hois

This system of electric hoisting using a flywheel to obviate peak loads comes under the third system as described by D. B. Rushmore,[1] and is similar to the electric hoist installed at the Winona mine in the copper country.

The shaft at the Negaunee mine is 940 ft. deep; there will be two skips hoisting in balance. The skip hoist is aligned with the shaft house, the cage hoist, necessarily at a small angle. Current will be furnished from the new power house under construction on the Carp River near Marquette. The wiring in the hoist house, from the switchboard to the hoist motors, is in a concrete tunnel under the floor; the tunnel is large enough for a man to work in.

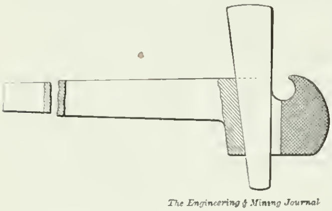
---

*Mining engineer, Negaunee, Mich.

[1] Eng. and Min. Journ., Dec. 16, 1911.

Wrench for Removing Stuck Drills

The accompanying sketch shows the design of the wrench that is used at the Mohawk mine in Michigan to aid in loosening drills that become jammed in the hole by the drillings. As can be seen, the wrench is quite similar to the one that is used at the Calumet & Hecla mines, described in the JOURNAL of Dec. 16, 1911. The grip on the drill is obtained by driving in a key or cotter that grips the drill between itself and the jaw of the wrench. The wrench is much heavier, and does not seem to be quite as handy as the one used at the Calumet & Hecla mines.



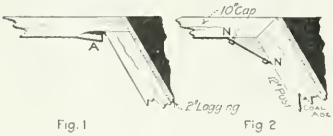
COTTER WRENCH FOR STUCK DRILLS

In working the drill out a chain is fastened to the drill, thence it is passed around the machine post. One man pulls on the chain while the other twists the drill with the wrench. In this way it is often possible to work a drill out when it is caught tightly in the drillings.

Timber Framing for Side Pressures

Side pressures in three-piece drift sets invariably split the caps when the usual method of notching is used, states Joseph Virgin in *Coal Age*. This often happens before the post has taken the full force of the side pressure.

To avoid the splitting the cap is cut at the ends at an angle of 45° and legs 2-in thicker than would otherwise be used are employed. The upper ends of the legs are also cut at an angle of 45°. By nailing in the corner the piece cut from the end of the leg and driving two small track spikes into the cap and two into the leg, as shown at *NN*, Fig. 2, in the accompanying illustration, a strong durable joint is obtained in a quick and simple way.



METHOD OF FRAMING FOR SIDE PRESSURE

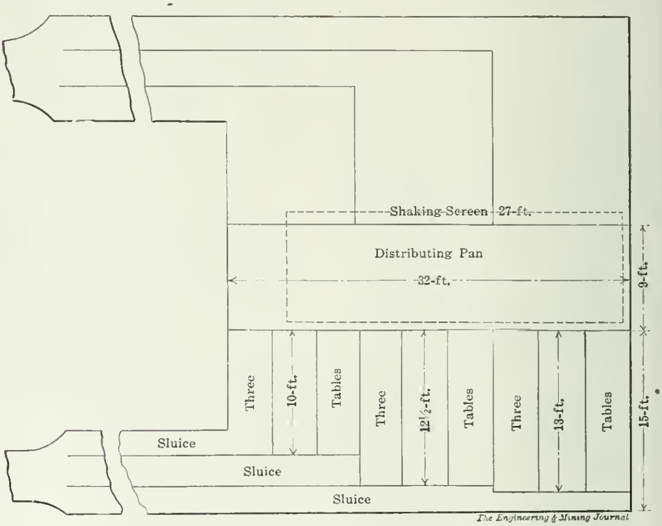
Cross System Gold Saving Tables

By LEWIS H. EDDY

The cross-system plan of constructing gold-saving tables has been adopted by a number of dredge operators in California within the last year or two. In some instances the system was installed with the original construction of the dredge; in others it has displaced the Holmes type of longitudinal tables. The latest installation of the cross-system on a new boat, of which I have definite information was on the 4-cu.ft., close-connected, bucket-elevator dredge equipped with revolving screen. This boat was designed and constructed by John Ross Wade on Butte Creek, near Chico, in June, 1911. The latest displacement of the Holmes type by the cross system was made in December by O. C. Perry on Pacific No. 1 dredge at Oroville. This is a 7½-cu.ft. bucket-elevator dredge, equipped with shaking screen, which was sunk on Nov. 27 and raised on Dec. 7. There is a slight deviation in the Butte Creek installation from the common cross-system plan in that the positions of cross tables vary from transverse to oblique in relation to the position of the screen; but the principle and the purpose apply in both plans alike. The purpose is to avoid the variation in the flow of water caused by the fore and aft motion of the boat resulting from the lowering and raising of the digging ladder; this variation is greater in the smaller boats equipped with longitudinal tables than in the largest boats.

The gold-saving tables constructed on the cross-system plan occupy the same situation on the dredge as the Holmes type with relation to the position of the screen. The position differs: the Holmes type are longitudinal, running parallel with the screen; the cross tables at right angles. The description of the installation on the Perry dredge at Oroville applies in general terms to all installations of the cross system. The screen equipment on this dredge is the reciprocal end-shaking flat type, 27 ft. long, 9 ft. wide, provided with a distributing pan beneath the screen, 32 ft. long, 9 ft. wide. The gold-saving tables and sluices are in two series, one on each side of the screen and connected to the pan, and are alike in all respects; so that the details of one series is sufficient for the purpose of this description.

The series contains three sets of tables and three sluices. The tables extend outward and at right angles from the distributing pan, and are connected at the outer end, each to a separate sluice running longitudinally. The tables composing the first or upper set are 13 ft. long; the top or upper frame piece of the uppermost table extends 2 ft. beyond this length, or 15 ft. over all and is attached at right angles to the outside frame of the outer sluice, forming the upper outside corner of the whole structure. The tables in the second or next lower set are 12½ ft. long, and extend to the center sluice. The tables in the third or lowest set are 10 ft. long, and extend to the inner sluice. The three sluices, varying in length according to their connection to the tables, extend several feet downward and converge into one which disposes of the water that has been carried over the tables. The pitch of the



CROSS-SYSTEM OF GOLD-SAVING TABLES ON PACIFIC DREDGE NO. 1, OROVILLE, CALIF.

tables longitudinally is 1¼ in., the pitch of the sluices is 1½ in.

It is obvious that the flow of the water over tables constructed on the cross-system plan will not be affected materially by the fore and aft oscillations of the dredge digging at different depths, but that agitation across the tables will result; while varying increase in the velocity of the water and variableness of the flow over tables constructed on the longitudinal plan evidently result from such oscillation. It is true that oscillation athwart ship may result, and does so result in the operation of small dredges working on head or side-lines; but the advocates of the cross system claim that there is not enough variation to appreciably affect the flow. The Holmes type of gold-saving tables, in use for a number of years, and for a time almost exclusively, has been variously modified according to the varying constructional features of dredges and the character of ground; but the plan adopted by Perry is more than a modification; and the present installation was induced by the successful operation of the same system on No. 4 dredge. The installation at Butte Creek is less a digression and more a modification of the Holmes type.

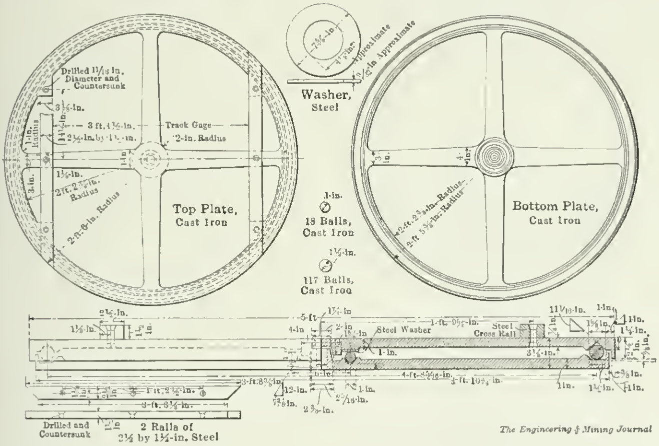
Removal of Paint and Varnish

One of the things which the newspaper is often accused of doing is publishing recipes without investigation. A contemporary recently recommended the following for the removal of varnish, paint or lacquer from hard paint brushes: 4 oz. benzol, 3 oz. fusel oil, mix and shake well, then add 1 oz. of alcohol. Allow the brush to soak for two or three hours. This mixture is good; we have tried it ourselves, but we wish to state that it required visits to eight paint and drug stores before we found one which had all the ingredients named. The cost of 8 oz. of the mixture at retail was 35c., so that it scarcely pays to make it up for one brush only. It is not a good mixture to use near open lights or fires, as it may remove the experimenter, the paint brush, and even the building, as well as the paint.

A Ball Bearing Turntable

Turntables are generally used at the shaft stations in the inclined shafts of the Lake Superior copper country, as the tram cars generally hold from 1¾ to 2½ tons. At the Tamarack, however, where the shafts are vertical and the cars hold 2½ tons as loaded, turnplates are used. These are somewhat thicker and hence more rigid than turn sheets, the usual substitute for turntables in other districts.

These turntables are not especially rapid in operation as, owing to the weight of the loads, speed is not so important as in Western mines where ton-cars are used. The turntables are put in the main tracks on the hanging-wall side of the shaft and are used so as to get the cars on the short tracks that lead right up to the edge of the plat. Some of these turntables are made with ball bearings, while others have two flat bearing rings. The turntables with the balls are stiff at first, but after the balls have worn smooth they are superior to those with bearing rings. If anything, the top part of the turntable could be cast a little heavier as occasionally an arm breaks. The gage shown is 3 ft. 4 in. which is the standard of many mines in the copper country. The drawing shows the turntables used in the Wolverine and Mohawk mines; the Calumet & Hecla company uses a similar table on tracks of four-foot gage.



The Engineering & Mining Journal

Turntable Used in Some Michigan Copper Mines

Unwatering with Electric Turbine Pumps*

By Cyril Brackenbury

The unwatering of the old Tresavean mine in Cornwall was successfully carried out by means of electrical high-lift turbine pumps, to below the 1420-ft. level below the adit 147 ft. below the surface. This is the largest and most successful operation of the kind achieved in the county with an electrical plant. Eight electrically driven high-lift turbine pumps were used in the work, but never more than three were worked together at the same time, the others were merely used as spares. Six of the pumps were designed for a delivery of 600 gal. per min. through a lift of 600 ft., when running at a normal speed of 1450 r.p.m. An extra 60-ft. head was allowed for suction lift and friction head.

Three of the pumps were used for sinking purposes, and five as station pumps. The sinking pumps were of the vertical, and the station pumps of the horizontal type. The impellers and diffusion vanes were made of phosphor bronze, and with the exception of one sinking pump, the casing of which was made of gun metal, the pump casings were made of special cast iron. The impeller shafts were made of nickel steel, and provided with water-cooled, white metal, thrust bearings. Each pump was provided with a throttle valve to regulate the discharge, immediately above which was fitted a check valve to support the weight of water contained in the rising main when the flow of water ceased from any cause. Similar check valves were placed in the rising main at distances of about 240 ft. apart. apart.

Each combined set consisted of pump and motor, bolted to the same bedplate in the case of the horizontal pumps, and to the same channel-iron frame in the case of sinking pumps. The motors were of the squirrel-cage induction type for the sinking pumps and slip-ring type for the station pumps, all arranged for three-phase alternating current, 50 cycles, 550 volts. At full load with a maximum current of 210 amperes, the motors were designed to give an output of 190 hp. The motors for the vertical pumps were of the inclosed type, water-cooled and ventilated internally by means of a revolving fan attached to the rotor shaft. The fan caused the air to circulate internally through the body of the motor, continually passing it next to the water-cooled side. This method was found satisfactory, as it kept the motor cool without danger of allowing the moisture in the shaft to enter the windings. The weight of the rotor was carried by a compound ball thrust bearing on the rotor shaft, which was connected to the impeller shaft by a flexible coupling, the two ends being fastened together by 16 small bolts inclosed in rubber washers.

---

*Excerpt from an article entitled "Unwatering Tresavean Mine," Bull. 88, I. M. M.

The power plant consisted of three high-pressure Lancashire boilers and three Bellis & Morcom compound two-crank high-speed engines, directly coupled to British Electric Plant Co. alternators, one set having been installed as a spare.

The alternators were of the revolving field-magnet type, with stationary armatures, each capable of developing 250 kw. at 550 to 600 volts, three-phase, 50 cycles, 375 r.p.m. The rotor was mounted on a steel shaft. The exciter was of the open shunt-wound multipole type, directly coupled to the alternator. There were two methods of regulation, by shunt resistance in the exciter field, and by resistance between the exciter and alternator fields; the former being the only one used. Two varieties of electric cable were used for the pumps; the smaller and more flexible type was used for the sinking pumps and lowered intermittently down the shaft, while the larger and heavier type was securely fixed in the shaft and connected with the station pumps. As the sinking-pump cables were only for temporary use, the conductors were allowed to be of smaller cross-sections than usual for the maximum current which might have been used. Each cable was 7.4 in. in circumference, three-core pattern, 0.15 sq.in. section, pure and vulcanized-rubber insulated, double wire armored, braided and compounded over all; weight, about 1240 lb. per 100 yd. Each cable for the station pumps was 10 in. circumference, three-core pattern, 0.217 sq.in. section, bitumen insulated, double-wire armored, braided and compounded over all; the weight was about 3210 lb. per 100 yd.

Each of the sinking pump cables was wound on a light-built steel drum, 6 ft. diameter, 6 ft. 6 in. between flanges 9½ in. deep. The inner end of the cable was originally connected with slip rings on the end of the drum axle, but the rings being found rather small for the purpose, a plug was later used. The other end of the plug was connected with a short length of cable leading from an oil switch at the feeder panel. The farther ends of both cables, together with the wire rope which supported them, passed over three 6-ft. pulleys at the shaft's collar, and thence down the shaft to a junction box suspended at the end of the wire rope. The suspending rope was made of plow steel, 3⅞ in. circumference, and was attached to both cables by means of wooden-lined iron clamps, so as to support the entire weight of both cables. The clamps were fixed about 40 ft. apart and were designed to run on wooden guide rods fastened to the dividers of the shaft.

The two station pump cables were securely fastened in the shaft by a series of wooden iron-bound cleats about 4 ft. long and 10 in. wide, which were themselves bolted to the wall plates or other strong timbers in the shaft. These cleats were placed about 15 yd. apart. The lower end of each cable was connected with an oil switch placed at the pump station, and the upper end was connected directly with the oil switch of the feeder panel.

The winding machinery for pumps, cables and men was driven by two electric motors, and also by a small steam winch, which was used as a convenience in lowering the pumps slowly, and it could be employed in case of emergency if the electric power failed. For raising and lowering the pumps and cables there was a combination three-drum hoist, driven by a 30-hp. electric motor; drum *A* was 6 ft. diameter, 4 ft. wide between flanges 12½ in. deep; drum *B* and *C* 6 ft. diameter, 3 ft. between flanges 10 in. deep.

The unwatering was delayed from time to time when it became necessary to remove obstructions that completely choked the shaft in several places. The station pumps were installed at the 450- and 996-ft. levels. The accompanying table shows the summary of the pumping campaigns. High-lift centrifugal pumps are not suitable for raising water containing much rough material which could pass through an ordinary Cornish pump without difficulty. The holes in the sinking-pump strainers were ¼ in. diameter.

SUMMARY OF TRESAVEAN PUMP CAMPAIGNS

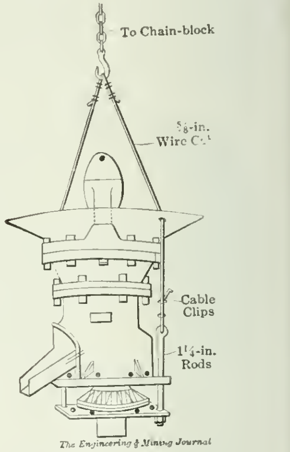
Description of Pump	Number of Campaign	Reason of Stop	Period		Gallons Pumped	Length of Run	
			From	To		Hr.	Min.
No. 1 sinker	First	Failing duty	4-26-09	9-18-09	64,434,125	2415	10
No. 2 sinker	First	Failing thrust bearing	9-23-09	2-14-10	95,895,358	3001	35
No. 1 sinker	Second	Failing duty	2-17-10	6-13-10	*71,434,675	2583	0
No. 2 sinker	Second	Failing thrust bearing	6-16-10	10-10-10	*46,400,217	2073	35
No. 1 station, west	First	Thrust bearing seizing	2- 4-10	9-29-10	59,210,685	2419	0
No. 1 station, east	First	General repair	4-25-10	11-19-10	90,259,195	3405	0
No. 1 sinker	Third	Failing duty and thrust seizing	10-14-10	3- 4-11	*59,997,021	3028	10

*Could not be obtained accurately, since exact measurements were only taken of all water delivered to adit.

Generally speaking, all campaigns were stopped on account of wear and tear to pump, which caused a falling off in the duty, and a tendency for the thrust bearings to heat up.

Lowering the Bottom Plate of a Gyratory Crusher

A rapid method for lowering the bottom plate with eccentric and gear of gyratory crushers is described by J. H. Oates, *Mexican Mining Journal*. The plate is lowered by a chain-block over the crusher. The cable used is of such a length that when lowered all of the distance the chain-block hook will not come to rest upon the top of the spider hood. The cables used are ⅝ in. diameter, six strands and are fastened by clips. The lower end of the cable passes through the hopper directly above the holes in the bottom plate, where the threaded bolts go for lowering the plate. The ends are passed through eyes in bolts made fast with two clips to each cable, as illustrated. The bolts generally used are the same as those that come with the crusher, only that they have an eye welded to one end.



The Engineering & Mining Journal

RIG FOR LOWERING BOTTOM PLATE OF CRUSHERS

By this method all of the bolts can be loosened while the crusher is running, and when all is ready the bottom plate can be lowered. It takes about two minutes to lower, and from five to 10 min. to raise the bottom plate, depending upon how expert the operator is in getting the shaft into place. Before taking out the plate bolts one should be sure that the cable clips are tightened thoroughly, and also that the cable is greased a little where it passes through the hopper.

Melting at the British Mint

The annual report of the British Mint, which has been published, gives an account of the operations of this department during 1910. No less than 371 tons of gold were melted during the year, being more than double the average of the 10 years, 1899-1908.

Some important changes have been made in the methods of melting the various metals used for coinage. Preliminary experiments on the use of gas and oil instead of coke have been in progess since early in 1909, and these experiments have involved the preparation of many designs for furnaces of various sizes, and the testing of a number of burners for obtaining high temperatures, some specially designed and others of patterns already in use in various trades. Electric furnaces were also experimented with.

Oil furnaces, burning both petroleum and creosote oils, were tested under varying conditions, and with air at pressures from 2 to 25 lbs., but it was finally decided that liquid fuel was unsuitable.

In the experiments with ordinary gas, states the *Gas Engineers Magazine*, a variety of systems was tested, involving the use of gas at ordinary and high pressures, combined with variations in the pressure of the air, and the burner ultimately adopted was made by S. N. Brayshaw, of Hulme, Manchester.

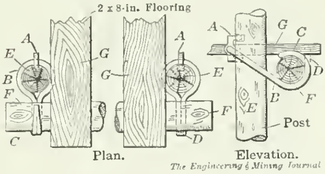
For the Brayshaw burners in use at the mint, the gas is taken at the ordinary pressure in the main, about 3 in. of water, and mixed with air from a blowing engine at about 2 lb. pressure. With care the noise of these burners can be reduced sufficiently to be unobjectionable; the furnace linings compare favorably with those hitherto used for coke in regard to endurance; and the crucibles used for gold are found to last longer, each crucible serving for an average of 18 heats as against 12 when coke is used. The adoption of gas as a fuel in place of coke has been accompanied by several incidental economies, and it is interesting to note that the present charge for fuel averages about 8½c. per cwt. of standard gold bullion as against 14c. when coke was used. It should be added that in this statement the fuel needed to warm up the furnace in the morning has been eliminated, but, including this, the cost rarely exceeds 10c. per cwt. on a day's work.

During 1910, the mint installed 16 gas-heated furnaces, each capable of taking a 400-lb. crucible. These 16 furnaces have a maximum capacity of 2¾ tons of sterling silver, or 2¼ tons of bronze per melt, and four melts of silver, or three of bronze, can be made in an ordinary working day; 8 a. m. to 6 p. m. Also five furnaces similarly gas-heated, but of a smaller size are in use for melting gold.

Considering the large quantity of metal melted at the mint, it will be seen that a substantial saving in the cost of fuel alone has been effected by the use of gas. The incidental economies are, however, still greater. The cost of carting and handling both coke and clinker is saved and the room formerly required for their storage is available for other use. The expenditure on crucibles, which is a large item, has been reduced by 33%. The work of melting is less laborious and the loss of metal much reduced.

Scaffolding for Drills in Wide Stopes

In stoping in a wide vein it is often the case, when an overhand stoping system is in use, that some provision must be made for mounting the machine drills. If a shrinkage system of stoping is being used, it may also happen that so much ore has been drawn from the stope that the height of broken ore in the stope is not sufficient to enable the miner to reach the back.



STAGE FOR DRILLING OR SAMPLING IN STOPES

In some of the Lake Superior copper mines and in certain mines of the Transvaal, long drill columns are used some of which have a length of 28 or 32 ft. It is not always convenient to keep such long columns on hand or the slope of the stope may be such as to make the use of such columns impossible.

The accompanying sketches illustrate a type of scaffolding that is much used[1] in the wide stopes of some of the mines of Western Australia. This scaffolding is built up of vertical posts *E* well footed and wedged in place at the top. At the required height steel dogs *A* are driven into holes cut in the backs of the posts. Through a hole in the backs of these dogs, pass the ring-hooks *B*, made of ⅞-in. round iron. The hooks for the end posts are curved back as shown at *C*, while those between the end posts are curved as shown at *D*. The dog holds the ring part of the hook from slipping, but most of the holding power of the hook is due to binding against the vertical post. Horizontal members *F* are carried in the hooks, and form the support for *G* the plank flooring.

Such a staging can be used for a variety of purposes about a mine besides that of supplying a stage for drilling. In sampling high backs a scaffold can be rigged with four posts set at the corners of a square with four horizontal members forming the sides of a square, that will give easy and safe access to the face to be sampled.

Measuring the Flow of Streams

The following method of determining the approximate flow of streams, is recommended by the U. S. Geological Survey.

To ascertain the velocity of the stream choose a place where the channel is straight for 100 to 200 ft. and has a nearly constant width and depth. Lay off on the bank a line 50 or 100 ft. in length, marking each end; then allow small chips to float down the stream, by one of the methods described below, noting the time required for these to traverse the distance laid off on the bank. The surface velocity in feet per second is obtained by dividing the distance in feet passed over by the float by the time in seconds it takes the float to travel this distance. The average of several such determinations will give the mean surface velocity of the stream. This result, multiplied by the coefficient 0.8, gives approximately the mean velocity.

To obtain the area of the cross-section of the stream, stretch a tape from shore to shore and take the depth of the stream at intervals of two to five feet. The average of these depths may be assumed as the mean depth of the stream. This average, multiplied by the total width, will give the cross-section of the stream in square feet.

The discharge is found by multiplying this cross-section area by the mean velocity, as obtained by the float measurements, the result giving the discharge in second-feet, or, in other words, the number of cubic feet flowing past the point of measurement each second.

In determining the velocity for small streams and when only approximate results are desired, the float is placed in the center of the stream only. For larger streams and when greater accuracy is desired, a tape is stretched across the stream and the distance between the banks is divided into a number of equal spaces or sections. Floats are then allowed to drift down the stream as near as possible in the center of each of these spaces, the same number of floats being used for each section. The mean surface velocity is then assumed to be the mean of the surface velocities obtained for the several sections. For each float the distance of its starting point from the right bank is recorded as indicated.

---

[1] Cleland, "West Australian Mining Practice."

Jones Step Process

Since September, 1908, there has been conducted on the Michigan iron ranges, a series of experiments by John T. Jones, of Iron Mountain, Mich., having for its object the profitable treatment of low-grade iron ores of the Lake Superior iron ranges. As previously mentioned in the JOURNAL, it has been attempted to do this by bringing the ores into contact with the volatile matter of coal or wood, and likewise with the fixed carbon which is found in these fuels, it being expected that the iron oxide of the ore would be reduced, leaving the iron in a metallic condition without in any way fluxing or melting the iron or gangue found in the ore; after this it is intended by a process of magnetic concentration, to free the iron from its gangue and to obtain a product fit for blast-furnace use, and perhaps of sufficiently high grade to be acceptable for openhearth-furnace use. The process is essentially a metallizing method.

DIFFERENT TYPE OF FURNACE USED NOW

The ores principally used in making these experiments are from the Kloman mine, at Republic, Mich.; the Kloman ore is low in iron and high in silica. By the Jones process it is hoped to increase the iron content and decrease the silica content to such an extent as to make a useable product. Experiments were first made in what is known as the Ardis furnace at Iron Mountain, Mich. This furnace was a long, brick-lined steel cylinder which revolved in an inclined plane, the feed being introduced at the upper end. A plant embodying this process but of different design is now being constructed at Republic, Mich., where the Kloman mine is situated.

The plan of operation at the Kloman mine, at which the new furnaces are situated, and the later metallizing operations are described by Albert E. White, of the University of Michigan, for the Michigan Geological Survey. The following account has been abstracted from an advance publication[1] of Mr. White's chapter in the "Mineral Resources of Michigan."

The low-grade Kloman ores will be mined by the glory-hole method, hoisted and crushed in a No. 6 McCully gyratory crusher. This will pass over 1½-in. grizzlies, the oversize going to a No. 4 Gates gyratory crusher. The whole product will then pass through rolls and screens until it is broken to ⅝-in. size or smaller. This product will then be metallized in Brückner roasters, in charges of 15 tons each. These roasters are arranged in series of two. While the ore in one is being metallized, that in the other is being heated by the passing through it of the waste gases from the first roaster. The metallized product is dumped into a water-sprayed pocket. The partly disintegrated product is then treated on a jig to remove any good merchantable coke that may be present. The concentrates are conveyed to a Brückner drier, after which they are crushed to the proper size and magnetically separated into metallized ore and fine coke.

BRUCKNER ROASTERS EMPLOYED

The Brückner roasters are 18½ ft. long by 8 ft. 8 in. internal diameter. It is stated that they will require 12 hp. to start, and 5 hp. to operate when in motion. It is expected that each one will hold 15 tons of ore at a charge, and it is hoped that but four hours will be required for the metallizing operation; two being consumed in heating, and two in the reduction, or metallization. By placing them in series of two, and utilizing the waste gases, as explained above, it is hoped that a charge of 15 tons of ore will be available every two hours from the two roasters. These roasters are equipped with oil burners for giving the supplementary initial heat.

ESTIMATED COST OF TREATING LOW-GRADE KLOMAN IRON ORES

MINING AND METALLIZING

Mining	2.66 tons @ $0.30	$0.798
Crushing	2.66 tons @ 0.08	0.213
Screening	2.66 tons @ 0.05	0.130
Concentrating	2.66 tons @ 0.08	0.213
Conveying	2.66 tons @ 0.10	0.266
Jigging	2.66 tons @ 0.05	0.133
Fuel	......	3.180
Repairs	2.66 tons @ 0.10	0.266
Tailing disposal	1.66 tons @ 0.08	0.133
Freight	1.00 tons @ 1.50	1.500
Total cost per ton of metallized product at Chicago	....	$6.832

SMELTING

Metallized ore	1.18 tons @ $6.83	$ 8.06
Limestone	0.50 tons @ 1.00	0.50
Coke	1000 lbs. @ 4.50	2.25
Labor and repairs	.....	1.25
Cost per ton of pig iron at Chicago		$12.06

ANALYSIS

	Crude Ore, Per Cent.	Concentrates, Per Cent.
Iron	40	85.0
Silica	35	12.5
Other gangue	7	2.5
Moisture	1	..

Charges of coal will be put into the roasters at the proper time for the purpose of completing the reduction of the ore. The roasters also have a 9-in. lining of firebrick, and at certain positions on the inside are placed firebrick projections to serve as lifters, for the purpose, if possible, of getting the coal underneath the ore in order that the escaping volatile gases may have an opportunity to come into as close contact with the ore as possible. The tube will revolve at varying speeds, depending upon conditions; it has a variance of from one revolution in 40 min. to 10 r.p.m. The metallizing and concentrating plant will be electrically driven throughout. The machinery includes a 200-hp. corliss engine, and a 150-kw. Western Electric alternating-current generator. It will probably be impracticable to obtain a product containing more than 85% iron, according to Mr. White, and it is said that such a product will also probably contain from 0.1 to 0.2% sulphur, and for this reason the natural outlet for the material will probably be the blast furnace.

COSTS

In obtaining the cost of $12.06 per ton of pig iron, shown in an accompanying table, it is stated that the crude ore is credited with containing but 1% of moisture, and 42% of gangue, of which 35% is silica. It is said that as 20% of the iron present is lost in the process of magnetic concentration, it will be necessary to use 2.55 tons of crude ore in order to obtain a concentrate containing 85% of iron. It is hoped that the crushing, screening, concentrating, conveying, jigging and repair costs will be materially reduced when operating on a large scale. Chicago has been assumed as the smelting center; it is expected that it will require roughly one-half ton of limestone to do the necessary fluxing. By assuming 1600 lb. of coke for a ton of silica, and 300 lb. of coke for a ton of metal, the total of 500 lb. of coke is claimed as the amount required for a ton of pig iron; 1000 lb., however, have been allowed. While some experiments have been made on other ores, both in and out of the state, present efforts are being exerted toward the problem of treating successfully the Kloman ore.

---

[1] Iron Ore, Feb. 10, 1912.

On Feb. 5, the Bunker Hill & Sullivan Mining & Concentrating Co. paid dividend No. 173 of $65,400. This makes a total of $13,290,450 paid in dividends.

American Institute Mining Engineers

The 102d general meeting of the American Institute of Mining Engineers began on Feb. 19, at 8:30 p.m., when the meeting was called to order, in the Institute headquarters, by Benjamin B. Lawrence, chairman of the local committee. After some introductory remarks by Mr. Lawrence, Charles Kirchhoff, the retiring present of the Institute, delivered an address on "Institute Aims and Ideals." Mr. Kirchhoff was followed by Professor Kemp, who told some entertaining stories, illustrated by lantern slides. This session was held in the assembly room on the fifth floor of the Engineering Building. Upon conclusion of the speeches the members present adjourned to the headquarters of the Institute on the ninth floor, where an informal "smoker" was held. The meeting was very well attended.

The annual business meeting opened Feb. 20, at a little after 10 o'clock, there being a large attendance, undoubtedly brought out by the knowledge that differences of opinion respecting proposed amendments to the constitution of the Institute were to be exhibited at this meeting. The meeting was called to order by Dr. Douglas. After the reading of the minutes of the previous meeting, Dr. Douglas stated that there were differences of opinion respecting the proposed amendments to the constitution, as well known, but that both parties desired to unite in harmonious action (a conference having previously been held), and that in view of the circumstances it would be desirable to suspend the regular order of business. A motion to that effect was unanimously carried. Mr. Channing then introduced a resolution to the effect that Messrs. James F. Kemp, Christopher R. Corning, George C. Stone, William H. Nichols, Jr., and A. R. Ledoux be appointed a committee, with the power to fill vacancies among their number, to investigate all the affairs and the operations of the Institute and see whether an increase in dues cannot be avoided, and to report to the board of directors by May 1, 1912, making such suggestions as they may deem best for the welfare of the Institute; and that the board of directors shall cause the report of this committee to be printed and distributed by mail to each member of the Institute to the end that it may be considered and acted upon at an adjourned meeting. This resolution having been seconded, was unanimously carried.

Dr. Douglas being obliged to leave the meeting, the chair was taken by Dr. A. R. Ledoux.

By subsequent motions all of the proposed amendments now before the Institute, including the proposals to change the name, to increase the dues and to classify the membership were laid on the table, and it was voted that the adjourned meeting be held on June 3, 1912, or if it should prove inadvisable to hold it on that date that it should be held at a subsequent date, to be mutually agreed upon by the committee of investigation and the board of directors, due notice of the date to be communicated to all members of the Institute.

The annual business meeting held in New York this week was largely attended. Action on the proposed amendments to the constitution was postponed and a resolution passed appointing Messrs. Kemp, Corning, Stone, Nichols and Ledoux a committee to study all the affairs of the Institute, their report to be considered at an adjournment of the meeting to be held on June 3, or later if necessary.

The next order of business being the election of three directors in the place of A. L. Walker, Joseph Struthers and Theodore Dwight, whose terms had expired, Messrs. Charles F. Rand, Edmund B. Kirby and George C. Stone were placed in nomination by the "insurgent" party, and Messrs. Walker, Struthers and Dwight were nominated as the regular ticket. Messrs. Spilsbury, Ingalis and Prof. J. W. Richards were appointed tellers to examine and report upon the proxies. They reported that George C. Stone held 869, George Otis Smith, 12, and Bradley Stoughton, 310. After the ballots had been taken, the chairman reported that 75 members had voted in person and 1191 by proxy, and that Messrs. Kirby, Rand and Stone had received 919, 927 and 926 votes, respectively; and Messrs. Dwight, Struthers and Walker, 340, 338 and 338, respectively. Upon motion by Professor Walker the election of Messrs. Kirby, Rand and Stone was made unanimous.

For officers and councillors the following ticket was nominated: James F. Kemp, president; Benjamin B. Thayer, Karl Eilers and Waldemar Lindgren, vice-presidents; Joseph W. Richards, John H. Janeway, Jr., and Sidney J. Jennings, councillors; Joseph Struthers, secretary. There were no other nominations. The entire vote of the members present in person and by proxy, 1263 in number, was cast for the ticket except the nominee for secretary, for whom the vote was smaller.

There being no further business, the meeting was then adjourned. Immediately after luncheon, which was served in the rooms of the Institute, the committee of investigation held a meeting for the purpose of organization. At 2 p.m., the members of the Institute convened for their first professional session, at which papers on fine-ore sintering and briquetting, electrostatic ore separation, and progress in roll crushing were read and discussed. In the evening there was a banquet at the Plaza Hotel; President Kirchhoff presided, the speakers being George Otis Smith, W. L. Saunders, Dr. R. W. Raymond, R. Mortimer Lamb and Col. Hay.

LIST OF PAPERS

The following list of papers, the majority of which were read by title, or presented in brief oral abstract only, was announced:

"The Sintering of Fine Iron Ore," by B. G. Klugh, Birdsboro, Penn.

"Agglomeration of Fine Materials," by W. S. Landis, South Bethlehem, Penn.

"The Gröndal Briquetting Process," by N. V. Hansell, New York, N. Y.

"Electrostatic Concentration or Separation of Ores," by H. A. Wentworth, Boston, Mass.

"Progress in Roll Crushing," by C. Q. Payne, New York, N. Y.

"Gold Hill Mining District in Western Utah," by Prof. James F. Kemp, New York, N. Y.

"Geology of the New Catskill Aqueduct," by Charles P. Berkey, New York, N. Y.

"Geology and Ore Deposits of the Silverbell Mining District, Arizona," by C. A. Stewart, University of Idaho, Moscow, Idaho.

"The Decomposition of Some Metallic Sulphates at an Elevated Temperature in a Current of Air," by Prof. H. O. Hofman and W. Wanjukow, Massachusetts Institute of Technology, Boston, Mass.

"Vanadium in Pig Iron," by Porter W. Shimer, Easton, Penn.

"Temperature Conversion Tables," by Dr. Leonard Waldo, New York, N. Y.

"Treatment of Copper Mine Water," by Prof. Joseph W. Richards, South Bethlehem, Penn.

"Stagnant Mine Waters," by Prof. Alfred C. Lane, Tufts College, Boston, Mass.

"Rational Valuation and Quality Efficiency of Furnace Stock," by Prof. John Jermain Porter, University of Cincinnati, Ohio.

"Bearing of the Theories of the Origin of Magnetic Iron Ores on their Possible Extent," by Frank L. Nason, West Haven, Conn.

"Geology of Harrison Gulch in Shasta County, California," by H. E. Kramm Ithaca, N. Y.

"Direct Determination of Small Amounts of Platinum in Ores and Bullion," by F. P. Dewey, Washington, D. C.

"An Early Discovery of Fuller's Earth in Arkansas," by J. C. Branner, Stanford University, Calif.

"Occurrence of Silver, Copper and Lead Ores at the Veta Rica Mine, Sierra Mojada, Coahuila, Mex.," by Frank R. Van Horn, Cleveland, Ohio.

"A Concise Method of Showing Ore Reserves," by N. H. Emmons, Copperhill, Tenn.

"Study of Pre-Cambrian Rocks of the Harney Peak District, South Dakota," by Gordon S. Duncan, London, England.

"Treatment of Complex Silver Ore at the Lucky Tiger Mine, El Tigre, Sonora, Mex.," by D. L. H. Forbes, Toronto, Ont., Can.

"Gold in Certain Copper Alloys, Soluble in Nitric Acid," by Edward Keller, Perth Amboy, N. J.

"Electrolytic Refining of Impure Copper," by Horace H. Emrich, Kyshtim, Russia.

"Fuel Economy of Dry Blast," by R. S. Moore, New York, N. Y.

"The St. Helen's Mining District, Skamania County, Wash.," by Horace V. Winchell, Minneapolis, Minn.

"The San Nicholas Mining District," by I. H. Wentworth, Matehuala, Mex.

"Abrasion and Dust Losses in Ore Drying," by Carl F. Dietz and Dyke V. Keedy, Boston, Mass.

"The Smokeless Coal Field of West Virginia," by Edwin Ludlow, Eccles, W. Va.

"Sintering and Briquetting of Fuel Dust," by Felix A. Vogel, New York, N. Y.

"The Shumacher Briquetting Process," by Joseph W. Richards, South Bethlehem, Penn.

"Mine Lamps," by David B. Rushmore, Schenectady, N. Y.

Ductility of Zinc

Commercial zinc wires, which contain a small proportion of lead, were stretched by means of weights (W. B. Haines, *Proc.* Royal Soc., 1911, p. 526) and the elongations under various tensions and temperatures measured and calculated. It was found that at 80 to 90° C. the metal becomes remarkably soft, as much so as at 150° C. At a little above 90° a sudden hardening begins, which, however, takes some time to develop. By the time 110° is reached, the zinc is as hard as it was at 30° C., but the wire is more brittle. From 110° onward there is a regular softening as the temperature rises, up to at least 200°, and probably at least to 250° C. The effect of heating to 120° C. and then cooling, is greatly to diminish the tenacity and ductility, through the inducing of a crystalline structure, which can be destroyed by hammering. Pure zinc fails to show the changes in the region of 100° Centigrade.

Caving of the Bunker Hill Shaft, California

By L. H. Eddy

The caving of the working shaft in the Bunker Hill mine at Amador City, Calif., on Feb. 7, imprisoning 68 miners for 24 hours, without injury, was caused by the parting of the hoisting cable, which allowed a half-loaded skip to plunge from the gallows frame into the mouth of the shaft, breaking and loosening the timbers. The accident occurred at 11 o'clock in the morning, while 67 miners and the shift boss were at work, most of them in the 1750- and 1950-ft. levels. The foreman, assayer and two other men came out of the mine on the skip preceding and one miner came out on the skip that fell into the shaft; but he had stepped off at the ground floor of the gallows frame and was well out of the way.

The skips are of 2½ tons capacity, but usually carry less than a full load; and weigh about 3000 lb. each. The one which caused the damage had been hoisted to the top of the gallows frame and dumped, but the full load was not cleared, and it is believed that the extra strain of about 1000 lb. of ore remaining in the skip was partially the cause of the breaking of the cable. The break was about two or three feet from the bale; the broken end remaining on the drum was so badly frayed before the power was shut off that any wear or previously broken strands could not be seen. The skip with the other broken end was still in the shaft when I visited the mine a few days later. Mr. Hampton, the superintendent, stated that the age of the cable might have been partially the cause of the break, though it had been in use only four or five years and was not subject to extraordinary loads. The size of the cable is 1¼ in., equal in size and strength to those used in other mines on the Mother Lode which do greater duty.

SHAFT CAVED FOR 90 FT.

The timbers in the shaft are 14x14 in., Oregon pine, and had been in place about a year and a half; the lagging for less time. There are no unsound or rotted timbers or lagging in the shaft. But there is loose ground immediately over the shaft at the point where the first break occurred and the weight of this and the 4000-lb. weight of the skip and its half load traveling at great velocity down an incline of about 62° broke some and loosened other timbers and lagging, caving the shaft for a length of about 90 ft. The heavy iron-rail track in the floor of the shaft remained intact, but the roof and the sides were damaged.

The telephone line connecting with the underground was broken, and was not repaired till 3 o'clock in the afternoon; but communication was immediately established through the air pipe with two men who were doing repair work at the 200-ft. level. The shift boss was then called from a lower level and instructions given from the surface to send all the men up by the ladders to the 200-ft. level, where they were informed of the situation and advised that they would be released without injury and provided with what they might need. There being sufficient air for temporary needs, the blower and compressor were shut down, and the desires of the men made known. Having their noon meal in their pails, the first request was for water by the English-speaking men and for *vino* by the Italians.

A novel method of delivering the water, wine and food that supplied the men during their imprisonment was adopted. A ⅜-in. rope about 500 ft. in length, or long enough to be operated as a see-saw, was used to lower the articles, which were secured in bullion sacks attached at both ends to the middle of the rope, and sent down through a 4½-in. column pipe. Loaves of French bread, bottles of water and wine, boiled eggs, baked and boiled potatoes, an Italian sausage called *salome*, tobacco, and various articles of food, prepared by the families of the men, were sent down during the afternoon, and until 2 o'clock in the morning. Then nothing more was heard from them until 7 o'clock, when they called that they were hungry and ready for breakfast. Their hunger had been anticipated, and they were immediately supplied. During the entire imprisonment the men were cheerful, and had no doubt of quick release. They declared they were having a picnic with nothing to do but eat, drink, smoke and sleep, and enjoy the novelty of the situation.

SHAFT CLEARED ENTIRELY FROM ABOVE

The work of clearing the shaft from the top was begun immediately upon the men being advised of the accident; and the surface men and night-shift miners of the Bunker Hill were relieved in short shifts by men from the Fremont and other mines in the neighborhood. All the men who went into the torn shaft did so at the risk of life, but they did it voluntarily and willingly. Instructions were given the shift boss to allow no work at clearing to be done from the lower end of the fill, owing to the danger of falling débris. It required about 23 hours to clear the shaft to admit a ladder and the body of a man. Then the coming out of the men required an hour and ten minutes. Instructions were given to send up first the men who could not speak English, and to allow only five men on the ladder at one time; after there had been 12 groups of five delivered, seven were permitted to mount the ladder, the shift boss waiting until all the 67 were on the surface.

The state law requiring two openings in mines had been complied with by the

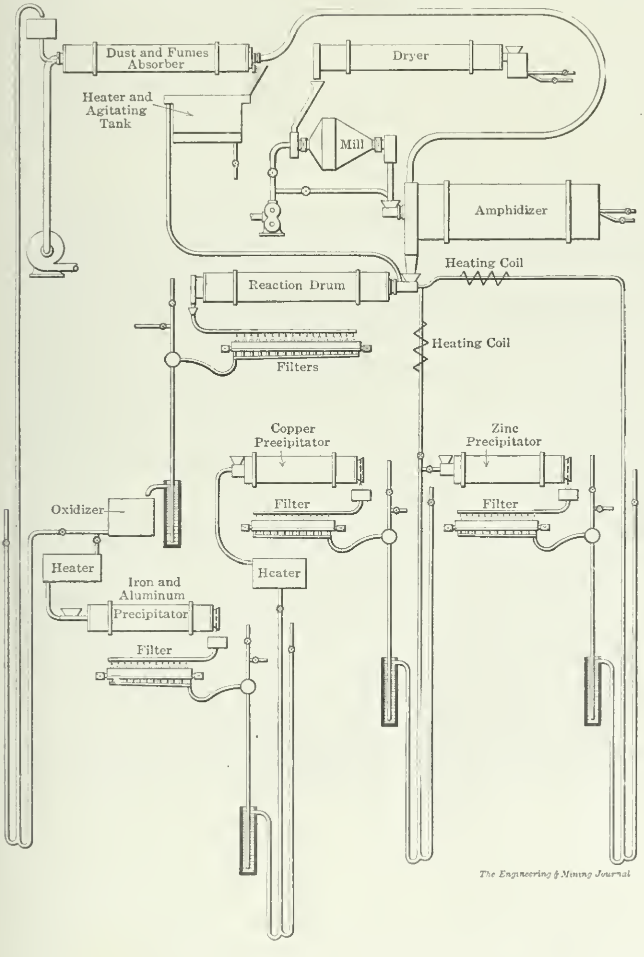
Bunker Hill in its earlier history, by means of a tunnel 1915 ft. long connecting by a 20-ft. upraise with the shaft at the 200-ft. level; but this tunnel had so long been unused, except for drainage, that it was closed to human exit. The work of clearing the tunnel had been in progress for some time under instructions of E. Hampton, who was appointed superintendent about three months ago.

A number of engineers have been invited by the Bureau of Mines to be present at an explosion test, to be conducted by Chief Engineer G. S. Rice, at the experimental mine near Bruceton, Penn., on Feb. 24. There will also be a test made in the air course of a Taffanel rock-dust barrier, such as has been adopted in French mines for checking coal-dust explosions.

The Bradley Process

In A. L. Walker's paper on the "Metallurgy of Copper in 1911," on p. 47 of the Journal of Jan. 6, 1912, the terms amphidizer and amphidization are used. In the French pat. (No. 430,692) taken out by the Bradley company, an "amphigen" is defined, according to the *Journ. Soc. Chem. Ind.*, Dec 15, 1911, as "an element which combines with the metal to form either an acid or a base," an "amphide" is "a salt of which the acidic and basic portions each contain an "amphigen," and "amphidization" is the process of producing the amphide.

It is difficult to see wherein the old terms oxygen, oxysalt, and oxidation do not meet these new demands.



Flow Sheet, Bradley Copper Process

The construction of the amphidizer comprises a horizontal rotating drum with a central heating flue and a burner at one end of the flue.

The ore is fed into the annular part of the drum by a screw-feed at the other end. The annular space is divided into a series of compartments by vertical partitions with inclined cross-tubes leading from one compartment to the next but one, and the arrangement is such that as the drum rotates, the ore passes towards the hot end of the drum through the first, third, fifth, etc., compartments in succession, and then passes in the reverse direction through the alternate series of compartments to a delivery orifice at the charging end. The air required for oxidation takes the same course.

In an accompanying illustration is shown the flowsheet of the Bradley process, in connection with which should be read the reference to the Journal of Jan. 6, 1912, given above. The parent specification states "any gold or silver present in the solutions may be carried down during the precipitation of the iron, aluminum and copper and subsequently removed or separated therefrom, in any preferred manner known to those skilled in this art." It is understood that Mr. Bradley has developed a special process for the recovery of the gold and silver.

De Beers Consolidated Mines

The report of the De Beers Consolidated Mines for the 12 months ended June 30, 1911, shows a total profit of £2,998,617, out of which dividends were paid at the rate of 40% on both the common and preferred shares, and £198,617 carried forward to undivided profit. The report for the year's working shows that at the De Beers and Kimberley mines the output was 0.28 carat of diamonds per load of blue ground treated; at the Wesselton mine 0.27 carat, at the Bultfontein mine 0.38 carat, and at the Dutoitspan mine 0.21 carat. There is a present stock of blue ground on hand at the various mines of 9,021,026 loads, which, at the average production per load for the last year, is equivalent to 2,373,850 carats of diamonds.

Mining and delivery of the blue ground to the washing floors costs about 76c. per load; the cost of washing is about 47c. per load, and the value of the diamonds recovered about $3 per load. No technical details of operation are given, but it is interesting to note that the Kimberley and De Beers mines up to date have produced 36,415,881 carats of diamonds. In addition to paying the dividends referred to above, final depreciation was written on the machinery and fixed plant at the mine, so that that now stands on the books at a value of £1. This is certainly conservative mining.

Ray Consolidated Quarterly Report

The second quarterly report of the Ray Consolidated Copper Co. covers the operations of the last quarter in 1911. The total underground development in both sections of the mine amounted on Jan. 1, 1912, to 158,898 ft., an increase of 22,000 ft. during the quarter. At the end of the quarter the ore blocked out ready for mining is estimated as follows: tributary to No. 1 shaft, 4,275,000 tons; tributary to No. 2 shaft, 625,000 tons. Practically all the work to be done in main development and transportation workings in both sections of the mine is finished down to the second level so that extensive development below that level will not be necessary for a number of years.

The No. 2 shaft and its equipment were not placed in operation until late in December, as the tonnage produced in the territory tributary to the shaft was not sufficiently large, up to that time, for economical operation of the hoisting machinery. At the time stated the tonnage from this section was 1000 tons per day, and it is expected this will be increased to 2000 tons daily by the end of the current quarter. The long No. 2 level connecting this shaft with the principal orebody was put through late in January and it will take about 60 days to put it in operating condition.

The rate of ore production for the quarter under discussion averaged slightly over 100,000 tons per month. Of this quantity approximately 75% came from No. 1 shaft, the remainder being taken from No. 2 shaft and the stock pile. It is estimated that the tonnage will be increased to 4000 tons daily early in March and to about 4500 tons daily near the end of that month.

ORE AVERAGED 1.75% COPPER

The report states that the average grade for the quarter was slightly less than 1.75%. It is expected that with the increased tonnage from No. 2 shaft the grade can be maintained at 2% or better. The average cost of mining for the quarter, including crushing costs, is given at about 76c. per ton. This average includes the high cost for handling the small tonnage of ore produced in the territory tributary to No. 2 shaft and transported to No. 1 shaft for hoisting.

The mine equipment is now practically complete with the exception of a new compressor which was recently purchased. This will have a capacity of 5000 cu.ft. per min., which, together with the capacity already installed, will give a total of 13,000 cu.ft. per min. This is deemed sufficient air for a production of 8000 tons per day.

The fifth section of the mill was completed and started up early in December. In the arrangement of this section certain improvements were embodied which were suggested by the operation of the four previous units. All but one of these sections have been modified to correspond with the fifth section and the remaining section will have the necessary alterations applied by Mar. 1. Four sections were in operation most of the quarter, although not at full capacity. The machinery for the other three sections is on the ground but will not be entirely installed until a capacity exceeding 5000 tons per day is required.

The production of copper in concentrates for the quarter is reported as 7,000,000 lb., which gives a total of about 16,000,000 lb. since operations began. The percentage of recovery was comparatively low, due to frequent closing down and starting up of sections in process of alteration and to lower grade of ore treated. It is stated that now, with the plant in steady operation, an extraction of nearly 70% is being maintained. The cost of milling is given as 57c. per ton.

All concentrates were shipped to El Paso and will continue to be sent there until about the middle of February, after which they will be delivered to the new smelting plant of the American Smelting & Refining Co. at Hayden. This latter arrangement, it is stated, will result in a saving of over 1½c. per lb. because of lower freight and smelting costs.

The Chemical Duties

WASHINGTON CORRESPONDENCE

The Democratic members of the Ways and Means Committee of the House have prepared a revision of the chemical schedule which radically alters rates of duty, particularly on heavy chemicals. The explosive manufacturing industry is also considerably affected by the new rates and the same is true of various other branches of the business. The bill has been ratified by the Democratic caucus and will shortly be debated and passed by the House. What will happen to it in the Senate is uncertain. Already, however, plans are spoken of for consolidating it with the pending steel bill and for passing the two as one measure. This would practically insure a Presidential veto, it is understood.

The chief significance of the new schedule is found in its radical change of classifications and arrangement of articles. On this subject the report prepared by the committee says:

> The chemical industry on account of its importance, was in 1883 given a special schedule in the tariff, and the present classifications are, with few exceptions, the same as when the schedule was first constructed. The industry has undergone a complete transformation since 1883, and it is not surprising that the classification of items adopted more than a quarter of a century ago is found to be out of adjustment with the conditions that exist today. No consideration appears to have been given to this condition in the tariff act of 1909. Rates of duties were changed in a number of instances, but neither the arrangement nor adjustment of the classifications was seriously considered nor were the changes in rates sufficiently extensive to meet existing requirements. Moreover, the rates on a number of products were increased over those of the act of 1897. These increases appear unjustifiable from any point of view, and were neither in line with the demands for a just and equitable revision nor in the interest of effective administration. With a view to improving the antiquated condition of schedule A and of having it conform to industrial and administrative requirements, the committee has given much time to the consideration of the subject of classifications and rates and believes that the bill is, in every way, a thorough and scientific revision of the chemical schedule.

Mt. Morgan Gold Mining Co.

The report of the Mt. Morgan Gold Mining Co., operating chlorination and smelting plants at Mt. Morgan, Queensland, Australia, shows a total ore extraction of 353,571 tons in the half year ended Nov. 30, 1911. Of this 135,500 tons were rejected as waste. Four hundred and twenty tons of copper precipitate and 26,726 oz. of gold were produced by chlorination, and 3278 tons of copper and 36,471 oz. of gold by smelting.

It has been decided to try pyritic smelting in the future, and it is hoped to produce matte of converter grade from ores in one operation. It had been intended to increase the production in the half year under review, but a gas explosion in the blast main injured some of the blowers, so that there was not enough air for the extra furnace which has been erected. New turbo-blowers were expected, however, in January and March, 1912. A dividend of 5% was paid for the fiscal year, and the surplus still stands at 7.7% of the capitalization.

Austrian Mineral Production

The figures on the 1910 mineral production in Austria, given in the JOURNAL of Dec. 23, 1911, were incorrect by the misplacement of the decimal point, and should have been as follows, the items standing in order of their value: Anthracite, 13,773,985 metric tons; bituminous, 25,132,855; iron ore, 2,627,583; silver ore, 23,629; lead ore, 22,841; quicksilver ore, 100,899; zinc ore, 34,637; graphite, 33,131; copper ore, 8005; gold ore, 31,744 metric tons. The value of Austria's total coal production was $55,937,641, and of iron ore $4,791,685.

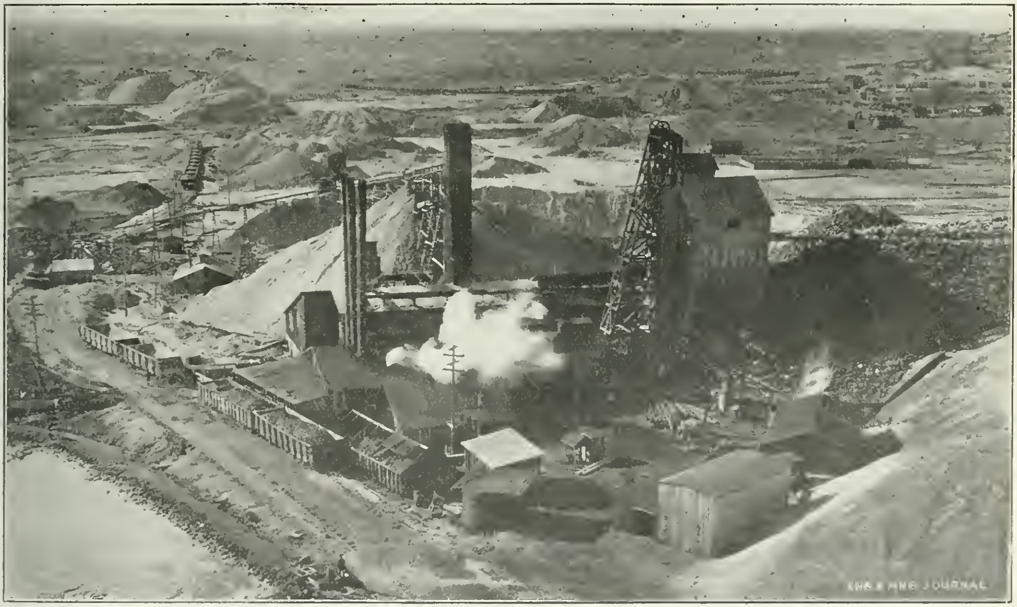
There were produced 1,504,786 metric tons of pig iron, valued at $25,607,413; 15,476 metric tons of lead, valued at $1,138,872; 49,692 kg. of silver, valued at $876,964; 178.9 kg. of gold, $117,959; and 603 tons of quicksilver of $694,961 value.

Ore Dressing in the Joplin District—I

By James L. Bruce[*]

An analytical review of the ore treatment in this important zinc-lead district. The first steps in ore dressing consist of sorting on grizzlies, crushing in Blake breakers and rolls, and screening in trommels. Methods of further treatment will be described in subsequent articles.

The importance of the industry in the zinc and lead fields of southwest Missouri, Oklahoma and Kansas is understood and appreciated only after becoming familiar with the large tonnage and value of the material handled daily. A few figures will give some idea of the consideration this industry deserves. The mining of zinc and lead ores in this district has been done by many thousands of producers; the records of ore produced and sold, especially in early days, are, even when obtainable, exceedingly unreliable. However, the figures in the accompanying table show the production by periods in Jasper, Lawrence and Newton Counties, Missouri, and in Cherokee County, Kansas, and Ottawa County, Oklahoma, taken from what I consider to be reliable sources.



Plant of the Continental Zinc Co., Joplin District

Lead and Zinc Production

It will probaby be a conservative estimate of the tonnage of crude ore mined, hoisted and milled to assume combined lead and zinc value averaging $2 per ton for the production prior to 1900, and $1.50 per ton for the production since then. This shows a total of 130,240,000 tons of crude ore mined and concentrated to date. During the last five years the average has been about 8,576,000 tons per year, and assuming 300 working days per year we find that the mills of the district are now handling about 28,580 tons per working day.

In the district for which these figures are given there are about 400 mills, of capacities ranging from 10 tons to 40 tons of crude ore per hour. From 30 to 50% of these mills are usually shut down, owing to unprofitable prices, exhaustion of mine, lack of development, etc., and many others operate intermittently for only two or three days a week, owing to insufficient supply of mill feed.

Most of the mills which are operated are run six 10-hour shifts per week, and probably 10 or 15% of them are run 12 ten-hour shifts per week. About 15 to 20% of this time is lost by delays for repairing machinery, etc., as practically all of the mills are built as single units and have to be entirely shut down in case any of the principal parts have to be stopped for repairs or inspection.

A Poor Man's Camp

The conditions under which the district has reached its present importance are unusual. It has been preëminently a "poor man's camp," and almost every miner who has spent any number of years in it, if he has not at some time owned a prospect, has at least made some attempt to "organize a company" of the more fortunate of his acquaintances to secure a lease and try their luck at finding "diggings." This does not mean that operations have been confined to such hand-to-mouth methods, for many large stock companies have operated successfully on an extensive scale, but to the present day few land owners operate their own properties and few operators own the lands on which they operate, or even attempt to secure options to purchase the same before leasing, prospecting and developing them, and building expensive plants to operate with. Many such options could, no doubt, have been secured and would have given the operators a chance to purchase after development at a price which would have been much less than the tax levied upon them in the form of royalties.

---

[*] General manager, Continental Zinc Co., Joplin, Mo.

The customary practice, which is much the same now as in earlier years, is for the operating company, either before or after organization, to secure by purchase or by direct application, a lease from the land owner. This requires the operator as a usual thing to operate continuously in a miner-like manner, and gives him the privilege of mining lead and zinc ores from a specified tract of land for a definite term of years, usually 10, in return for which the land owner who retains ownership of the ore is to pay him an agreed percentage (usually from 80 to 90%) of the returns from ore sales. Such leases are usually granted for tracts of from 5 to 20 acres, and occasionally 40 acres.

As a consequence of these conditions and also because the nature of the topography and drainage permits a fairly good mill site on almost any piece of ground most of the properties operated are comparatively small, a 40-acre tract being considered a large one for a single lease. The shallow limit of the ore (little being found below 250 ft.) makes many of the mines short-lived, compared with deep mining of other districts. The convenience with which fuel supplies, etc., can be secured, makes the average operating cost per ton of crude ore of mining and milling for several small plants not very much in excess of that for one large central plant.

The result of this situation is that there are few individual mills in the district handling over 500 tons of crude ore in 24 hours. In fact the advantages to be gained by consolidation into large properties operating in large units would be offset in a large measure by the expense and difficulty of organizing such a consolidation and by the costs of transporting the crude ore to the central milling plant and the waste material away from it.

Three Types of Ore

The ore formations occur in three general types, which may be described as runs, pockets and blankets. The ore has in all probability been deposited from solution in waters descending from the overlying Pennsylvanian measures, now pretty well removed from the district by erosion; the bodies described as "runs" being the product of circulation in underground channels of comparatively uniform width and height; those described as pockets, the product of circulation in irregular underground caverns connected by small circulating channels or feeders; the blanket formations, the result of circulation through an open or porous stratum of nearly uniform thickness and lying flat.

Coincident with such ore deposition, or nearly so, occurred the chemical or mechanical deposition of secondary flint, dolomite, selvage and soapstone. All of these, together with the chert boulders and fragments that remained undissolved in the channels and with remnants of the uncomformable overlying Pennsylvanian formation, united to fill most of the cavities and leave the orebodies which we now find.

In the run and pocket formations the "dirt" or crude ore is of two different characters, that known as "soft ground" being a heterogeneous mass of chert and lime boulders and fragments separated by mud, selvage or decomposed rock, in which the greater part of the minerals occur. These ores, when they contain much shale, mud or soapstone, present difficult crushing and screening problems. The second or hard-ground class of crude ore consists of rich pockets or disseminated deposits of mineral imbedded in the secondary flints, calcites and dolomites, which cement together the fragments and boulders of the primary rocks that the underground circulating waters have failed to erode or dissolve from the channels.

Definition of Sheet Ground

The character of ore occurring in the blanket formations is similar to that in the hard-ground pocket and run formations but one particular type, the sheet ground, is so extensive as to warrant particular description. There is some confusion regarding the use of the term "sheet ground," but a general application is to use it in referring to any ore deposit, whether sheeted or disseminated, that occurs in that part of the Mississippian formation known as the Grand Falls chert. This seems to offer the clearest distinction. The galena and blende ores in the more typical sheet ground occur in lenses or sheets between the strata of the Grand Falls chert, and are accompanied by and imbedded in a dark-colored secondary flint, which fills the interstices in the Grand Falls chert. Little sedimentary material, shales, clays, calcites, dolomites or limestone are ever found in the sheet-ground ore deposits, and the material handled is practically only galena, blende and the dark and light flint. A large part of the light flint breaks in thin flat pieces, which increases the difficulties of screening and concentrating. The gangue is exceedingly hard and cuts and abrades much more than most of the rocks from shallower depth.

Little of the lead ore of the district is intimately disseminated with either the blende or the gangue, but most of it occurs in crystals which are easily freed or isolated, in consequence of which few

PRODUCTION OF LEAD ORE (CONCENTRATE) IN SOUTHWEST MISSOURI, OKLAHOMA AND KANSAS

	Jasper		Lawrence		Newton		Cherokee		Ottawa		Total	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value
Prior to 1895	257,303	$11,708,802	31,628	$1,352,595	80,432	$3,676,632	68,573	$3,152,725	.....	......	437,936	$19,890,754
1895–1899 inc.	72,680	2,823,762	5,780	213,301	6,882	269,323	56,426	2,402,658	.....	......	141,768	5,709,044
1900–1904 inc	111,245	5,580,578	3,218	139,935	13,372	626,804	19,941	1,039,810	150	$8,550	147,926	7,395,677
1905–1909 inc	157,661	9,896,313	1,472	93,317	10,826	693,887	14,970	1,011,406	7,824	449,992	192,753	12,144,915
Total	598,889	$30,009,455	42,098	$1,799,148	111,512	$5,266,646	159,910	$7,606,599	7,974	458,542	920,383	$45,140,390
1910											43,685	2,234,057
1911 est											46,100	2,650,000
Total											1,010,168	$50,024,447

PRODUCTION OF ZINC ORE (CONCENTRATE) IN SOUTHWEST MISSOURI, OKLAHOMA AND KANSAS

	Jasper		Lawrence		Newton		Cherokee		Ottawa		Total	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value
Prior to 1895	997,464	$21,004,789	114,414	$1,721,537	198,563	$2,286,746	309,729	$5,893,734	....	....	1,611,170	$30,906,806
1895–1899 inc	465,649	11,450,298	81,104	1,668,915	47,634	886,173	302,481	8,014,823	....	....	896,868	22,020,209
1900–1904 inc	898,202	28,164,063	76,538	2,137,137	91,707	2,267,626	161,959	4,735,641	633	$21,245	1,229,039	37,325,712
1904–1909 inc	943,103	38,760,669	63,367	2,087,346	93,429	2,777,567	169,893	7,294,757	36,592	1,256,572	1,306,384	52,176,941
Total	3,304,418	$99,379,819	335,423	$7,614,935	431,333	$8,218,112	935,062	$25,938,955	37,225	$1,277,817	5,043,461	$142,429,638
1910											286,381	11,817,574
1911 est											265,000	10,720,000
Total											5,594,842	$164,967,212

mills have a recovery of less than 90 or even 95% of the lead contents of the "dirt" milled. The blende on the other hand may all occur intimately associated with the gangue, requiring fine crushing to release it, being in this case described as "chatty," or part of it may be quite readily freed or isolated, while the remainder is chatty, or again practically the entire blende contents may be readily freed from the gangue. Each type requires special consideration in concentrating.

MARKETING THE ORE

The concentrates, when put in the mill bins, are ready for marketing, and no further expense is incurred except a slight one for analyses. The various smelters purchasing zinc "ore" employ agents to buy. These agents, after buying the ore, have it loaded on wagons and weighed on custom scales or on scales furnished by the seller, then loaded into box cars and sampled with a "gun" that takes a sample in a manner similar to a cheese sampler. This is mixed and quartered down to make two or three samples, each weighing about three or four pounds, one of which is for the buyer and one for the seller, while the third, if taken, is retained for an umpire in case of disagreement. The buyer and seller each have assays made for zinc, iron and moisture, and if results check reasonably well, a settlement is made on the "split" assay or average of the two, and the seller is given a check or draft in payment.

The price is usually made by competitive bidding of the buyers, who offer the producer whatever base price they hope to purchase the ore for. The "base price" is understood to mean the price per ton of 60% zinc ore when not penalized. The "settlement price" is calculated after the ore has been loaded and assayed, and is arrived at by deducting $1 from the base price for each per cent. that the zinc of the split assay runs below 60%, or adding $1 for each per cent. in excess. From this is deducted $1 for each per cent. of iron in excess of 1%. Ores are not directly penalized for the presence of lead or lime, but an indirect penalty results from the less favorable base-price offers usually made on "leady" or "limey" ores. Many smelters will not use zinc ores that have lead contents exceeding ¼% or lime in excess of 2%. Finely ground ores, such as sludge or table ore, are less desirable and are usually sold at base prices of from $3 to $4 below the ordinary base.

SMELTERS PURCHASE WEEKLY

The smelters purchase weekly unless overstocked, and many of the producers sell weekly. Others, however, prefer to speculate on the market conditions at times, and often hold their ore from one to four weeks or more in hopes that general prices will be higher, competition on their class of ores keener, or because of the greater desirability of large bins of ore. History shows that the base price of ore does not bear any well defined ratio to the price of spelter, and it would appear that a base price, determined from the price of spelter with a fair and equitable treatment charge allowed the smelters and properly determined penalties for undesirable impurities, would give greater stability to prices and to the industry.

A few such contracts have been in force on the following basis: When spelter is $5 per cwt., at St. Louis, the base price to be $37. For each increase or decrease of 10c. in spelter price add or deduct 85c. per ton of concentrates. Two per cent. of iron contents allowed without penalty. From 2 to 5% iron, penalty to be $1 for each unit of iron in excess of 2%. All iron over 5% to be penalized 50c. per unit. One dollar bonus to be paid for ores containing less than 0.5% lead. Average St. Louis spelter prices of the week preceding production, as quoted by the American Metal Market, are to govern settlements.

LITTLE UNDERGROUND NIGHT WORK

As practically no underground mining of any consequence is done except on the day shift and there is a slight insufficiency of good labor even for this, it is difficult to secure good men for any special night work below the surface. On top, however, there are always men in search of jobs and this competition makes it easier to secure good men for night work in the mills, so that the efficiency of night labor for milling operations is not remarkably less than that of the day shift. As a consequence, where mining developments are extensive enough, many plants mine and hoist enough dirt on the day shift to keep the mill busy for two 10-hour shifts. In such a case "cull men" who break up the boulders that are too large to go through the grizzly, and sort out the coarser waste, are required only on the day shift. The number of men required for this purpose varies with the character of the dirt, the coarseness and hardness and whether it is muddy or not. A fair average, I think, is about one man for every 125 tons to 150 tons per shift. Thus a mill handling 500 to 600 tons in two shifts would require four or five cull men on the day shift.

In the mill itself the character of the dirt or the method of treatment determines the number of men required to properly handle it. In many of the smaller mills or mills with free ore having no concentrating table or only one table, only two men are required, the crusher feeder and the jigman who attends the jigs and tables. At larger plants equipped with from two to six tables and with a number of settling tanks, classifiers and screens which need attention, three men and sometimes four are used on each shift: One man to feed the crusher; one man for the jigs or when there are two rougher jigs and lots of repair work to be done in the mill on account of acid water or defective equipment, sometimes there is one man on the rougher jigs and one on the cleaner jig; a table man attends the tables, settling tanks, classifiers and fine screens. Thus a small 125-ton mill running single shift would require a cull man, a crusher feeder and a jig man, while a 300-ton mill if operating two shifts with bad water would require from 10 to 13 men for the two shifts. Practically all men employed are Americans and are efficient workmen. Most of them live in the nearby towns and reach their work by means of an excellent interurban electric-railway system or with horse and buggy. Few of them are members of any union.

ORE SORTED ON GRIZZLIES

Concentration as practiced in the district may be considered as commencing when the hoisted dirt is dumped on the grizzly bars. In years past, and even now at some of the smaller mills or at custom mills, the dirt is hauled in wagons from the shaft at which it is hoisted, and dumped on a platform on a level with the crushers to which it is fed by men with shovels. At practically all of the mines of any consequence, however, the dirt is hoisted in "cans" or cars at a shaft adjacent to the storage bin and dumped on a chute which discharges directly upon the grizzly bars. These usually consist of pieces of 60- to 80-lb. rail cut 6 to 8 ft. long and laid about 5 or 6 in. apart, cut off close to the web and the tread uppermost. They are separated from one another by a rod run through the web of the rail with short pieces of pipe strung over the rod for spacers. The grizzly is supported by heavy timbers at each end. One objection to the rod and pipe for spacers is the necessity of taking the whole grizzly apart to replace one or two worn rails.

An improvement is made by using pieces of iron cast to fit between the rails. These are fastened down to the timbers by lag screws which are run through a bolt hole in the casting. Grizzlies for lighter work are made by spiking down pieces of pipe which have been flattened out at the ends. One or more cull men inspect the oversize on the grizzly, break up any which contains ore and allow it to drop through the grizzly. They load the remaining waste on a car which is then run to the waste dump. On hard, coarse dirt each man can cull from 100 to 150 tons per shift, sorting out from 5 to 15% as waste. When two or more men are at work together, a baseball mask covered with heavy screen is sometimes used as a protection against flying rock.

The dirt after passing through the grizzly bars, if not already in the mill bin, is ready for transportation to the same. This is usually accomplished in a two-ton car fitted with a door on the front end and traveling on an incline to the top of the mill hopper, where loose wheels outside the rear running wheels engage inclined guides so as to raise the rear end of the car, at the same time freeing the door and dumping the contents. This method of transporting for short distances is both rapid and cheap, seldom exceeding 1c. per ton handled. A typical car will be shown in a subsequent article. The mill bin or "hopper" is usually constructed large enough to contain dirt for a two-shift mill run and the hoppers of adjoining shafts are made large enough for one shift's hoisting, which is sent to the mill hopper toward the end of the hoisting shift.

The first cost of mill equipment and construction, disregarding hoisting engines, compressors, blacksmith shop and a proportion of the cost of power plant, etc., all of which are rightly chargeable to mining equipment, varies from $80 to $120 for each ton of capacity per 10-hour shift. This includes mill hopper, mill building, mill machinery, elevators and spouting, tailings flumes, mill ponds, etc., and a proportionate part of the cost of the power plant.

Mills Poorly Housed

The winter season is short, with only a few extremely cold snaps, and consequently little study is given to the housing of the mill; as a result the majority of the buildings are much too poorly housed in, and frozen elevator boots, settling tanks, etc., and frost-covered belting and pulleys are a source of considerable trouble. There is no doubt that the comfort and freedom from delays occasioned by better housing would in most cases much more than repay the extra cost. One item in particular that has escaped attention in almost all instances is that of collecting the leaks about the mill and running them back into the concentrating system. While many of the mills are at first so designed that there is little loss entailed by improper drainage under them, most of them later on accumulate sand piles which turn the drainage to the wrong channels and cause big losses. The best solution would seem to be a construction allowing plenty of space for arranging spouting under the mill, with a concrete floor, completely walled about, underlying the entire mill and provided with channels to carry the accumulations to elevators which would throw them back into the system.

Most of the mills are built by contractors, often from crude and incomplete specifications and drawings if indeed they have any at all, and while many of them do commendable work, others seem to be quite inconsiderate of any point except to get it done as cheaply as possible and leave the mill "in operating condition." I have seen, not one alone but many, concrete foundations built on top of grass or loose sand; knee braces for heavy mill timbers offering no more support than that offered by a few 30-penny nails driven through them, while details such as lining up shafting and blocking the journal boxes to place are seldom thought of by the contractor.

Practically all the mills are constructed of wood, or wood frame covered by galvanized iron, the principal objections to the latter being its noise and lack of protection from the cold weather. Only one steel-framed mill, that of the Mercantile Mining & Milling Co., north of Webb City, has been built, and the lack of machine-shop facilities at most of the mines would seem to preclude the advisability of steel construction. The country being so flat there is as a rule little choice in selecting a mill site. Some have made the mistake of discharging the tailings toward the lowest point adjacent to the mill, thus destroying the best natural pond and drainage collector, and making it much more difficult to save the water.

After the crude ore is in the mill bin the milling operation consists of four principal operations which will be considered in the order named: crushing; coarse concentration; fine concentration; disposition of waste.

Blake Crushers Generally Used

In the crushing department the methods employed differ much more than the types of machinery. The most general system is to crush to about two inches in a Blake-type breaker, then pass through spring rolls, elevate to a trommel screen from which the oversize goes to oversize rolls and back to the elevator again. The undersize from the screen then goes to the rougher jigs. This is varied in other plants by using a shaking screen ahead of the breaker of somewhat coarser mesh than the trommel, and running the undersize to the No. 1 elevator; or in others by omitting the No. 1 rolls and elevating direct from the breaker to the trommel and using more or larger return rolls; the elevating of this coarse material is especially hard on belts and elevator cups, however.

In still other plants the oversize is elevated by a separate elevator and sometimes returned to a second trommel the undersize from which joins the undersize from No. 1 for the rougher jig feed. In some cases the undersize from the shaker screen is run direct to the rougher jigs. In a few cases the breaker is followed by a trommel the undersize of which goes direct to the jigs, and the oversize goes to oversize rolls and is elevated to the first trommel or to a second one, the undersize of which also goes to the jigs and the oversize back to the rolls. All crushing is done wet, no dry crushing having been attempted in the district up to the present. In fact the sheet-ground ores are practically the only ones amenable to dry crushing as all others are apt to contain, at least part of the time, mud and soapstone which would clog up the breakers and rolls if crushed dry.

The shaking screen is usually made in the form of a trough from 6 to 8 ft. long, converging from about 24 in. width at the upper end to 14 or 16 in. at the lower end, inclined about 2 or 3 in. to the foot, with a sheet of perforated metal in the bottom and either swung on four rods from 4 to 6 ft. long or supported by two guide wheels on each side running on rails. It is driven from one or two eccentrics on a countershaft set at the rear of and below the frame. The use of only one eccentric causes the screen to twist and cramp the eccentric unless the screen is properly guided.

Crushers Manufactured Locally

The breakers are all of the Blake type and of local manufacture. The frame is made of a solid casting, which supports the stationary jaw, the front bumper (on which is supported the movable jaw), the eccentric, bumper and the wedge blocks for adjusting length of stroke. A breastplate of cast iron is bolted to the frame to take the wear behind the stationary jaw, and the space between is filled with babbitt metal to set it solid. To this breastplate the stationary jaw is bolted. Side plates are bolted to the frame on the inside of the opening and false removable wear plates on either side of the movable jaw. Toggle plates are made either plain or reinforced but it is advisable to use not more than one reinforced toggle plate, as the weaker one then gives a cheap breaking part in case iron gets into the breaker. The eccentric bumper is cooled by a water jacket. One and sometimes two drive pulleys and two heavy flywheels are provided and speeds range from 350 to 425 r.p.m. Sizes vary from 8x14 in. to 12x18 in. The latter is capable of crushing as much as 35 tons per hour of mixed coarse and fines to about 2-in. size.

Almost all the rolls are of local manufacture. The shells, made usually of chilled hard iron, are mounted on cast-iron cores which are keyed or pressed on shafting, and are held by a ring of shingles driven tightly between the shell and the core at each side. The driven shell is made wider and with flanges at each edge between which the narrower follower shell runs. This feature saves overflowing of the feed at the edges and relieves the roll frame of much of the shock. Shells without flanges have proven unsatisfactory on the light-framed rolls in use. The journal box of the driven shaft is rigidly supported in the frame while the box of the follower shaft is free to slide between the way bar and the bed rail. The two shells are held together by four springs acting on each movable journal box. The pressures on two journal boxes are equalized by adjustable screws which separate the springs and the boxes. Failure to keep the adjustment equal is apt to crowd the shell to one side and break the flange off one side of the driven roll.

Roll sizes vary from 16x10 in. to 42x16 in. and speeds from 30 to 35 r.p.m. The flanged shell is driven by a gear from a countershaft supported from the roll frame. Manganese-steel and forged-steel shells have been used in place of the customary hard iron but few have found the service rendered sufficiently greater to pay for the extra cost. The hard-iron shells when worn out can be easily broken off while the steel shells often have to be burned off. This difference leaves nothing in favor of the steel shells on the score of fewer necessary changes.

Details of Elevators

Mill elevators for all except the lighter work are gear driven. The boxing is usually built outside the framework though there are some elevators lined on the inside. The latter is but little more expensive and prevents the framework cutting out and weakening the housing or becoming water soaked and warping out of shape. The housing should be wide enough to allow changes or repairs on the belt or pulleys to be quickly made. This should be about 12 in. on each side of the belt. The elevator boot should have enough depth below the feed spout to allow of taking up the belt stretch 18 in. or more without cutting the belt. The boot should be about 10 in. wider than the inside of the elevator lining so that the elevator jacks for taking up the belt stretch may be set outside the elevator housing and have their bearings on the lower pulley shaft protected from the falling sand and grit.

Almost all elevator boots are made of 1-in. boards and soon allow leakages either out of or into the elevator. This causes losses or may allow coarse material to run into sand elevators. Concrete boots with the feed coming properly in at the front of the belt would be an economical investment in nearly all instances. They would in addition provide a more stable foundation for the elevators. The elevator hood should be drawn in close to the top pulley and battered. This protects the shaft boxes and at the same time keeps the belt from running off the pulley. The hood should also be built at least 24 in. above the travel of the cups to keep material from striking the top and being thrown back on the belt. The front part of the hood should be easily removable to facilitate handling the top pulley.

Most elevators are set with the belt on a slight incline, about 1 ft. for every 10 or 12 ft. of height. This keeps the belt from flapping, prevents the necessity of taking up the belt so frequently, allows the catch box to be drawn in closer to the belt and allows the material thrown back into the elevator to fall free of the belt and lower pulley. The catch box should be within about two inches of the returning cups and down low enough so that it may be drawn well back under the discharge. It should have plenty of fall so as to carry the material away from the edge of the dump box next to the belt and should be long enough to prevent the material splashing back into the elevator. The "take up" in most common use here, and a satisfactory one, consists of a 4x6 timber set on each end of the lower pulley shaft and held in place by guides. It is lowered by means of a 2x6 or 2x8 lever over the top of it, which is held in place by a wedge.

Pulleys and Belts

Top and bottom pulleys are usually of cast iron either keyed or pressed on shafting and vary from 24 in. in diameter to 36 in. It is poor practice to use pulleys less than 30 in. diameter for 8-ply rubber or 10-ply canvas belting or heavier. Belting for the heavier service is almost all either 8-ply rubber or 10-ply stitched canvas belting. Personally I have found 10-ply rubber belting more economical than 8-ply for heavy work. The widest belts in use for elevator work are 24 in. Some belting with extra cover on one or both sides has been used but not enough to definitely either prove or disprove its economy. Elevator cups are all made locally of one piece of No. 10 or 12 sheet steel with ends lapped over and riveted. They are provided with four or more holes for bolting to the belt with either ¼- or 5/16-in. elevator bolts, and the larger cups, 16 in. and upward, are usually reinforced by a brace of sheet steel between the front and back of the cup. Cups on the larger belts are spaced from 20 to 24 in. apart and are separated from the belt by means of small rectangular pieces of old belting through which the elevator bolts pass. This prevents the edge of the cup cutting the belt.

I have secured much better service from belting and less expense for elevator cups by using on 18-in. belts or wider special cups of half the belt width or a little more but of the same cross-section as the wider cups, and placed from 9 to 12 in. apart alternately against one edge and then the other of the belt. These were fastened with 5/16-in. elevator bolts instead of ¼-in., the larger heads cutting the belting less. This method gives a more rigid cup, less likely to be bent and battered out of shape, and distributes the wear on the belt better, the cups wearing the belt only half way across instead of entirely across as with the larger cups. In changing cups the cups on either edge are set down or up one-fourth of the distance to another cup on the same edge.

The life of elevator cups, belts, etc., depends greatly on the speed at which they are run. Too low a speed is as detrimental as too high a speed because the cups are kept too full and the material in that event is at all times spilling out of the cups and falling back on the belt. Speeds customary in the district vary from 300 to 400 ft. per min., the slower speeds applying to the coarser and heavier material.

Trommels for Screening Jig Feed

Trommel screens for the jig feed are made by keying two or three cast-iron hubs or spiders on a piece of shafting, bolting four arms to each and mounting a circular steel band on each spider. The screen jackets are then put on over these and the ends held together by a steel drawband. Each arm is protected from wear near the screen by a small cast-iron sleeve bolted over it. The capacity of the screen may be increased from 15 to 25% by bolting three or four small angle irons to the screen jacket on the inside. The smaller trommels are made in one section from 36 to 72 in. long by 36 to 48 in. in diameter, while the larger ones are made with two sections of screen jacket overlapping 3 or 4 in. on a central support. A later article will contain a cut of the screen spider and drawband.

The usual speeds are from 25 to 30 r.p.m. The customary practice is to pass the jig feed through half-inch round perforations in sheet-steel jackets, usually of No. 8 thickness although a good many No. 6 jackets are used. Some 7/16-in. and even some ⅜-in. perforations are used, the latter but seldom, however. Many of the sheets in use have fewer perforations per square foot than usually considered standard practice and have consequently longer life. The capacity, however, is limited and a larger size trommel is necessary to do the same amount of work so that the standard practice is preferable if the trommel is loaded to capacity. The slope usually given is from 1¼ to 2 in. per foot.

For a plant exceeding 20 tons per hour capacity I think the best practice is to construct the mill hopper large enough to hold without shoveling, all the dirt hoisted in 24 hours, and set sufficiently high to run the dirt over a shaking screen from which the oversize after going through the breaker joins the undersize and goes to a revolving trommel, the undersize from which is spouted directly to the jigs, the oversize dropping to oversize rolls and being elevated to the same trommel or to one set parallel with it. This practice eliminates a great deal of expensive elevating at the expense of a comparatively small increase in first cost for setting the mill hopper, breaker, etc., higher.

(To be continued)

The Electrometallurgy of Tin

In speaking of recent experiments upon the electrometallurgy of tin, *le Journal du Four Electrique* (January, 1912) reaches the conclusion that the solution of the problem has been found as regards general lines of work, and that it remains only to study the minor questions of detail. The statement is made that the yield of tin ores is much increased by electric-furnace treatment, that the process is continuous as against intermittent smelting in the reverberatory, that the formation of "hardhead" is reduced greatly, and that the quantity of carbon necessary for reduction is no more than 14% in the electric furnace, as against 20 to 25% in the reverberatory. The floor space necessary for the installation is smaller, and the consumption of the electrodes is negligible.

Some calculations are given as to the energy required for the reduction of cassiterite; the basis of these calculations is as follows: For the reduction of 118 grams of tin from stannic oxide, 145,300 gram cal. are required. The reaction, $C + O_2 = CO_2$, gives out 96,960 cal., and the reaction, $2 C + O_2 = 2 CO$, 58,000 cal. It is necessary, then, in order to set free 118 grams of tin that we should have, for the first reaction, 145,300 — 96,960 cal., or 409.661 kg.-cal. per kilogram of tin set free, and since 1 kw.-hr. equals 864 kg.-cal., it is necessary per ton of tin to have 474 kw.-hr. of energy. This figure becomes 855 kw.-hr. if we apply the equation $2 C + O_2 = CO$. As in practice, each of these reactions gives about 50% of the reduction, it is necessary to count on the average as the consumption of energy required, which is 665 kw.-hr. per ton of tin. The temperature in the smelting zone is estimated at 1400 or 1500° C., and the calorific balance of the furnace is then as follows: For the reaction, 665 kw.-hr.; for heating the slag, 130; for the specific heat, 45; losses by radiation, 130; losses through hot gases, 130 kw.-hr.; a total of 1140 kw.-hr. per ton of tin.

The experiments were made in a furnace like that of Harmet for the reduction of iron ores, constructed of magnesite brick. A product was obtained containing about 99% tin, little iron, and free from arsenic. At the beginning of the campaign, which usually lasted from 10 to 12 days, the furnace was heated for a day with wood and coke in order to dry the bricks and then charged with about 14 kg. of anthracite coal per 100 kg. of ore, this proportion, however, depending on the nature of the latter. A current was then passed of about 1000 amp. at 60 v., these figures changing to 40 v. and 2500 amp. when the reaction commenced. A half-hour afterward the slag commences to form and its aspect alone suffices to show whether the charge is of the proper composition or not. Experiments have also been made to recover the tin from the furnace slags by an electrolytic method. These were fused with soda and the mass afterward dissolved in water and electrolyzed with plates of iron as a cathode. Excellent deposits of tin were obtained, but the yield was not high.

Mason Valley Smeltery, Nevada

SPECIAL CORRESPONDENCE

The Mason Valley Mines Co., on Jan. 6, blew in its first furnace at Thompson, Nev. This is the latest copper-smelting plant to commence operations in the United States, and a brief preliminary description may be of interest. The ore supply is from the company's own mines at Mason, and from those of the Nevada-Douglas Copper Co., at Ludwig, both in the Mason Valley mining district in Lyon County. The Mason Valley mines supply the sulphides, the Nevada-Douglas ores being mainly carbonate, although there is some sulphide ore in the latter mine. Both ores are nearly self-fluxing, only about 5 per cent. of lime rock being used on the charge.

The ore is delivered to the sampling mill in 50-ton dump cars and is transferred from there to the bins on a belt conveyor. It is dropped through chutes into an automatic scale, the charge trains running underneath the scale and loading direct from them. The charge trains are made up of six cars, pulled by an electric motor.

The furnace recently blown in is of the water-jacketed drop-bottom type, 46x300 in. at the tuyeres. The furnace has 24 jackets in all, and there are 25 tuyeres on each side; the spout is at the end of the furnace and delivers into a small forehearth. From there the slag and matte flow into a larger settler, the slag being taken away by an electric motor in 20-ton slag pots. The matte is at present tapped into a casting machine of the type used at East Helena, Mont. This, however, is inadequate at times, and it is probable that a large circular settler of the usual type will be placed between the ends of the furnaces, taking the slag from two furnaces, when necessary.

At present the matte is shipped to Garfield, Utah. The plant is so designed, however, that converters can be installed without adding to the present building.

Blast is supplied by two Connersville blowers, run by electric motors, the power being obtained from two different stations, so as to avoid shutting down in case of accident to one.

The new plant started off smoothly, and for the first 10 days an average of about 350 tons of ore were smelted under low blast (20 oz.). Since then about 600 tons of ore have been smelted daily, with the blast pressure running from 30 to 35 oz. The other furnace will probably not be blown in until the full tonnage of ore is coming from the mine. The slag averages about as follows: SiO_2, 45%; FeO, 23%; CaO, 20%; Al_2O_3, 6 to 9%. The matte varies between 42 and 50%, the aim being to make always a matte over 40% copper.

The town of Thompson is built on a slope just below the smeltery and is owned by the company. There is a hotel with all modern improvements, and about 15 modern houses, seven more being under construction. Jules Labarthe is manager, and A. J. McNab is superintendent.

FURNACE BUILDING, POWER HOUSE AND SAMPLING MILL OF THE MASON VALLEY SMELTERY, THOMPSON, NEV.

The Settling of Mill Slimes

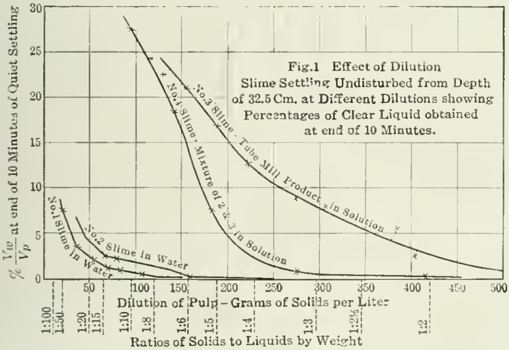
By D. L. H. Forbes*

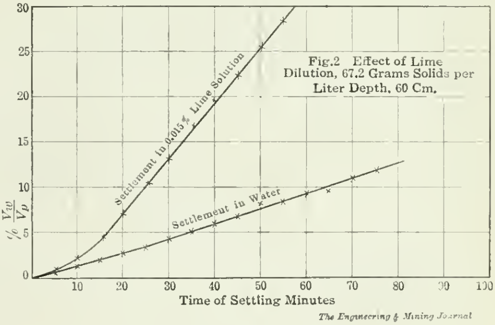
Certain standards for conducting tests are proposed which will enable operators better to predict and manufacturers to meet settling requirements. Experiments with four types of slime gave results tending to show that settling efficiency decreases as depth is increased, and that lime, cyanide and other electrolytes are accelerators.

For the purpose of the practical mill man, slime is that portion of the crushed ore which consists of particles fine enough to overflow in his classifiers; consequently, what would be termed slime in one mill might in some other mill be considered to contain a considerable quantity of sand.

CHARACTERISTICS OF SLIME

In the broadest meaning of the term, however, slime is a mixture of fine ore particles of varying size, physical character, and shape, such that when mixed with water or weak solutions, the particles tend to remain in suspension and maintain the character of a homogeneous liquid for an appreciable length of time. The term "colloidal" should be used only to describe the noncrystalline or amorphous slime particles, which, when mixed with water, produce a gelatinous suspension approaching in character a solution of glue or soap. Ordinary mill slime contains both colloidal and crystalline particles of clay and silica. According as the percentage of colloidal particles increases in the slime, the viscosity of the water in which it is mixed also increases, and it is well known that the rate of settlement of slime is inversely proportional to the viscosity of the water for the same temperature. It is not surprising, therefore, to find in practice that one of the elements which most influences slime settlement is the physical character of the ore and that slimes of the same relative fineness from two places may have widely differing rates of settlement.





GRAPHICAL REPRESENTATION OF THE EFFECT OF DILUTION AND OF LIME IN SETTLING SLIME

A great amount of literature has been written on the subject of slime settlement, yet no satisfactory standards of comparison have been made for the guidance of the mill designer who must provide settling capacity for the slime based upon results obtained in existing mills treating ore which is supposed to be similar to the one with which he has to deal.

It has sometimes been noted in the case of slimes that were difficult to settle that small tests gave misleading results when applied to calculations of settling capacity in large tanks. Slime that would give several inches of clear water when settled for an hour in a 5-gal. can would be found to require a longer time to give the same depth of clear water in a large tank. The reason for this was not clearly understood and the whole subject of the settlement of slime was left obscure in so far as the intelligent prediction of results from small-scale experiments was concerned.

TESTS WITH FOUR TYPES OF SLIME

Four types of slime were dealt with in the series of experiments, the results of which are given in tables Nos. 1, 2, 3 and 4. Slimes Nos. 1 and 2 contain much larger percentages of the clayey portion of the ore and the particles are relatively smaller than in slimes Nos. 3 and 4. No. 3 slime is a coarse quartz slime produced by grinding in tube mills, while No. 4 is a mixture of Nos. 2 and 3 in the proportions corresponding to the original constituents of the ore.

No. 1 slime is the overflow from Dorr thickeners and has the following characteristics: Specific gravity, 2.63; screen test—on 80 mesh, 0.3%; on 100, 1.3%; on 150, 1.3%; on 200, 0.6%; through 200, 96.5%; thickness of pulp after two days' quiet settlement, 209 grams of solids per liter; liquid, weak cyanide solution titrating 0.042% KCN.

No. 2 slime is the product of drag classifiers. Its characteristics are: Specific gravity, 2.89; screen test—on 60 mesh, 1.3%; on 80, 2.7%; on 100, 3.9%; on 150, 4%; on 200, 3.5%; through 200, 84.6%; thickness of pulp after two days' quiet settlement, 241.9 grams per liter; liquid, water with traces of sodium cyanide and lime in solution.

No. 3 is a tube-mill slime and has the following characteristics: Specific gravity, 2.75; screen test—on 80 mesh, 3.8%; on 100, 5.9%; on 150, 9.3%; on 200, 6.8%; through 200, 74.2%; thickness of pulp after two days' quiet settlement, 647.4 grams per liter, cyanide solution, 0.15% KCN and 0.09% CaO.

Since the point that interests the mill designer is the amount of settling capacity to allow for a given slime, the comparison of results is stated in terms of the volume of clear liquid divided by the total volume of the pulp expressed in per cent.

In Fig. 1 is given a graphic comparison of the behavior of the four different slimes when settling undisturbed from the same depth for 10 minutes at different dilutions. It will be seen that, in the case of slimes Nos. 1 and 2, the curves flatten out along the zero-efficiency line before the pulp has a solid to liquid ratio of 1 : 4, while, in the case of slime No. 4, the limit of practical settlement

---

*Mining and metallurgical engineer, 306 Manning Chambers, Toronto, Ont.

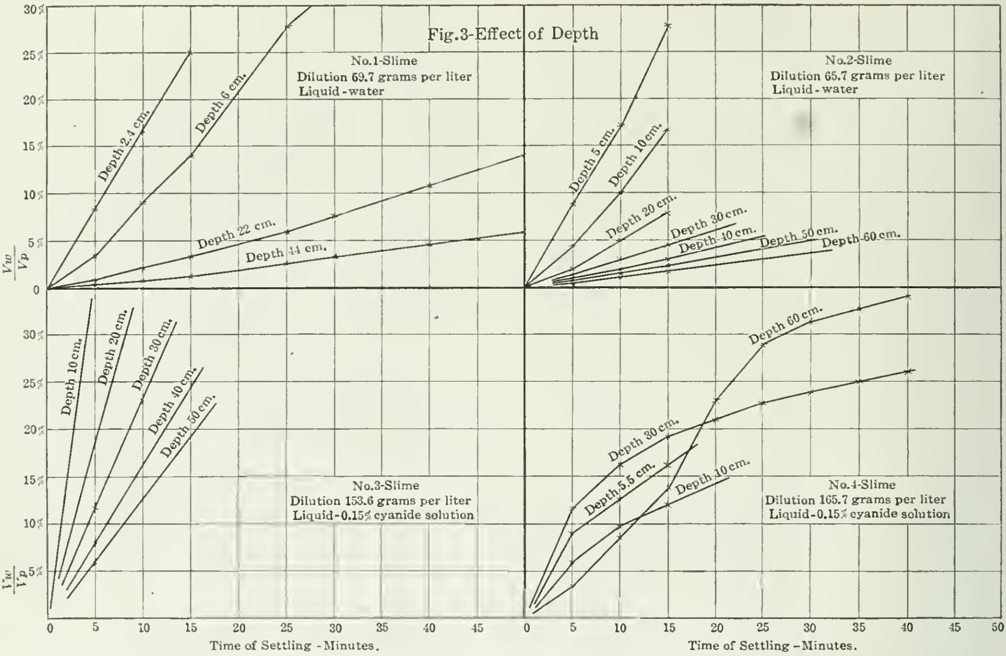


Fig.3-Effect of Depth

Fig.4-Scale for Grading Slimes according to Settling.

Standard Conditions for Test:

1. More than 75% of slime particles to pass a 200 mesh screen and less than 10% to stay on 100 mesh.
2. Settling column to be 30 cm. in height.
3. Average specific gravity of slime particles to be between 2.5 and 2.8.
4. Liquid to be water.

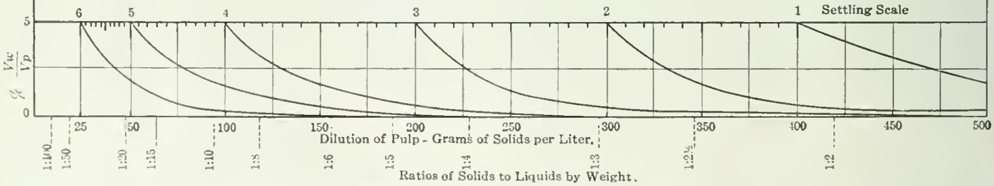


Fig.5-Scale for finding Size of Settling Tanks.

Formula.-

Required Area of Settling Tanks = $\frac{D}{d} f T N$, where T - Tonnage of Dry Slime per 24 hr. to be settled to practical limit;

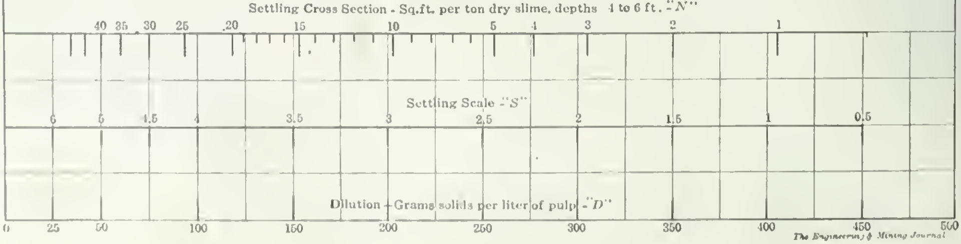
and S - Number of slime on Settling Scale;

N - Number on Settling Cross Section, vertically above S;

D - Number on Dilution Scale vertically below S;

d - dilution (in grams per liter) of pulp to be thickened;

f - experimentally determined factor for liquid used,- for slimes above 4 in settling scale, f 0.5 app. in weak lime or cyanide solutions, for water $f = 1$.



The Engineering & Mining Journal

is reached at about 1: 1.5. With No. 3 slime on the other hand it is possible to thicken to a consistency of less than 50% moisture.

Fig. 2 shows the accelerating effect of a coagulant such as lime upon the settling of No. 2 slime. It should be mentioned in this connection, however, that the final settlement at the end of 48 hours was found to be practically the same for settling in water and for settling in 0.015% lime solution. It is well to remember that lime should never be used in large amounts for settling purposes, because an excess of lime increases the viscosity of the water and so tends to retard settling. To obtain the best efficiency in the use of lime, it should be added to the ore previous to crushing[1] so that a coating of coagulated colloids may at once form around the particles of silica and protect them from the dissolving action of the water. When the ore is crushed in water without the addition of lime or cyanide, a considerable amount of silica goes into solution in the colloidal state and the viscosity of the water is correspondingly raised.

SETTLING TESTS ON SLIME NO. 1

Test	Position of Tube	Diameter, Mm.	Depth of Pulp, Cm.	Dilution, Grams per Liter	Mm. Depth of Clear Liquid at End of						$\frac{V_w}{V_p}$ % at End of					
					5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.
1	vertical	32.5	40	209.0	0	0	0	0	0	?	0	0	0	0	0	?
2	vertical	32.5	30	167.2	0	0	0	0	?	0.5	0	0	0	0	0	0.17
3	vertical	32.5	45	104.5	1.5	2.5	4.0	7.0	11.0	14.0	0.33	0.55	0.89	1.56	2.41	3.10
4	vertical	32.5	30	83.6	1.5	3.0	5.5	9.5	14.0	17.0	0.50	1.00	1.83	3.16	4.67	5.66
5	vertical	32.5	35	69.7	2.0	1.0				19.0	0.57	1.15				5.45
6	vertical	32.5	6	69.7	2.0	5.5	8.5		17.0	19.0	3.34	9.20	14.12		28.40	31.70
7	vertical	32.5	3.3	69.7	2.0	3.0	6.0				6.05	9.10	18.20			
8	vertical	32.5	2.4	69.7	2.0	4.0	6.0				8.35	16.70	25.00			
9	45°	32.5	35 *	69.7	7.1	17.0	31.0	46.0			2.02	4.85	8.89	13.15		
10	60° from hor.	32.5	35 *	69.7	3.5	10.5	18.5				1.00	4.30	5.28			
11	30° from hor.	32.5	35 *	69.7	14.0	30.0	†	†	†	†	4.00	8.57				
12	40° from hor.	32.5	35 *	69.7	9.5	26.5	†	†	†	†	2.71	7.59				
13	42½° from hor.	32.5	35 *	69.7	9.0	20.8	32.5				2.57	5.94	9.29			
14	vertical	32.5	35	52.2	4.5	8.5	12.0				1.29	2.44	3.43			
15	vertical	32.5	32.5	34.8	6.0	12.0	18.0				1.84	3.69	5.53			
16	vertical	32.5	32.5	19.0	10.0	25.0	40.0	60.0			3.08	7.69	12.70	18.90		
17	vertical	32.5	32.5	9.5	indistinct	indistinct	75.0?				?	?	23.03			
18	vertical	120.0	22.0	69.7	2.5	5.0	7.5		12.0	15.0	1.17	2.27	3.40		5.46	6.83
19	vertical	32.5	22.0	69.7	2.0	5.0	7.0		13.0	17.0	0.91	2.27	3.19		5.91	7.72
20	vertical	32.5	44.0	69.7	2.0	3.5	5.6		11.0	14.0	0.45	0.79	1.27		2.50	3.18

*On the incline. †Settled slime not able to gravitate.

SETTLING TESTS ON SLIME NO. 2

Test	Position of Tube	Diameter of Tube, Mm.	Depth of Pulp, Cm.	Dilution of Pulp, Grams per Liter	Mm. Depth of Clear Liquid at End of						$\frac{V_w}{V_p}$ % at End of					
					5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.
1	vertical	32.5	32.5	241.9	0	0	0	0	0	0	0	0	0	0	0	0
2	vertical	32.5	32.5	161.3	0.2	0.6	1.0	1.5			0.06	0.18	0.31	0.46		
3	vertical	32.5	32.5	138.2	1.0	3.0	5.0	7.0			0.31	0.93	1.54	2.16		
4	vertical	32.5	32.5	80.6	3.5	7.0	12.0	17.0	26.0	31.0	1.07	2.16	3.70	5.25	8.00	9.54
5	vertical	32.5	32.5	65.7	4.0	8.0	12.0				1.23	2.46	3.70			
6	vertical	32.5	32.5	52.6	5.0	12.0	18.0	30.0			1.58	3.70	5.55	9.24		
7	vertical	32.5	32.5	43.8	7.0	15.0	22.0	36.0			2.16	4.62	6.78	11.80		
8	vertical	32.5	5	65.7	4.5	8.5	14.0				9.00	17.00	28.00			
9	vertical	32.5	10	65.7	4.5	10.0	17.0				4.50	10.00	17.00			
10	vertical	32.5	20	65.7	4.0	10.0	16.0				2.00	5.00	8.00			
11	vertical	32.5	30	65.7	4.0	9.0	13.5				1.33	3.00	4.50			
12	vertical	32.5	40	65.7	4.0	7.5	12.0				1.00	1.87	3.00			
13	vertical	32.5	50	65.7	3.5	7.5	11.5				0.75	1.50	2.30			
14	vertical	32.5	60	65.7	3.5	7.5	11.5				0.51	1.25	1.91			

Effect of Lime on Settling

Test	Position of Tube	Diameter of Tube, Mm.	Depth of Pulp, Cm.	Dilution of Pulp, Grams per Liter	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.
15*	vertical	32.5	60	67.2	3.0	7.0	12.0	16.0	21.0	26.0	0.50	1.17	2.00	2.67	3.50	4.33
16†	vertical	32.5	60	67.2	4.0	14.5	28.0	45.0	64.0	82.0	0.67	2.41	4.67	7.50	10.67	13.67

*With water. †With 0.015% lime solution.

Particular attention is called to the graphic illustration of the effect of depth, shown in Fig. 3. Slimes Nos. 1, 2 and 3 give results which plot in nearly straight lines, while No. 4 slime, which is a mixture of 2 and 3, shows considerable irregularity. In nearly every case, however, it is seen that the settling efficiency for a given dilution and time diminishes as the depth of the pulp is increased.

Conditions Affecting Settling

From the results of these experiments, I am led to believe that the following conditions govern the rate of settling slime in still water: (1) The size and shape of the slime particles; (2) the percentage of colloids present; (3) the dilution of the pulp; (4) the height of the column of pulp in which settling takes place irrespective of the size or shape of the horizontal cross-section; (5) the average specific gravity of the slime particles; (6) the presence and amount of electrolytes in the water.

The size of the particles in a given slime may best be expressed by the standard screen test, noting particularly the percentage of material that will pass a 200-mesh screen. The average specific gravity of the particles will vary according as there are many or few grains of the heavy minerals present.

From the fact that depth has such an important influence on rate of settlement, it is evident that tanks as shallow as practicable should be employed, and even in tanks two or three feet in depth, the inclined baffles advocated by Courtenay De Kalb and B. L. Gardiner as aids to settling may be used to advantage in many cases, for the inclined baffles set close together at a slope of 45 deg. constitute an apparatus in which the settling depth between each pair of baffles is only 1.414 times the space between them.

---

[1] "The Chemical Control of Slimes," by H. E. Ashley, Trans. A. I. M. E., March, 1910.

Of the six principal factors, influencing the relative settling efficiency for the same period of time, it is possible to standardize all but Nos. 1, 2 and 5 and, by specifying certain limits for size and average specific gravity, we may obtain a set of nearly standard conditions for the comparison of all mill slimes, by the observance of which the relative settling efficiency may be made to vary only in accordance with the physical character of the material dealt with.

SETTLING TESTS ON SLIME NO. 3

No. of Test	Position of Tube	Diam. of Tube, Mm.	Depth of Pulp, Cm.	Dilution of Pulp, Grams per Liter	Mm. Depth of Clear Liquid at End of						$\frac{Vw}{Vp}$ % at End of					
					5 min.	10 min.	15 min.	20 min.	25 min.		5 min.	10 min.	15 min.	20 min.	25 min.	
1	vertical	32.5	32.5	512.0	1.0	2.0	3.0	....	....	....	0.31	0.62	0.92	....	....	..
2	vertical	32.5	32.5	409.6	2.0	9.0	20.0	....	....	....	0.62	2.77	6.15	....	....	..
3	vertical	32.5	32.5	384.0	4.0	17.0	33.0	43.0	....	....	1.25	5.24	10.30	13.42	....	..
4	vertical	32.5	32.5	307.2	9.0	25.0	42.0	59.0	....	....	2.77	7.72	12.91	18.15	....	..
5	vertical	32.5	32.5	272.5	15.0	30.0	48.0	....	....	....	4.62	9.25	14.75	....	....	..
6	vertical	32.5	32.5	192.0	29.0	53.0	80.0	....	....	....	8.92	16.31	24.61	....	....	..
7	vertical	32.5	32.5	153.6	33.0	68.0	....	....	....	....	10.30	20.95	....	....	....	..
8	vertical	32.5	32.5	128.0	37.0	73.0	....	....	....	....	11.40	22.41	....	....	....	..
9	vertical	32.5	5.5	153.6	26.0	29.0	....	....	....	....	47.2	52.9	....	....	....	..
10	vertical	32.5	10.0	153.6	37.0	55.0	....	....	....	....	37.0	55.0	....	....	....	..
11	vertical	32.5	20.0	153.6	39.0	72.0	....	....	....	....	19.5	36.0	....	....	....	..
12	vertical	32.5	30.0	153.6	37.0	72.0	....	....	....	....	12.3	24.0	....	....	....	..
13	vertical	32.5	40.0	153.6	33.0	66.0		....	....	....	8.2	16.5	....	....	....	..
14	vertical	32.5	50.0	153.6	32.0	67.0		....	....	....	6.4	13.4	....	....	....	..

SETTLING TESTS ON SLIME NO. 4

No. of Test	Position of Tube	Diameter of Tube, Mm.	Depth of Pulp, Cm.	Dilution of Pulp, Grams Solids per Liter	Mm. Depth of Clear Liquid at End of					$\frac{Vw}{Vp}$ % at End of				
					5 min.	10 min.	15 min.	20 min.	25 min.	5 min.	10 min.	15 min.	20 min.	25 min.
1	vertical	32.5	32.5	414.1	?	?	1.0	....	....	?	?	0.31	....	...
2	vertical	32.5	32.5	276.1	1.0	3.0	4.5	....	....	0.31	0.92	1.38	....	..
3	vertical	32.5	32.5	184.1	13.0	23.0	28.0	....	....	4.0	7.1	8.6	....	..
4	vertical	32.5	32.5	138.1	36.0	61.0	115.0	....	....	11.1	18.8	35.4	....	...
5	vertical	32.5	32.5	110.4	44.0	80.0	135.0	....	....	13.5	24.5	41.5	....	...
6	vertical	32.5	32.5	92.0	30.0	90.0	141.0	....	....	9.2	27.7	43.4	....	...
7	vertical	32.5	5.5	165.7	5.0	7.0	9.0	....	....	9.1	12.7	16.3	....	...
8	vertical	32.5	10.0	165.7	6.0	10.0	12.0	....	....	6.0	10.0	12.0	....	....
9	vertical	32.5	30.0	165.7	35.0	49.0	58.0	63.0	68.0	11.7	16.3	19.3	21.0	22.7
10	vertical	32.5	40.0	165.7	24.0	68.0	93.0	....	....	6.0	17.0	24.2	....	...
11	vertical	32.5	50.0	165.7	24.0	53.0	85.0	....	....	4.8	10.6	17.0	....	....
12	vertical	32.5	60.0	165.7	21.0	52.0	84.0	138.0	175.0	3.5	8.7	14.0	23.0	29.2

PROPOSED STANDARDIZATION OF TESTS

I would propose the following standard conditions for testing slimes:

Size—The size of the particles to be such that more than 75% of the material will pass a 200-mesh screen and less than 10% of the material will stay on a 100-mesh screen.

Dilution—The dilution of the pulp to be expressed in grams of solids per liter of pulp.

Height—All tests to be made with the pulp column 30 cm. high.

Specific Gravity—The average specific gravity of the particles to be between the limits 2.5 and 2.8.

Electrolytes—Water without the addition of lime, cyanide, alum, calcium chloride or other salts to be used for the standardization tests.

When the above standard conditions are followed in the tests, practically all mill slimes may be classified and given numbers according to their settling curves, as in Fig. 1. The dilutions are abscissas, and for ordinates the percentages of volume of clear water divided by volume of pulp at the commencement for a settling period of ten minutes are taken. Only from three to four simple experiments are needed to establish the curve for the slime in this way, and the place where the curve cuts the 5% efficiency ordinate line determines its number in the settling scale, as shown in Fig. 4. The division 1 on the scale corresponds to a settling efficiency of 5% at the dilution 400 grams per liter; 2 to an efficiency of 5% at 300 grams per liter; 3 to an efficiency of 5% at 200 grams per liter; 4 to an efficiency of 5% at 100 grams per liter; 5 to an efficiency of 5% at 50 grams per liter; while 6 would correspond to an efficiency of 5% at a dilution of only 25 grams per liter.

Placed in this scale, the four slimes on which experiments were made (if the settling of all had been in water) would be numbered as follows: No. 1 slime, number in the settling scale, 5.7; No. 2 slime, 5.3; No. 3 slime, 1.4; No. 4 slime, 3. While this scale is merely an arbitrary one, it will serve approximately for predicting the settlement of mixtures of two slimes whose grades are known. No. 4 slime in Table No. 4 is a mixture of Nos. 2 and 3 in the proportions of 40% and 60%. Multiplying the settling number of each by its proportion in the mixture and adding the products, we obtain 2.96 for the estimated settling number of the mixture. No. 4 slime was found to be a trifle over 3 by plotting the curve of actual experiments.

A USEFUL SETTLING SCALE

The usefulness of such a settling scale will be apparent in several ways. The manufacturer who may be called upon to furnish settling tanks for a small mining company will need only to know the settling number of the slime to be handled, and he will then be able to predict with a fair degree of accuracy to what dilution it will be possible to settle the slime. For instance, in the case of a slime whose number is 2.5, it will be possible to thicken to a dilution of about 500 grams per liter; while in the case of a slime of grade 4.5, the dilution of 300 grams per liter may be predicted as the practical limit of thickening by settling apparatus. In comparing the settling efficiency of the same slime in water with its efficiency in weak solutions of cyanide or lime, it will be safe to figure the latter at at least twice the former for slimes that are above No. 4 in the settling scale. For slimes that are less than 4 in the scale, the benefit of lime or cyanide will not be so great, but may be easily estimated from a set of simple experiments.

For predicting efficiencies at different depths, the safest procedure would be to make an experiment that would establish the relation between the efficiency at the standard depth of 30 cm. and that at the depth of tank that it is most practical to use.

From the experiments with slimes Nos. 2 and 3, it would appear that for small depths the efficiencies are nearly in the inverse ratio to the depth, so that a slime that would have an efficiency of 3% at a depth of 30 cm. settling for a period of ten minutes, would be expected to have only about 1% efficiency at 90 cm. depth for the same time.

In Fig. 5 are shown a formula and tentative scale, by means of which the designer may determine within the requirements of average mill practice what sizes and number of settling tanks to use for any particular case. As an example, take a mill slime that has been found by test to grade about 3.5 in the settling scale, and which has a factor of 0.8 for settling in a solution containing 2 lb. of lime per ton; required the number of square feet of tank area and the practical limit of settling, the slime to be introduced in lime solution to the tanks at a dilution of 190 grams per liter and at the rate of 80 dry tons per day. By reference to the scale, Fig. 5, we find that N corresponding to 3.5 is 15, while the corresponding D is 150, so that, using the formula,

$$Area = \frac{D}{d} fTN$$

we have required tank area equals

$$\frac{150}{190} \times 0.8 \times 80 \times 15 = 758 \text{ sq ft.}$$

This tank area could be given by either one circular tank 31 ft. diameter by 5 ft. deep; or two circular tanks 22x5 ft.; or three circular tanks 18x5 ft. The practical limit of thickening for this slime is found by consulting the curves in Fig. 4, and is at a dilution of from 350 to 400 grams per liter.

If the slime in the above example had been found by test to grade only 1.4 in the settling scale, the other conditions remaining the same, the required tank area would be only

$$\frac{360}{190} \times 0.8 \times 80 \times 1.8 = 218 \text{ sq. ft.}$$

and the thickened pulp discharged from the tank would be at close to 50% moisture. One tank 16.5 ft. in diameter would in this case be sufficient.

Large deposits of coal in the department of Arauco, Chile, are announced in the *Diario Ilustrado*.

The Missing Zinc at Broken Hill

In a recent paper upon the Broken Hill ore deposits published in the *Transactions* of the Australian Institute of Mining Engineers, it was admitted that the problem of the geology of ore deposition at Broken Hill was still unsolved. This paper is discussed in the *Australian Mining Standard,* Dec. 7, 1911. This problem is one of economic as well as geological importance. To the end of 1894 the Proprietary mine extracted 2,144,000 tons of oxidized ore, which was practically free from zinc, and which was estimated to have originally contained about 600,000 tons of zinc. That these figures are practically correct seems undoubted, as it is highly improbable that this great oxidized orebody was not the result of oxidation, which would, of course, have resulted in the secondary enrichment of a primary orebody generally similar in character to the sulphide now being mined in the lower levels of the Broken Hill mine.

In the oxidation of a body of mixed galena and blende, such as the Broken Hill primary ore, the zinc would tend to dissolve before the lead and, being more readily soluble, would remain in solution longer. From this, one would expect to find an oxidized zone free of zinc followed by a zone of secondary enriched galena practically free of zinc, then a zone of secondarily enriched blende poor in lead, and, finally, the primary ore containing galena and blende. The zone of secondarily enriched galena has been found and worked, supplying large quantities of lead ore, and what is apparently primary ore is now being mined, but up to the present there have been no quantities of zinc found which would seem to account for the vast amount of zinc leached from the oxidized zone.

The subcommittee appointed by the Broken Hill Scientific Society, which compiled the paper published in the *Transactions,* seems to favor the idea that the zinc has gone into solution and been carried in this condition by surface waters below the present limit of mining. The truth of this can only be shown by extensive deep-level exploration, but it seems improbable that such extensive circulation of surface waters below the ground-water level would be possible, especially against the rising temperatures at depth.

Another theory is that the dissolved zinc may have been precipitated over a wide area, the precipitation agent not being plentiful, and so the secondary enrichment would be so widely distributed that its character would not be recognized and this secondarily enriched ore would be looked upon as primary ore. If this be true, the zinc content of the Broken Hill ore will diminish with depth. Although extensive comparisons of assays at various levels seem to show a slight decrease of the zinc content with increasing depth, the decrease hardly seems to be sufficient to account for the lost zinc by this theory of an extensively distributed secondary enrichment.

J. Bowie Wilson in his discussion of this paper in the *Australian Mining Standard* suggests that a possible solution of the problem may be the same as that which is found at Leadville; that is, that the zinc has remained in the oxidized zone to a greater extent than at present appreciated and that the resulting oxides and silicates of zinc being of an earthy and unmetallic appearance have escaped detection. While these oxides and silicates may have been looked for, there is nothing in the paper to show it, and it would be expected that some mention of it would have been made in so excellent and extensive a discussion of the Broken Hill deposit. This problem is, as said before, not alone one in geology, but is of great economic importance for the discovery of this missing 600,000 tons of zinc would undoubtedly have a stimulating effect upon mining at Broken Hill.

The Longitudinal Railway of Chile

Of general interest to investors and promoters in Chile is the new Longitudinal Railway of Chile, extending from Cabildo to Arica, and connecting with existing lines from Arica to Tacna, and Cabildo to Valparaiso. The route will lie somewhat inland, and will include a large proportion of rack line (*Engineer,* Jan. 19, 1912). The contract for the section from Copiapó to Arica was given to the Chilean Longitudinal Railway Construction Co. at £3,055,750, while the Howard Syndicate took the contract at £4,026,000 for the Copiapó-Cabildo section.

The gage is to be one meter, with a 6% grade limit on rack sections, and 3% on adhesion. The limits of curvature are 80-m. radius on adhesion lines, and 140-m. radius on rack. The chief tunnels will be at La Grupa, between Cabildo and Liniáhuida, length 1277 m.; at Las Palmas on the same section, length 1034 m.; at Las Astas on the same section, length 787 m.; and at Espino, between Illapel and San Marcos, length 1470 m. The longest bridges will be between Cabildo and Liniáhuida, one of ten 30-m. spans, and another of four 60-m. spans with an extra 30-m. opening, and one between Islon and Vallenar, of ten 30-m. spans. The total length of the new road will be about 578 km. Actual work is being done by Norton Griffiths & Co., on the south, and MacDonald, Gibbs & MacDougall on the north.

The Wizard Rock Drill

It is doubtful if any machine has been the subject of more thought and experiment and departed less from the original design than the rock drill. In 1867, the Burleigh drill was successfully used to drive the Hoosac Tunnel. It was the first practical machine in which the drill steel was fastened to the piston and cut the rock by means of percussive blows from the reciprocations of the piston. Since that time about 1500 patents have been granted for rock drills and improvements thereon, but with few exceptions, outside of those pertaining to air-hammer drills, these patents have been along the line of improvement on the general design of the first percussion piston drill. Of course, the rock drill of today is far superior to the rock drill of 40 years ago, owing to improved methods of manufacture, use of stronger and lighter materials, better workmanship with interchangeability of parts and refinements of design, but the rock drill is still notoriously inefficient as regards work done for power consumed.

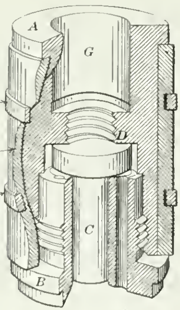


Fig. 1. Details of Cushion Valve

To increase the efficiency and reduce the cost of upkeep, without sacrificing any of the points of sturdiness necessary to withstand general service conditions, has been the problem of the rock-drill engineer. An interesting device has been applied recently to a rock drill of the ordinary construction, which seems from the results of tests and general service during the last year, to effect a real improvement.

An important aim in the design of all rock drills is to provide some means of preventing the head of the piston from striking the back head of the drill cylinder. In some types of drill this is accomplished by so regulating the valve motion that the admission of fluid to the upper or back face of the piston for the down or working stroke begins before the completion of the return stroke. Thus, a cushion of air between the head of the piston and back head of the drill is compressed at the final stage of the return stroke to prevent the piston from striking the back head.

The McKiernan-Terry Drill Co. has recently introduced a novel method of cushioning the return stroke by the use of a simple device that can be applied without departing from the most approved drill designs of the present time. In Fig. 2, of the accompanying illustration, this new feature is shown in section. The drill cylinder is shown at *A*, the piston at *B*, and *C* is the rifle bar with ratchet at *D*. The lower end of the rifle bar is finished as a tapering lug *E*, which engages the check valve *F*. This check valve is a piston-like device, which will be described in detail presently, that closes the upper end of the hollow piston *B*, forming a chamber *G*, known as the compression chamber. The rifle bar is bored with a central longitudinal port *I*, through which the operating fluid may pass to the compression chamber *G* from the upper end of the cylinder through *H*, a transverse port.

At the beginning of the down stroke the head of the piston is, of course, close to the back head of the cylinder. Upon admission of the fluid the piston begins to move forward from the pressure on the back of the piston and from the pressure of the fluid that passes through the transverse port *H*, down port *I*, past the valve *F* to the compression chamber *G*, where it acts upon the face *J* of the piston. The effective pressure area during the down stroke is thus increased by the area of *J*, or a little more than a square inch.

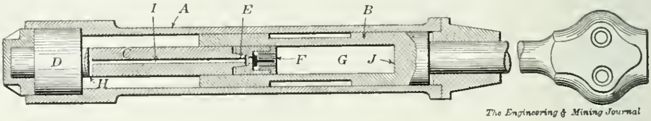


Fig. 2. Diagram of Wizard Drill Cylinder

At the beginning of the return stroke the fluid in the compression chamber is compressed, the initial pressure closing the valve *F* so that no fluid can escape through the ports *H* and *I* during the return stroke. The result is that the entrapped fluid in the compression chamber *G* is gradually compressed during the return stroke. As the volume of this air gradually decreases, the pressure and temperature rise so that at about the end of the stroke the pressure in the compression chamber is so high that a large amount of the energy of the return stroke has been absorbed in compressing this fluid. This cushion of compressed fluid effectually prevents the piston from striking the back head.

In this way the admission of fluid for the down stroke can be delayed until the completion of the return stroke. Then the port opens and the working stroke is performed under pressure at the back of the piston, and the expansion of the highly compressed fluid in the compression chamber, producing a high initial velocity of the piston. Toward the end of the stroke, the valve *F* may open to admit more fluid to the compression chamber to make up for any leakage.

The introduction of this compression chamber not only effectually guards against striking the back head, but greatly accelerates the working stroke so that an unusually severe smashing blow is dealt, yet it in no way impedes the up stroke. The effect of the compression chamber is probably more pronounced when operating with air than with steam.

The check valve is shown in detail in Fig. 3, where *A* is the steel body with tapering opening *G*, which fits over the tapered end of the rifle bar and is held in place by friction. The inner portion *B* is made of steel and carries the valve *C*. The valve seat is shown at *D*. Over the steel body *A* a phosphor-bronze bushing *E* fits, which supports the two piston rings *F* that are provided to make a tight fit in the compression chamber.

The device has been tried out for a year, and it has been found that the valve is subject to little wear. Some trial runs made in New York rock, Fordham gneiss in this instance, demonstrated that the machine could outdrill some other machines of excellent manufacture and design. In drilling down holes, the superior "mudding" features were particularly notable. The mud was thrown a foot above the collar of an 18-ft. hole.

In drilling Fordham gneiss, one hole was drilled to a depth of 18 ft. in 69 min. total time, or 49 min. actual drilling time, with a 3⅝-in. machine. The next morning a 15-ft. hole was drilled in 60 min. total, or 44 min. actual time. In the afternoon one hole was drilled to a depth of 17½ ft. in 69 min. total, or 51 min. actual time, and a second hole to a depth of 18 ft. in 58½ min. total, or 42 min. actual time. The Peabody Granite & Concrete Co., of Boston, reports that in a two-month's trial in granite, the average depth drilled per hour was 5.7 feet.

The Southwestern Utahnite Safety Powder Co. has been organized at El Paso, Tex., for the manufacture of a new explosive called "Utahnite." It is claimed that the powder does not freeze, can be handled with safety, and that it shatters without scattering, a test being cited where a boulder 5x6x6 ft. was shattered in small pieces without scattering any fragments beyond a radius of 6 feet.

The California Gold Dredge—II

By Robert E. Cranston *

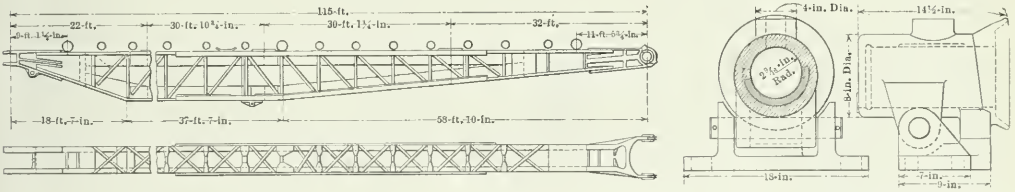
The mechanical features of the digging ladder and accessory parts are discussed. The plate-girder ladder is more common than the lattice type. The bucket line is gear-driven, its operation being controlled by a friction clutch and a brake wheel; an electro-magnetic clutch is preferred by the author.

The design of the digging ladder varies with the depth and nature of the ground to be handled. It is either a plate girder or a lattice girder or truss.

PLATE-GIRDER DIGGING LADDER MOST USED

The plate-girder type is the most common and in my opinion the best. A little weight may be saved by using the lattice type, and although it may be as strong as a plate girder, there is in the lattice type more danger of rivets working loose, causing ultimate collapse.

Ample space should be allowed under the ladder rollers, otherwise the spill from the buckets will collect and prevent the rollers turning. The ladders are made in several sections so that they may be more easily transported. Where the splices occur great care should be taken to make the joints of ample strength. I have seen several digging ladders fail and in nearly every case the failure occurred at one of the splices. In figuring the strains in a digging ladder it should be considered not only as a beam supported at two or three points, but also as a column. Where a single line is used for side swinging, the strains must also be figured for side as well as vertical stress.



The Engineering & Mining Journal

DIGGING LADDER AND LADDER ROLLER BEARING FOR 9-CU.FT. DREDGE

At the lower end of the ladder cast-steel forks are riveted to the structural portion of the ladder. These forks are made differently by various designers, but their duty in all cases is to carry the lower-tumbler bearings and give a space for the lower tumbler to revolve in. These forks should have great lateral strength since there is a tendency to spread under the severe digging conditions. I have found it of advantage to make the inside edges of these forks fit closely to the outside of the tumbler, since if a large space is left rocks lodge and grind out both the tumbler and the forks. In my last design I have put in replaceable manganese-steel liners on the inside of the forks and hope that it will prevent much of the wear on tumbler flanges.

There are several designs of lower-tumbler bearings used. In the most common the lower portions of the forks are made to form one-half of the bearings and to this the other half is bolted. In this design a replaceable cast-iron bushing is made to fit inside the main casting, often of the self-aligning type. I have used a design similar to that of the locomotive connecting-rod end, which is fastened and adjusted by means of taper keys. The bearing is made of cast iron in two halves and slides between the upper and lower extensions of the forks. Square holes are machined through these extensions to take the keys. The half bearings are interchangeable and can be used for the upper or lower half and for either side. This style of bearing has been found very satisfactory, since it is cheap and easily replaceable.

Many attempts have been made to use protective devices for keeping grit out of the bearings, rubber, felt, brass and iron rings having been tried. The rubber and felt have been entirely discarded. Some still use bronze or iron protective rings, but they are all more bother and cause more delays than they are worth. A hole through which grease may be introduced is provided at an easily accessible place on the bearings. The grease is introduced by means of a grease gun with a screw-operated piston.

I use a lower-tumbler shaft with shallow flanges turned at either end. These flanges fit into recesses on the outside of the tumbler bearings, thus preventing the ladder forks from spreading. Where hollow shafts were used it was common practice at one time to put a rod lengthwise through the shaft, a nut at either end preventing the forks from springing apart. With the modern practice of making the lower forks extremely massive there is little danger of springing and precautions need not be taken in this direction.

ROLLER BEARINGS EASILY REMOVED

Spaced along the digging ladder at regular intervals are the roller bearings supported in chairs by pins which allow movement in a plane at right angles to the length of the ladder. The first bearings used were fixed rigidly and much trouble was experienced by breaking roller shafts, probably caused by movement in the ladder truss. I think it likely, with the heavier ladder construction now in vogue and the larger-sized roller shafts, that the fixed bearing would give little trouble; but even so, the present common design is better since the bearing may be quickly and easily removed, and this is a desirable feature in any part of a dredge.

The roller bearings are made with half-round bushings similar to those used in the bucket hubs. Cast iron, manganese steel and bronze are used for this purpose. Cast-iron roller bearings are being replaced by cast-steel. Where a self-adjusting bearing is used it should be supported near the middle and be of ample length; otherwise it will tend to tip down and wear out unevenly and rapidly.

In some of the dredges a pan is provided below the rollers which conveys the slop-over of the buckets to the lower end of the ladder where it will be picked up again. This is a good idea, but care should be taken to make it at least 12 in. below the rollers and in small, easily replaceable sections. If not deep enough it is likely to be a source of much annoyance by filling up and stopping the rollers, or if made in long unprotected sections it will wear out and require much work and loss of time in replacing.

The lower end of the ladder is supported at either one or two points, the

---

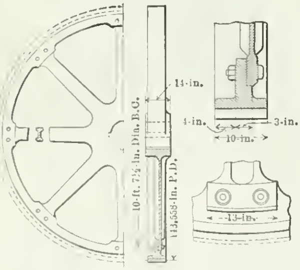
*Mine manager, Ashburton Mining Co., Sacramento, Calif.

Note—An article entitled "Design and Mechanical Features of the California Gold Dredge," published in Journ. A. S. M. E., February, 1912.

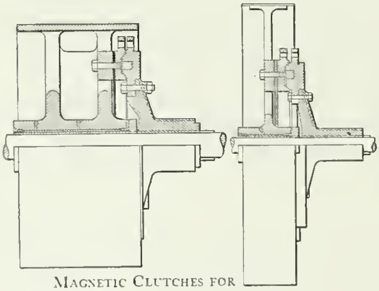
single suspension being used for the shorter ladders and the two-point suspension for the longer ones. Several different designs are in use, the most common being a double set of blocks, one on each side, attached to heavy forged rods or bars connecting with the ladder. Heavy chains, forged or cast links and pin links are also used. Another type has a single set of blocks attached to a cross-piece, the connection to the ladder being made from each of its ends. The attachment to the ladder is usually made by means of a cross-shaft or pin running through bearings fastened to the under side of the ladder.

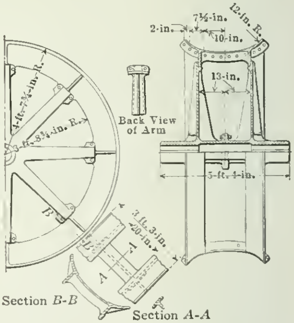
Two Methods of Pivoting Ladder

The upper end of the digging ladder is pivoted either on the tumbler shaft-bearing support or on a separate mounting entirely detached from the bucket drive. By employing the first method the tumbler shaft may be used as a center and the relative position of the bucket line and upper tumbler will remain constant for all depths of digging. In the second method the pull on the bucket line will be at different angles to the position of the ladder. The first method, therefore, has a decided advantage, but it also possesses the disadvantage of preventing the easy removal of the upper tumbler and shaft, is more expensive, and in case of accident to the ladder the bucket drive may be involved through the tumbler shaft-bearing support. Massive cast-steel forks are used when the ladder is pivoted on the tumbler-bearing supports, and they should extend well down the structural part of the ladder in order to give ample space for riveting.



Bull Wheel for 9-Cu. Ft. Dredge.


Magnetic Clutches for Bucket Drive and Main Winch.



Bucket Idler for 9-Cu. Ft. Dredge.
The Engineering & Mining Journal

Along the sides of the ladder wooden chafing beams are bolted, the outer faces of which are protected by steel plates. I prefer beams put at both top and bottom of the ladder, so that they will steady it when digging hard. The beams on the ladder rub against similar ones on the sides of the well. Those in the well are put either at right angles to the ladder at intervals, or one may be placed on each side of the well parallel to the deck and on the streak above water line. If this form of chafing beam is used, both the ladder and the well beams should have beveled timbers fitted above them, so that rocks will not lodge and cause trouble when the ladder is raised or lowered. The disadvantage of placing the chafing beams at right angles to the ladder is that in case anything catches on one of them near the bottom and tears off a plate it is extremely difficult to repair, while if the beams are entirely above the water line they are easily accessible. The only disadvantage of placing them in this way is that the distance from the contact point of ladder and beam to the ladder's end is greater by the draft of the hull, and in case of side strain the bending moment is greater. Where a shore sheave is used and the end of the swinging line is attached to the lower end of the ladder there is little side strain, and in this case the horizontal wearing plates are best, in my opinion. Where a single swinging line is used, running directly to the shore, considerable side strain is exerted on the ladder, and the chafing beams at right angles to the ladder are preferable. Some designers provide rollers for the sides of the ladder, which serve the same purpose as the chafing beams.

Buckets Are Gear-driven

The buckets are driven by a chain of gears mounted on the main gantry. The use of a chain or shaft drive from the lower deck has now been entirely abandoned in California practice. Some dredges drive direct from the digging motor to the pulley shaft on the main gantry. Others use a countershaft on the main deck, from which also is driven the ladder hoist. Neither type has any great advantage over the other, and, if properly designed, either method will give satisfactory results.

The upper tumbler may be driven by a gear at one end of the tumbler shaft, or one at each end, with a double set of intermediate pinions, gears and pulley-shaft pinions. The single drive is, of course, cheaper and simpler, but experience has shown that after many years of service the single drive is inclined to get out of line, even when solidly built. I very much favor the double drive and would advise its use.

The bull wheels or tumbler-shaft gears are cast of steel in sections, sometimes with a split and sometimes with a solid hub. The rim is cast in one piece or in halves. Some designers use cut teeth, others rough cast. There can be no doubt but that the cut teeth run more smoothly, but for the rough work in hand I do not believe that the extra cost is warranted, particularly since the teeth are soon worn down and the benefit of the cut teeth disappears. In order to prevent breaking, all sharp angles should be avoided in the design of the spokes. They are subjected to constant shocks and vibration, and the gears will invariably break at a sharp reëntrant angle, should such occur at a vulnerable point. In order to make a snug fit and also to keep the rim from becoming elliptical, the spokes should either have a shoulder fitting on a machined inner edge of the rim, or the ends of the spokes should be turned to fit a machined shoulder on the rim. The latter method is preferable, since it does away with sharp corners which, as explained above, are always points of weakness.

It has been common practice to use one large bolt to fasten each spoke to the rim. Two smaller bolts are better since a more even distribution of spoke cross-section can be maintained by this design and it gives a longer spoke end to bear against the machined rim. A good many spokes have been broken near the rim where the cross-section is ample but where a point of weakness exists owing to the reëntrant shoulder above mentioned.

The intermediate-shaft pinions are made solid and as small in diameter as is consistent with good design. These pinions wear out quite rapidly and should be so arranged as to be easily replaced.

The intermediate-shaft gears are designed of a size to give the bucket line the desired speed. They are often made with separate rims so that they may be replaced when worn out without throwing away the rest of the gear.

The pulley-shaft pinions are made similar to the intermediate-shaft pinions and as small as good design will allow.

Friction Clutches Used

Whether the digging motor is belted direct to the bucket-drive pulley shaft, or to a countershaft on the ladder-hoist foundations and from there to the bucket-drive pulley shaft, some form of friction clutch is used to connect and disconnect the bucket drive, and for purposes of safety in case the buckets encounter obstructions beyond their strength. Any of the standard forms of friction clutches may be used, but I prefer the electromagnet clutch and use it in all my designs. It is by far the simplest to operate, is positive and will slip at exactly the same pull every time, according to the amount of current sent through its coil by the rheostat controlled from the pilot house.

The clutch used is simple in design. A cast-iron pulley is made so that there is a flat ring or web joining the spokes at about half the distance from hub to face. To this web is bolted a soft cast-iron ring. Between this and the pulley are inserted two thin sheets of copper and one of soft iron between the copper plates. These ring-shaped sheets are used in order to keep the lines of force where they are most wanted and to prevent the current making a permanent magnet of the pulley, shaft, etc., which would cause the clutch to drag when released. The pulley has a long hub bushed with bronze and runs free on the shaft.

A long cast-iron hub with two feather keyways at 180° and a web extending out to the same diameter as the ring on the pulley is made to slide along the shaft. To this web is bolted another soft-iron ring similar to the one bolted to the pulley. An annular groove of rectangular cross-section is machined in this ring midway between its inner and outer circumference, into which fits a coil of magnet wire. By introducing an electric current into this coil through controller rings, magnetic lines of force are induced which will draw the two soft-iron rings together, the pressure depending on the amount of current put through and the number of turns in the coil. The edges of the soft-iron rings are beveled so as to make a female joint on the pulley and a male joint on the sliding hub. The steeper the slope of these edges the less current will be required to do the requisite work, but if the cones are made too steep it will be difficult to disconnect the clutch. Forty-five degrees does very well. Good results are given by 440 turns of No. 16 magnet wire, and 4 amp. at 110 volts are put through the coil when working average ground. These figures are for a 200-hp. clutch.

The shafting for the bucket drive should be made of ample dimensions and of good material. I use nickel steel annealed and a factor of safety of 10. The gears should be fitted neatly and securely keyed. The upper tumbler-shaft bearings are made on an angle so as to have the bearing cap at right angles to the average line of pull of the bucket line. Cast-iron liners are sometimes used, but I prefer a babbitted bearing. The bearings should be well fastened so that they cannot slide forward, there being a heavy pull in this direction. These bearings, like the others of the bucket drive, are made of cast steel.

The intermediate- and pulley-shaft bearings are made of the ordinary type of babbitted base and cap, but are heavier than standard and use large-diameter bolts, which should be made of a soft grade of iron or steel, since unless this is done they are likely to crystallize and break.

It is customary to have the pulley shaft extended and a brake wheel keyed on. This brake is operated from the pilot house and is used by the winchman to hold the buckets from going over the upper tumbler when the bucket line breaks, to stop quickly in case of an accident, and to hold the bucket line when making repairs or changing buckets.

Pulleys Break near Hub

Standard Medart pulleys are generally used. They give considerable trouble on account of broken spokes. I have recently used with success a wooden bucket-drive pulley similar to that commonly employed in stamp mills, and on the last boat I designed a Medart pulley with spokes made extra heavy near the hub and tapering to a little more than standard cross-section at the rim, since nearly all the trouble arose from spokes breaking near the hub. If a cast-steel hub and spokes could be made it would be the best pulley for the puropse. Several of the steel foundries say that they would not care to attempt to cast a spider with as small spokes as the standard Medart and that a very heavy spoke would have to be made in order to overcome shrinkage trouble. If spokes could be made of cast steel and of as light or lighter design than the standard Medart it seems as if it would be an ideal pulley for dredge use.

Too much attention cannot be given to making the supports for the bucket drive of sturdy construction. In the first place these foundations are 20 or 30 ft. above the main deck and are subjected to constant and racking strains. If any portion of these supports gives, it throws the shafting out of line with obvious results. One form of support now much used and considered very good has the upper chord of the main truss made high enough to take the upper tumbler-bearing supports directly on its top. By this method the main gantry is braced fore and aft in a most excellent manner and it is a much more rigid construction than where the gentry extends above the chord. Large steel castings are used to tie the timbers together and to support the bearings directly. The details vary on different dredges and apparently have all given good service. One point which should be carefully looked into when designing this part of the dredge is so to place all bolts that they may be readily accessible and replaceable.

Where the depth of gravel to be dug demands a long string of buckets, an idler is used to support the sag. This idler is situated at the throat of the well as low down as convenient. It is made up of a cast-steel hub and a double set of spokes bolted on to a wide rim made to fit the curve of the bucket lip. The shaft is keyed to the hub and revolves in two bronze bushed bearings set on the deck or other convenient place.

Grizzlies below Dump Hopper

Below the dump hopper an inclined set of grizzly bars is put in. These extend as far forward as the sag of the buckets will allow. The bars are put ¾ to 2 in. apart. Below this grizzly is a collecting pan which directs the gravel to the forward end of a sluice with riffles, occupying the space between the gantry posts and sloping toward the after portion of the dredge. This sluice is run back as far as the grade will permit and then dumps its contents into riffled side sluices running forward one on each side of the well. These discharge into the well 15 or 20 ft. forward of the well throat. Water is furnished from one of the pumps and washes the material dropping through the grizzly bars.

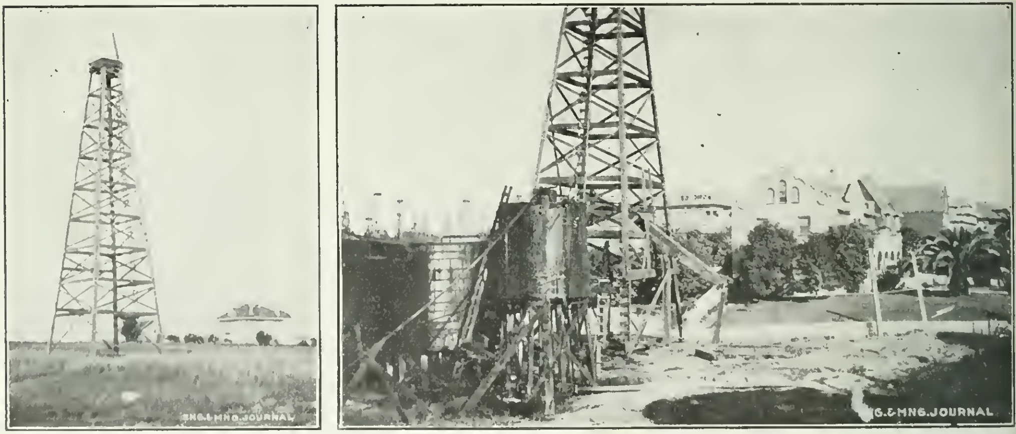
The hopper into which the buckets dump diverts the gravel into the screen. It is made either with a steel lining or by having a depression left at its bottom which fills up with rocks and gravel, thus forming its own lining. It is obvious that the last method is much more economical than the steel-lined hopper and that so far as its bottom is concerned it will last indefinitely; the only difficulty is that unless the hopper is left of ample dimensions it is likely to clog up when digging large quantities of material, particularly clay. By using a steel lining for the bottom of the hopper a little space may be saved, and if a large quantity of clay is to be handled the latter method might be preferable, but for ordinary conditions the rock bottom seems to be all that is necessary.

The hopper is built up on three sides of the upper tumbler, the top being at about the level of the bucket lips as they go over the tumbler. The forward upward edge is built to such a height as to miss the bucket lips by a few inches when the ladder is in its lowest position, and it is of advantage to put inclined guide plates on each side of the bucket line to divert the slop-over of the buckets into the hopper below. The rear vertical wall of the hopper is subjected to considerable wear by the striking of the rocks and gravel against it when the buckets dump and it should be lined with an easily replaceable steel plate. A good way is to suspend a ½-in. plate from the top by means of a few bolts, leaving the bottom entirely free.

(*To be continued*)

Installations of Girod Electric Furnaces

Rubery Owen & Co., of Darlaston, England, have been granted a license for the use of the Girod electric furnace. The first furnace will have a capacity of three tons.



Oil Derricks on Residence Property in Los Angeles

The Girod furnace is now in operation at the following works:—Simonds Manufacturing Co., at Lockport, N. Y.; S. A. E., Procedes Paul Girod, at Ugine, France; Oehler & Cie., at Aarau, Switzerland; Société John Cockerill, at Seraing, Belgium; F. Krupp & Co., Essen; Stotz & Co., at Kornwestheim, near Stuttgart; Stahlwerk Becker at Krefeld; Gutehoffnungshutte, at Oberhausen, in Germany; Ternitzer Stahlwerk, Schoeller, at Ternitz; Danner & Co., at Judenburg, in Austria; and Ungarisches Staats-Stahlwerk, at Diosgyor, in Hungary.

It is also stated that a large American steel works, whose name, and plans cannot be divulged at this time, have also signed a contract for a Girod electric-furnace license.

Reduction of Rare Oxides

The inconvenience of attempting the reduction of oxides such as vanadium, uranium, or tungsten by means of carbon or of carbon monoxide is well known, owing to the metals having a tendency to absorb the carbon. It has also been proposed to employ calcium carbide as a reducing agent, first to avoid the contamination of the metals by carbon and also to profit by the well known properties of calcium; that is to say, the production of great heat by oxidation and the formation of a slag or scoria of energetic reducing action.

A proposed method to avoid this is given in French pat. 427,537 of the Electric Furnaces & Smelters, Ltd., in which it is suggested that the reduction be effected by means of a mixture of a carbide and a silicide. The carbide which is employed by preference is that of calcium, which presents a small molecular weight in comparison with the atomic weight of the metals such as tungsten or uranium. $WO_3 + CaC_2 = W + CaO + 2CO$.

A silicide which is recommended for employment in cases where the presence of iron does not constitute a detriment is ferrosilicon. The silicide ought to be employed in the proposed mixture in proportions between 2 and 50 per cent., the proportion varying in a certain measure according to whether or not the product reduced may or may not contain a small amount of silicon. In an alloying element for armor plate, for example, a large proportion of silicon is admissible and consequently a great part of the reducing mixture would be constituted of ferro-silicon. The reduction of tungsten from tungstic acid, however, would be obtained by means of a mixture of calcium carbide and a little ferrosilicon under the action of exterior heat furnished by preference from an arc or resistance electric furnace.

Prospecting on City Lots

By C. L. Edholm*

A new oil derrick erected in the fashionable Wilshire Boulevard residential district of Los Angeles recalls stories we all have read about claim-jumpers in mining camps and the gun fights that followed their attempts to seize property. In this case, however, the courts will settle the claims of the disputants; on one side the owners of residential property in the best part of the city; on the other, a group of prospectors who have filed on the land in accordance with the United States mining laws and who are prospecting for oil.

The land was acquired from the Southern Pacific railroad and subdivided into lots upon some of which homes of the highest class were built. The residences in the background of the accompanying halftones are good examples of the type of houses in this part of the city. The quarter section was granted to the railroad company many years ago as agricultural land, mineral land being exempt under the provisions of the grant. The claimants therefore hold that the quarter section is Government land, open to entry for mining claims, provided mineral is found. They also state that sufficient oil has been discovered in the ground to justify them in asserting it to be mineral land. Oil fields are being exploited within a mile or so of the tract in question.

---

*4824 Figueroa St., Los Angeles, Calif.

Mining and Metallurgical Patents

A Classified List of New Inventions

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by The Engineering and Mining Journal upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COPPER

EXTRACTION — Improvements Relating to the Extraction of Copper from Ore Containing that Metal. W. E. Evans, Berlin, Germany. (Brit. No. 100 of 1911.)

LEACHING—Method of Extracting Copper from Calcined Ore or Slags. Antony Gadomsky, Tiflis, Russia. (U. S. No. 1,014,868; Jan. 16, 1912.)

GOLD AND SILVER

AMALGAMATOR RIFFLE. Robert L. Royse, Martinsville, Ind. (U. S. No. 1,013,066; Dec. 26, 1911.)

AMALGAMATING SYSTEM. Levi J. Kendrick and Jesse G. Tunnicliffe, Berkeley, Calif. (U. S. No. 1,013,496; Jan. 2, 1912.)

CYANIDING—Apparatus for Recovering Gold and Silver by Use of Cyanide Solutions. William L. Imlay, Philadelphia, Penn. (U. S. No. 1,014,224; Jan. 9, 1912.)

DRY CONCENTRATOR. Clarence W. Edgar, Los Angeles, Calif. (U. S. No. 1,016,680; Feb. 6, 1912.)

FILTERING APPARATUS. David J. Kelly, Salt Lake City, Utah. (U. S. No. 1 015,961; Jan. 30, 1912.)

STAMP MILL. Edmund Sheffield, Jr., Greenview, Calif. (U. S. No. 1,015,910; Jan. 30, 1912.)

STAMP SHOE. Charles L. Lawton, Hancock, Mich. (U. S. No. 1,012,664; Dec. 26, 1911.)

IRON AND STEEL

CONVERTER. Alexander Tropenas, Montelimar, France, assignor to Tropenas Converter Co., New York, N. Y. (U. S. No. 1,013,702; Jan. 2, 1912.)

CRUCIBLE FURNACES — Hoist for Crucible Furnaces. Louis Hubert John De Bats, Zelienople, Penn., assignor of one-fourth to Alfred G. Zehner, one-fourth to F. Edwin Zehner, and one-fourth to Jacob C. [illegible] lleman, Zelienople, Penn. (U. S. No. 1,013,377; Jan. 2, 1912.)

MANUFACTURE OF STEEL. William R. Walker, New York, N. Y. (U. S. No. 1,014,425; Jan. 9, 1912.)

LEAD, ZINC AND OTHER METALS

ALUMINA—Process of Producing Alumina. Edward D. Kendall, Elizabeth, N. J., assignor of one-third to E. N. Dickerson, Stovall, N. C. (U. S. No. 1,013,022; Dec. 26, 1911.)

ALUMINUM—Process of Electroplating Aluminum and Its Alloys. Ernst Becker and Otto Becker, Iserlohn, Germany. (U. S. No. 1,014,5[illegible]9; Jan. 9, 1912.)

LEAD—Apparatus for Separating Dross from Molten Lead. John O. Bardill, Herculaneum, Mo. (U. S. No. 1,013,635; Jan. 2, 1912.)

VANADIUM—Process of Producing Copper, Lead or Iron Vanadate from Vanadiferous Ores. Warren F. Bleecker, Boulder, Colo., assignor, by mesne assignments, to Rare Metals Mining & Milling Co. (U. S. No. 1,015,469; Jan. 23, 1912.)

ZINC—Metallurgy of Zinc. Frank Laurent Clerc, Boulder, Colo. (U. S. No. 1,012,816; Dec. 26, 1911.)

ZINC—Process of Producing Pure Zinc Sulphide and Thiosulphates. Pierre Pipereaut and Antony Vila, Paris, France. (U. S. No. 1,013,511; Jan. 2, 1912.)

ZINC-LEAD ORES—Metallurgy of Metal Sulphides. E. A. Ashcroft, Sogn, Norway. (U. S. No. 1,001,900; Dec. 19, 1911.)

NONMETALLIC MINERALS

ASPHALT—Method of and Apparatus for Treating Asphalt Oils for the Production of Asphalt and the Recovery of Lighter Products. Franklin H. Dunham, Santa Paula, Calif. (U. S. No. 1,013,283; Jan. 2, 1912.)

PHOSPHATES—Treatment of Phosphates. Nathaniel P. Pratt, Atlanta, Ga., assignor to Pratt Process Co., Atlanta, Ga. (U. S. Nos. 1,014,254 and 1,014,255; Jan. 9, 1912.)

PYRITES BRIQUET AND PROCESS of Making Same. Jacob S. Robeson, Camden, N. J. (U. S. No. 1,013,614; Jan. 2, 1912.)

MINING—GENERAL

BLASTING DEVICE. Louis E. M. Harris and Thomas S. Harris, Westernport, Md. (U. S. No. 1,015,021; Jan. 16, 1912.)

BREATHING APPLIANCE. Henry Albert Fleuss, Thatcham, and Robert Henry Davis, London, England. (U. S. No. 1,013,541; Jan. 2, 1912.)

DIAMOND DRILLING—Safety Device for Diamond-Drill-Rod Couplings. Victor Soderstrom, Virginia, Minn. (U. S. No. 1,016,106; Jan. 30, 1912.)

DRILL—Hammer Drill. William Prellwitz, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,015,509; Jan. 23, 1912.)

DRILL—Rock Drill. Robert W. Kreis, Jennings, Mo. (U. S. No. 1,012,656; Dec. 26, 1911.)

DRILL-SHARPENING MACHINE. James W. Coyle, Carterville, Mo., assignor of one-half to W. A. Cristy, Joplin, Mo. (U. S. No. 1,016,551; Feb. 6, 1912.)

DRILLS—An Improved Bushing Extractor for Rock Drills and the Like. Chris. Jensen, Nelson, B. C., Canada. (Brit. No. 4601 of 1911.)

DRILLS—Engine for Rock Drills. Benjamin Hastings, Barberton, Ohio. (U. S. No. 1,015,798; Jan. 30, 1912.)

DRILLS—Improvements in and Relating to Coal and Rock Drills. Pryce Davies, Hengoes, South Wales, Eng. (Brit. No. 19,620 of 1911.)

DRILLS—Improvements in Rock Drills. Ingersoll-Rand Co. New York. (Brit. No. 17,415 of 1911.)

DRILLS—Improvements Relating to Rock Drills. G. H. Rayner, Abbeydale, Eng. (Brit. No. 231 of 1911.)

HOISTING—Mine-Carriage and Elevator Automatic Safety Brake. Gerrit Von Daam, Scranton, Penn. (U. S. No. 1,016,114; Jan. 30, 1912.)

LAMP—Hydrocarbon Miner's Lamp. Jules Goulet, Brussels, Belgium. (U. S. No. 1,013,765; Jan. 2, 1912.)

MINE CAR. James M. Cook, Westmont Borough, Penn. (U. S. No. 1,012,817; Dec. 26, 1911.)

MINE-CAR WHEEL. John S. Skelly, Monongahela, Penn. (U. S. No. 1,015,351; Jan. 23, 1912.)

MINE-DOOR OPERATOR. Pliny Mace, Irwin, Penn. (U. S. No. 1,014,886; Jan. 16, 1912.)

PUMPS—Automatic Valve for Mine Pumps. William F. Maddox, Linton, Ind. (U. S. No. 1,016,573; Feb. 6, 1912.)

SHAFTS—Method of Sinking, Lining and Cementing Shafts. Paul Albert Legrand, Brussels, Belgium. (U. S. No. 1,014,656; Jan. 16, 1912.)

ORE DRESSING—GENERAL

CLASSIFIERS—Improvements in Ore Classifiers. Compagnie d'Entreprises de Lavage de Minerais, Paris, France. (Brit. No. 18,453 of 1911.)

CONCENTRATING TABLE. William L. Muender, Montford, Wis. (U. S. No. 1,015,823; Jan. 30, 1912.)

CONCENTRATION—Ore-Concentrating Machine. Orrin H. King, Chicago, Ill., assignor to United States Concentrating Co. (U. S. No. 1,014,327; Jan. 16, 1912.)

CONCENTRATION AND CLASSIFICATION—Apparatus for the Wet Dressing of Sulphide Ores. Benjamin Sedgely Smith, Manly, near Sydney, N. S. W., Australia. (U. S. No. 1,014,977; Jan. 16, 1912.)

CONCENTRATOR—Ore Concentrator. Ira F. Monell, Boulder, Colo. (U. S. No. 1,013,205; Jan. 2, 1912.)

CONCENTRATORS—Improvements in Ore Concentrators. Behrend Concentrators Co., New York, N. Y. (Brit. No. 1829 of 1911.)

CRUSHER. Thomas Leggett Sturtevant, Quincy, and Thomas Joseph Sturtevant, Wellesley, Mass., assignors to Sturtevant Mill Co. (U. S. No. 1,013,459; Jan. 2, 1912.)

CRUSHER PLATE. Ferdinand Mora Canda, New York, N. Y., assignor to Chrome Steel Works, Chrome, N. J. (U. S. No. 1,015,871; Jan. 30, 1912.)

CRUSHING MACHINE. Edgar B. Symons, Milwaukee, Wis. (U. S. No. 1,013,626; Jan. 2, 1912.)

QUARTZ MILL. Samuel S. Jennison, Cleveland, Ohio, assignor to Denver Quartz Mill & Crusher Co., Denver, Colo. (U. S. No. 1,014,305; Jan. 9, 1912.)

SEPARATION—Liquid Ore Separation. Francis I. du Pont, Wilmington, Del. (U. S. No. 1,014,624; Jan. 9, 1912.)

METALLURGY—GENERAL

ARSENATE OF LEAD—Method of Manufacturing Arsenate of Lead. Edwin O. Barstow, Midland, Mich., assignor to Dow Chemical Co., Midland, Mich. (U. S. No. 1,014,742; Jan. 16, 1912.)

BRICK FOR METALLURGIC FURNACES. William N. McKnight and Robert H. Youngman, Pittsburg, Penn., assignors to Harbison-Walker Refractories Co., Pittsburg, Penn. (U. S. No. 1,016,350; Feb. 6, 1912.)

CHARGING FURNACES — Apparatus for Charging Furnaces. David Baker, Philadelphia, Penn. (U. S. No. 1,016,539; Feb. 6, 1912.)

ELECTRIC FURNACE. Francois Louvrier, Mexico, Mexico. (U. S. No. 1,013,189, Jan. 2, 1912.)

ELECTRIC FURNACES — Improvements in Electric Metallurgical Furnaces. Victor Stobie, Sheffield, Eng. (Brit. No. 674 of 1911.)

FURNACE JACKET. Charles A. Fischer, Chicago, Ill., assignor to Allis-Chalmers Co., Milwaukee, Wis. (U. S. No. 1,012,831; Dec. 26, 1911.)

FURNACES—Improvements in or Relating to Furnaces for Smelting Metals or the Like. F. W. Winner, Wiesbaden, Germany. (Brit. No. 10,939 of 1911.)

MELTING FURNACE. Willis W. Case, Denver, Colo.; Nettie J. Case, administratrix of said Willis W. Case, deceased. (U. S. No. 1,013,838; Jan. 2, 1912.)

METALLURGICAL FURNACE. John R. Moffit, Denver, Colo.; Eugenia A. Moffitt, Denver, Colo., administratrix of said John R. Moffitt, deceased. (U. S. No. 1,014,971; Jan. 16, 1912.)

REDUCTION—Process for the Reduction of Ores. William Koehler, Cleveland, Ohio. (U. S. No. 1,013,498; Jan. 2, 1912.)

RETORT FURNACES—Mixing the Heating Gases and Combustion Air in Retort Furnaces and the Like. Ofenbau-Gesellschaft m. b. H., Munich, Germany. (Brit. No. 15,287 of 1911.)

ROASTING FURNACES — Improvements in or Relating to Mechanical Roasting Furnaces. K. J. Beskow and A. Ranen, Helsingborg, Sweden. (Brit. No. 12,214 of 1911.)

SMELTING FURNACE, with Electric Refining Hearths Connected Thereto. Alois Helfenstein, Vienna, Austria-Hungary. (U. S. No. 1, 015,439; Jan. 23, 1912.)

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Herbert C. Enos has returned to the city of Mexico, after examining mines in Guerrero.

W. L. Saunders, president of the Ingersoll-Rand company, has returned from a trip around the world.

Rensselaer H. Toll, of Denver, is at Mineral Hill, Nev., completing the Mineral Hill Consolidated mill.

J. H. Hodgson, mining engineer of London, Eng., is making an inspection of the Porcupine region in Ontario.

C. W. Botsford, mining engineer for a New York corporation, is looking over the Magdalena district in New Mexico.

W. E. Corey has been elected a director of the International Smelting & Refining Co., in place of Adolph Lewisohn, retired.

Information is sought of Charles Henley, a mining engineer, whose last known address—about five years ago—was Hillside, Arizona.

D. C. Jackling, of Salt Lake City, has been chosen a director of the Butte & Superior Copper Co. in place of J. B. Becher, retired.

Carl A. Allen, assistant professor of mining at the Colorado School of Mines, spent a few days in the Trinidad, Colo., coalfields recently.

George W. Schneider, professor of mining at the Colorado School of Mines, recently examined mining properties near Washington, D. C., in Maryland.

A. Jarman, recently professor in University College, Auckland, N. Z., has been appointed assistant general manager of the Waihi Grand Junction mine at Waihi, New Zealand.

John W. Skeele, for some years past vice-president of the Lehigh Valley Co., has been chosen president of the new Lehigh Valley Coal Sales Co. George N. Wilson is vice-president.

C. W. Saxman, formerly mechanical engineer of the Latrobe-Connellsville Coke Co., has been elected general manager of the Copper Reef Consolidated Mining Co. at San Carlos, Arizona.

Ernst Sjöstedt, of Sault Ste. Marie, Canada, is making a three-months' trip in Europe, partly on business, partly on pleasure, and partly to study the present status of electric smelting in Europe.

H. Ives, who has been manager of the Platteville, Wis., office of the Galena Iron Works, has resigned to accept a position as general purchasing agent for the American Zinc & Lead Co., with office at St. Louis.

J. S. Dennis, of Calgary, Alta., has been appointed head of the new Department of National Resources of the Canadian Pacific Ry., which includes the charge of the company's coal mines and coal lands in western Canada.

J. C. Maben, Sr., president of the Sloss-Sheffield Steel & Iron Co., after spending several weeks in Birmingham, Ala., in the general offices of the company, has returned to New York, where he has taken up his residence.

James Bowron has been elected president of the Southern Iron & Steel Co. He has been vice-president and general manager of the company for several months. He was at one time treasurer of the Tennessee Coal, Iron & R.R. Co., and has been connected with coal and other corporations in the Birmingham district.

W. H. Cunningham, general manager, and C. R. Conner, manager of mines of the West Kentucky Coal Co., Sturgis, Ky., resigned Feb. 1, and have formed a copartnership as consulting and contracting engineers, with offices in the Robeson-Prichard Building, Huntington, W. Va., and the Blackstone Building, Ashland, Kentucky.

OBITUARY

Amasa B. Campbell died at Spokane, Wash., Feb. 17, aged 67 years. He was well known as a mine owner and operator in Washington, Idaho and British Columbia.

Oliver Hart, engineer, fell to the bottom of the shaft of the Last Chance mine in the Nashville district near Eldorado, Calif., on Jan. 31. His body was recovered later, after the water had been pumped from the shaft.

Solomon Brisacher died at Salt Lake City, Utah, Feb. 11, aged 75 years. He was born in Germany, but came to this country when a child. He settled in Utah in 1885, and engaged in business there. Later he became owner of mining properties in Utah and Nevada and was considered wealthy until five years ago, when he lost heavily in Goldfield and other Nevada mines.

Llewellyn W. Johns, formerly general mining superintendent of the DeBardeleben Coal, Iron & Railroad Co., died Feb. 4, at his home at Birmingham, Ala., aged 67 years. He was born in Wales, in 1844, came to this country as a mining engineer and became associated with the Pratt Coal & Coke Co. He later went to the DeBardeleben Co., until the Tennessee Coal, Iron & Railroad Co. absorbed it.

Francis H. Stillman died at his home in Brooklyn, N. Y., Feb. 17, aged 62 years. He was born in New York and graduated from Yale University. He engaged in the manufacture of machinery and aided in building up the successful business of the Watson-Stillman Co., manufacturer of hydraulic machinery, of which he was president. He had been a director of the National Association of Manufacturers and president of the National Metal Trades Association.

Jerome A. Snedaker died at Denver, Colo., Feb. 10, aged 54 years. He had just returned from a business trip to Duluth. Mr. Snedaker went to Colorado in 1881 and settled at Aspen, where he remained for several years. Having made considerable money in the Aspen district, Mr. Snedaker went to Denver and began to practice as a mining engineer. He was associated with A. E. Reynolds for several years. During his life in Colorado, Mr. Snedaker became wealthy. He leaves a widow and one son, who is a student in the Colorado School of Mines.

Societies and Technical Schools

American Mining Congress—The Southwestern Land and Zinc Chapter of the Mining Congress has been organized at oplin, Mo., with 100 members. Col. H. H. Gregg is president.

International Congress for Industrial Hygiene and the Prevention of Accidents—The members of the American honorary committee of this congress, to be held at Milan, Italy, in May next, are: James McCrea, E. A. S. Clarke, George B. Cortelyou, Philip T. Dodge, S. C. Dunham, Elbert H. Gary, John Hays Hammond, A. Barton Hepburn, Seth Low, Charles Nagel and James Speyer. On the national committee, 38 representatives of various industries and other interests will serve.

International Congress of Applied Chemistry—The officers and committee in charge of arrangement for the eighth meeting, which will be held in New York and Washington in September next, have prepared a pamphlet for distribution among prospective authors of contributions to the congress. This contains rules and suggestions to be followed in writing the papers to be presented. Bernhard C. Hesse, 25 Broad St., New York, is secretary of the congress.

Colorado School of Mines—The sum of $12,500 was recently turned over to the authorities of the School of Mines for the equipment of the new ore testing plant. The building for the plant was built a year ago and $50,000 was allowed by the legislature for the necessary machinery; one-fourth of this is what is now available. Many donations of machinery have been made by various manufacturers and it will now be possible to equip, ready for operation, the concentration section of the plant. Prof. W. G. Haldane will be in direct charge of the work.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Feb. 14—The present active quartz mining in the three chief counties of the Mother Lode region includes the operation of 20 stamp mills dropping an aggregate of 900 stamps; the installation of new stamp mills, cyanide mills, hoisting machinery, and a large amount of repair and development work in the reopening of the old mines and prospecting new claims. There are a few mills idle temporarily, pending repairs or the installation of additional machinery. Notwithstanding the rather long period of dry weather there is no disposition to anticipate a shortage of water, but rather an inclination to depend upon the prospect of an average precipitation.

There is a spirit of progressive development and operation at Tuolumne, Sonora, Jacksonville, Jamestown, Angels, Campo Seco, Jackson, Sutter Creek, Amador City and Plymouth. A similar movement in new work obtains in Mariposa County, at the south end, and Eldorado County, at the north end of the Mother Lode. No recent season has been more active in any of the mining towns and districts either in the number of stamps dropping or in new installations. The noteworthy installations in progress are in Tuolumne and Amador Counties. The Black Oak, near the town of Tuolumne, is installing a new 75-ton all-slimes cyanide mill; the Dutch, near Jamestown, is adding 20 new stamps to the present 20-stamp mill; both of these plants will be in operation in April. The new hoist at the Plymouth Consolidated in the north of Amador County, is about completed, and the unwatering of the mine should be in progress soon. A new 20-stamp mill is being built at the Poundstone, near Sutter Creek; this mill is manufactured by the same local establishment at Altaville, that built the Plymouth hoist. The South Jackson Mining Co. is preparing for the erection of an electric hoist, with a capacity of 2000 ft., to be employed in the development of a new mine at Jackson. In Calaveras County the most recent new installation was the addition of 10 new stamps to the 30-stamp mill at the North Star mine, at Angels. Another recent installation at Angels that is of interest is the placing of a new Pacific concentrator in the Stickels mill by the Utica company; this is now being given a practical test of efficiency and economy. Various economies in appliances and in construction of treatment plants are being tried out and many improvements in methods have been adopted in the present season. There is, in fact, an evidence of progress in almost every department of mine operation on the Mother Lode, and the strongest indications of permanency of quartz-mining advancement.

Denver

Feb. 16—Resuscitation of the old mining camp of Creede, a few mines of which are credited with a production of $12,000,000, is assuming concrete form. These mines are the Creede United, Amethyst and the Last Chance, the owners of which have granted a 20-years' lease to a new corporation known as the Creede Triune Mines Co. of which John H. Berkshire, president of the National Bank of the Republic, Kansas City, Mo., is the head; John Evans, chief engineer of the Denver Tramway Co., is vice-president and Judge J. E. McFadden of Kansas City, Mo., secretary. The plan of development is to go below the present level, known as the Nelson tunnel level, on the Amethyst, and to follow the known oreshoots downward, with an initial expenditure of $200,000 in this exploitation work. W. F. De Camp, once superintendent of the Portland mine, Cripple Creek, is in charge of the work, and he will sink a 2-compartment shaft from Amethyst ground.

In *Bull.* 512, by Whitman Cross and A. R. Schultz, of the U. S. Geological Survey is a description of about 20 lava caps or mesas in the Leucite Hills in the Rock Springs coal-mining district of Wyoming, with estimates of the potash contents in the rock in sight, based on analyses which show an average of 10%, and total nearly 200,000,000 tons of potash. But the bulletin states: "Several reduction processes for extracting potash from igneous rock have been patented, but thus far none has proved commercially successful. The extraction of all the potash from these refractory silicates involves many difficulties, and not only has no process yet been perfected, but in the opinion of many industrial chemists no promising process has even been suggested that can be successfully applied on a commercial scale." The American Potash Co. of which Theodore F. Van Wagenen, mining engineer of Denver, is president and general manager, owns property in this district and claims to have developed a process that has worked satisfactorily in the laboratory. The company will proceed to erect a test plant on the ground and experiment on a working scale to ascertain whether the potash and alumina can be extracted and marketed at a profit such as the laboratory tests indicated.

Butte

Feb. 14—Although there has as yet been no radical reduction in the cost of producing copper as a result of the substitution of compressed air for steam as power by the Anaconda company, owing to the fact that only four or five mines are being operated in this manner, still from a cost of 11c. per lb., at which cost the metal was mined only a few years ago, a reduction to a point under 9.5c. per lb. has already been made, and this in the face of the fact that the mines have been steadily growing deeper, meaning greater expense. The reduction is the result of many economies in both mining and smelting operations.

The survey of the route of the new extension of the Butte, Anaconda & Pacific R.R., into the Georgetown district, has been completed, and it is expected that grading will be commenced by Mar. 1 and that the road will be completed by early autumn. Several bids for the contract work have been received, and they will all be in within a few days. The new extension will have a length of about 22 miles, consisting of 16 miles of main line beyond the present end of the line, and approximately six miles of sidetracks. The road will follow Warm Springs Creek to a point near the 8-mile house, where heavy country causes a detour of 1.5 miles to be made before returning to the valley which it will follow to Silver Lake and which body of water it will skirt on the north shore as the wagon road does. It will then follow the foothills, passing a short distance from the Gold Coin mine, and will terminate at the Southern Cross mine in the Georgetown district. The entire grade will be slightly under 2 per cent.

Salt Lake City

Feb. 15—The Knight Power Co. and the Utah County Light & Power Co. have consolidated under the name of the Knight Consolidated Power Co. The company has nine plants in this state: Two in Mill Creek Cañon; two in American Fork Cañon; one in the town of American Fork; one in Alpine Cañon; one in Santaquin; one on the Provo River, and one on Snake Creek. More plants will be constructed throughout Utah, as occasion arises. The capitalization is $2,000,000. Jesse Knight is president and A. P. Merrill is general manager.

An unusual accident happened on Feb. 15 at Bingham, Utah, though our readers who are acquainted with the precipitous slopes of Bingham Cañon will appreciate the circumstances. Several men were killed and injured when a locomotive hauling an ore train left the Rio Grande track, rolled down a hill, and crashed through the roof of the Bingham State Bank.

The work done on the Utah Metal Mining Co.'s tunnel, which is being driven to connect the Bingham and Tooele sides of the Oquirrh Mountains, amounts to 7500 ft., and according to the annual report just issued, it is expected that the 4000 ft. remaining will be completed by August. Since December, when new drills were installed at both ends, the work has been progressing at the rate of 20 ft. per day, 10 ft. being made from each end. The cost per foot is exceptionally low. The work is approaching ground where mineral is expected. In the Bingham end there is a firm, hard porphyry with a little copper staining in the seams. On the Tooele side, it is expected that the Jordan and Commercial limestone beds, which outcrop 2000 to 2500 ft. above the point where the tunnel begins, will be cut less than 8000 ft. from the portal. All the work on the Tooele side has been done by hydro-electric power generated from water sources owned by the company. These streams, which have been greatly developed during the year, are a valuable asset.

Houghton, Mich.

Feb. 16—As the price for copper metal continues to hold above 14c. per lb., the general feeling in the Lake district assumes a more optimistic tone. Exploration work continues in the horizon of the Lake and Baltic lodes, both north and south of Portage Lake. Recent disclosures by drilling have brought the Mayflower property into particular prominence and together with underground developments at the St. Louis exploration and the New Baltic property have attracted attention to the possibilities of that horizon lying near the Eastern sandstone and north of Portage Lake. Until this work was started, this section had been neglected for many years. It bids fair now to be the scene of considerable future exploratory operations. Recent reports state that the Calumet & Hecla company have offered $15 per share for the minority stock of the St. Louis Copper Co., the company reserving the right to refuse or take all or any part of the stock to be offered on or before Apr. 15, if less than 2500 shares are offered. Of the 40,000 shares of this company, the Calumet & Hecla now owns 35,500 shares.

According to reports, the old Osceola property may again occupy a prominent position as a bone of contention between the present management, which is the Calumet & Hecla company, and the minority stockholders, represented by the old Osceola Protective Committee, which has been inactive for some time. One of the questions to be asked of the management includes the reason for continuing the shutdown of the property with copper metal selling for 14c. per lb. or more.

Negaunee, Mich.

Feb. 16—The two concrete shafts sunk by the Foundation Co. on Sec. 35 near Rice Lake, in the Gwinn district, have been completed to bedrock and sinking in rock is in progress. The overburden was about 90 ft. thick and compressed air was used, with the caisson method. The water level was but a few feet below surface; clam-shell dredging was possible for several months until compressed air became necessary from Nov. 1 to Dec. 30. The same air compressor was used for both shafts, the caisson work being finished at one shaft before starting the other. The shafts are circular in outside cross-section, and rectangular inside. The shafts have been named the Mackinaw and the Gardner. It is the policy of the Cleveland-Cliffs Iron Co., for whom the work was done, to sink two shafts at a property for improved ventilation and to afford a means of escape in case of accident.

Porcupine

Feb. 16—The South Porcupine board of trade is making preparations for a celebration to signalize the starting of the Dome mill, which is set for Mar. 23. It is expected that the Dome directors will be here, and many other well known mining men have been invited. Every effort will be made to make memorable the date for the starting of the era of production in Porcupine. Business in the district continues to be stagnant, and there does not seem to be any immediate indication of its becoming better. Few new companies are being formed, and there is practically no possibility of raising money from the public for the development of new properties. The only things that do not seem to suffer are the prices asked for claims. These remain as high as ever.

Chihuahua

Feb. 11—The revolutionary disturbances are working hardships on the mining industry throughout the state, but foreigners have not suffered either personal or property damage. The same regard is being shown for foreigners as during the revolution of last year. Owing to the suspension of service on the Mexico Northwestern Ry., a number of properties closed down, principally in the Cusihuiriachic camp, while operations have been greatly curtailed by large companies owing to inability of marketing their products and of getting in supplies. Service, however, is being resumed, with little fear of further interruption. Regular train service between here and El Paso has been maintained for over a week, and service south is anticipated within two weeks and perhaps sooner depending on the time and labor required for repairing the track and bridges.

The local smeltery has operated regularly at normal capacity, and as the plant has plenty of ore on hand and is receiving a regular supply from the Santa Eulalia camp, in addition to having an abundance of coke, there is no probability of a shutdown. The fuel supply has also been well arranged for and several trainloads of coke are to be shipped from El Paso soon. This secondary disturbance comes at a most inopportune time, considering the fact that with the recent visit of the New York and Mexico officials of the company, an appropriation of about $250,000 was made for betterments including two new furnaces, machinery and dwelling houses. The foundations and pits for these furnaces are already completed and the steel work is *en route* from the factories. It is not believed that any delay will be occasioned by the trouble, however.

The situation locally is not regarded as serious inasmuch as the Maderista authorities have things well in hand now. The wives and families of many Americans have left for the states, but the majority of the men are staying in expectation of an early adjustment of affairs. It is apparent that neither the workingmen nor the majority of the former Maderista soldiers are in any way sympathetic with the cause, whatever the latter may be. The workmen have shown this by the starting of a widespread movement for the organization of citizens' protective bodies, similar to the American vigilance committees, for the better protection of themselves from bodily and property harm and incidentally for the affording to foreigners of guarantees which the local government might or might not be able to give, if serious trouble should arise. The former Maderista soldiers, and particularly those who after the close of the former revolution returned to their ranches and ordinary vocations, have shown this by volunteering their services to the Maderista leader Gen. Pascual Orozco, who is showing himself to be the man of the hour as well as the same popular idol of the people. The miners particularly are on record as opposed to further trouble, stating that they want to work uninterruptedly, and not to renew their experiences of idleness and hunger of last year's revolutionary times. These are matters which taken collectively have tended to minimize the seriousness of the trouble among thinking foreigners.

The Mining News

The Current History of Mining

Alaska

Bonanza—This copper mine has paid to shareholders an initial disbursement of $1,000,000, the declaration having been made possible by the opening of the recently completed railroad. This dividend is the first disbursement of any consequence to be declared by an Alaskan copper mining company. The increasing price of the metal means renewed activity in the copper fields of that section, and several companies which have been idle are getting ready to ship copper now. In April, 1911, the Bonanza began to ship and it continues to be the heaviest shipper of copper in Alaska. During recent months it has shipped 16,000 tons of ore averaging about 70 per cent. copper, or about $3,500,000 worth of metal.

Arizona

Gila County

Southwestern Miami—At the annual meeting of the stockholders held in Globe, Feb. 12, it was voted to increase the capitalization from 50,000 shares to 100,000 shares, par value $5. The increase of 50,000 shares was taken by William A. Paine, of the firm of Paine, Webber & Co., of Boston, Mass., and associates, at $4 per share for $2, paid-in stock, which, with the money received from the recent call of $1 per share on 35,000 shares will give over $200,000 for payments on the property and for its development. There are now issued and outstanding 15,000 shares of full-paid stock, and 85,000 shares of $2-paid stock upon which $3 per share can still be called, giving an additional $255,000 should it become necessary. It is proposed to purchase two additional churn drills, making three in all, and to continue the exploration of the property. It is estimated that the money now on hand will be sufficient to meet the payments on the property, purchase the additional equipment and operate the three churn drills for nearly two years, or until Jan. 1, 1914.

Barney—The churn-drill hole that is being drilled in the bottom of the 400-ft. shaft on this group, has passed out of the schist into dacite and is now over 800 ft. below the collar of the shaft. E. B. Tinker is superintendent.

Live Oak—The enlargement of No. 2 shaft from two to three compartments has been started. Jack McIvor has the contract for the work and has hired some of the best miners of the district. The shaft is 928 ft. deep and will be enlarged by raising from four or five points. It is expected that the work will be finished in about 2½ months. In the meantime a double-drum hoist and two 150-hp. boilers will be erected, and development of the orebody from this shaft will be resumed as soon as the shaft work is finished. Development is now in progress from No. 1 shaft near the eastern end of the property. M. E. McCarthy is superintendent.

Inspiration—Work is progressing on the water-supply dam for the concentrator and tests are still being conducted by J. M. Callow in the experimental mill. A trestle is being built from the main tunnel to the site of the new warehouse.

Miami—The mine is producing at the rate of over 2500 tons per day from the 420-ft. level and development on the 570-ft. level continues. Five units of the concentrator are in operation. In place of the rigid rolls, a Hardinge ball mill is being tried out in one unit and a set of spring rolls in another.

Yavapai County

United Verde—At the annual meeting held recently, it was disclosed that the company's investments at the end of 1911 were valued at $1,666,394, unchanged from the previous year. During 1911, production amounted to 33,167,987 lb. copper, 461,145 oz. silver and 15,239 oz. gold. Gross proceeds were: Copper, $4,174,478; silver, $246,665; gold, $315,691; total, $4,736,834. Regarding the new smeltery, Vice-President MacDonald stated that a portion of it had been ordered, and that the company will be able to finance the construction, possibly through borrowing money. No details regarding capacity of the new plant could be obtained.

California

Amador County

Bunker Hill—It will require further time to complete the repair of the working shaft which was caved on Feb. 7 by the falling of a skip, the latter causing the imprisonment of the day shift men for 24 hr. The report circulated that the timbers in the shaft were rotted, is untrue; they have been in place only about a year and a half. The 40-stamp mill was kept running on a surplus supply of ore. Work on the exit and drain tunnel is also in progress. E. Hampton is superintendent.

Keystone—The owners of this and the Wildman-Mahoney mines have brought suit against the California Consolidated Co. to quiet title. The representative of the defendant has vacated the Keystone under instruction of the sheriff. The property is being developed under the direction of C. R. Downs, superintendent.

Eureka—The recent visit to Sutter Creek and inspection of this mine by Col. Edward H. Green, of New York, is taken to mean that the property is to be reopened. It has been idle for the last 26 years but was formerly a producer. The South Eureka, about 800 ft. distant, is one of the large dividend payers of the district, with 80 stamps dropping, and the Central Eureka is also a pay producer, with a 40-stamp mill. There is no apparent reason for the continued idleness of the Eureka.

Butte County

Blue Hog—John Lopizich, of Los Angeles is reported to have inspected this mine recently. The property was purchased a short time ago by the Feather River Land & Mining Co., of which Mr. Lopozich is a director.

Morris Ravine—The largest nugget uncovered in Butte County for a number of years was taken from this mine on Jan. 27. It is 5 in. long, 3 in. wide, and weighs 27 oz. Richard Phillips is owner.

Kern County

Midway Gas Co.—Application has been made to the supervisors of Kern County for a franchise for a gas pipe line from the Buena Vista hills through the county. This is a part of the system for which a franchise has been sought in Los Angeles County. The application is made by A. C. Balch, secretary of the Pacific Light & Power Co. An offer is made to pay the county 2% of the gross receipts after the first five years of operation. Three pipe lines are contemplated.

Arondo—The working force is being increased at this mine at Randsburg and it is reported that more milling machinery will be added soon.

Cashier—This company at Harrisburg is said to be considering the erection of a new mill this summer.

Mariposa County

Crown Lead—The stamp mill is being overhauled and a large number of men are idle.

Nevada County

Champion—Self-dumping ore skips have been installed at the Providence shaft. The skips dump into a large bin having three chutes. This installation provides rapid handling of ores from the lower levels.

Alaska—The new buildings have been completed at this mine at Pike and work under Robert Hathaway has started on the mill; 20 stamps will be added to the present 20 and the mill will be moved nearer the hoist.

Shasta County

Victor Power & Mining—It is reported that this company has consolidated with the Grand Central Gold Mining Co., and that it also has an option of purchase on the Midas mine. The Victor has a 20-ton mill and the Grand Central owns 10 claims the main veins of which can be economically worked from the 500-ft. level in the Victor ground. The Midas is an old mine and a large producer. It was recently said to be nearing the end of its large production, but since then new orebodies are reported to have been opened. A combination of the closely related mines in Harrison Gulch would be a step toward economic and modern mining.

Sierra County

Jensen—Rich free-milling quartz has been found in this property at Downieville, while extending the main tunnel.

Davis—At these placer diggings, four miles north of Downieville, coarse gold has been recently uncovered.

Telegraph—At this gravel mine, near Downieville, the veins of quartz recently cut are to be developed soon; machine drills are now being installed.

Four Hills—A cyanide expert has been employed for some time at this mine, near Downieville, with the result that a plant will be installed as soon as equipment can be brought in.

Emerald—At this group, in Jim Crow Cañon, the arrastra, recently installed, has begun grinding $20 ore, developed during the last year by the owners, Smith & Shippsy, of Downieville.

Dodson—Gravel carrying coarse gold continues to be found by James F. Hunt in the tunnel being driven here. A power hoist and pump are to be installed to drain the mine.

Siskiyou County

McKinley—This mill in the Humbug district will soon start crushing ores mined in the several claims on this and other properties. J. P. C. Nash is owner.

Colorado

Cripple Creek District

Aileen—Lessee Grigsby, at this property, on Guyot Hill, is reported to have opened 3 ft. of smelting ore at a depth of 600 ft., from which he has shipped 10 cars in six weeks.

Prince Albert—This company, on Beacon Hill, has decided to lease its entire property to some responsible individual or corporation.

Tornado—P. Witenberg, lessee at this property, on Raven Hill, is said to be getting rich ore on the Walker vein and is producing a car per week, one of which, recently sent out, is expected to bring $1200.

American Eagles—This mine is stated to have produced 500 tons of high-grade ore in January, the richest shipment from the 1100 level being settled for at $257 per ton.

Six Points—Lessees Polly & Chilson recently sent out a shipment which they estimate will run 15 oz. gold per ton.

Gold King—A strike of 18 in. of sylvanite ore, assay samples of which give 26 oz. gold per ton, is reported by Victor Porter, lessee at this mine, in Poverty Gulch.

Ajax—The first cleanup at the Clancy process mill, at the Ajax mine, is being made, and Judge Colburn, president, has promised official figures as to the saving and the costs.

Gunnison County

The Gold Links mines, the Raymond property and the Carter, all adjoining one another on the now celebrated gold belt on Ohio Creek, about five miles above Ohio City, are working full forces, and as each has its own mill at the mouth of their long crosscut tunnels, they are turning out large amounts of bullion, concentrates and smelting ore. The general character of the ore is galena carrying gold, the general average of the value, outside of the smelting ore, being about $15 per ton, and the width about 4 ft. The smelting streak carries from 2 to 8 oz. gold and 7 to 10% lead. They are all supposed to be on the same vein or on two closely parallel veins in the granite and gneiss formation.

Lake County—Leadville

Lessees on the Bullion shaft, Stray Horse Gulch, the Bennett lease on the Farmers, the Silent Friend in South Evans Gulch, and No. 5 shaft on the La Plata, California Gulch, are all shipping ore.

Dinero—The vein has been driven on for 700 ft. in the tunnel from the point where intersected and shipments of good grade are going out steadily.

St. Louis—Work has been resumed on the St. Louis tunnel in Big Evans Gulch, and a new electric hoist is to be installed in the tunnel where a shaft will be sunk 450 feet.

Mt. Champion—In the tunnel of this company in Lackawanna Gulch, 6 ft. of gold-silver-lead ore have been opened.

Summit County

In the Breckenridge district, the operators of the dredges in the stream placers expect a heavy output of gold for the year, as all three of the dredges will be working in virgin ground of known richness. The Reliance dredge, which is equipped with steam heat, has been working all winter and dredging 30 ft. below the surface. The Reiling boat of the French Gulch Dredging Co. is being overhauled and refitted for the season's work, and so is Bucyrus No. 2 boat of the Colorado Gold Dredging Company.

Wellington Mines—This company, the largest producer in the district, has sunk its shaft to 825 ft., and is now drifting on 5 ft. of lead-zinc-iron ore. A new magnetic separator is being installed to handle the zinc middlings from the 100-ton concentration mill on the property.

Golden Beaver—A strike of rich auriferous copper pyrite ore is reported from this property, in the upper Blue River district; the vein is 2½ ft. wide. J. G. Detwiler is president of the company.

Idaho

Deer Creek Mining & Milling Co.—This company is contemplating the installation of machinery on its properties in the Deer Creek section of the Salmon River region, as soon as the roads are favorable for moving machinery.

Michigan

Copper

During the last few weeks a large amount of copper has been shipped by rail from the various smelteries. The shipments have been so consistent and of such size that the amount of available copper in storage at the various docks has been greatly reduced; upon the opening of navigation the amount of copper on hand will be less than it has been for a number of years.

Hancock—The shaft is down about 3320 ft. in a trap formation streaked with copper, which is believed to be the capping of the Pewabic lode. When this lode is reached, attention will be given to the opening of the ground preparatory to mining on a large scale. The shaft and equipment is of the best in the district, and is capable of handling a large tonnage. The company owns its stamp-mill site, but nothing further has been done along this line.

Oneco—The shaft on the property is down about 1100 ft. Stations have been established at intervals of 100 ft. all the way down, and in cutting the plat at the ninth level, some rich ground was exposed in the hanging wall of the lode. Developments at this property are being watched with interest, as are those at other properties lying in this horizon, particularly the St. Louis, Mayflower and New Baltic.

Isle Royale—Conditions at this property are in good shape, production is being gradually increased to the limit of the present stamping facilities, and, at the present price of copper metal, the company is more than meeting expenses. In all probability steps will be taken within a short time to increase the milling facilities, and it is rumored that the company will issue 5% bonds to meet these requirements.

Osceola—At a recent meeting in Detroit, attended by W. J. Uren, Charles Turner, W. C. Kauth and others it is reported that 15 questions were drafted and presented to the Calumet & Hecla management with the request that they be answered prior to the annual meeting of stockholders in March. These questions pertain principally to Osceola affairs and it is said that the so called Hyams interests will make a determined fight for control of this property.

St. Marys Mineral Land Co.—The report for the year ended Dec. 31, 1911, shows receipts of $798,896 made up as follows: Previous balance, $368,576; Champion Copper dividend, $250,000; notes collected, $156,400; pay for wood and timber, $12,046; ground rent, $2286; miscellaneous, $9587. Expenditures were: King Philip assessment, $83,905; Winona, $56,774; Hancock, $40,000; Ojibway, $2000; Franklin, $3142; Old Colony, $80; Houghton Copper, advanced, $17,500; dividends, $480,000; miscellaneous, $34,231; cash on hand, Dec. 31, $81,263. On Dec. 31, the real property of the company consisted of 93,246 acres besides mineral rights to 14,038 additional acres.

Iron

Jones & Laughlin—Diamond drilling is being carried on at the Mitchell mine, near Winthrop, the contract for which has been let to the Duluth Diamond Drill Company.

Oliver Iron Mining Co.—Following a visit of Pres. W. J. Olcott, the company's mines at Ishpeming will resume 6 days' work per week on day shift in place of the 4-day week which has been in force for nine months. About 400 men are affected; no night-shift mining has been done yet.

Cleveland-Cliffs Iron Co.—The protest against taxes paid for 1911 on mines in the Ishpeming-Negaunee district has expired, as no suit was filed in the 30 days following the protest.

Rolling Mill—The second shaft at this mine, in the Negaunee Basin, has been raised to surface from the 620-ft. level; the opening is 8x8 ft. and will be enlarged to 12x14 ft. Raising has been in progress for five months, with three miners on each 8-hr. shift, who trammed the rock 650 ft. to No. 1 shaft. The new shaft is west of shaft No. 1, which is 730 ft. deep. Hoisting machinery will be installed at shaft No. 2, and mine ventilation will be improved. About 140 men are employed at the mine. Capt. E. N. Corey is in charge of the underground work.

Hollister—A large pump has been installed in this mine of the M. A. Hanna company at Crystal Falls. The underground workings are extremely wet and the ore is dried in a mechanical dryer before being shipped.

Minnesota

A new mine may be opened this season on a 40-acre tract near the Adriatic mine at Aurora. It is reported that a shaft will be sunk, at a site near the Adriatic No. 2 stockpile.

Minnesota Steel Co.—This subsidiary of the U. S. Steel Corporation, at West Duluth has ordered 1554 tons of structural steel for iron-ore and limestone bins in its new plant.

Missouri

S. V. & D.—This mine near Carthage has been reopened and made a "turnin" recently.

Golden Glow—This mine at Webb City has installed a 700-ft. rope-haulage system.

Hill Top—A company has taken over this old mine at Oronogo and will drain the ground and erect a large mill. F. E. Weeks, of Joplin, is manager.

Great Western—This mine at Thoms Station will soon have its mill completed.

Short Creek Mining Co.—The company has taken a lease on the Connor land at Central City, has drained the ground and will move the Blue Grass mill to the land.

Continental—This company is preparing to install a gasoline locomotive for underground haulage at its mine in Prosperity.

Park—W. C. Thomas has made several good drill strikes on this land at Thoms Station.

Edmond Lyon—Three hundred tons of zinc concentrates have been sold by this company at Webb City, and 1500 tons are still in the bin.

Weaver—This company operating north of Carl Junction has sold 400 tons of ore.

West & Becker—This company has just completed the erection of a mill at its mine at Thoms Station.

Martin Peters—The erection of a mill is being commenced by this company on its lease at Thoms Station.

Montana

Butte District

Tuolumne—The new hoist was started recently and production will be increased.

Butte & Superior—Directors of the company have been in Butte on a trip of inspection of the property. Among those present were Capt. A. B. Wolvin, president; William White, J. F. Killorin, and John G. Williams, all of Duluth, and N. B. McKilvie, a New York director, in company with A. K. Furland, and Leo Furland of Paris, France. The visitors inspected the mine and the construction of the new mill, and made the trip to Basin to see the operations of the mill there. While in Butte they were the guests of the officials of the Anaconda company and were shown through the mines and the Washoe plant at Anaconda.

Broadwater County

The mining camp of Radersburg is steadily progressing and at present there are nearly 400 men on the payrolls there, with many properties being operated and new ones being opened. Although not definitely known, it now seems certain that construction will soon commence on a branch of the Chicago, Milwaukee & Puget Sound R.R. from Three Forks into the camp, as the intended route has been surveyed and mining operations there would seem to justify the building of the road. On the strength of this probability the camp is experiencing a small boom.

Carbon County

Ruby—This company was recently organized with a capital of 1,000,000 shares, $1 par, to operate a group of six claims 3.5 miles from Cooke City. In the past some development work has been done and gold, copper and rubies were discovered in the deposits. On one of the claims a tunnel has been driven 125 ft., and a crosscut driven to a good body of ore. Also a shaft was sunk 25 ft. on the vein and fair gold ore was found. A shaft has been sunk 32 ft. on another claim and a tunnel driven 50 ft., at which point sulphide ore was found in the face. The Mountain Rose claim is traversed by six veins, all of which, after a small amount of prospecting, were found to contain ore of varying grade. It is planned to develop the property thoroughly.

Lincoln County

Kalispell-Lincoln—The company has announced that a 5-stamp mill will be installed at the property in the West Fisher district this spring. Recent tests are reported to have been satisfactory.

Park County

Yellowstone Portland Cement Co.—This company, a $6,000,000 corporation, will soon begin installing the machinery in the first unit of the cement mill on the Yellowstone River near Gardiner, and it is expected that by June 1 the plant will be in readiness to manufacture the only white cement turned out in America, from the immense deposits of wonderfully pure limestone in that region. At a meeting of the company's directors, Feb. 7, officers were elected as follows: T. J. Walsh, of Helena, president; Frank Henry, of Livingston, vice-president; C. S. Hefferlin, of Livingston, treasurer; and A. H. France, secretary.

SILVER BOW COUNTY

Laurium-Montana—Work is progressing steadily at this property a few miles south of Butte. The main tunnel is in nearly 300 ft. and the vein matter has been improving recently. The quartz is highly mineralized and carries considerable pink manganese containing a good silver content and some gold. John E. Parthan, of Ely, Minn., a heavy stockholder and manager of the company, has just inspected the property.

Nevada

COMSTOCK LODE

Ophir—The west crosscut from the south drift on the 2100-ft. level has cut a seam of quartz in a strong formation and this is being developed. The assays from this latest prospect are low to date. The quartz closely adjoins old stopes that yielded thousands of dollars in the early days. The recovery last week, from the 2100- and 2200-ft. levels was $12,065.

Mexican—The mill resumed operations last week after a shutdown for a cleanup and for the installation of a new classifier; 398 tons of ore were treated. The average value of the heads was $17.95 per ton and the gross value of the ore treated was $7144. The capacity and grade of the heads are now being gradually increased, and an effort made to bring the plant up to specifications. Sampling the stopes in the mine, preparatory to ore extraction, has now been completed.

Cosmopolitan—Three shifts of men have been placed at work in the mine, and regular ore shipments are being maintained to the Fischer mill.

Comstock-Quartz—Arrangements have been completed for the reopening of this property. New and uptodate hoisting and mining equipment will be installed as soon as possible.

Crown Point—Ore shipments last week included 884 tons to the Yellow Jacket mill. The latter plant has been operating steadily on Crown Point ore since Jan. 25. A railroad car of concentrates was shipped to the smeltery last week.

Belcher—North drift No. 2 on the 1400-ft. level is being extended along the course of a promising vein, from which several cars of low-grade ore have already been saved. It is believed that the mine will soon become a regular producer.

Combination—Preliminary work has been started with the idea in view of again placing this shaft in commission. Lumber has been ordered to brattice two compartments down to the present water level. The shaft was one of the largest on the Comstock in the early days and was sunk to the 3100-ft. level, where it cut the main Comstock vein. The shaft is of four compartments and is in good condition.

NYE COUNTY

Jim Butler—President Heller has stated that operations through the Wandering Boy shaft will be resumed soon. This shaft is 600 ft. deep and will be carried deeper. A powerful electric hoist will be substituted for the present gasoline one. The ore will be treated at the Tonopah-Belmont company's mill.

McNamara—The new guides and timbers are in place in the shaft to the 800-ft. level in preparation for development at and above this point. Some trouble was experienced in filling the filter presses recently and it was necessary to close the mill for a short time. This trouble has been overcome and a good tonnage is being treated.

West End—Development work continues. On the 400-ft. level a crosscut north has been started from a point about 200 ft. east of the shaft. The winze from the 300-ft. level has reached a depth of 57 ft. and a connecting drift has been started.

Halifax-Tonopah—The triple-compartment main working shaft has reached a depth of 830 ft. and is sinking in hard andesite formation.

North Star—Good shipping ore is being opened on the upper levels. The ore bins at the railroad switch are now being filled with ore.

Tonopah Mining—The report of the company for January shows that 14,943 tons of ore were milled, of an average value of $18.60 per ton. The gross receipts were $309,165 and net profits were $143,340.

Tonopah-Belmont—The report for January states that 7698 tons of ore were milled and 2665 tons were shipped to smelteries, the net profits for the month amounting to $151,487.

Montgomery-Shoshone—The annual meeting called for Feb. 14 was adjourned without date for lack of a quorum. Two plans were to have been presented; one called for the filing of a petition in involuntary bankruptcy. The company's indebtedness, other than current bills, totals $236,403 and interest from Jan. 1, 1912. The second plan provided for the sale of the machinery and other movable property of the subsidiary companies in Nevada and the payment of the proceeds to the consolidated company.

New Mexico

GRANT COUNTY

Lucky Boy—A car of 14 tons of ore recently shipped from this mine is reported to have averaged 7.47% vanadium.

American Vanadium Co.—It is rumored that this company will work the Georgetown mine for vanadium.

Chino—The single unit in operation up to Jan. 1, treated about 700 tons per day. With the second unit in commission, the daily tonnage is being increased to about 1000 tons per unit. It is estimated that the recovery from the sulphide ores has been over 70%. The third section of the mill is about ready.

SOCORRO COUNTY

Deadwood—Some excellent ore has been uncovered on the third level. The mill is running steadily, treating mostly custom ore.

Ernestine—The cleanup for the last 10 days of January yielded 9450 oz. of gold and silver bullion and 9250 lb. of concentrates. The mill is treating nearly 700 tons of ore per week. The oreshoot encountered some time ago is producing the best mill ore in the mine.

Pacific—A gasoline hoist is being installed at the south shaft of this mine of the Oaks company and will be ready for operation soon. Some good ore is being broken in the tunnel and the south shaft is producing a small tonnage. All the ore is treated at the Deadwood mill.

Socorro—One unit of the De La Vergne oil-engine equipment is being tried out.

Oregon

Blue Ledge—Title to this copper mine in Jackson County has been conveyed by U. S. patent to Robert S. Towne. It is reported that development on a larger scale will be undertaken soon.

Cornucopia—The company is said to be planning improvements at the Union mine in Baker County, to double the present capacity. Fine-grinding will be used.

Oriole—At a recent meeting at Grants Pass it was decided to install a new 50-ton mill. The shaft will also be sunk deeper.

Utah

BEAVER COUNTY

Majestic—A small force is working at the Harrington-Hickory mine, pending the arrival and installation of the new pumping equipment.

Progressive—Good ore is being mined at this property in the Star district. A 30-ton car netting $900 was shipped in December.

JUAB COUNTY

Tintic shipments for the week ended Feb. 9 amounted to 192 cars. The Centennial-Eureka shipped five cars more than the week preceding, the Mammoth six, the Iron Blossom five and the Yankee two.

Colorado—The ore recently opened on the 300-ft. level of No. 2 shaft, appears to be making toward the east into new ground, a short distance below the large stopes. During the week ended Feb. 9 two cars running about 30% lead and from 45 to 50 oz. silver per ton were mined from this orebody.

Beck Tunnel—Drifting from the shaft is being done on the 900-, 600- and 175-ft. levels, and work in ore is being done in the old workings and along the Uncle Sam side line. It is said that present shipments of two cars per week, are to be increased.

Grand Central—The shaft is being sunk 3½ ft. per day. Shipments are being maintained.

Opohongo—The weekly output, principally from the third, sixth and seventh levels, is 200 tons. The orebody has been mined as far as the 700 level, where it is being drifted on. This work has progressed for 60 ft. in low-grade ore. On the 1000-ft. level, where prospecting is being done, the fissure has been followed 50 feet.

Eagle & Blue Bell—Ore has been opened a short distance above the 1300. During January, 24 cars were shipped from the 1300 level, the ore running approximately 1.6 oz. gold and 20 oz. silver.

Iron Blossom—Ore is reported to have been opened in both of two raises from the 600-ft. level of the No. 3 workings. These are, respectively, 100 ft. to the north and 100 ft. to the south of ore at present being mined. The copper ore opened from the 600-ft. level is being followed by means of a raise also. Two shifts are working. Production for the week ended Feb. 9 was 44 cars. There has been a steady increase in production for the last six weeks. March had the largest output of any month in 1911, when from 44 to 46 cars per week were produced, with three shifts working. The average monthly production for the year was a little more than 32 cars. The gross monthly earnings at the present rate of production with ore bringing from $12 to $15 per ton, after payment of freight and smeltery charges, are estimated at $120,000.

Mammoth—Increased shipments are being made from the orebody opened several months ago on the 700- and 800-ft. levels in a new part of the property. The ore is being followed on the 700-ft. level where the showing is particularly good, and on the 600 drifting is being done for the vein. During the week ended Feb. 9, the mine shipped 12 cars.

Victoria—A new body of ore is reported on the 1200-ft. level. Work continues on the raise from the 1200 to the 1050, and the latter is being connected with the 900 by means of raising. This work will facilitate mining and give better ventilation.

Yankee—Work is being done on the 1800- and 1900-ft. levels. Shipments of dump ore are being made at the rate of two cars per day.

SALT LAKE COUNTY

Utah Consolidated—There is a porphyry dike on this property 10 to 45 ft. wide, cutting the Highland Boy limestone from the fifth level. This dike has been driven through on the 1100-ft. level, and ore has been drifted on for 25 ft. on the hanging-wall side of the limestone. Where first opened the body was 6 ft. thick, carrying 2.2% copper. With depth the area of limestone above the dike increases. On the 1100, the lowest level, there is still a width of 60 ft. of limestone below the dike. So far the copper ore of the mine has come from below the dike, the limestone above it having been little developed on the upper levels, on account of the smallness of its area there. About 2000 ft. of underground development are being done monthly; ore shipments are being increased, and reserves added to.

Ohio Copper—The net earnings for December are estimated to be about $30,000, and the cost of production less than 9c. per pound.

Columbus Consolidated—The mine has been unwatered. On the tunnel level drifting is being done in search of the Enterprise fissure. In drifting to the east on the 400, a body of shipping ore from 8 in. to 3 ft. wide has been opened for 20 ft. A car of this ore has been shipped, and it is expected to bring about $55 per ton. Ore averaging 5 ft. in width has been found in a raise from the same level. Improvements have been made at the mill which has closed down, pending the blocking out of more milling ore.

Cardiff—Owing to bad roads, work on ore has stopped, and development is being done. The most important work is in the lower drain and development tunnel, 300 ft. below the main tunnel. This is in 250 ft., and is progressing 3 ft. per day. During last summer the monthly average shipped was 125 tons, valued at about $6000.

Utah Mines Coalition—The annual stockholders' meeting was held Feb. 5, and the directorate was reëlected. Duncan MacVichie is president. A winze, which is being sunk from the 900-ft. level, is down 65 to 75 feet.

Tar Baby—The tunnel is in 300 ft., and there is copper and iron staining in the face.

Kennebec—Work has been resumed by Heath & Werthlin, leasers on this property.

Copper Bank Mining—This property, northwest of the Verde, consists of six claims in Big Cottonwood Cañon, lying between the power plants. At the stockholders' meeting recently held, a new board of directors was elected. C. E. Street is president.

SUMMIT COUNTY

Barry-Coxe—The new lower tunnel, which is being driven on the vein, is in 85 ft. and the ore mined is reported to be paying expenses, though it is somewhat bunchy.

Beggs-Miller—This company's concentrating plant below Park City will soon resume operations. The mill has 24 MacQuisten tubes and three Wilfley tables. It was designed to treat the zinc tailings of the Grasselli company. The plant has recently been closed to make some changes and adjustments.

Washington

U-Like—This property at Corlew, Ferry County, is being operated by C. H. Lewis and J. H. Clay with satisfactory results. A crew will work through the winter.

Hope—This company is considering the erection of a 125-ton mill on the property, Ferry County. Robert Mabry, Spokane, has charge of the work.

Wisconsin

Peaceful Valley—The 100-ton mill equipment, near Cuba City, was totally destroyed by fire on Feb. 12. It is reported that the plant will be rebuilt immediately. H. L. Hulburt Cuba City, is general manager.

Lucky Six—The "Dodger" mine, situated between the Squirrel and Peacock properties at Mifflin, has been sold to Milwaukee men. The mine has made a good showing with a 20-ton mill completed a few months ago. James Vial is superintendent.

East End—The shaft on this property, at Platteville, has been completed, and stockholders believe they have found the vein of the Klar Piquette mine, immediately adjoining. A mill will be constructed. M. H. Bruner is general manager.

Washburn—Drilling on this property, 10 miles north of Platteville, has revealed rich ground ahead of the old workings. The mine will be reopened after a 2-years' shutdown.

National Zinc Separating Co.—Foundations have been completed for the roasting and magnetic separating plant, near Cuba City; the plant will treat zinc ore from the mines owned and operated by the Vinegar Hill Zinc Company.

Crahall—The milling plant on this property, at New Diggings, has been completed by the Field Mining Company.

Canada

British Columbia

According to press dispatches, the British Columbia government proposes to send engineers to the country between Stewart and Ground Hog Mountain to obtain data as to the conditions for the construction of a railroad from Stewart to tap the Ground Hog Mountain coal fields. This line eventually is to form a link in another transcontinental system.

Nova Scotia

Canada Consolidated Clay Co.—This company has been organized, at Pictou, with an authorized capital of $2,000,000, with the object of amalgamating the clay companies of the Maritime Provinces. Some of the financiers connected with it have secured control of the more important brick- and china-clay deposits.

Ontario—Cobalt

Cobalt shipments for the week ended Feb. 16 were: La Rose, 229,804 lb.; McKinley-Darragh, 224,019; Drummond, 180,000; Nipissing, 120,076; O'Brien, 64,097; Kerr Lake, 64,000; Hudson Bay, 61,905; Buffalo, 60,939; Beaver, 59,801; Townsite, 59,000; total, 1,131,641 lb. Bullion shipments were: Nipissing, 127,329 oz.; Temiskaming, 31,646; Buffalo, 8600; Kerr Lake, 2321; City of Cobalt, 1618; total, 171,436 ounces.

Colonial—This company, which went into bankruptcy in December, has been reorganized and will issue bonds for $200,000 to raise funds for development.

Coniagas—An important discovery has been made in stoping out No. 9 vein. Hitherto when the Keewatin formation was reached on the properties west of Cobalt Lake, the veins pinched out at the contact. In this case, however, the vein was followed into the Keewatin and has been opened for 25 ft., showing 3 to 4 in. of ore running over 2000 oz. per ton. If the vein persists at depth, a winze will be sunk and another level run in what was previously supposed to be barren territory.

Little Nipissing—The lease held by this company from the Peterson Lake company has been cancelled under a clause providing for its termination in case of no work being done for one month. The property is now being operated by the Peterson Lake company.

Buffalo-Ontario Smelting & Refining Co.—This company has purchased property on Cataraqui Bay, Kingston, for the erection of a smeltery for the treatment of Cobalt and other ores.

Temiskaming—The annual report shows a production during 1911 of 1,213,754 oz., of the gross value of $643,322, and profits amounting to $271,423, of which $224,999 were paid in dividends. The total amount paid in dividends to date is $1,009,155.

Ontario—Porcupine

Mulholland—The management has decided to sink the main shaft to 300 feet.

Dome Extension—Good ore has been discovered in the crosscut from the 200-ft. level of the main shaft.

North Dome—This property is suffering from a shortage of water and may have to shut down for a time, until an adequate supply can be obtained.

Dome Lake—A compressor plant will be installed on this property. The vein, which is 3 to 4 ft. wide on surface, has been stripped and traced for over 900 ft. Two shafts are down 60 ft. in good ore, but the results of diamond-drill work have not been encouraging, as at a depth of 100 ft. the pay streak averages only about 1 ft. and the grade is erratic.

Crown Chartered—It is understood that the company's finances are now in satisfactory condition, and that work is to be resumed on the Davidson property.

McIntyre—Feb. 23 is the date officially set for the first trial run of the 10-stamp mill, and it is hoped to begin regular working by Mar. 1. A drift is being run from shaft No. 1, which will be the main working shaft, to No. 4 shaft on the south side of Pearl Lake, through which drift the ore will be carried in tram cars.

Imperial—The management has decided to close down the property temporarily, until proper machinery can be installed and adequate funds for development obtained.

Porcupine Gold—The blind vein, cut at the 200-ft. level, in opening up the station, has been drifted upon for 30 ft. At the point where it was cut it shows about 5 ft. of ore.

Mexico

American Smelting & Refining Co.—All five plants of the company in the republic are in operation, and no difficulty has been experienced because of the political situation. Government troops have afforded the company protection where needed.

Chihuahua

El Rayo—The new 14-in. rolls arrived in Parral recently and have been shipped to the mine. It is reported that the company will build an aërial tramway for carrying firewood to the mine.

Veta Colorado—Shipments of concentrates and bullion are being made regularly from the mill at Villa Escobedo. The concentrates are sent to the smeltery at Torreon.

Alvarado—The water at the Presena mine is reported to be at the eighth level and it is expected that the large station pump on that level will be started soon. The Dorr thickeners at the mill have been started. Work is expected to start soon at Las Cruces mine. This property has an inclined shaft, 450 ft. deep, equipped with a 25-hp. hoist and two boilers.

Tepehuan Mexican Syndicate—Machinery, including a new hoist and a Cameron sinker pump, was shipped from Parral recently. One hoist is in operation at present; the intention is to pursue development vigorously.

Dolores—An accident due to foul air recently resulted in the death of two miners at this mine. The accident took place in a 300-ft. drift and is said to have been caused by the failure of the day shift to turn on the air at the end of the shift.

La Republica—Scarcity of labor has retarded progress at the mine and mill, since work was resumed in December. In September, the mine closed down because of an excessive flow of water; this was finally controlled and work was resumed. During January 34 bars of bullion worth about $37,000 were shipped and in December it is said more than $12,000 worth of concentrates were shipped to the smeltery. The mill is treating about 40 tons per day, which will be increased if labor conditions improve. J. Gordon Hardy is consulting engineer.

Mexico

El Oro—During January the mill crushed 25,410 tons of ore which yielded $186,550 gross. Working expenses were $101,880; development, $18,700; permanent improvement, $9950; mine profit $65,970; railway profit $12,480; and $78,450 total profit.

Sonora

Cieniguita—It is reported that the reorganization of the various Cieniguita companies is about completed on a satisfactory basis; that the Mexican company will be clear and free of all indebtedness of every kind and character, and that the debts and obligations of the various holding companies will be taken care of; further, that the stockholders of the various holding companies will be fully protected in their various interests. Inquiry at headquarters among those effecting the reorganization, develops the fact that John B. Farish, whose name has been mentioned in connection with the Cieniguita companies, is in no way interested in the corporations or the reorganization of them.

Asia

Chosen

Oriental—During December, 26,141 tons of ore were crushed, yielding $137,294 gross and net $51,779. Operating costs were $79,429; operating profit, $57,864; improvements and developments, $6085. The Kuk San Dong 40-stamp mill was hung up the entire month because of labor shortage.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Feb. 21—The special features of the trade this week seem to be the increasing disposition of large consumers to accumulate stocks, and some relaxation of the pressing demand due to the weather. The call for stocks is coming to be insistent, but railroad transportation is still slow and there is difficulty in getting coal to market. These conditions prevail both in the East and the West.

Nothing further has been done in relation to calling another meeting of the rate conference. It is probable that nothing will be done until after the anthracite miners' demands are presented, as they probably will be next week. The anthracite-mining companies have issued a statement to show the fairness of the existing agreement and the effect upon prices of any increase in wages.

Eastern operators are taking much interest in the probable general strike of miners in Great Britain, which is now reported to be almost certain.

German Coal Trade—Exports and imports of fuel in the German Empire, year ended Dec. 31, metric tons:

	Exports	Imports	Excess
Coal	27,412,218	10,913,948	Exp. 16,498,270
Brown coal	58,071	7,069,064	Imp. 7,010,993
Coke	4,555,477	598,958	Exp. 3,956,519
Briquets	2,477,492	200,933	Exp. 2,276,559
Total	34,503,258	18,782,903	Exp. 15,720,355
Total, 1910	30,436,048	19,458,046	Exp. 10,978,002

The increase in total exports was 4,067,210 tons; the decrease in imports, 675,143 tons.

Coal production of German Empire, year ended Dec. 31, metric tons:

	1910	1911	Changes
Coal	152,881,509	160,742,272	1. 7,860,763
Brown coal	69,104,867	73,516,789	1. 4,411,922
Total mined	221,986,376	234,259,061	1.12,272,685
Coke made	23,600,362	25,405,108	I. 1,804,746
Briquets made	19,567,016	21,827,667	I. 2,260,651

Of the briquets reported in 1911 a total of 16,836,679 tons was made of brown coal or lignite.

IRON TRADE REVIEW

New York, Feb. 21—The iron and steel trades are in practically unchanged condition. If anything, there is an increase in new orders, coming chiefly from structural demands, and from railroad-bridge and car orders. There is still competition for orders and prices remain low. Rail orders are rather slow, and will probably remain so until the fencing over specifications and quality is over.

Conditions at the mills are better, as the extremely cold weather seems to be over. Railroad transportation is still slow, however, notwithstanding the improvement in the weather. Complaints are made of shortage of cars and defective motive power in many quarters.

New business in pig iron is fair, but prices do not advance. The general belief in lower ore prices is one element in the resistance to any increase in pig. No one knows what Lake ore prices will be, but few doubt that there will be a reduction from last season. Any reduction in ore, however, may be offset by advances in coke.

A conference was held last week in New York, at which representatives of a number of railroads and leading steel manufacturers were present. The subject of discussion was the quality of steel rails and the possibility of adopting standard specifications and methods of manufacture, in order to secure better rails. No results are reported, but it is understood that marked differences of opinion were developed.

Baltimore

Feb. 19—Exports for the week included 882 lb. selenium to Hamburg; 4,225,700 lb. steel rails and 388,889 lb. track material to Tampico, Mexico. Imports included 1100 tons ferromanganese and 74 casks silicospiegel from Liverpool; 9720 bars Swedish charcoal iron and 32 casks manganese ore from Hamburg; 23,700 tons iron ore from Cuba.

Birmingham

Feb. 19—Southern pig-iron manufacturers have a strong line of inquiries in hand and no special complaint is made as to conditions. Pig-iron prices hold at $10.50 per ton, No. 2 foundry, and while the sales have not been so numerous of late as they were in January, there is a satisfactory condition. The make in Southern territory is not likely to be increased for a while yet and the accumulated stocks of iron appear to be quite sufficient to help out in case of a rush in the demand. There is more iron being shipped out and melted in the home territory than is being manufactured here, but manufacturers say that this can continue for a few months without depleting all stocks. The sales already made for delivery during the first half of the year are good, while a little business has been booked for the latter half of the year. No effort has been made to secure any volume of business for the last half of the year.

The steel situation in this section is looking up and reports have it that Southern railroads have announced prospective business which is practically assured the local companies. There is a steady demand for fabricated steel and steel-wire goods.

Charcoal iron is in fairly good demand, $22@22.50 being the quotation. The scrap-iron market shows a little improvement, as does the business with the foundries and machine shops in the Southern territory. The cast-iron pipe people are still melting a large quantity of iron.

Chicago

Feb. 19—Sales of pig iron continue light, the melters adhering to their practice of buying in small quantities and often, which they have followed for several months. Inquiries are more numerous and one is for several thousand tons, but most of these inquiries are regarded as attempts to feel the market. The furnace representatives are trying hard to hold prices to the quotations of $14 for Northern and $10.50, Birmingham, for Southern No. 2, the local price on the latter being $14.85. Business is better in Northern than in Southern foundry iron, though few sales run over 500 tons each.

The market for iron and steel products is better than the pig-iron market. Structural material continues to sell well, with a number of bridge and building contracts closed in the last week in local and Western territory and increasing requirements appearing for spring building. Beams and channels under 15 in. are quoted at 1.28@1.33c. Railroad supplies other than rails are in good demand; the rail business continues light. Bar iron is active, with 1.25c. minimum on the products of local mills and hardly any cutting under by the Pittsburg producers. Sheets and plates are not so active, but there is a fair trade in both, and wire goods are selling heavily. Considered as a whole, the market for finished products seems to be decidedly improving, while pig iron shows no signs of weakening and some features that indicate a stronger tone.

Cleveland

Feb. 19—Some sales of ore have been made, but no prices have been fixed. Sellers and buyers of ore have been very slow in getting together. Shipments of ore from Lake Erie docks in January were 284,569 tons. This light business was mainly due to the extremely cold weather.

Pig Iron—Several sales of basic are reported, and a fair tonnage in small orders for No. 2 foundry. Prices, Cleveland delivery, are $15.15 for bessemer, $13.10@13.25 for basic, $13.25 for No. 2 foundry and $16.50 for Lake Superior charcoal.

Corrigan, McKinney & Co. have arranged to build a third stack for their blast-furnace plant on the west side of the Cuyahoga River. The new stack will have a capacity of about 75,000 tons yearly, and will be run on basic pig for the openhearth-steel plant which the company is preparing to erect.

Finished Material—The wire trade is the most active branch of the business just now. The sheet market is rather quiet, and not much is doing in bars. There is more competition for plate orders, and prices are being shaded.

Philadelphia

Feb. 21—Another period of inactivity has set in, which is not being disturbed by important inquiries. Large consumers in and near this city do not believe the slight advance made recently can be maintained. In accordance with this belief no efforts are being made to negotiate for further forward deliveries. Nearly all large consumers are comfortably supplied for some time and the only activity anticipated depends on the casual purchases of the small trade. In the aggregate this business is quite large. Furnace interests generally express satisfaction with the present situation and the absence of probable competition from Southern furnaces. Two or three quite large lots of low-grade iron have been sold for delivery scattering over three or four months. Basic pig is weak. Forge iron is selling from week to week in the customary way. Foundry irons are strong. This week's sales of malleable figure up a little above the average. No. 2 X averages $15; gray forge and basic $14.50. Some southern forge has been offered as low as $13.50 and two or three sales are likely to result.

Billets—The latest transactions in billets show that recently quoted prices are maintained but the orders are very light.

Bars—Open weather has permitted more prompt shipment of delayed supplies. There is better distribution from stores. A good jobbing demand for making up depleted assortments will soon set in.

Sheets—Black and galvanized are selling better in small lots from stores for immediate delivery.

Pipes and Tubes—Cast pipe orders are large and steady. Merchant pipe has improved. Tube work is abundant.

Plates—The week has been comparatively quiet. The only encouragement is in inquiries for boiler plate. Shipyard work is taking much material.

Structural Material—Considerable bridge, ship and car work is now under consideration, most of it for April and May delivery. Bottom prices remain.

Scrap—Dealers report very little business. The only sales are for immediate delivery. Prices are at barely remunerative limits.

Pittsburg

Feb. 20—On the whole, the finished-steel market has neither gained nor lost ground in the past week. There appears to be no greater weakness in prices than there was, and in plates some of the mills have found the market stronger in the past few days than they expected. While bars, plates and shapes are quotable at 1.10c., Pittsburg, and have been so quotable for several weeks, there is at least one important mill which will not sell at less than 1.15c., while there are several mills which would shade this figure only in exceptional cases, as, for instance, to retain a particular customer. In bars and shapes the market is quite firm at a minimum of 1.10c., this price not obtaining in the case of all business.

There is no difficulty in the mills having all the specifications they need to maintain full operations. They had an excellent accumulation at the first of the year, and while in some cases new specifications since then have been below production, the deficit is not large. In unfinished steel there is an actual scarcity.

The important new feature in the situation is the scarcity of box cars, suitable for loading commodities like black plates and tin plates. There has been a scarcity for several weeks, due to cold weather, and this has reached an acute stage within the past few days, so that material has accumulated in warehouse and in some cases the continuance of full operations in certain departments has been threatened. The slow movement has had an interesting result, in that some buyers have been moved to increase their specifications in order to provide against future emergencies of this sort. The freight movement continues slow, although the present mild weather is expected to loosen up the situation. The Pennsylvania, New York Central and other roads a few days ago placed an embargo on freight intended for Michigan and adjacent territory, the whole State of Michigan being tied up by the worst freight congestion known in years.

Pig Iron—The pig-iron market continues uneventful. The consumers of foundry iron for the most part covered for the present quarter before the close of the old year, and are taking deliveries at a satisfactory rate. Little fresh demand is coming up. The operating furnaces are well sold and are making little effort to sell iron. Basic iron is generally quoted at $12.50, Valley, but the last important sale, some time ago, was on the basis of $12.25, Valley. It is reported that the Pittsburg Steel Co. bought about 12,000 tons for March delivery at about this figure. We continue to quote: Bessemer, $14@14.25; basic, $12.25@12.50; No. 2 foundry, $13@13.25; malleable, $13@13.25; forge, $12.50@12.75, all f.o.b. Valley furnaces and 90c. higher, delivered Pittsburg.

Ferromanganese—The market continues quiet, with the price well maintained at $41, Baltimore, for prompt or forward.

Steel—Some of the large producers are behind in deliveries of both billets and sheet bars, and there is considerable inquiry for small prompt lots. F.o.b. Pittsburg, bessemer billets command $19.50@20 and bessemer sheet bars $20.50@21, but openhearth sheet bars are a trifle easier, not being in as much demand as bessemer, and are quotable at $20@20.50, Pittsburg. Bessemer billets at Youngstown are quotable at $19@19.50 and bessemer sheet bars at $20@20.50. Rods are nominally $25, Pittsburg.

Sheets—The sheet market holds up fairly well, the majority of producers being comfortably sold up. The leading interest's specifications are excellent, and it is not a factor in the market at prices less than the basis of 1.90c. for black and 2.90c. for galvanized. These figures, however, are shaded rather freely by several independent interests. We continue to quote: Black sheets, 28 gage, 1.85@1.90c.; galvanized, 2.85@2.90c.; blue annealed, 10 gage, 1.35@1.40c.; painted corrugated, $1.33@1.35 per square; galvanized corrugated, $2.47@2.50 per square.

St. Louis

Feb. 19—The market continues to be a waiting one and no large orders are expected till next month. There is a fair business in small orders. Quotations for No. 2 Southern are still $10@10.25, Birmingham, or $13.75@14, St. Louis; No. 2 Northern, $14@14.75, St. Louis.

Demand for coke continues good, with prices at $5.05@5.20, St. Louis.

Iron Ore Trade

The Great Northern R.R. Co. has announced that its freight rate on iron ore from the mines to Lake Superior docks for the season will be 60c. per ton, the same as is now charged by the other Minnesota roads. This is a reduction of 20c. per ton from last season.

E. N. Breitung & Co., of Cleveland, report some good sales of ore, most of them on prices to be determined later. Other sellers and buyers are slow.

Foreign Iron Trade

German Foreign Trade—Exports and imports of iron and steel and of machinery in the German Empire, year ended Dec. 31, metric tons:

	Exports	Imports	Excess
Iron and steel..	5,377,287	600,563	Exp. 4,776,724
Machinery	474,130	76,129	Exp. 398,001
Total	5,851,417	676,692	Exp. 5,174,725
Total, 1910.....	5,269,214	629,675	Exp. 4,639,639

Increase in exports, 582,203 tons; increase in imports, 47,017 tons.

Belgian Iron Trade—Exports and imports of iron and steel in Belgium, year ended Dec. 31, metric tons:

	Exports	Imports	Excess
Pig iron........	11,610	693,235	Imp. 681,625
Billets, etc.	143,568	69,003	Exp. 74,565
Finished mat..	1,354,536	289,408	Exp. 1,065,128
Total..........	1,509,714	1,051,646	Exp. 458,068
Total, 1910....	1,422,887	1,046,144	Exp. 376,743

The increase in exports was 86,827 tons, or 6 per cent.; that in imports was 5502 tons, or 0.5 per cent.

British Iron and Steel Trade

Exports and imports of iron and steel, and of machinery, in Great Britain, month of January, are valued by the Board of Trade returns as below:

	Exports	Imports	Excess
Iron and steel	£4,387,160	£1,085,083	Ex. £3,302,077
Machinery...	2,014,218	356,351	Ex. 1,657,867
Cutlery and hardware..	569,162	118,592	Ex. 450,570
New ships....	183,222	....	Ex. 183,222
Total..... ..	£7,153,762	£1,560,026	Ex. £5,593,736
Total, 1911..	6,453,643	1,348,652	Ex. 5,104,991

Increase in exports, £700,119; increase in imports, £211,374. The quantities of iron and steel exports were, in long tons:

	1911	1912	Changes
Exports	396,467	449,903	I. 53,439
Imports	134,147	180,536	I. 44,386

Tinplate exports to the United States decreased from 5921 tons in 1911 to 234 tons this year.

METAL MARKETS

New York, Feb. 21—The markets have shown few changes during the week. A fair business is reported in most lines.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Jan. 1912..	$ 1,915,202	$ 5,165,543	Imp $3,250,341
1911..	923,676	9,540,830	Imp. 8,617,154
Year 1912..	1 915,202	5,165,543	Imp. 3,250,341
1911 .	923,676	9,540,830	Imp. 8,617,154
Silver:			
Jan. 1912..	6,027,905	4,358,009	Exp. 1,669,896
" 1911..	5,651,076	3,551,426	Exp. 2,099,650
Year 1912..	6,027,905	4,358,009	Exp. 1,669,896
" 1911..	5,651,076	3,551,426	Exp. 2,099,650

Exports from the port of New York, week ended Feb. 17: Gold, $34,976; silver, $1,531,208, chiefly to London and Paris. Imports: Gold, $456,510, principally from Mexico; silver, $62,385, largely from South America.

Gold—Prices on the open market in London continued at 77s. 9d. per oz. for bars and 76s. 4d per oz. for American coin. There was no special demand. In New York a total of $2,900,000 gold was taken for shipment to Argentina.

Iridium—Prices are unchanged, $64 per oz. being asked for pure metal.

Platinum—The market is quiet, and we continue to quote $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Feb. 7, that the market is steady. Prices are 10 rubles per zolotnik for crude metal, 83 per cent. platinum, at Ekaterinburg; 38,600 rubles per pood for the same grade at St. Petersburg. These prices are equivalent to $37.60 and $37.83 per oz., respectively.

Notwithstanding the stimulus of high prices, production increased little last year. The output in Russia for 1911 is 334 poods of crude platinum, an increase of 22 poods, or 6.6 per cent., over 1910. The total for 1911 was equal to 175,818 oz. crude, or approximately 145,929 oz. refined platinum.

Silver—The market has been carried up for silver by combined speculative and legitimate operations to 27⅞d. At this figure heavy sales on China account broke the price to 26¾d. Reaction took the price up again to 27 5/16d., but orders have not been sufficient to sustain this figure so the situation today is quiet at 27 1/16d. in London.

SILVER AND STERLING EXCHANGE

Feb.	15	16	17	19	20	21
New York....	59⅝	58⅛	58½	59⅜	59⅜	58⅞
London....	27 7/16	26¾	27	27 5/16	27¼	27 1/16
Sterling Ex.	4 8705	4 8720	4.8730	4.8730	4.8735	4.8740

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Feb. 8, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India...	£1,332,300	£953,300	D. £379,000
China........	176,000	350,000	I. 174,000
Total......	£1,508,300	£1,303,300	D. £205,000

India Council bills in London averaged 16.13d. per rupee for the week.

Gold in the United States, Feb. 1, is estimated by the Treasury Department as follows: Held against gold certificates, $1,035,612,369; in Treasury current balances, $164,195,516; in banks and circulation, $603,474,436; total, $1,803,282,321, an increase of $6,281,405 during January.

Gold and silver movement in Great Britain, year ended Dec. 31:

	Imports	Exports	Excess
Gold..........	£48,693,753	£40,100,540	Imp.£ 8,593,213
Gold, 1910..	67,321,767	50,898,445	Imp. 6,423,322
Silver........	14,293,747	16,923.637	Exp. 2,629,790
Silver, 1910.	14,100,310	13,826,768	Imp. 273,542

Of the silver imported in 1911 a total of £11,897,923 was from the United States.

Copper, Tin, Lead and Zinc

NEW YORK

Feb.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
15	14¼ @14½	14 10 @14.15	42¾	4.00	3.92½	6.45 @6.60	6.30 @6.45
16	14¼ @14½	14.10 @14.15	43	4 00	3.92½	6 45 @6 60	6 30 @6 45
17	14¼ @14½	14 10 @14.15	43	4.00	3.92½	6 45 @6 60	6 30 @6 45
19	14⅜ @14½	14 20 @14.25	43	4.00	3.92½	6.45 @6 60	6.30 @6 45
20	14⅜ @14½	14 20 @14.25	42⅞	4.00	3.92½	6.45 @6.60	6.30 @6.45
21	14⅜ @14½	14 20 @14 25	43⅛	4.00	3.92½	6 45 @6 60	6 30 @6.45

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Feb.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
15	62⅞	63 9/16	67	194½	191½	15¾	26¾
16	63⅛	63 13/16	67¼	195½	191¾	15¾	26¾
17	......	......	......	......	......	......	....
19	63	63¾	67½	194½	191½	15¾	26¾
20	63	63 11/16	67¼	194¼	191¼	15¾	26¾
21	63⅜	64	67¼	195¼	192	15¾	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The persistent policy of certain of the leading sellers in holding their prices firm at 14½c., delivered at consumers' points, 30 days, appears at last to be telling on the market. From all accounts, consumption is well maintained throughout the world. There have of late been some inquiries from the Far East, which would indicate that the Japanese production, which to a large extent was exported to Europe and to this country, does not now suffice to satisfy the requirements of China and Japan. In the early part of the week sales of electrolytic were still made at 14¼c., delivered, usual terms, but with the continued abstention from the market of some of the large interests the relatively moderate demand was sufficient to advance the price, which became 14⅜c., delivered, usual terms, at which price copper was still offered at the close. Some moderate sales of Lake copper for domestic consumption at 14⅜@14½c. have been reported. The business in electrolytic has been fairly divided between domestic and foreign shipment. The market closes firm at 14⅜@14½c. for Lake copper, while electrolytic copper in cakes, ingots and wirebars is quoted at 14.20@14¼c. Casting copper is quoted nominally at 13⅞ to 14⅛ as the average for the week.

The London standard market, while fluctuating within narrow limits, has displayed a firm undertone, and closes slightly higher at £63 7s. 6d. for spot and £64 for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for smaller quantities. Copper wire is now 15¼c. base, carload lots at mill.

Copper exports from New York for the week were 10,065 long tons. Our special correspondent gives the exports from Baltimore at 1730 tons.

Visible stocks of copper in Europe on Feb. 15 are reported as follows: Great Britain, 39,310; France, 5380; Rotterdam, 4600; Hamburg, 8100; afloat from Chile, 2450; afloat from Australia, 6000; total, 65,840 long tons, or 147,481,600 lb. This is a decrease of 2840 tons, or 6,361,600 lb. from the Jan. 31 report.

Tin—Shipments from the East for the first half of this month are extraordinarily large, and when this fact became known it had a depressing influence on the London market. The latter has become extremely dull and transactions have dwindled down to a minimum. It is reported that the Syndicate members refuse to deal on the new Metal Exchange contract, and that the bulk of the dealings in Straits-Malacca tin are consummated outside of the Exchange at about £1 over the posted Exchange quotations. Owing to the large shipments to this market and the recent arrivals, spot tin is very easy and selling slightly below the importation point. The market closes firm at £195 5s. for spot and £192 for three months, and here about 43⅛ for February tin.

London Metal Exchange quotations are now for "Standard" tin, under the new rules, and not for Straits or Australian as heretofore. The quantity of tin available for trading is increased by the new contract, but the quantity of tin available to consumers of the metal is not affected by the change.

Messrs. Robertson & Bense report the receipts of tin ore and concentrates at Hamburg, Germany, in January at 1226 tons; 1216 tons from Bolivia and 10 tons from South Africa.

Tin production of the Federated Malay States in January was 3829 long tons in 1911, and 3715 in 1912; decrease, 114 tons.

Lead—The market is unchanged at 4c., New York, and 3.92½c., St. Louis, at which prices the leading sellers are understood to have booked a large business, outside producers having in the main stood out of the market in the meanwhile.

The foreign market has been steady throughout the week at £15 15s. for Spanish lead and 5s. more for English.

Spelter—Near-by deliveries are still held at a heavy premium, but business this side of April has been of very small volume. Fair-sized orders were placed for April and May, and smelters are inclined to raise their prices for the future months. The market closes firm at 6.30@6.45c., St. Louis, and 6.45@6.60c., New York.

The London market is unchanged at £26 15s. for good ordinaries and 2s. 6d. more for specials.

Zinc dust is quoted at 7⅜c. per lb., New York.

Base price of zinc sheets was advanced ¼c. on Feb. 13 and is now $8.25 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—Business is steady, and prices show little or no change. Quotations are 19¼@19¾c. per lb. for No. 1 ingots, New York delivery.

Antimony—Business remains rather of a retail order, but Cookson's has been advanced a little, to 7¼@7⅜c. per lb. Hallett's is unchanged at 7⅜@7½c., which 6¾@6⅞c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is steady at unchanged prices. The New York quotation is $46 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $45 for domestic orders and $42.50 for export. The London price is £8 7s. 6d. per flask, while £8 5s. is quoted from second hands.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 17—The highest price paid for zinc sulphide ore was $49 per ton, the base, per ton of 60 per cent. zinc, $43@46.50. Zinc silicate ore sold on a base of $25@27 per ton of 40 per cent. zinc. The average price is $42.20. The high price of lead ore was $52, and the average price, all grades of lead, was $50.24 per ton.

While this week's shipment of zinc ore is over 6000 tons, yet it represents but a little over one-half the tonnage sold, as the district was scoured from one end to the other where there was a carload of ore in the bins, and a number of purchases were made of next week's output. The highest estimate of unsold ore made tonight was a little rise of 600 tons, while a number of estimates are under 500 tons. A majority of the smelting companies were in on the division of stock. With the enormous purchases the demand for cars far exceeded the supply, which has been short for several weeks, and resort was made to loading in open coal cars.

SHIPMENTS, WEEK ENDED FEB. 17

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville.	4,616,390	. ....	1,092,670	$128,877
Joplin........	2,188,250	......	203,040	54,510
Carl Junction	928,560	......	......	22,285
Galena.......	680,110	......	89,530	16,940
Alba-Neck....	689,020	......	.....	15,847
Miami.......	382,430	......	202,700	12,155
Oronogo......	506,530	......	92,470	11,210
Granby	147,040	485,590	31,090	9,740
Duenweg.....	247,700	......	86,690	7,491
Cave Springs.	322,100	......	24,000	6,730
Spurgeon	132,430	220,000	10,570	5,860
Carthage	217,790	......	...	4,573
Springfield ..	48,720	....	32,850	1,620
Jackson......	56,110	......	.....	1,200
Quapaw......	54,690	......	...	985
Aurora.......	......	65,000	.....	910
Wentworth...	30,170	......	......	633
Totals......	11,248,050	770,590	1,865,610	$301,566
7 weeks...	63,852,860	4,034,420	10,253,730	$1,750,644

Blende val., the week, $244,284; 7 weeks, $1,406,941
Calamine, the week, 10,400; 7 weeks, 54,804
Lead value, the week, 46,882; 7 weeks, 288,899

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January....	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February...	40.21	...	39.16	.....	54.46	
March......	39.85	......	38.45	......	54.57	....
April.......	38.88	.	37.47	.... ..	56.37	
May.........	38.25	.....	36.79	. .	55.21	
June........	40.50	......	38.18	. . .	56.49	....
July........	40.75	.	38.36	.... ..	58.81	
August	42.50	.	41.28	.	60.74	
September	42.63	.... ..	41.29	.	59.33	..
October...	42.38	.....	40.89	......	54.72	..
November.	45.40	....	43.25	.. ..	57.19	
December	44.13	....	40.76	..	62.03	
Year..	$41.45	.	$39.90		$56.76	.

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Feb. 17—The base price paid this week for 60 per cent. zinc ore was $46. The base price offered for 80 per cent. lead ore was $48; no sales of lead ore were reported.

SHIPMENTS, WEEK ENDED FEB. 17

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point.... ...	702,570	.... .	
Benton...	660,000	.. ..	193,700
Galena.. . .	645,800	. .	
Platteville	581,730	..	
Hazel Green.	479,800	......	
Harker......	361,800	.. ...	
Cuba City .	275,050	.....	
Shullsburg.....	130,000		
Montfort	79,360	80,000	.
Rewey	62,000	....	...
Total....	3,978,110	80,000	193,700
Year to date.........	24,134,700	666,080	1,698,300

Shipped during week to separating plants, 1,439,400 lb. zinc ore.

Chemicals

New York, Feb. 21—The general market shows no special animation, but is in fair condition. There is much interest in the new chemical schedule now before Congress.

Copper Sulphate—The market is unchanged. Prices are firm at last figures, $4.90 per 100 lb. for carload lots, and $5.15 per 100 lb. for smaller orders.

Nitrate of Soda—The market is still rather quiet, but there has been a slight firming up of prices. Quotations are 2.22½c. per lb. for spot and for futures up to June 30; and 2.20c. for later positions.

Sulphur—Messrs. Parsons & Petit, New York, furnish the following figures of the operations of the Consorzio Obbligatorio in Sicily for the five months of its fiscal year, from Aug. 1 to Dec. 31; the figures are in long tons:

	1910	1911	Changes
Production	180,171	161,727	D. 18,944
Shipments	133,297	143,940	I. 10,643
Stocks, Dec. 31	641,249	551,422	D. 89,827

The decrease in the production is owing to the shutting down of small mines, and the closing of the large Trabonella mine, owing to an explosion. It seems that this large mine will remain closed for many years, the damage having been much greater than was anticipated.

Arsenic—Demand is good and prices are unchanged, $2.62½@2.87½ per 100 lb. being asked for white arsenic.

Petroleum

The monthly report of the *Oil City Derrick* gives new wells completed in January as follows: New York, Pennsylvania and West Virginia, 271; Lima-Indiana, 23; Kentucky, 13; Illinois, 81; Kansas and Oklahoma, 208; Texas and Louisiana, 42. In all the divisions there were 638 wells completed, 315 fewer than in December. The new production was 31,488 bbl., a decrease from the December report of 4727 bbl. Of the completed wells, 108 were failures and 61 gas wells. On the last day of January there were 392 rigs up, an increase of 37, and 886 wells drilling, a decrease of 97, making a total decline of 60 in new work.

MINING STOCKS

New York, Feb. 27—On Feb. 15 trading on the Exchange was rather active, but price changes were small, except for an advance of 1¼ in Amalgamated Copper. Trading on the Curb was active in spots only. Mason Valley and Braden were active among the coppers. There were some good sales of Porcupines, but Cobalts were slow. Prices closed about even.

Feb. 16 business on the Exchange was not heavy and there was a sharp drop in some of the leading issues. On the Curb trading was rather narrow. There was some interest in Butte Coalition again among the coppers. Wettlauffer Silver and Yukon Gold made considerable sales, at receding prices.

Feb. 17 business on the Exchange was light, but prices were inclined to be firm. Curb trading was irregular, with mining stocks in small demand and no considerable change in prices.

Feb. 19, while prices on the Exchange were generally firm, business was quiet. Sales of stock reported were the smallest since July 7 last. The Curb was dull and irregular, mining stocks receiving very little attention.

Feb. 20 and 21 the market continued dull and narrow. Steel common was heavy and coppers were slow on the Curb, while little was done in other mining stocks. One sale of Homestake was reported at $87.75 per share.

Sales at auction in New York, Feb. 15, included 61,170 shares Peregrina Mining & Milling common, $10 par, at 10c. per share; 1717 shares Pinguico Mines common, $10 par, at 10c. per share; 10 shares Mexican Milling & Transportation preferred, $100 par, at $10 per share, and 12,695 shares common, $10 par, at 10c. per share; five shares Guanajuato Reduction & Mining, $100 par, $10 per share; seven shares Guanajuato Development preferred, $100 par, $20 per share, and 7245 shares common, $100 par, at 50c. per share; 50 shares Tombstone Consolidated, $10 par, 5c. per share; 80 shares Imperial Copper, $10 each, 5c. per share; $16,000 Rex Carbon Coal Co. bonds, December, 1909, coupons attached, $2150 for the lot.

Boston, Feb. 20—Spasmodic movements in Mayflower and Old Colony shares have been the features in a dull but generally firm market. There have been fair-sized advances in other copper stocks and the market for these shares looks healthy, even though there is a lack of public interest in the entire market.

Advices from the Mayflower property continue favorable and a good-sized movement is afoot to wrest control of this property from its present management and effect a consolidation with the Old Colony. This can be thwarted by the St. Mary's Mineral Land Co., which owns 25,000 of the 100,000 shares.

Mayflower made a record price at $10.75, advancing $3.75 during the week. Old Colony during the same period rose $2.50 to $7.50. Osceola has risen $6.75 to $114.50, which is followed by talk that interests unfriendly to Calumet & Hecla are again making an attempt to make a contest for control this spring.

North Butte, Isle Royale, Mason Valley, Hancock and Winona have also been strong and active at times.

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	Nov.	Dec.	Jan.
Alaska shipments	1,274,655	4,995,008	3,701,010
Anaconda	20,850,000	....	26,350,000
Arizona, Ltd.	2,960,000	3,100,000	3,200,000
Balaklala	....	....	....
Copper Queen	6,946,775	8,365,265	6,748,264
Calumet & Ariz.	4,390,000	4,486,000	4,544,000
Detroit	1,941,498	1,969,313	1,941,970
East Butte	983,405	....	....
Mammoth	1,793,181	1,721,404	....
Mason Valley	....	....	600,000
Miami	2,500,000	2,500,000	2,600,000
Nevada Con	5,207,983	4,679,674	....
Old Dominion	2,082,000	2,610,000	2,044,000
Ray	2,517,000	2,660,000	....
Shannon	1,256,000	....	1,550,000
South Utah	361,681	267,514	189,678
United Verde*	2,500,000	2,000,000	....
Utah Copper Co.	9,117,961	9,039,557	....
Lake Superior*	18,600,000	17,500,000	....
Non-rep. mines*	8,983,000	....	....
Total production	94,265,139	....	....
Imports, bars, etc.	17,224,725	21,101,256	....
Total blister	111,489,864	....	....
Imp. in ore & matte	4,767,217	5,159,997	....
Total	116,257,081	....	....
Brit. Col. Cos.:			
British Col. Copper	....	....	....
Granby	....	....	....
Mexican Cos.:			
Boleo	....	2,645,640	2,315,040
Cananea	....	3,706,000	3,552,000
Moctezuma	1,682,768	2,864,464	2,732,867
Other Foreign:			
Cape Cop., S. Africa	857,920	....	....
Kyshtim, Russia	1,170,000	1,570,000	....
Spassky, Russia	685,440	721,280	....
Famatina, Argen.	174,720	217,280	....
Exports from:			
Chile	4,704,000	5,824,000	8,064,000
Australia	7,168,000	11,200,000	7,056,000
Arrivals in Europe from other count.†	12,064,640	16,331,840	13,144,320

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
I, 1911	115,696,591	42,078,557	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
	VISIBLE STOCKS		
	United States	Europe	Total
II, 1911	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Curb stocks have been heavy and the market has been somewhat uncertain. Eagle & Blue Bell rose to $1.06¼. Other features on the Curb have been the strength of Lion Hill and the weakness of Davis Daly.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1 00
Alpha Con., Nev	Feb. 21	Mar. 13	0.05
Alta, Nev	Jan. 26	Feb. 16	0.05
Andes, Nev	Feb. 7	Feb. 28	0.06
Black Jack, Utah	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.60
Confidence, Nev	Jan. 16	Feb. 6	0 20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Crown Point, Utah	Feb. 15	Mar. 11	0.006
Exchequer, Nev	Feb. 14	Mar. 6	0.05
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0.06
Hancock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
King David, Utah	Feb. 13	Mar. 6	0.005
Lehi Tintic, Utah	Feb. 29	....	0.01½
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
Ojibway, Mich	Jan. 10	....	1.005
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz	Jan. 15	....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002
Swansea Con., Utah	Jan. 17	Feb. 8	0.01
Tintic Standard, Utah	Jan. 8	Feb. 5	0 00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25 887
February	51.534	52.222	......	23.794	24.081	......
March	51.454	52.745	......	23 690	24.324	......
April	53.221	53.325	.....	24 483	24.595	......
May	63.870	53.308	......	24.797	24.583	......
June	53.462	63.043	......	24.651	24 486	......
July	54.150	52.630	......	25.034	24 286	......
August	52.912	52 171	.....	24 428	24.082	......
September	53.295	52.440	......	24 567	24.209	......
October	55 490	53.340	....	25.596	24.594	......
November	55.635	55.719	....	25 680	25.649	..
December	54.428	54 905	.....	25.160	25.349	..
Year	53 486	53.304	..	24 670	24.592	.

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14 337	55.600	62.760
February	12.256	.	12 611	..	54 974	....
March	12.139	.	12 447	...	54.704	..
April	12.019	...	12.275	...	54.034	.
May	11.989	.....	12.214	..	54.313	...
June	12 385	...	12 611	.	56 365	...
July	12 463	....	12.720	..	56.673	...
August	12 405	.	12 634		56 266	
September	12.201		12.508		55 253	....
October	12.189	.	12.370		55 170	
November	12 616		12 769		57 253	.
December	13 552	..	13 768	..	62.068	
Year	12 376	...	12.634		55.973	

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	
February	41 614		August	46 319	
March	40 157		September	39 755	
April	42 185	.	October	41 185	
May	43.115	..	November	43 125	.
June	44 606	...	December	44 655	..
			Av. Year	42 281	..

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4 435	4 334	4 327	13.009	16.619
February	4 440	....	4 266	......	13.043	.....
March	4.394	..	4 238	......	13.122	......
April	4 412	....	4 262	......	12.889	....
May	4.373	..	4.223	......	12 984	....
June	4 435	..	4 292	....	13.260	..
July	4.499	.....	4.397	......	13 530	....
August	4 600	....	4 406	......	14.260	...
September	4 485	....	4 366	......	14 744	....
October	4.265	...	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	16.648	.....
Year	4.420	....	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	...	5 368	......	23 276	.....
March	5.563	....	6.413	....	23 016	......
April	5 399	...	5.249	......	23.743	.....
May	5.348	...	5.198	......	24.376	......
June	5 520	......	5 370	......	24.612	......
July	5 695	......	5 545	......	25.006	......
August	5 953	.....	5 803	....	26 801	......
September	5 869	......	5 719	......	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.796	......
December	6.301	......	6.161	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14.40	$13.32	$14.75	$14 00
February	15 90	......	14 50	......	14.81	......
March	15.90	......	14 65	....	14.96	......
April	15 90	......	14 65	......	15 00	......
May	15.90	......	14.30	......	14.72	.....
June	15 90	......	14 06	......	14.56	......
July	15 90	......	14 03	...	14 63	......
August	15 90	......	14 00	....	14 47	......
September	15 90	.....	13 57	.....	14 40	......
October	15.43	......	13.44	..	14.34	......
November	14.92	......	13.30	....	14 25	......
December	15.15	.....	13.10	....	13.90	......
Year	$15 72	......	$13 94	.....	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Feb. 20	
Name of Comp.	Bid.
Acacia	.05¾
Cripple Cr'k Con.	02¼
C. K. & N	15
Doctor Jack Pot	.05½
Elkton Con	.59
El Paso	.67½
Findlay	05
Gold Dollar	.15¼
Gold Sovereign	.02¾
Isabella	.12½
Jack Pot	.05
Jennie Sample	.06
Lexington	01
Moon Anchor	01
Old Gold	03¼
Mary McKinney	50
Pharmacist	.02
Portland	91
Vindicator	70
Work	.03

SALT LAKE Feb. 20	
Name of Comp.	Bid.
Beck Tunnel	.14
Black Jack	.14½
Carisa	15
Cedar Talisman	02
Colorado Mining	36
Columbus Con	26
Daly-Judge	6.50
Grand Central	.79
Iron Blossom	1 22½
Little Bell	.43
Lower Mammoth	.03½
Mason Valley	12.50
May Day	13
Nevada Hills	2 25
New York	03¾
Prince Con	1 02½
Silver King Coal'n	1 52½
Sioux Con	11
Uncle Sam	32
Yankee	15

TORONTO Feb. 20

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6 80	Pearl Lake	19
Hudson Bay	‡70 00	Porcu. Gold	43
Temiskaming	35	Porcu. Tisdale	03
Wettlaufer-Lor	78	Preston E. D.	05
Apex	05	West Dome	37½
Central	3 62½	Standard	18
Doble	50	Foley O'Brien	30
Dome Exten.	41	Rea	1 00
Hollinger	10 75	Crown Chartered	13
Imperial	.05	Swastika	23

SAN FRANCISCO Feb. 20

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.09	Belmont	9.60
Belcher	65	Jim Butler	37
Best & Belcher	.16	MacNamara	.21
Caledonia	4.25	Midway	.25
Challenge Con.	.20	Mont.-Tonopah	1.12½
Chollar	.15	North Star	.30
Confidence	.80	West End Con	.87
Con. Virginia	.82	Atlanta	.15
Crown Point	.60	Booth	.05
Gould & Curry	07	C.O.D. Con	.12
Hale & Norcross	.32	Comb. Frac	.14
Mexican	3.60	Jumbo Extension	24
Occidental	60	Pitts.-Silver Peak	1 22½
Ophir	1.45	Silver Pick	.06
Overman	1.65	St. Ives	30
Potosi	.10	Tramp Con	‡.01
Savage	.27	Argonaut	‡2.50
Sierra Nevada	.35	Bunker Hill	5 50
Union Con	1.17½	Cent. Eureka	33
Yellow Jacket	.52	So. Eureka	‡5.50

N. Y. EXCH. Feb. 20	
Name of Comp.	Clg.
Amalgamated	65⅛
Am. Agri. Chem	58¾
Am.Sm.&Ref.,com	71⅝
Am. Sm.& Ref., pf.	103⅞
Am. Sm. Sec., pf. B	86½
Anaconda	35¾
Batopilas Min	1¼
Bethlehem Steel pf	68⅞
Chino	25⅝
Federal M. & S., pf.	40
Goldfield Con	4⅜
Great Nor., ore ctf.	37½
Homestake	87¾
Miami Copper	23⅞
Nat'nal Lead, com.	53½
National Lead, pf.	107
Nev. Consol	19
Pittsburg Coal, pf.	78
Ray Con	16¼
Republic I&S, com	19⅞
Republic I & S, pf.	73
Sloss Sheffi'd, com.	37
Sloss Sheffield, pf.	‡108¼
Tennessee Copper	36¾
Utah Copper	56⅝
U. S. Steel, com	60⅜
U. S. Steel, pf	108⅝
Va. Car. Chem	54¾

N. Y. CURB Feb. 20	
Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	.48
Braden Copper	5¼
B. C. Copper	4
Buffalo Mines	1 20
Butte & Vipond	53
Butte Coalition	22¾
Cobalt Central	‡.01
Con. Ariz Sm	⅝
Davis-Daly	⅝
Diam'field-Daisy	9
Ely Con	½
Florence	65
Giroux	4⅜
Gold Hill Con	‡
Greene Cananea	7¾
Greenwater	07
Guggen. Exp	180
Inspiration Con	18⅜
Internat. S. & R	128
Kerr Lake	3
La Rose	3⅞
McKinley-Dar-Sa.	1⅞
Min. Co. of A. new	3⅜
Nev. Utah M & S	1/16
Nipissing Mines	7½
Ohio Copper	1 1/16
Pacific Sm. & M.	5/16
Porcupine T'nsite	‡.03½
Precious Metals	‡1⅜
Ray Central	2
Red Warrior	‡1½
South Utah M. & S	‡¾
Standard Oil (Old)	780
Stand'd Oil of N. J	360
Stand'd Oil Subs.	335
Stewart	1 1/16
Tonopah	7 1/16
Tonopah Ex	1 7/16
Tri-Bullion	9/16
Tularosa	¾
Yukon Gold	3⅜

LONDON Feb. 21

Name of Com.	Clg.
Camp Bird	£1 9s 6d
Dolores	1 10 0
El Oro	0 16 6
Esperanza	1 19 3
Mexico Mines	7 2 6
Oroville	0 5 6
Stratton's Ind.	0 3 1½
Tomboy	1 2 6

BOSTON EXCH. Feb. 20	
Name of Comp.	Clg.
Adventure	7⅜
Algomah	6
Allouez	40½
Am. Zinc	24¾
Ariz. Com., ctfs.	4
Bonanza	42
Boston & Corbin	6½
Butte & Balak	4½
Calumet & Ariz	60
Calumet & Hecla	430
Centennial	18¾
Con. Mercur	.03
Copper Range	53
Daly West	5¼
East Butte	12⅝
Franklin	13
Granby	35
Hancock	35
Hedley Gold	18
Helvetia	1
Indiana	14½
Island Cr'k, com.	‡43½
Island Cr'k, pfd.	86¾
Isle Royale	24⅝
Keweenaw	1¼
Lake	36
La Salle	4½
Mass	8¼
Michigan	3
Mohawk	55½
New Arcadian	‡3⅞
New Idria Quick	‡7¾
North Butte	26
North Lake	6⅛
Ojibway	5
Old Dominion	46
Osceola	112½
Quincy	76¾
Shannon	9⅞
Shattuck-Ariz	17½
Superior	26
Superior & Bost	3
Tamarack	28
Trinity	5½
Tuolumne	4
U. S. Smelting	35¾
U. S. Smelt'g, pf	48
Utah Apex	2⅞
Utah Con	15
Victoria	4½
Winona	7⅛
Wolverine	100
Wyandot	2½

BOSTON CURB Feb. 20	
Name of Comp.	Last
Ahmeek	240
Bingham Mines	3¾
Boston Ely	1¾
Boswyocolo	.09
Cactus	16
Calaveras	2½
Chief Cons	95
Corbin	3⅛
Cortez	1⅛
Crown Reserve	2⅞
First Nat. Cop.	2¼
Majestic	43
Mazatan	⅛
Moneta Pore	16
Nevada-Douglas	3½
New Baltic	4½
Oneco	2¾
Raven Copper	.30
Rhode Island Coal	.26
San Antonio	‡3½
South Lake	5
Trethewey	70
United Mines	‡¼
United Verde Ext.	.39
Vulture	‡5¾

‡Last quotation

The Engineering and Mining Journal

Vol. 93. MARCH 2, 1912. No. 9.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 10,000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page
Editorials:
The Adirondack Gold Swindle..... 437
American Institute of Mining Engineers 438
Steel Profits 438
Metaltics—By the Way............. 439
William C. Wetherill............... 440
Butters Wins First Decision in Filter Litigation 440
The Bonanza Dividend............... 440
Smelting Trust Inquiries............ 440
Naumkeag Copper Co................ 440
Correspondence and Discussion:
Soldering Aluminum .... Where the Primer Should Go....The Metallurgy of Nickel .... San Francisco Mine. Oaxaca .... Stratton's Independence Mill.... 441
Details of Practical Mining:
*Tram Car for Stope Filling.... Support at the Bottom of a Stope ....*A Sample Reducing Machine....List of Water Equivalents....*The Whitmore Brake and Overwind Prevention Gear ....Sand for Hot Bearings.... Hanging Electrical Turbine Sinking Pump.... *Measuring Pocket for an Inclined Shaft.... *Dipper Trips for Steam Shovel 443
The Promoter 448
Arizona Copper Co. 448
Chino Copper Co....................... 449
*A Large Rock Crushing Plant..... 450
*The Treatment of Metallic Junk. Donald M. Liddell 452
*The California Gold Dredge—III. Robert E. Cranston 453
Aluminum for Transmission Lines... 458
Kentucky Barytes and Calcite...... 458
*Ore Dressing in the Joplin District—II...........James L. Bruce 459
Gage for Sheet Zinc................. 463
Compensation to Injured Workmen in Michigan.......P. B. McDonald 463
Hillside Houses for Working Men... 463
Conservation of Natural Gas........ 463
Mining Index 464
Personal, Obituary and Societies.... 468
Editorial Correspondence 469
Mining News 471
Markets 477
*Illustrated.

The Adirondack Gold Swindle

The exploitation of the bogus Klondike in the Adirondack region of New York, which has been discredited repeatedly by the Journal and by the state geological survey, has been well illuminated during the last week by the New York *Sun*, always a leader among the daily papers in the exposure of frauds. These Adirondack swindles have been of a particularly noxious variety in that in the main they have been perpetrated upon persons in the rural districts, who are inexperienced in this sort of guile, but it appears that certain smart "promoters" succeeded in putting salt on the tails of some birds in Wall Street.

The Adirondack gold swindles are nearly related to the "gold-out-of-sea-water" fake, but are the direct descendants of the "green-gold" myth, which has been the subject of many essays in the Journal, as our readers know. For the benefit of those whose recollection fails, we shall repeat, briefly, that the earliest form of this myth, so far as we have been able to discover in our researches, was the idea that there exists a kind of gold called "green gold," not with reference to its color but rather to its immaturity (its state of being unripe and imperfect), which escapes detection by the rude methods of the assayer, involving fusion at bright red heat and leading to the volatilization of this tender young gold. By refined methods, according to the exponents of the theory, such gold could be caused to mature immediately and could be extracted in munificent quantity from rock, sand, mud, etc., that did not appear to contain any gold. This myth, according to our studies, dates back to the early days of gold mining in California, but we should not be surprised if it were known to Agricola and possibly in the times of Crœsus.

The survival of this myth and the lingering of the belief in the minds of persons who are not swindlers, though they may fairly be pronounced illiterate, has been one of the curiosities of modern times. Not all of the Adirondack gold "miners" are swindlers; some of them are merely stupid. We have received many communications from them. In one case we caused a test of alleged gold-bearing sand to be made, which was reported in the Journal of Mar. 19, 1910. An Adirondack sand-digger sent us two samples, taken by himself, from which he claimed to get $1.70 to $2.75 per ton, although Prof. Locke, of the Massachusetts Institute of Technology, was unable to get more than a trace. He sent us these samples with the hope that they "may lead to such an investigation under the auspices of the Journal as may settle the matter." We submitted these samples, in the original packages, under the seal of the sender, to A. R. Ledoux & Co. and to Ricketts & Banks, assayers and chemists, of New York, than whom no one stands higher in public confidence. Both of these chemists were warned to be on guard against volatile gold, and consequently they made their assays by two methods, viz., the ordinary fire assay, carefully conducted, and the wet assay. Any young or delicate gold did not have any chance to escape. Both chemists agreed that both samples contained only traces of gold, and neither was able to report any difference between the fire and the wet assays.

It was, of course, to be expected that the swindlers of the green-gold variety would modify their claims on the strength of the theories of the radiochemists. If copper may be transmuted into lithium, why not silicon into gold? Thus we find one of the Adirondack "scientists" leaching sand in a pan containing a slab of secret "radiomagnetic" substance, the discovery and effect of which are explained in the following words of wisdom:

> I have been studying radium and its action ever since Mme. Curie discovered it, and when Prof. Rutherford by the use of uranium nitrate transmuted copper into lithium, I went deeper into it. My discovery of this process was almost wholly accidental, however. I was working in a Western mine with some chemicals and threw a certain composition which had failed into a vat with other waste, among which there was some ore. I forgot about it for a few days, and when I looked into the vat again found that all the metals in it had agglomerated. A further investigation showed why they had done so. It was wholly through the radiomagnetic action of one of the elements I had thrown into the vat.

Thus the green-gold myth has completed the circle to the older one of the alchemists. Our notice to suckers is that Adirondack sand contains only green gold and that green gold is the stuff that gold bricks are made of.

American Institute of Mining Engineers

The events at the annual meeting of the A. I. M. E. last week will doubtless have an important bearing upon the future of the Institute. The administration had proposed a series of amendments to the constitution. These aroused much opposition among the membership, but this did not take an organized form until nearly the last moment, when it was crystallized by a circular signed by 20 members asking for proxies. The response was immediate, manifesting the wide-spread feeling that a change in the policy of the Institute was desirable, and the "insurgents" were put in a position to control the meeting and carry out their program.

Their program was temperate. The opposition had been centered upon the proposal to increase the dues. It was not denied that an increase might be necessary and the way to carry out that intention without delay was left open, but it was held that this should not be done until it had been determined by an independent committee that it is an unavoidable expedient. This, of course, involves a study of all of the affairs of the Institute.

A resolution to this effect was passed at the meeting, a committee of five being named coincidently. The constitution of this committee was distinctly conservative, it being manifested thereby that the spirit of the opposition was not to be hostile to the previous régime, but rather to be helpful.

There has never been any suspicion that there have been any improprieties in the conducting of the Institute, but there had been a feeling that the running of its affairs from headquarters had settled into ruts, and especially a feeling that the organization had in late years failed to be as helpful to its membership as it might be.

Mr. Kirchoff, the retiring president, strove earnestly during his term of office to improve things and accomplished a good deal, and it was universally regretted that he was unwilling to take the presidency for another year. The Institute was fortunate, however, in obtaining the services of Professor Kemp, who is held in the highest esteem on all sides. While there was a full appreciation of the self-sacrifice and accomplishment of the president and officers of the Institute during the last year, it was considered that something might be gained by a study of the affairs of the Institute from a new angle. This is a duty that has devolved upon the committee of five.

The responsibilities of this committee are heavy. Upon its report and recommendations will be based probably the future policy of the Institute. It is recognized that the Institute by merely supplying to its members a collection of excellent technical papers does not wholly meet the expectations of its members. The main problem is to make the organization more generally useful. In this the members themselves have responsibilities. The best things come to those who help themselves, not to those who are merely helped. For a successful rejuvenation of the Institute, there must be a general coöperation. The interest that was aroused in the last annual meeting, which was better attended than any other for a long time, is ample evidence that the membership of the organization is capable of attention to its affairs.

Steel Profits

The passing of its preferred-stock dividend for the quarter recently closed, by the Republic Iron & Steel Co., is attributed by its published statement to the low prices of finished products that have prevailed for several months. No complaint is made of the volume of trade, the company stating that 90% of its mill capacity is employed. The Republic last fall started the movement which developed into the the present conditions of low prices and large business, and it is the first company to make open complaint. Undoubtedly the low prices have reduced the margin of profit in the iron and steel business, though there has been much compensation in the way of increased work and the fuller employment of mills. The Republic company, however, has generally worked on a narrow margin and has several times before been obliged to pass its dividends. It has rather a loosely joined organization, covering a number of plants, North and South, and was heavily capitalized, after the fashion of the trust development of 10 or 12 years ago. Notwithstanding the complaint of low prices, it earned a substantial surplus, though not quite sufficient to meet its dividend requirements for the quarter. Other companies may find their net earnings reduced; but it is probable that results will be better, on the whole, than if the conditions of last summer had continued.

The opening discussion on the anthracite wage agreement is now going on in New York between committees of the operators and miners. Since the last strike the trade has been carried on substantially under the agreement formulated by the Anthracite Strike Commission of 1902; but now the miners have demanded an advance of 20% in wages and an eight-hour day for all day labor. The operators have announced that they are not ready to grant such concessions, and it remains to be seen whether any compromise can be reached. The western discussion over the wage agreement is at a standstill, both parties apparently waiting for the result in the East. The conference on Feb. 27 reached no result and adjourned for a week. The outlook in the anthracite field is ominous.

Canadian iron production in 1911 was the largest ever reported, approaching nearly 850,000 tons, a quantity nearly 10 times that reported 12 years ago. Nova Scotia and Ontario both contributed to the increase. The production is largely of basic iron, and the openhearth furnace is the chief steel producer in the Dominion.

French and German producers of aluminum are again reported to be negotiating to end the competition which has kept down prices. The result is uncertain.

Metallics

An iron washer, or small iron weight, free to move on a laboratory screen, greatly hastens the screening operation.

Based on Rowland's determination of the mechanical equivalent of heat (1 B.t.u. equals 778 ft.-lb.), 1 kg.-cal. equals 859 kw.-hr.

For permanganate iron titrations the use of a titration mixture of $MnSO_4$, H_2SO_4 and H_3PO_4 is often proposed. It appears that H_3PO_4 alone is equally effective. Use about 5cc. of sirupy acid.

In shaft sinking, it is advisable to cut good roomy plats at first, as the subsequent enlargement of a small plat is troublesome and relatively more expensive.

The electric properties of Monel-metal wire which has lately been put upon the market are as follows: Electric resistivity, 256 ohms per mil-foot. (The temperature coefficient is 0.0011 per deg. F.). Electric conductivity, 4% on the basis of 100 for copper.

Dredge buckets are now usually made of three parts, with a cast-steel base, pressed-steel hood, and manganese-steel lip. All-manganese-steel buckets are being tried, however, on one of the new dredges in the Oroville district in California. The all-manganese-steel buckets being tried at Oroville are made with the base and hood in one piece, to which a manganese-steel lip is attached.

Where tie-rods are used in parts of a mill building subjected to intense vibration, the nuts can be prevented from working loose and dropping off by threading the ends of the rods an inch more than necessary to take the nut. The nut is turned down tight until this extra inch of threaded rod protrudes. The protruding end is slotted longitudinally for 3/4 in. with a hacksaw and the end of the rod slightly expanded by driving the point of a blunt wedge into the slot so as to spread the ends of the rod.

It is suggested (*Revue de Chimie Industrielle*, Jan, 1912) that the temperatures of fusions of various mixtures of salts could be used for the determination of the temperatures of metals which are being worked. The following fusion temperatures are given: Calcium nitrate, 550° C.; barium nitrate, 600°; potassium iodide, 682°; potassium bromide, 730°; potassium chloride, 775°; sodium chloride, 800°; sodium carbonate, 810°, sodium sulphate, 865°; barium chloride, 955°; potassium sulphate, 1070°. The following mixtures give certain intermediate temperatures: Sodium and potassium sulphate in equal parts, 850°; sodium chloride, 42 parts, potassium chloride, 58 parts, 665°; chloride of sodium, three parts, bromide of potassium, seven parts, 625 degrees.

By the Way

Some of the Wyoming asbestos companies that have been selling large quantities of stock to the public are being investigated by the U. S. Postal Department. Unless these stock issues were printed on paper made from the companies' own product so as to stand the test of fire, there would seem to be a warm time in prospect for some of the promoters.

A truly remarkable statement appearing in the prospectus of a copper company has been brought to our attention. It is as follows: "Attention! For reasons best understood by mining men, stock in this company is not as safe an investment as Government bonds, or cash in a bank; and we advise no one to encumber his home or an assured income to obtain funds to invest in the stock of this company." This is certainly remarkable and very likely to be true.

While the following is not strictly germane to mining, it may, by analogy, strike a responsive chord with some of our readers. Mr. Harcourt, at the British North Borneo dinner, said that a city friend was approached with a view to floating a rubber company. "How many trees have you?" he asked. "We have no trees." "How much land have you?" "We have no land." "What, then, have you?" "I have a bag of seeds." The latter seems to be the "rubber" equivalent for an option.

The Russian government has granted concessions for the building of a system of railways in the territory south of the Siberian Ry. in the valley of the upper Obi, on the west slope of the Altai Mountains. These lines will facilitate the opening of the mineral deposits—copper, silver-lead, iron and gold—known to exist in the Altai, but now unworked on account of the cost of transportation. One line is to run from the Siberian Ry. south by west to Barnaul. Semipalatinsk and Bivsk, about 500 miles. The other is from Aris, on the Oremburg Ry., eastward to Pishpek and Wiernsk, about 400 miles. From the last named line an extensive can be readily built into Mongolia.

Commissioner Lane, of the Interstate Commerce Commission, says: "We are going to prosecute the express companies for overcharging the public. This investigation was made for the purpose of developing the facts in this regard. The commission has 3000 complaints of overcharges, and 10,000 letters on its file complaining of this practice." When asked if he meant criminal prosecution, Lane answered: "Certainly I meant criminal prosecution. The facts will be presented to the federal grand jury at the proper time." The investigation by the Interstate Commerce Commission was based on alleged extortion and unequal rates; overcharges and over-weighing; collections made at point of delivery on prepaid packages; inefficient service; combination with the railroads, and usurpation of governmental, banking and commercial functions.

The *Congressional Record* discloses that Victor Berger, the Socialist member, and a San Francisco newspaper have become convinced "that a conspiracy exists among the officials of the Treasury Department to close the refining branches of the United States mints and to turn over to the smelting trust the business of refining gold and silver bullion intended for coinage." The contributions of the present Congress to the knowledge and practice of the mining industry have been more or less remarkable—one might also say, fictional.

Lost mines are not unknown in this country; it seems that there are some in Europe also. A correspondent sends to the *London Mining Journal*, from Stavanger, a description of the discovery last summer of a legendary old mine near Todalshaug, Molde, in Norway. According to local tradition, a gold mine was worked at the spot up to the beginning of the 17th century, when, owing to an incursion of about 900 Scotsmen, under the leadership of a certain Captain Sinclair, who landed in 1612 with a view to passing into Sweden through Norway, the mine was covered up, and, despite occasional efforts at discovery, its precise location was forgotten. The invading force was almost annihilated in the neighborhood, but a few survivors inter-married with the population, and the tradition has been strengthened by the evidence of a Scotch type among some of the inhabitants of the valley. The last effort to discover the mine seems to have been made about 50 years ago, but without success, and the recent find is the result of an accident. The particular spot is only visited during the summer months, when the cows are taken up to high pasture. Last summer, when the animals were driven up, it was found that a landslip had occurred during the spring, and that about 3000 tons of débris had been carried away, and an old shaft 9 ft. long and 6 ft. wide, plugged with round timber, more or less petrified, stood revealed. There still exist the remains of an old quay from which, presumably, ore was shipped in ancient times. The correspondent writes further that he has sampled the ancient dumps, the assays showing gold, silver and 16 to 18 per cent. copper. He thoughtfully adds that there are waterpowers close by, which will furnish 150 hp. or more. After which we are not surprised to hear that "it is hoped this mine will soon be reopened." Probably the Lost Mine of Norway, Ltd., will soon be floated in London. The existence of "inhabitants of Scotch type in the valley" gives a fine air of truthfulness to the letter.

William C. Wetherill

William Chatlin Wetherill died suddenly at Denver, Colo., Feb. 10, aged 60 years. He had been connected for 23 years with the operations of the New Jersey Zinc Co. and its subsidiary companies, and was well known and highly esteemed both as an engineer and for his personal qualities. He was born at Newark, N. J., in 1852, his father being Col. Samuel Wetherill, inventor of the Wetherill process for making zinc oxide. The whole family, in fact, was concerned in zinc metallurgy, his brother, John Price Wetherill being the inventor of the well known Wetherill magnetic separating process, while another brother, S. P. Wetherill, was for many years a paint manufacturer in Philadelphia.

William C. Wetherill graduated from the Philadelphia Polytechnic School as a civil engineer, and studied for a time at Lehigh University, being in the class of 1870. His first professional engagement was with Charles F. King on some railroad work in Pennsylvania. In 1878 he went to Brazil as locating engineer for the Madeira & Mamoré R.R. in that country. Returning to the United States in 1880 he was for a year employed in the location of the Northern Pacific line in Montana and then went to Mexico as chief engineer of the Mexican National under Gen. W. J. Palmer. In 1885 he located the very difficult line of the Beech Creek R.R. into the Clearfield coal district in Pennsylvania. After a few years (1885 to 1889) spent in railroad contracting work with Charles F. King, in Missouri and Virginia, he became engaged in zinc mining and smelting, taking the position of general manager at Joplin for the Empire Zinc Co., of Missouri, which later became a subsidiary of the New Jersey Zinc Co. In 1901, after the dismantling of the Empire works, he removed to Denver, having been chosen vice-president and consulting engineer of the Empire Zinc Co., of Colorado, which position he held up to the time of his death.

Mr. Wetherill leaves a widow and two daughters. He was a member of the American Society of Civil Engineers, the Colorado Scientific Society, the Franklin Institute and the Engineers' Club of Philadelphia; also of the Sons of Colonial Wars, the Madeira & Mamoré Association and the Denver Athletic Club. He was the author of several technical papers, chiefly written for the Colorado Scientific Society.

Mr. Wetherill was one of the most charming of men and was esteemed and loved not only by his wide circle of friends, but also by a host of acquaintances. His death is felt keenly as a personal loss by all of these. There are few men possessing finer qualities as a man and a friend than W. C. Wetherill. His professional career was long and honorable and useful.

Butters Wins First Decision in Filter Litigation

The suit brought by the Moore Filter Co. against the Tonopah-Belmont Development Co., Tonopah, Nev., on the ground that the Butters filter plant installed at the Tonopah-Belmont mill infringed the Moore process patent, was decided in favor of the defendants by the U. S. District Court, at Trenton, N. J., this week. This case has been in controversy since early in 1908.

From the first, the Butters company assumed the burden of the defense and it became virtually a test case to determine whether the Butters patents in the United States were distinctive; there was no question as to the validity of the Moore patents.

The basis of the decision of the court was that the stationary type of filter is not the equivalent of the Moore movable type. Since the Moore Filter Co. exclusively controls the Cassel patents, which are claimed to be the basic patents on all the stationary types of filters, an appeal will be taken immediately and will probably be heard before summer.

The Bonanza Dividend

Initial distribution of $1,000,000 by the mines at Kennecott, Alaska, known as the Bonanza group, and owned by the Morgan-Guggenheim syndicate, seems large on the mines' capitalization of $2,500,000, but is small when the amount spent on the mines and the Copper River R.R. by the syndicate, upward of $23,000,000, is taken into consideration, says the Boston *News Bureau*.

The Copper River R.R. is paying its own operating expenses, but it will be a long time before the road can meet its interest charges, which would total $1,000,000 per annum at 5% on $20,000,000 invested. The Copper River R.R. has been able to operate by installing oil burners on its engines and bringing oil from California.

The Bonanza mines have, roughly speaking, about 100,000 tons of copper ore averaging more than 65% copper, of which approximately 16,000 tons have been extracted. Engineers who went over the mines estimated that they contained ore which would yield profits of about $6,000,000, or a net of $3,000,000 when the time elapsed necessary to extract the ore and the interest during that time on the money invested are taken into consideration. The properties cost the syndicate $3,000,000. It was never thought that the profits on the Bonanza mines would give a profit on the mines and the railroad investment combined. Return on the railroad investment was expected to come from the opening up of the Alaska territory and the development of coal lands and mineral-bearing properties by outside capital.

Smelting Trust Inquiries

WASHINGTON CORRESPONDENCE

A sudden flurry of interest in the so called "smelting trust" during the last week has produced two resolutions of inquiry in the House of Representatives. The first is by Mr. Martin, of Colorado (No. 419), and provides:

> Resolved, that the Attorney General be hereby directed, if not incompatible with the public service, to inform the House whether the Department of Justice has in its possession any information touching the existence of a smelting trust in the United States, including the American Smelting & Refining Co.; whether complaint of the existence of a smelting trust, or touching the operations of the American Smelting & Refining Co., as the same might be affected by the Sherman anti-trust law, has reached the Department of Justice; whether any steps have been taken or are in contemplation to investigate the existence of or prosecute any smelting trust; together with copies of any information touching the existence and operations, if any, of such trust.

The other resolution was introduced by Victor Berger, of Wisconsin, who wishes to have a report as to whether the smelting trust was in a conspiracy with the Treasury officials to close the refining branches of the mint and to turn this business over to the smelting trust.

Naumkeag Copper Co.

The Naumkeag Copper Co. is to be formed to take over properties at Houghton, Mich., on the south side of Portage Lake, comprising the Dakota (200 acres), South Side (200 acres), land of the Canal company (160 acres), Naumkeag (400 acres), Pacific (140 acres), Sheldon-Douglas (160 acres), total, 1260 acres. The new company is to be organized on the basis of 200,000 shares of par value of $25 each. Of the capital stock, 102,000 shares, marked $10 paid in, is to be issued immediately in payment for the properties and to put $253,000 in cash in the treasury. The new company is financed by the General Development Co., with the distinct understanding that it is a development venture and not a proved mine. The General Development Co. and its associates will control about 56,000 shares of the stock issued, which holding will be pooled, pending developments, and no stock will be offered to the public by the General Development Company.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Soldering Aluminum

Will you please advise me as to whether there is any simple and reliable system of soldering aluminum?

G. H. R.

[According to Joseph W. Richards, aluminum can be soldered by an alloy of 78.34% Sn; 19.04, Zn; 2.38, Al; and 0.24, P, the last serving as a deoxidizer. In later practice the solder was made by melting together 1 part phospor tin, 11 parts zinc, and 29 parts tin. It is claimed by C. H. Land (ENG. AND MIN. JOURN., Jan. 21, 1911) that aluminum can be soldered by immersing the edges in molten tin and scratching with a steel scratch brush while immersed, until a coating of tin is formed, after which the pieces can be soldered together with ordinary solder.

In *Power* (Feb. 27, 1912) the following methods are also given:

"Aluminum can be readily welded electrically, but soldering is not satisfactory. The high heat conductivity of the aluminum withdraws the heat of the molten solder so rapidly that it "freezes" before it can flow sufficiently. A German solder said to give good results is made of 80 per cent. tin and 20 per cent. zinc, using a flux composed of 80 parts stearic acid, 10 parts chloride of zinc and 10 parts chloride of tin. Pure tin fusing at 480 deg. F. has been employed as a solder, and soft solder with chloride of silver as a flux has also been used."

In welding aluminum by the oxyacetylene blowpipe, it is necessary, to obtain the best results, to use a flux on the portions to be welded (*Brass World*, Feb., 1912). This flux answers a two-fold purpose: (1) It protects the metal from oxidation when melted by the blowpipe flame. (2) It serves to dissolve the oxide formed on the surface of the molten metal.

According to a process recently patented by the Aktien Gesellschaft für Autogene Schweissung, of Zurich, Switzerland, the following flux is excellent:

Potassium chloride....	50 parts
Cryolite	6 parts
Calcium chloride....	30 parts

These proportions may be varied, if desired, but the quantities given are used for ordinary work. The best results are obtained by melting the whole together and then pulverizing before using on the aluminum. This gives a homogeneous mass of the flux which melts evenly.—EDITOR.]

Where the Primer Should Go

In the JOURNAL of Feb. 17, 1912, Percy E. Barbour asks the question: Where should the primer be placed? The answer to this question seems to me clear. It all depends upon the kind of fuse used to ignite the detonator.

My reasons for making this statement are; that it is generally conceded that in using high-grade explosives the intensity of the explosion varies with the strength of the fulminate detonator; that the detonator acts with diminishing effect as the distance from the detonator is greater; that the greatest burden or resistance that the explosive must overcome to break the rock, is usually at the bottom of the drill hole, and that explosives of the type of dynamite not only fail to develop their full strength when burned instead of being detonated, but the gases evolved from burning dynamite are more noxious than those evolved from its detonation.

The inference naturally drawn is, that since the greatest resistance is at the bottom of the hole the dynamite at that point should be exploded so as to develop its maximum force; therefore the primer should be placed at or near the bottom of the hole. This is the proper place for the primer when the cap is electrically detonated.

It might be well here to mention some of the ways electric detonators are placed in the primer. They are inserted by opening one end of the cartridge, forcing a small pointed stick about the shape and size of a lead pencil into the powder, and then inserting the cap. The paper wrapper of the cartridge is then wrapped about the wires and securely tied. As a precaution against pulling out the wires during loading of the hole, they may be doubled back so as to parallel the cartridge, the wires being securely tied to the cartridge at two places, preferably an inch or two from the ends. The primer may also be inserted in a hole punched in the side of the cartridge with the pointed stick tying the wires to the sides so as to hold the cap securely in place. The angle of the cap to the wires at the side of the cartridge should be obtuse as an acute angle necessitates a sharp bend in the wires that may break the sulphur filling of the cap. In blasting in wet ground the cracking of this sulphur filling may admit water to the fulminate, and interfere with or prevent its detonation. Never should the cap be held in place by making a half hitch around the cartridge with the wires. It takes more time to tie in the caps with string and thus secure straight wires, but it is a precaution that should be insisted upon.

The method of inserting the electrically detonated cap in the end of the cartridge is preferable to side insertion as the cap is then more protected by a cushion of powder all around it and there is less possibility of abrading the insulation that might result in laying the wires bare and cause a short-circuit; hence a misfire.

It is obvious that the primer can be placed in the bottom of the hole either with the cap at the bottom, if the wires are doubled back, or at the top if not so doubled. In the second method the cap will be in the upper end of the first cartridge and close to the lower end of the second. It would probably detonate the second cartridge more forcibly than if the cap were at the bottom of the hole, although to all practical purposes the two end sticks might be regarded as equally detonated whatever the position of the cap.

ALTERNATIVE FOR ELECTRICALLY DETONATED PRIMERS

With the doubled-back wires perhaps the best position of the primer is just above the first-placed or bottom cartridge with the cap end of the primer or second cartridge introduced into the hole first. The bottom cartridge then acts as a cushion that prevents any chafing of the wires, during tamping, that might take place against the rock at the bottom of the hole if the primer were used at the bottom; the pressure might be enough to crack the sulphur if not enough to abrade the insulation. A little clay tamped into the bottom of the hole will also provide a good cushion as a precaution against chafing. The chafing of the wires is probably a greater consideration than any difference in detonating effect arising from the position of the cap. Using the primer as the second cartridge, therefore, has an advantage over using it at the bottom, but if carefully introduced, there is not much greater risk of short-circuiting by using the primer at the bottom.

As a further precaution against short-circuiting some blasters separate the two wires just above the inserted cap and double each wire back separately so that they are on opposite sides of the cartridge, uniting them again at the other end and securely tying them in position on the cartridge with string.

At some mines it is customary to slit the sides of the cartridge with a knife so that the explosive will swell out and completely fill the hole when tamped. When this is the practice the electric cap should never be inserted or poked loose down the hole into the charge. Use a primer cartridge as usual without slitting its sides as in the case with the other cartridges of the charge, or else slit it and force carefully and gently into position so as not to break the powder out through the slit. A primer should be gently tamped if at all to break out the powder through the slits. In blasting deep holes it is not unusual practice to use more than one primer at intervals in the charge and connect the wires in series.

Electric detonators are rarely used in mines because in such work it is desirable to fire a number of rounds of holes with an appreciable interval between them. It is not practicable to fire several groups at intervals by electricity by laying separate wires from the blasting-machine to the face, but delayed-action detonators are now being introduced so that a time interval will elapse between each successive group and with only one operation at the blasting-machine. There is no danger of igniting dynamite when using electric detonators as a short-circuit will not develop a spark sufficiently hot to ignite the powder. The wires of all the caps in the charges are wired together in series and it is possible to send a small yet measurable current through the circuit to test the connections before sending through a current that will detonate the caps. The delayed-action caps should interest mine operators in the possibilities of using electric detonators in all work and doing away with ordinary fuse altogether.

NO OPTION WHEN USING FUSE

When using ordinary fuse there is but one place for the primer: the top or last cartridge to be inserted. This is because there is danger of setting fire to the dynamite if the fuse has to burn through it before reaching the cap. The primer has no place in any other part of the charge. It should also be stated that the cap should be inserted by opening the end of the cartridge and inserting it to no greater depth than two-thirds the length of the copper shell. The wrapper is then wrapped about the fuse and securely tied in such a manner as not to compress the fuse itself. If the cap is entirely imbedded in the cartridge or placed in the side of the cartridge, the fuse may set the powder afire. The loss of force through burning of the powder will be greater than any difference in explosive force arising from remoteness of a given cartridge from the primer. Even with only two-thirds of the cap imbedded in the powder, it may be pressed in flush with the top of the cartridge by the tamping.

There is, I believe, a tendency to avoid using strong caps. This is not as it should be and in few cases will the saving warrant the practice. Personally I have always preferred using not weaker than a No. 6 cap and when using low-grade dynamites a No. 8. A strong cap always insures a strong detonation of the charge, and the lower the grade of the dynamite the stronger should be the cap.

In opencut mining mixed explosives are used, such as dynamite with black powder. The ratio of dynamite to powder is usually small, the former really acting as a detonator that ignites the black powder by its flash. In coal-mining practice some miners reverse this order and place the dynamite at the bottom of the hole without a cap, the black powder igniting the dynamite. The claim is made that the stronger explosive terminates the shot at the back, giving a clean break. It is claimed that in such practice the dynamite detonates, but I think this extremely improbable. These miners also state that placing the dynamite at the top and using it to ignite the powder causes excessive shattering of the coal at the outer side. In metal mining I do not see that these conditions enter the question at all. The black powder is ignited by the flash of the primer and, as black powder takes an appreciable interval to burn, placing the dynamite at the bottom would cause the propagation of ignition in an upward direction and give rise to a tendency to produce a blown-out shot. It seems to me that, in consideration of this, in mixed-explosive blasting the proper place for the primer is at the top of the charge whether fired by fuse or electric detonator.

In conclusion I would state that in all mixed-explosive blasting and where fuse is used the primer should be placed last or at the top of the charge, and when using explosives of the dynamite type with electric detonators, at the bottom or, perhaps better, next to the bottom or first cartridge used.

CLARENCE C. SEMPLE.

New York, Feb. 26, 1912.

The Metallurgy of Nickel

Not long ago I wished to make some studies on the metallurgy of nickel, and was surprised to find that there seemed to be no book on that subject, but that all the available literature consisted of short chapters in general metallurgics, or of scattered references in the technical magazines. The greatest source of trouble seems to be that the production of nickel is largely in the hands of one or two producers who earnestly discourage publication of their methods. Nevertheless there must be enough scattered knowledge among the members of the engineering profession to make a fairly authoritative treatise, if it could all be gotten together. Some years ago the JOURNAL opened its columns to a discussion of the art of pyritic smelting. Why couldn't the "Discussion" page be used for a time for the publication of informal notes on the metallurgy of nickel. Judging from my reading, the following topics would all be of interest: What is the true efficiency of the top-and-bottom smelting process, i.e., how clean a separation can be made of nickel and copper by this method? What is the electrolyte and current density used in the electrolytic refining process? Where are the precious metals taken out and how? Is the method given in the textbooks of fractionally separating nickel and cobalt by bleaching powder in commercial use?

E. F. HOPKINS.

Cincinnati, O., Feb. 1, 1912.

San Francisco Mine, Oaxaca

In the JOURNAL of Jan. 6, 1912, under the heading "Mining in Oaxaca in 1911," it is stated that "the San Francisco mine is now idle." I wish to inform you that this is not the case. The mine has not been idle at any time during the last year, and development is still being carried on. The mine has not been shipping heavily for the simple reason that freight and smelting charges are about $25 per ton, but it is the intention of the company to erect a mill as soon as conditions in Mexico improve. As the statement in the JOURNAL has been read by shareholders in this property, who live in various parts of the United States, I ask you to make this correcting statement.

TEHUANTEPEC SILVER MINES CO.,
E. W. Hockley, Manager.

Taviche, Oaxaca, Feb. 8, 1912.

Stratton's Independence Mill

My attention has been called to the article on Stratton's Independence mill, by Messrs. T. C. Linderfelt and J. K. Stewart, published in the JOURNAL of Feb. 10, 1912. This description of our mill and methods is unauthorized, mostly untrue, quite unreliable and unworthy of serious attention.

PHILIP ARGALL.

Denver, Colo., Feb. 15, 1912.

[The article in question was essentially of a merely descriptive character, in which class of article error is least to be expected. We have become convinced that it is seriously erroneous and that its authors imposed upon us in spite of the scrutiny of their MS. that we thought was careful. EDITOR.]

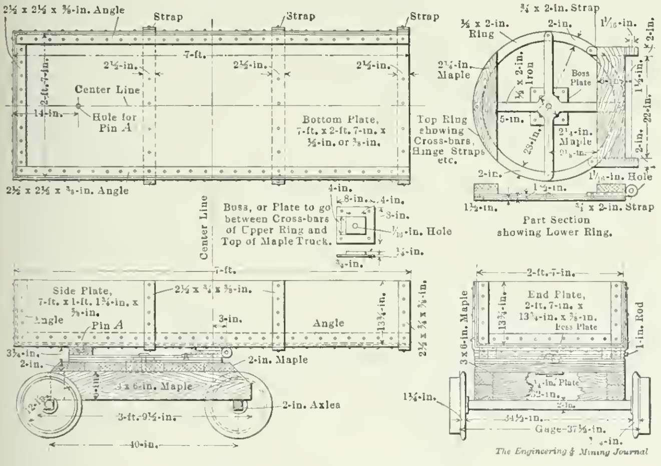
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Tram Car for Stope Filling

The accompanying drawing shows the details of construction of cars used in the stopes at the Copper Range mines at Painesdale, Mich., where a waste-filling system of mining is used. These cars hold a ton of waste and have the long, low bodies characteristic of copper-country mine cars. In this way the height that the shoveler has to lift the ore is kept low.



The Engineering & Mining Journal

Trimountain Car for Stope Filling

The long body is of advantage in spreading the filling, as it allows the filling to be dumped somewhat farther to one side than could be done with a car with a short body. The body of the car is fastened to the truck by a hinge carried on a turntable on the truck frame. Owing to the speed with which the maple decays underground, the wooden truck is now being made of fir Some of these cars are equipped with Peleter bearings just like the main cars on the level, while others have ordinary bearings. The bolt going through the hinge can be taken out easily when the car is to be raised into or lowered out of the stope, and the body can be dismounted for handling it through the chutes.

Support at the Bottom of a Stope

By Claude T. Rice

An interesting problem in mining exists at the No. 8 Hecla shaft of the Calumet & Hecla Company, at Calumet, Mich., where a pillar 200 ft. high, measured along the dip of the lode and extending from Hecla No. 7 to Hecla No. 8 shaft, a distance of 800 ft. is being mined. This ground was left under No. 47 level when that level drained a certain part of the mine.

All the ore down to that depth has been worked out except the shaft pillars 85 ft. wide on each side of the shafts and the old level pillars about 18 ft. high, measured along the slope of the vein that were formerly left under each level. Below the No. 47 level practically all the ore has been mined out to the No. 60 level. Apparently the ground both above and below this block of ore has closed in and filled the old stopes. This has thrown a considerable weight upon the roof, as is apparent from the swelling of the floor of the drifts leading to the stopes in this block. On the No. 48 level a drift stope was run some time ago 20 ft. wide along the dip and about 6 ft. high, but now this opening, with the exception of the drift along which are cars run, and which is maintained by heavy timbering and constant easing, is almost entirely closed in.

The conglomerate bed is 16 ft. wide in the block in question and rich, probably averaging 4 per cent. copper from foot to hanging wall. The ore is being breasted out in overhand stopes 100 ft. long that are timbered with three-post stull sets of the usual Lake Superior type. These are set at centers of about 6½ ft. apart, both in the direction of the dip and of the strike of the bed. The dip is about 38 deg. Below the No. 49 level there is supposed to be a pillar of ore about 15 ft. thick measured along the dip of the lode.

Stoping began on both levels from No. 8 shaft, the stopes being started on both levels at the far end of the block with a pillar 100 ft. wide left next No. 7 shaft. The stope on the No. 48 level was started first, and in both stopes there have been until recently two machines working, the miners working on contract. Owing to the slowing up of the mining in the upper stope, due to the great weight on it which is continually crushing the timber and delaying the drilling, the lower stope has caught up with the upper, and both are now about 75 ft. up from the level.

In the upper level the roof has become so heavy that the stull sets in the lower 25 ft. of the stope have broken so that it has been necessary to build in solid between the broken stulls in order to keep the roof up and maintain a passageway for the ore to the level. Broken pieces of timber about 4 ft. long are used so that the bottom of the stope is composed of a series of rough bulkheadings built up tight against the hanging with ore passes through them about 3 or 4 ft. wide. Above the lower 25 ft. there is about 25 ft. of stope in which at least one post of each stull set is broken, while in the top part of the stope the timbering is in fair condition. Working in the ground has been going on for about seven months so the weight is not due to slow mining. The back in the upper stope is tightly laced as soon as the timbering is put in, although when first mined it is in fair condition.

In the lower stope there is not a single set that has given away from crushing, although a few posts have been broken by boulders that have come down the stope from blasting. The roof in the lower part of the stope is tightly laced, but in the the last 15 ft. it is in such good condition that no cap piece is being put in, although a block is placed under the top blocking of the leg post of the sets so that a cap piece or wall timber to carry the lacing can be put in later if necessary.

In both stopes the width of ore from foot to hanging wall is the same, 16 ft., and outwardly there is no reason why the weight should be so different except because of the manner in which the two stopes were started. In the opinion of the mine captain, who has been working in the conglomerate lode for many years, the fact that he decided to leave a ledge of ore at the bottom of the lower stope instead of opening clear across the lode, as he did in the upper stope, is the only explanation; at least that was the way it appeared on going through these stopes. It would seem as though in the upper stope the continuity of the arch had been broken and so even at the bottom when the stoping had only fairly begun the ground was heavy. In the lower stope the ledge of ground that was left served to carry the support from the level pillar to the roof, consequently, there was no settling of the roof in the lower part of the stope like in the top stope, while the cutting-out stoping was being done to make room for timbers, and so the roof in the rest of the stope did not move as appears to have been the case in the upper working.

On the other hand in the upper stope, as there was no ledge of ore to help arch the back while the cutting-out stoping was going on there was a chance for the hanging wall to settle. This happened, and after it once had started, timbers were unable to hold up the roof. Bulkheads had to be put in between the broken stulls, but even they could not stop the settling until they had been compressed thoroughly. This settling of the roof in the bottom of the stope permitted the roof in the upper part also to settle, and consequently, owing to the roof at the bottom being cracked and broken, the roof over the whole stope got in motion. In the other stope, the roof at the bottom was held up by the arch until timbers could be put in, which were then able to hold the roof as the arch was not cracked and there was a good brace of solid ground extending up from the level. Therefore, as the roof in the upper part of the stope could not, as it were, slide downward parallel to itself through settling of the roof in the lower part of the stope, it did not crack and consequently even near the top, when approaching the heavy ground of the stope above, the roof does not need to be laced to hold it up.

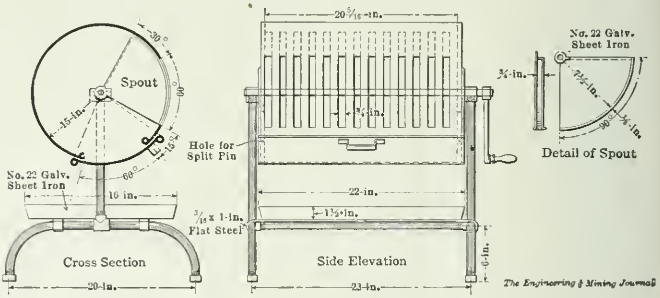
This instance shows the importance of keeping the roof in the form of an arch as much as possible, especially at the bottom of a stope, so that there is a solid ledge of ore for the hanging wall to stand on. If motion can be prevented in the roof of a stope, the ground does not become very heavy, but once anything starts it to moving, each inch of movement at the bottom allows the rock above to move the same amount, seams open up and the whole roof of the stope becomes bad.

A Sample Reducing Machine

The sample reducing machine, the details of which are shown in the accompanying drawing, was designed by E. W. Miller for the Bureau of Mines, for the special purpose of reducing samples of coal, but which can also be used for sampling other minerals. In this machine an attempt has been made to combine the mixing and reducing of a sample in one piece of apparatus which shall be portable and cheap to build which shall protect the sample from drying air currents, and by means of which the work can be easily and quickly done. Preliminary experiments with this apparatus seem to indicate that these requirements and have been fufilled and it is believed that it will be found suitable for use either with a power or a hand crusher.

The machine consists of a cylinder of galvanized sheet iron hung on a horizontal shaft passing through its axis by means of which it may be revolved. The cylinder is left open on one side for its full length and for 60° of its circumference, a sliding door concentric with the cylinder being provided to close this opening. The cylinder is further provided with a series of sectoral spouts open to the exterior of the drum for 60° of their arc and entirely on one edge in the interior of the cylinder. The spouts are ¾-in. wide and are spaced ¾-in. apart, the radial edges of the spouts forming an angle of 90° at the center of the cylinder.

The operation of the machine is as follows:—A quantity of crushed coal, which should never be more than enough to fill the cylinder half full, is placed therein, the door is closed and the crank turned in an counter-clockwise direction. None of the coal can now fall out, but it will be thoroughly mixed by the repeated plowing of the spouts, closed side first, through the mass. After several revolutions, the direction of rotation is reversed. There is now presented to the coal a series of vertical planes which divide it into a number of equal portions, each alternate portion falling out through the openings in the cylinder wall. With each revolution of the cylinder in this direction, half of its contents is thus discarded and with a little practice it is possible to judge by the amount falling out each time, when the sample has been sufficiently reduced. When this point is reached, a pan is placed under the cylinder and one revolution with the door open, serves to discharge the final sample.



Sample Mixing and Reducing Machine

This machine may be built in any desired size. The machine here shown was designed for reducing a 50-lb. sample, the intention being to use it for samples already partially reduced by other methods.

List of Water Equivalents

The U. S. Geological Survey is authority for the water-measurement equivalents given in the following list:

One second-foot equals 40 California miner's inches (law of Mar. 23, 1901).

One second-foot equals 38.4 Colorado miner's inches.

One second-foot equals 40 Arizona miner's inches.

One second-foot equals 7.48 U. S. gal. per sec.; equals 448.8 gal. per min.; equals 646,272 gal. for one day.

One second-foot equals about one acre-inch per hour.

One second-foot for one 31-day month equals 61.49 acre-feet.

One million U. S. gal equals 3.07 acre-feet.

One California miner's inch equals 0.187 U. S. gal. per sec.

One Colorado miner's inch equals 0.195 U. S. gal. per sec.

One acre-foot equals 325,850 gal.

One cubic foot equals 7.48 gal.

One horsepower equals one second-foot falling 8.8 ft.

The formula $\frac{\text{sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower may be used to calculate water power on a waterwheel realizing 80% of the theoretical power.

The Whitmore Brake and Overwind Prevention Gear

In the accompanying illustration is shown an improved Whitmore patent brake engine and overwind prevention gear which was recently fitted on a pair of winding engines, 26x60 in., working with 90 lb. steam pressure at the Huncoat Pit, Accrington, Lancashire, England. The winding engine has a flat drum 14 ft. diameter with two cast-iron brake paths 15 ft. 3 in. diameter to which was fitted a double set of post brakes, the tension rods of the brakes being made of forged steel with all screws cut on swelled portions, to prevent any undue strain on the threads. The brakes are fitted with the Whitmore patent arrangement for automatically taking up the wear on the blocks and ensuring that the brake engine will always exert its full pressure on the brake.

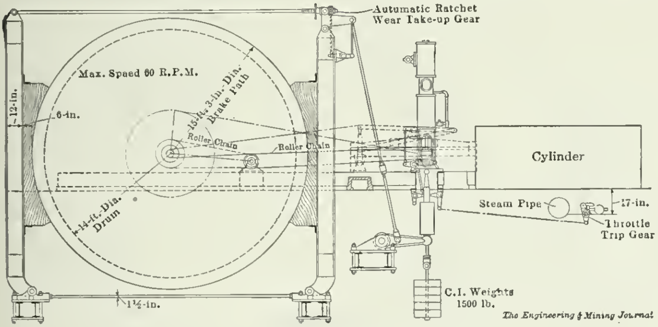


Diagram of Whitmore Brake for Hoists

The brake engine, which is of the vertical design, is coupled to the post brakes through the medium of a spring box to prevent any undue strain or shock when quickly applied. In addition to the steam, deadweights are applied at the same time, of sufficient power to hold the engine with full load in the shaft, in the event of the main or supply pipe to the brake engine failing.

The full power of the brake with steam plus deadweights will hold the engine with all steam on the cylinders plus a heavy descending load; the object being to have a brake sufficient to cope with any emergency.

The brake engine is secured to a pair of cross-channels, fixed in the foundations and box bedplates, and which carry the overwinder as well. The overwinder, which is of the Whitmore latest C-type, consists of a parallel ball governor driven by steel roller chain off the crankshaft of the engine. Fitted to the governor column are the index screws, driven with machine-cut gears, with a double pair of nuts, and so arranged that the wheels can be altered for varying lengths of rope, without any keys requiring to be withdrawn. This is a special feature, and useful for engines required for sinking purposes where the length of rope is constantly changing.

The action of the Whitmore gear is as follows:—Directly the engine overspeeds in the middle of the wind, the speeding hooks engage the wing nuts, and gradually apply the brake, through the brake engine, stopping the engine slowly, but with an increasing brake power, as the brake becomes fully applied. Before the brake engine is applied, however, the throttle valve is closed by tripping the connection between the driver's throttle valve-handle and the actual valve. This mechanism is similar to the ordinary escapement motion of the corliss engine valve-gear, the valve being closed by a deadweight and lever. In actual practice this valve is closed before any strain is set up in the crankshaft from the brake being applied, but in case the throttle valve fails to close, there is still allowed enough power in the brake to stop the engine with all steam on the pistons.

As the cage approaches the surface in ordinary winding, there is fitted on the Whitmore gear what is termed the third attachment, that trips a spring, if the drum is traveling at too fast a "crawl" speed in the last two turns of the drum, and suddenly applies the brake. This portion of the gear comes into action in case the driver suddenly gives the engine steam again, say three or four turns of the drum from the top, and so would be coming to the surface too fast. Also this is the safeguard to prevent the bottom cage, when men are being lowered, from getting a severe bump on the bottom bearers.

For the prevention of overwinding, or starting the cage in the wrong direction, a second pair of nuts is provided, which give, by a rotative action, a quick tripping of a catch on the connection to the brake engine, releasing a spring, to close the throttle valve and apply the brake to its full power, suddenly.

In a number of northern mines, a practice is made, on Sundays, of allowing the cage in the downcast shaft to be lowered one to two turns of the drum from the top position, in order to get more air into the workings. Should the driver make a mistake and, instead of lowering the cage, go fast to the top, then there is fitted on the overwinder a fourth attachment, which prevents overwinding, by suddenly applying the brake before the top position. A modification of this fourth attachment serves the same purpose of preventing starting in the wrong direction, with two or three deck cages, provision being made on the gear so that if the driver purposely wishes to bring the cage to the surface, he can do so by lowering his cage first by half a turn of the drum. This arrangement does not come into action on the ordinary direct winding, but only in case of dropping the cage down, and then making the mistake of starting in the wrong direction. The overwinder is entirely an emergency controller, and on coming into action can be wholly re-set by one man with one spanner.

At the Huncoat pit there has been fitted to the overwinder a contrivance termed the "differential speed gear for men and coal-winding," by means of which, when men are being lowered, the driver, by setting his lever on the platform to "Men" position, limits the maximum speed of the engine to 30 r.p.m., instead of the normal speed of 60 r.p.m. maximum for coal-winding. This renders the over-winder more sensitive in all its actions.

In order to save the unkeying of wheels, on pits that lower timber at night or raise water, a slip plate is fitted to the chain-driving wheel on the overwinder, to allow the extra motion for lifting the cage higher, every afternoon, without uncoupling the overwinder.

Sand for Hot Bearings

During the last few months a series of articles has been published in *Power* in which the use of sand for hot bearings has been widely discussed by various readers. The correction of overheating in bearings by the use of abrasives is not, according to the general consensus, commendable. This may in part have been due to a misconception of what was meant by the term sand.

The idea, as originally suggested, was to remove the "high spots" on the journal by adding some fine, soft abrasive, such as Sapolio or Bon Ami, to the boxes while the shaft was turning at a comparatively low speed. The continued use of such an abrasive, it was argued, would grind the journal and its bearing down to a smooth even surface. Then all the abrasive was to be removed absolutely and the usual lubricants supplied to the bearing before resuming normal shaft speed.

Many machinists and engineers argued against the use of "sand," believing that a sharp, coarse abrasive was meant by that term. The use of any gritty or coarse sand would naturally scratch and wear both boxes and journals irregularly and increase the tendency toward heating.

Sharp gritty material will become imbedded in the bearing metal and become a constant cause of heating. Brickdust, Sapolio and such fine, soft abrasives, are frequently used, especially upon large shafts. Properly used they may accomplish the desired object, but, in the hands of those who do not understand what they are doing, such a cure is apt to prove worse than the disease.

Hanging Electrical Turbine Sinking Pump*

By Cyril Brackenbury

In unwatering the old Tresavean mine in Cornwall, through the Harvey shaft, the electrically driven turbine sinking pumps were supported in the manner herein described.

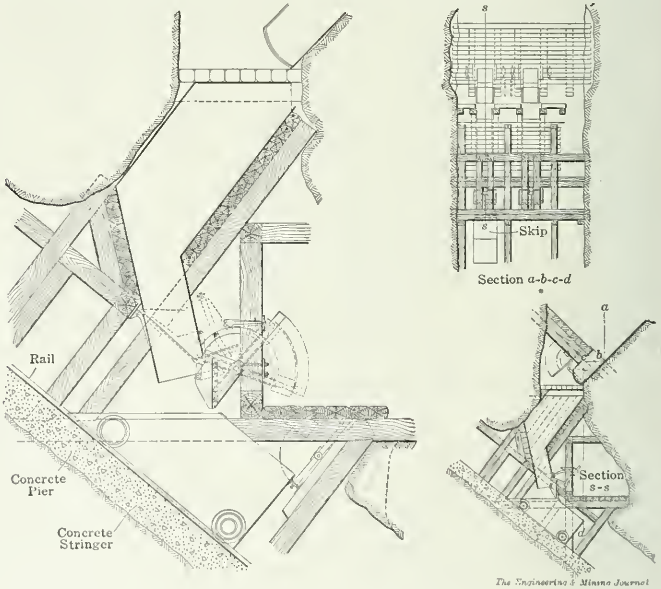
In one of four other mines where high-lift turbine pumps were used for unwatering purposes, the pump was suspended by a four-fold rope system and in the other three cases by a two-fold rope system. The four-fold system required two pulleys on each pump and two pulleys for each pump on the headframe; the two-fold system required only one pulley on each pump and one pulley for each pump on the headframe At the Tresavean mine it was decided to use a single-fall larger rope attached to a pair of triangular plates carrying a two-fold rope sling passing around the pulley wheel of the pump. The single fall of larger rope, although double the strength, has, of course, only to be half the length of a two-fold rope and, consequently, there is only half the length to be looked after and greased. The short sling, which is of just sufficient length to clear comfortably the bend of the delivery pipe, makes a convenient way of supporting the pump frame without straining it.

In the case of the Tresavean mine, taking into consideration the comparatively great depth the water would have to be lowered, it was decided to support the rising main along the walls of the shaft, connecting the bottom of it by means of a short reverse bend with the top of the pump delivery, a telescopic expansion joint being inserted above the top of the pump delivery and just below the bend to the rising main. It was further decided that the pump should always be supported by chains, as well as by the rope, except when it was actually being lowered or raised in the shaft. In order that the weight of the pump could be taken up quickly and conveniently, two adjustable stretching screws were made for each pump, and short length ¾-in. chains were made in lengths of 25 and 9 ft., each chain having a large hook at one end and a large link at the other. The 9-ft. lengths were made with special large links, set about the same distance apart as the adjusting links of each stretching screw.

This arrangement, together with two large S-shaped hooks, about half the length of the screw, made it possible conveniently to tighten up the chain supporting the pumps for any position of the pumps. The upper ends of the chains were slung around temporary horizontal timbers securely supported in the shaft, and the pumps could be suspended 200 ft. or so below these supports on a series of chains hooked together, the special 9-ft. length only being used at the bottom. Each tightening screw was shackled to the eye at the top of each of two steel plates, which were securely bolted to the two channel irons of the pump frame. Two sets of chains were attached to each pump, and these were sufficiently strong to carry the full weight of the pump and water column of the rising main, but the chains were never tightened so as to take the full weight, only sufficiently so to take the greatest strain off the supporting rope. Each time the pump was lowered it only took a few minutes to hang the new chains and tighten them up to the proper position.

Measuring Pocket for an Inclined Shaft

The North Kearsarge shaft No. 4 is sunk in the foot wall of the lode, and the ore is trammed to loading bins at the shaft that serve two levels. These bins are covered with a grating of crossed rails so that boulders must be broken to 18 in. to go into the bins. On the skip chutes proper a counterbalanced arc gate that closes from below through a system of toggle levers is used, as shown in the accompanying drawing.



Skip-loading Device at Osceola Mine

On the measuring pocket, doors of unique design are used The lower one opens and closes the upper gate so they might be described as being of the clam-shell type. Owing to the shape of the levers by which the two gates are suspended the bottom gate moves up less rapidly than the top gate and therefore always closes after and over the other. This is shown in the accompanying drawing which shows the gates open in full lines and closed in dotted lines. On each side on the lower gate is a semicircular arm in the top of which is a notch. Two hooks, connected by a bar and seated on the posts that brace the bottom of the measuring pocket, drop into these notches and latch the gates in position when they are closed.

---

*Excerpt from an article entitled "Unwatering Tresavean Mine," Bull. 88, I. M. M.

By means of a lever these hooks are raised, then the weight of the ore forces the back door backward and the front door forward, giving the ore a free passage down to the skip. Extending from the front gate are the arms carrying the counterweights, one on each side. These are adjusted so that a slight lift is necessary on the lever arm of the gates to close them, but the adjustment is so close that the jar of the skip gate as the skip leaves the bin will close the doors.

Dipper Trips for Steam Shovel

An investigation is being made at Panama[1] to determine the relative efficiency of two steam-shovel trips, operated by steam, known as the Geddes and Wichman trips. These are the culmination of a development in the improvement of dipper-tripping devices that began soon after the first steam shovel was set to work in Culebra cut.

When the dipper is loaded, the spoil within bears down upon the door and tends to hold it firmly in place, so that the force required to open the latch is often considerable. When the shovels arrived on the Isthmus, they were equipped with a single-lever latch operated by a 1¼-in. rope in the hand of the craneman, attached at its other end to the dipper trip. Several jerks were often necessary to open the latch, and almost invariably a great effort was required.

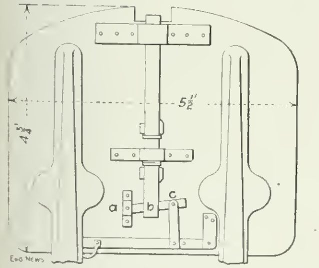


Fig. 1. Trip on 95-ton Steam Shovel

The first improvement was to compound the lever system of this original trip, as shown in Fig. 1. The original arrangement was the simple lever with the fulcrum at *a*, the weight at *b* and the power at *c*. Among improvements upon the compound-lever device, one that was given a trial in 1909, was the spring trip shown in Fig. 3. It consisted of a lever and a bar passing through a slot *e* in the latch, with a spring attached at its outer end, the power for unlatching being supplied by the spring. The door was closed by its own weight when in the digging position, placing a tension of 1300 lb. upon the spring. This device worked satisfactorily, but the toggle joint required constant renewing and some difficulty was experienced in obtaining springs of suitable strength, so that the appliance was finally abandoned.

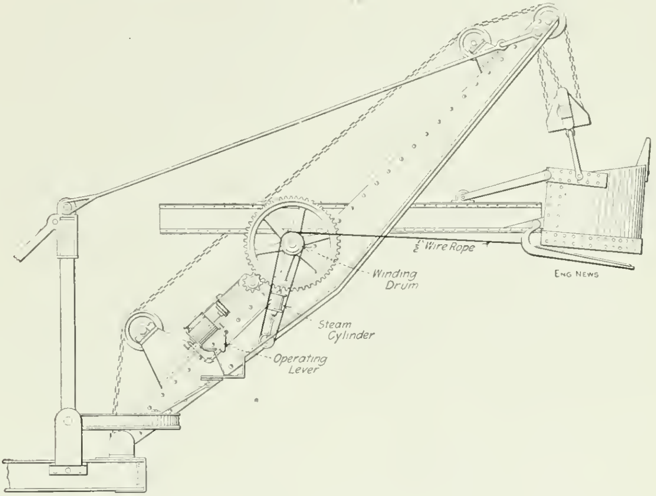


Fig. 2. Wichman Steam-operated Tripping Device on Steam-shovel Boom

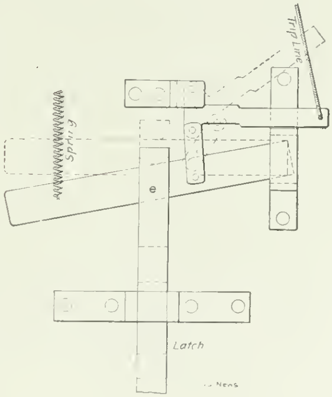


Fig. 3. Spring Latch Trip on Steam-shovel Dipper Door

The first steam-power trip was a device placed upon his shovel by Thomas Custy, a steam-shovel engineer, in 1908, but after a few months' trial this was discarded. This device was improved upon by A. H. Geddes, also a steam-shovel engineer, until it become practicable, and a patent has been granted to him. The Geddes trip was described in the Journal of June 24, 1911. In this device a steam cylinder is situated on the dipper trip near the dipper. The cylinder's piston is connected with the dipper latch through a chain and a series levers, and when steam is admitted to the cylinder the rest of the system operates the levers and unlatches the door. After a thorough trial this device was adopted, as the capacity of a shovel could be increased 100 cu.yd. per day by its use.

The latest device, that shown in Fig. 2, was invented by F. S. Wichman, of the mechanical division. The latch is opened by a pull made upon a ½-in. wire rope by the outward thrust of the piston of an air-brake cylinder. The cylinder is mounted upon the boom of the shovel and a drum is mounted upon the face of the thrusting gear on the shipper shaft, which revolves with the shaft, thus winding or unwinding the trip rope as the shipper shaft moves up or down. Thus the rope is kept taut at all times.

To give the lengthwise pull on the cable, a 6-in. diameter steam cylinder is mounted below the drum. The piston rod of this cylinder has a Y-yoke at its outer end to receive a sheave, over which the cable passes on its way to the drum. Steam admitted to the cylinder when it is desired to trip the dipper goes through a three-way cock operated by a lever at the craneman's seat. When the steam is not on, a spring in the cylinder moves the piston back into position and the tripping operation may be repeated. This device has undergone a successful test on two 95-ton steam shovels.

---

[1] Abstract of an article in the Canal Record of Nov. 8, 1911.

The Promoter

The New York *Evening Post* has been publishing some interesting characterizations of certain phases of life in Wall St. Here is one on "The Promoter."

It must be supposed that the promoter inherits his gifts. He never could acquire them. In his pursuit of capital on behalf of an opportunity he will endure hardships beyond belief; if the capital at the last moment eludes him he is undiscouraged. There is other capital, and he takes up another trail with the fortitude of a saint. He will consider no other way to gain a living than that of bringing opportunity and capital together and getting something for his trouble. It is a deal. With a deal in prospect, he may become hungry and homeless, but if you were to offer him a salary of $5000 a year to be worked for, he would decline it. He simply would not know what to do with a salary—how to spend it. He cannot understand people who work so many hours a day at a certain thing for so much money per week or month, when they might be putting through deals, one of which, if successful, would mean a lot of money all at once.

The world is full of opportunities. The world also is full of capital, but it is much harder to pry people loose from their capital than to find the opportunity. That is why the promoter's work is difficult. Nothing to him is strange. Opportunity is varied. It may be an airship model, a pneumatic horse collar, a rotary engine, a chain of retail stores, a magazine scheme, an invention in refrigeration, or anything which by effort of the imagination may be thought to fill a prospective want. But of all the opportunities, the most manageable are those to be found in mines—gold mines, silver mines, copper mines, zinc and lead mines, coal mines, or other kinds.

One who knows a promoter very well will be apt to acquire a queer notion of what a mine is. The average man's notion is that a mine is so much ground, out of which minerals may be got by digging; but to a promoter a mine is something very different. It begins with an option, develops into a contract, takes the form of beautifully engraved certificates, and ends with his own profit—or else in failure. A mining promoter will have in his pocket any kind of mine you happen to think of. Do you speak of copper?

"Copper?" he says, and looks at you with interest. "Why, I've got a mine that will break the corner they are trying to run in copper metal. It's the best thing I ever heard of."

"Where is it?"

"Right here," he answers, and he produces it forthwith from the breast pocket. "There's the blueprint. I'm going to stick to copper. There's a saying, you know—to lose money get a gold mine, to make a little money try a silver mine, but to get rich take a copper mine."

"The last time I saw you," if you have the bad grace to say it, "the only kind of mine you had any use for was a silver mine in Cobalt?"

"Yes, I did try silver mining," says the promoter, "but it played out. I'll give you a silver mine if you want it."

"Give it to me?" you say.

"Yep, I'll give it to you. I've got it with me. I haven't any use for it. I believe it's a good mine, though."

"But what do you mean when you say you will give it to me?"

"Just that. I'll sign it over to you with a scratch of the pen, all for nothing. There's $50,000 due on it the first of the month, and the balance of $100,000 sixty days later. I think it can be opened for about $250,000."

You refuse it, and he restores it to his pocket. Perhaps you do not see him again for several months, and then one morning, after you have read in the newspapers of a wonderful gold discovery in a place called Porcupine, you meet him.

"What have you done with your copper mine?" you ask.

"I'm working on it," he says, but it is evident from his lack of enthusiasm that he has already "worked upon" it much in vain, and is about to abandon that opportunity for another.

"What's this I hear about a new gold strike in a place called Porcupine?"

His face lights up. You have touched a match to the excelsior of optimism.

"That," says the promoter," is going to be the greatest gold camp in the world. Old miners won't believe it. It's too good."

"Well, tell me something about it," you suggest.

"I've got one of the best mines up there," the promoter announces. "It is right next to——"

"But this place has only been discovered. Everybody is waiting for the winter to break up in order to get to it."

"That's all right," says the promoter. "I've got one of the choicest mines in the whole district."

"Have you been there?"

"No."

"Well, don't you mean you have merely an option on a claim that you never saw?"

"How else do you get a mine?" says the promoter, and is offended until you show a more wholesome interest. Then in ten minutes you learn more about the geology of this particular Porcupine and of all other great mining camps than you ever could get from books; also the information that in a few months the public will be gold mad again, and that the man who gets a company started first and places his stock on the market will reap his reward. All that he needs is a man with $60,000 to pay down on the option; what he has is an option to buy the option on a particular claim. After the option itself has been bought for $60,000, there will be one hundred and twenty days in which to find $240,000 more to buy the claim. The price of the claim is $300,000, but the $60,000 option money will apply on the cost. Then $2000 more will incorporate a company and print the stock, and nothing can stop the promoter from getting rich after that. He will take a certain quantity of stock for himself. What will become of the claim after the company has been incorporated and two or three million dollars' worth of stock sold, will be governed by the honesty of people with whom the promoter will be through so soon as he has got his own stock and sold it for his profit. He may be a copper miner after that, or a man on the verge of madness over a newfangled explosive which a little chemist in an East Side tenement has discovered, and which will make war so bloody that it will have to be stopped.

If you have not $60,000 with which to buy the Porcupine option, perhaps you can lend him $5 until three o'clock.

Arizona Copper Co.

The report of the Arizona Copper Co. for the year ended Sept. 30, 1911, shows a total production of bessemer copper of 34,569,019 lb. as compared with 32,161,205 lb. for the previous year. This is the largest output since the company began operation. The total ores mined from the company's properties during the year amounted to 744,746 dry tons, which indicates a yield of 46.4 lb. of copper per ton of ore. Of the total ores mined, 94% were concentrated, the remaining 6% being direct-smelting ores, the latter figure including pyrites for the acid plant and siliceous ores for converter lining. Of the total copper produced, 82% came from sulphide and 18% from oxide ores.

The mines making the largest production were: the Humboldt, producing 281,417 tons, of which 263,901 tons were concentrating ores, 8673 tons direct smelting, and 8784 tons siliceous ores for converter lining; the Coronado mine, which produced 142,571 tons of sulphide ores, of which all except 20 tons was concentrated; and the Metcalf mine, which produced 102,666 tons of oxide concentrating ores from surface and underground workings.

In the Longfellow group of mines the caving system has been still further extended during the year under review. In the year ended September 30, 1910, 51.2% of ore was taken out by the old method of timbering and back filling. During the year ended Sept. 30, 1911, this proportion has been reduced to 33.9%. The electrification of the second level of the Humboldt mine has been completed.

Motors hauling about 50-ton trains have replaced the mule.

Reduction Works

During the year 582,335 dry tons of sulphide concentrating ores were treated, of which 319,130 tons were treated at No. 6 (Morenci) concentrator and 263,205 at the Clifton concentrator. The average ratio of concentration was 5.6: 1. No. 6 concentrator was enlarged from 900 to 1500 tons per day capacity, although the work was not sufficiently far advanced to affect the results for the year. The ores are now delivered through the new No. 6 shaft to crushed-ore bins of 1000 tons capacity, from which the ore is automatically fed to a conveyor belt and the coarse smelting ore is picked out by hand. This belt then delivers it to a grizzly with bars placed 2 in. apart, the oversize going to a crusher which reduces it to 2 in. This ore passes through revolving trommels with manganese-steel jackets perforated with ¾-in. round holes. The oversize is delivered on a wide slow-traveling conveyor belt on which a further sorting of smelting ores can be done. It then passes under powerful magnets by which any pieces of steel or iron are removed and the ore drops to heavy crushing rolls set to crush to ½ in. The product of these rolls, together with the fines separated by the trommels, now drop to a third conveyor belt, which delivers it into the fine-ore storage bin of 2000 tons capacity.

From the fine-ore bin the feed for the mill is drawn by automatic feeders and delivered to conveyor belts and passed over automatic continuous self-registering weighers and delivered to the first set of Hancock jigs. These deliver their concentrates directly in the bin on an electric hauling track on the surface. The tailings from these jigs pass into the original No. 6 mill where the first wet crushing is done by rolls and the crushings are elevated to No. 2 jigs in their old position. The tailings from these are further ground in Huntington mills and treated on concentrating tables and vanners, as before—the fine concentrating machines having been increased in capacity by the addition of the old vanners from concentrator No. 5.

During the year the oxide concentrator treated 104,764 dry tons of ore, the tailings from which, amounting to 90,526 dry tons, were treated in the leaching plant. From these ores 11½% of the total copper production was obtained. The sulphuric-acid plant supplied the leacher with 3779 tons of acid. The total ores and concentrates smelted during the year amounted to 150,991 tons, with fluxes and byproducts resmelted the amount was 230,833 tons. The average yield of copper from ores and concentrates was 11.22 per cent.

The proposed new works of the Arizona Copper Co., which includes the remodeling both of the concentrating and the smelting plants has already been discussed at length (Eng. and Min. Journ., Dec. 16, 1911) as well as the financing by which this reconstruction will be carried out.

Chino Copper Co.

The first quarterly report of the Chino Copper Co., covering the fourth quarter of 1911, shows that at the close of development in the latter part of September, 466 drill holes had been completed to an average depth of 386 ft., the total footage drilled being 179,871. Of these, 386 holes encountered ore, the average thickness of which was 107 ft. Drilling for ore development was discontinued because the principal orebody was sufficiently well defined to permit of comprehensive plans for mining and, so it is stated, because enough ore had been opened to provide for the full capacity of the mill for over 30 years. Development of other known orebodies will be deferred. Drilling was done in 200-ft. squares except where physical characteristics necessitated closer spacing.

Nearly 55,000,000 Tons Developed

The total quantity of ore developed to Oct. 1, 1911, was 54,970,646 tons, having an estimated average grade of 2.24%. Of this, over 32,000,000 tons lie above the level to which steam-shovel mining will be carried. Westward extensions of the orebodies have been indicated by "scout" drilling and it is stated that the tonnage of these additional areas is large. The limits of the orebodies have been well defined north, east and south.

Some dump cars and another locomotive have been added to the equipment; another steam shovel and two more locomotives are in process of delivery and these will bring the total to six shovels and 11 locomotives. Railroad yards and connections with the Santa Fé R.R. were in operation before Jan. 1. All the permanent trackage necessary for mining operations has been completed and the total length of the company's tracks is now about 10½ miles.

Stripping and Mining

Up to Jan. 1, 1,938,000 cu.yd. of material had been moved by steam shovels; of this, 377,000 tons were ore and were stockpiled. The average cost of this stripping and mining is given at about 31c. per cu.yd. An increased water supply for all purposes has been developed and equipped. The Romero, Whim Hill and Chino sections of the mine are now available for steam-shovel work and the Hearst section should be ready in April. At the Hearst section shipments will start on clean ore; a large amount of carbonates will continue to come from the upper levels of the other sections for a few months.

Concentrator

The first section of the concentrator was placed in operation about Oct. 15 but did not run regularly until Nov. 1. The second section was completed in December and placed in commission about Jan. 1. The third section should start before Mar. 1. Excavating for the two additional sections, making a total of five, started in October; steelwork for the addition to the main building is now well underway and most of the necessary machinery is on the ground. One of these sections is expected to go into commission in May and the other about July 1, when the total capacity of the plant will be 5000 tons per day. The power plant designed originally for three sections has been found ample for five. The volume of water available has been found to be as great as expected.

During November and December the first section treated about 700 tons per day. As this ore contained a large quantity of oxidized copper, the mill extractions have been low. The grade of ores treated is said to have been above the average, and the results in terms of pounds of copper are claimed, therefore, to be nearly as high as would be the case in securing high recoveries from a normal grade of ore.

During December the recovery amounted to 30 lb. of copper per ton and the cost of production inclusive of everything, is given as less than 8.3c. per lb. Two sections since Jan. 1 have been treating approximately 800 tons each per day. The rate of tonnage per section is being increased, but some delay has been experienced in securing railroad equipment for hauling ore to the mill. It is stated also that because of the carbonate character of the ore, milling is difficult and it would be impracticable to operate at full capacity on this grade and character of ore as it would result in decreased recovery. It is claimed, however, to have been demonstrated that the sections of the mill as at present constructed and in operation are capable of handling a minimum of 1000 tons each per day of ores of normal grade and character. It is estimated by Messrs. MacNeil and Jackling that the January costs will not exceed 8¼c. per lb., in which event the profits from the operation of two sections for the month will amount to over $60,000, or approximately $1.40 per share. No difficulty has been experienced in the operation of the mill and no alterations of consequence have been necessary.

According to Paul Speier, the production of cadmium in Upper Silesia in 1911 was 42,000 kg. The market opened at 600 marks per 100 kg. and in response to a good demand rose gradually to 700 marks.

A Large Rock Crushing Plant

A plant, situated near the Kensico dam site in Westchester County, New York, will be built solely to crush rock for the concrete work on the dam. The crushing equipment includes two Blake-type crushers, the initial one with a 5x7-ft. clear opening, and a set of 30x60-in. rolls with lateral adjustment. The estimated maximum capacity of the plant will be 500 cu.yd. per hour.

For the construction of the Kensico dam, in Westchester County, New York, to create a storage reservoir in connection with the new Catskill water supply for the City of New York, the contractor, H. S. Kerbaugh, will install a very large crushing plant, designed by the Traylor Engineering & Manufacturing Co., of 30 Church St., New York.

The plant will have one of the largest Blake-type crushers ever built. The unusual size of the crushing units makes a description of the plant of interest. It is situated at Valhalla, in the suburbs of White Plains, on the New York Central railroad, 30 miles from New York, and is described by Samuel W. Traylor in an article in *Engineering News* for Feb. 22, 1912, from which the following account is abstracted.

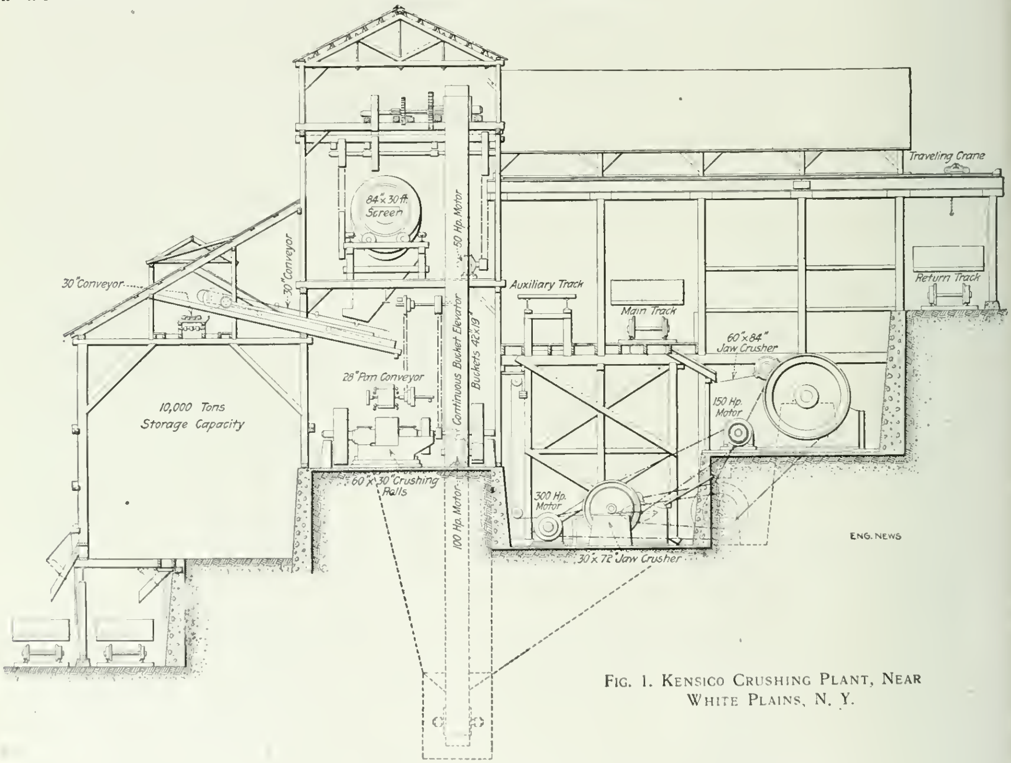


FIG. 1. KENSICO CRUSHING PLANT, NEAR WHITE PLAINS, N. Y.

CRUSHING PLANT

The layout of the crushing plant is shown in Fig. 1. The progress of the rock through it will be as follows: Quarry rock is brought in on the high-level tracks and is dumped into the initial 5x7-ft. crusher, which reduces the rock to a size of 9 in. and finer. It then passes over a grizzly with 4½-in. openings, the undersize or through product going directly to the elevator, while the oversize is run through the second crusher with an opening 3x6 ft., reducing it to 4 in. and finer. This product, with the undersize from the grizzly, then goes to the elevator and is raised to a 7x30-ft. screen. This screen is so designed that all material ¼ in. and finer is removed for a sand product and stored separately, while the coarse aggregate, or stone between ¼ and 2½ in., is distributed by a 30-in. conveyor into a 10,000-ton storage bin, located at the lower end of the plant directly over the outgoing railway tracks. The oversize from the screen goes to a small bin, which is equipped with a 28-in. steel-pan feeder and is delivered uniformly to a heavy-duty 30x60-in. crushing roll; the product from this roll being returned to the same elevator and screen.

The storage bins will be so constructed with bottom- and side-discharge gates as to permit of loading standard-gage cars running under the bins as well as at the sides, preventing any congestion at this point and making available the full storage capacity of the bins by reason of the many points from which the product is discharged.

From this brief description the simplicity of design and economy in operation will be noted, as well as the small number of individual machines required for so large a capacity. The equipment of the crushing plant is as follows: One jaw crusher, with a clear opening of 5x7 ft.; one jaw crusher, with an opening of 3x6 ft.; one continuous bucket elevator, with buckets 42 in. wide by 18 in. deep by 19 in. projection; one all-steel 7x30-ft. revolving screen; one 30x60-in. heavy-duty crushing-roll.

There is a special unloading device supported by the crane extending over the large crusher, delivery tracks and chutes. This device consists of an air lift, the cylinder being 20 in. in diameter, to work under an air pressure of 80 lb., and having a lifting capacity of 10 tons. As the cars pass in front of the chutes, one man can quickly dump them by hoisting one side of the car, making a very economical arrangement.

The initial crusher, as designed, will take any piece of rock that will ordinarily come from the quarry, and this greatly reduces the cost of quarrying, handling and crushing.

The matter of repairs is of small moment in this plant, as it is estimated that all wearing parts will last for two years or more in continuous operation without renewals.

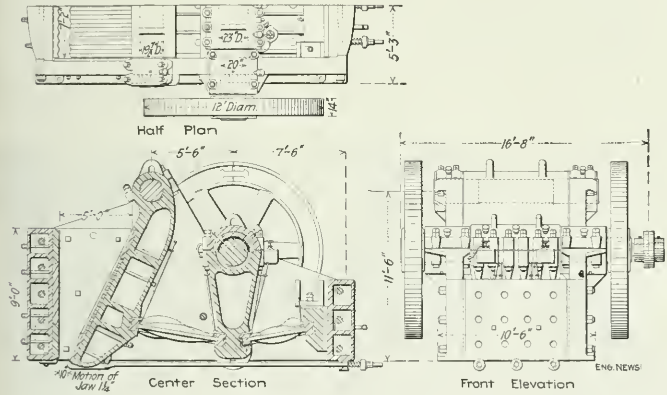


Fig. 2. The 60x84-in. Breaker for the Kensico Crushing Plant

The Large Breaker

The large or initial crusher being built for this plant has a jaw opening of 5x7 ft., and will easily take a stone weighing 10 tons and reduce it within 1 min. This crusher is constructed of cast steel throughout, with the exception of the large flywheels, and has a total weight of 450,000 lb. The flywheels are 12 ft. in diameter and weigh 15 tons each. The swing-jaw shaft is 20 in. in diameter and weighs 6 tons, while the pitman shaft is 24 in. in diameter in the pitman and 20 in. in the bearings, and weighs 8½ tons. The swinging jaw of this machine is 13 ft. in length by 7 ft. wide, and weighs 74,000 lb. The wearing plates are made entirely of manganese steel in sections which are interchangeable, so that the different sections may be changed about from time to time, thereby greatly increasing their life.

All bearings are water-cooled, and compression grease cups 12 in. in diameter are provided as an integral part of such bearings for lubrication.

The overall length of the crusher is 24 ft., the width 15 ft., and the height 13 ft. A better idea of the construction of this machine may be obtained by referring to a sectional view, Fig. 2.

The second crusher has an opening of 3x6 ft. and is of the same type as the large one, with an over-all length of 13 ft., width 13 ft., and height 9 ft. The swing-jaw shaft is 12 in. in diameter, and the pitman shaft 14 in. in the pitman and 12 in. in the bearings. The flywheels are 8 ft. in diameter by 12 in. face, and have a peripheral speed of 5000 ft. per min., being operated at a speed of 200 r.p.m. The total weight of this machine is 210,000 lb.

The 30x60-in. heavy-duty roll will be one of the largest smooth-faced rolls yet built in this country, considering the width of face and weight of machine. This roll has an overall dimension of 16 ft. The shafts are 16 in. in the hub and 14 in. in the bearings, each bearing having a length of 46 in. The frame is cast in one piece, and alone weighs 30 tons. The drive pulleys are made of cast steel, the main pulley being 96 in. diameter by 24 in. face, while the smaller pulley on the movable roll is 60 in. diameter by 14 in. face. This roll is operated at a speed of 50 r.p.m., or a peripheral speed of 785 ft. per min.

The rolls are equipped with an ingenious lateral adjusting device that prevents corrugating or channeling of the roll tires. The bearing of this roll is so constructed that it is double the size required for the work being done, is positively dust proof and efficiently lubricated. Its capacity is 300 cu.yd. per hr., crushing from 4 in. down to 2 in.

The large crusher is operated by a 300-hp., 3-bearing, form "M," mill-type induction motor, of the slip-ring type, and has about 2½ times full-torque load in starting. It operates at a speed of 560 r.p.m. This motor is equipped with a self-starting regulator, 33x27-in. pulley, and drives a jack shaft with a 26-in. triple leather, endless belt, the pulley on this shaft being 94x27 in. This jack shaft is equipped with an approved individual friction cut-off clutch which permits the starting of the crusher after the motor is in motion. On this jack shaft is a 60-in. heavy sheave wheel, with 15 grooves for 1½-in. rope, by which the large crusher is operated, the driving sheave on the crusher shaft being 11 ft. in diameter. A suitable tension carriage and idler sheave is installed in connection with this rope drive.

It will be noted that on account of the intermittent load, due to the irregularity in the size of product fed into a crusher of this size, it becomes necessary to have great flexibility in the transmission, although it is apparent that when this crusher is operating at full speed, with the enormous momentum of the two 12-ft. 15-ton flywheels revolving at a peripheral speed of 3400 ft. per min., there can be but little variation.

The motor for operating the 3x6-ft. crusher is 150 hp., 560 r.p.m., and of the same type as the 300 hp. motor above mentioned. It is equipped with self-starting regulator, and a pulley 29x21 in. is belted direct to the crusher, with a 20-in. extra double leather, endless belt.

The crushing rolls are operated by a 100-hp., 560-r.p.m. motor, of the same type as the others, and equipped with a pulley 21x17 in., which drives a 108x17-in. pulley on a jack shaft, this jack shaft operating the rolls and also the countershaft that drives the roll feeder.

The elevator and screen are driven by a separate 50-hp. type "K" squirrel-cage induction motor, equipped with self-starting regulator, and operates at a speed of 850 r.p.m.

There are two conveyors in the plant—one, the short or cross conveyor, is operated by an individual 5-hp. type "K" motor, direct-connected through gearing and countershaft; the other, or main conveyor, is driven by a 15-hp. type "K" motor, direct-connected through gearing and operating at a speed of 850 r.p.m., and provided with an automatic starter.

The entire plant will be electrically operated by power transmitted from New York, with current of the A. C. form, 3-phase, 60-cycle, 440 volts, stepped down from 2200 volts.

The Alaska-Treadwell Gold Mining Co. has increased its dividend to 75c. quarterly. The current dividend, payable on Feb. 28, amounts to $150,000. This is the largest quarterly declaration since 1910, when the dividends aggregated $3.25 for the year.

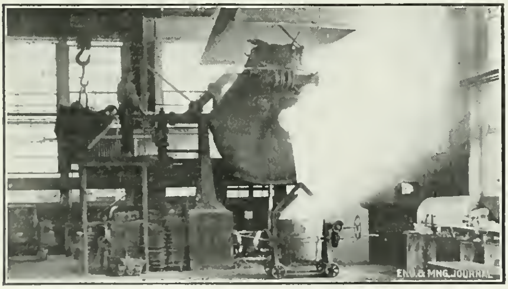
The Treatment of Metallic Junk

By Donald M. Liddell*

A general review of the junk-smelting industry. Small plants keep alive by close supervision and small economies. Their product, as a rule, is of good quality.

Statistics of the recovery of metals from scrap and junk are conflicting and confusing unless they be carefully defined. Most users of copper and lead have scrap and trimmings, which they remelt or return to the refiners for resmelting. Manifestly such metal should be excluded from statistics because it has never been used. The correct view of the secondary recovery of metals is, in my opinion, confined to what is obtained from the reworking of old material, i.e., material that has been used, collected, and restored to the market in the form of ingot, etc., thus becoming to all intents and purposes new material, with which it is in fact competitive. Such recovery is practiced not only by smelters who make it their special business, but also by the refiners whose chief business is the treatment of virgin copper and other metallic ores.

Consequently it is with this caution that the following figures[1] are quoted for the recovery of old metal in 1910:



Tilting Furnace for Scrap

Oil Fired Copper Reverberatory

Copper, including alloys other than brass, 51,000 tons; brass, 62,000; lead (as such) 29,384; lead in alloys, 25,939; spelter, 41,223; zinc, in other alloys than brass, 6686; bar antimony, 9; antimony in alloys, 2,770 tons. The recovery of copper on this basis would be equal to about 17% of the domestic consumption of new copper; of lead to 11.5%; and zinc, 23.2%. The total value of the scrap metal recovered was $45,525,000.

The Junk Business Probably Growing

While prophecy is an unsafe field, it seems probable that in coming years the importance of the secondary-copper and tin industries will undergo marked increase: copper, owing to the fact that the great use of this metal, owing to the expansion of the electric trade, is comparatively recent, and replacement has not begun in many cases. Tin should show a great increase owing to recovery of tin from old cans, an art which is still in a backward state[2], but of which the ultimate success cannot be doubted.

Copper Mainly Treated at Big Refineries

In general, the recovery of copper is chiefly confined to the large refineries. This is in great measure due to the amount of capital necessary to carry the large stocks of metal necessary to this industry; the objections to blast furnaces in cities; and the fact that much of the product must be treated by the electrolytic refiner even after recovery. For instance, a typical analysis of material from one secondary smelter was; Cu, 98.38%; Ag, 10.5 oz.p.t.; Au, 0.14 oz.p.t.; Pb, 0.425%; Sn, 0.102; As, 0.045; Sb, 0.117; Ni, 0.132; Fe, 0.044%; Zn, none (!); total accounted for, 99.381%. From another smeltery the pig carried only 95% of copper.

A typical city collecting plant operates as follows. The lead-dross furnaces are used during the cooling-down stage to burn off insulated copper wire. The cleaned wire, if light, is "cabbaged" and sold. If heavy, is baled and sold. There is a large press for heavy scrap. Brass scrap is either baled or barreled for use by brass founders, or made into ingots and sold. Dross from the ingot making is treated and retreated until all available copper is extracted, the drossed zinc being volatilized. Some losses in copper melting are interesting.[3] With heavy bare copper wire, the melting loss in 9054 lb. melted was 1.83%; with fine wire, including loss due to adhering insulation, 10.54%; while with yellow brass punched scrap, the shrinkage was 3.5%.

The metallurgy of copper at the large refineries is usually comparatively simple; if the material is high-grade it is put in with the refined-copper charge; if low-grade, it is put through the blast-furnace, and thence goes to the anode furnace. An interesting point in this connection is that charges of pure clean scrap wire give higher-conductivity bars than do most cathode charges. Only one plant seen had a concentrating table in use. The metallurgy here was somewhat complex. Low-grade material containing copper in metallic form was put over the concentrating table, and the concentrate sent either to blast-furnace or reverberatory, according to grade. Low-grade material containing nonmetallic copper was sent to the blast furnace, after briquetting, if necessary, and the blast furnace product sent to a reverberatory. There the charge was given a rough refining and cast. The bars were then recharged into another reverberatory and given a final refining, and cast as casting ingots. The reverberatory slags of course went back to the blast furnace. The use of wet concentration has by no means the vogue it apparently should, and as a rule, both in small and large plants, dust-chamber capacity is far under what it should be.

Briquetting in the scrap plants is a somewhat easier matter than around ore smelteries, as the threads in buffings and sweepings acts as does hair in mortar. Lime is usually added as a binder and the Chisholm-Boyd-White press seems to be favored.

---

*Associate editor, Engineering and Mining Journal.

[1] Press Bulletin, U. S. Geol. Survey, Aug. 1, 1910.

[2] Eng. and Min. Journ., Dec. 30, 1911.

[3] E. A. Barnes. Before American Foundrymen's Association.

COPPER INDUSTRY NOT INTEGRATED LIKE IRON

Probably most of the so called secondary-copper recovery is not really such. In the iron business the integration is complete, and the same firm often owns everything from mines to rolling mill. In the copper trade, the American Smelters Securities Co. turns out sheets at one of its plants, but no wire mill is owned by a refiner, while many wire mills do not remelt their own scrap, so that the copper refiners are constantly treating large tonnages of wire-bar scrap, i.e., copper which has never seen any actual service.

There is also a good deal of insulated wire which is simply treated by burning, the resultant mass pounded to free the wire from the burned insulation, and the clean wire cabbaged for sale to brass and copper founders. The saving of the ashes of the insulation for the lead and copper contained, is however, not always looked after as closely as it should be.

Brass scrap usually comes to the junk dealer in comparatively clean form, and much of the treatment consists only of grading the brass and melting into ingots, or else cabbaging for use in brass founding. Low-grade material usually goes through a blast furnace, but this loses the zinc. Two companies were seen using electro-magnetic separators to free brass from included iron. These turn out a superior ingot, beside making a better recovery of brass, as well as being paid for the scrap iron recovered.

The accompanying illustrations[4] show what is perhaps the present last word in scrap smelting. These are taken in the junk plant of the Westinghouse Foundry & Manufacturing Co., and represent oil-fired furnaces, and a plant in which ultimate efficiency rather than immediate capital expenditure has been considered.

LEAD TREATMENT

The recovery of lead, owing to its ease of melting, and the number of small local users of lead and lead alloys, makes this the strong point of the scrap smelter, and it may here be said that the ingenuity of device displayed would put many a big refinery or smeltery to shame. Only two plants out of eight lead smelteries visited had a blast furnace, and one was idle. Excellent work, however, is carried on in the reverberatories. One slag examined showed 0.79% of lead. A partial analysis of the slag gave: Insoluble, 36.22%; FeO, 32.81; CaO, 13.12; S, 0.55%. This with the lead, accounts for only 83.49%.

Another slag, from a different works, gave: Pb, 0.92%; Cu, 0.22; Sb, tr; Sn, 0.41; SiO_2 (true), 41.35; Al_2O_3, 27.05; FeO, 9.24; CaO, 17.50; MgO, 3.14; total accounted for, 99.83%. When it is considered this slag is skimmed directly off a metal bath; with no regulus present, and carries what many persons would consider a prohibitive amount of alumina, the high degree of metallurgical skill of the small smelters becomes evident.

The general impression I have gained is that most of them calculate their charges with much care, both in regard to composition of resulting metal and slag, while the furnaces are built to embody many desirable features. For instance, most of those seen took the air into the firebox through passages under the furnace bottom, thus preheating the air and chilling the bottom. The bridges were either air or water cooled. The working door was usually directly under the stack opening, and the stack usually fitted both with a direct throttling damper and one to check the draught by opening the base of the stack to the outer air.

Theory might indeed, point to a little greater use of waste heat in the larger establishments, such as for waste-heat boilers, fuel economizers, heating lavatory water, or drying briquets, but in general these small plants showed their reason for being in their small economies and close supervision, and some of them had the very apparatus mentioned above.

A typical lead plant is described below in detail, except that the furnace will not be described at length, as it conformed to the general features noted above. This plant is devoted solely to the treatment of high-grade lead and tin drosses (that is, those which do not require a blast furnace for their reduction) and zinc scrap, and is about 100 ft. square.

SAMPLING AND BUYING

The drosses are bought on a fire assay, the sample for which may be either drawn at the works, or sent by the consignor as a basis for bids. As in many other scrap plants, a pound-price offer is usually made on the basis of the seller's sample and in case the work's sample checks the original closely, no further adjustment is made. After acceptance of terms the various lots are mixed together for reverberatory treatment, and it is evident that to the technical skill of this mixing is due much of the success of the plant.

The mixture of drosses goes direct to a reverberatory in charges of about 3000 lb. each, charcoal being used as a reduction agent. This reverberatory has a hearth area of about 4½x7 ft. There are no water jackets, but heavy iron plates cover the entire exposed surface, and are secured by the usual arrangement of buckstays and tie rods.

There is a short vertical flue, about 4 ft. high, leading from the furnace, and then an overhead horizontal flue, about 24-in. square inside and about 12 ft. long, after which comes a stack. There is said to be little flue dust recovered from the overhead flue. None of the other furnaces or kettles is fitted with any dust- or fume-saving device. It is questionable whether any use of the dross-reverberatory fume would be made at this plant, if recovered, as any zinc in the drosses treated is burned off and escapes via the stack.

This furnace is run day and night, turning out about six charges per day, so mixed as to be self fluxing. Tapping is through a hole kept open with a 2½ in. bar. The metal flows out into a small kettle just in front of the tap hole, of such a size as to be just large enough to hold the metal and foul slag. The clean slag then flows out and over the foul slag (which is mainly unreduced litharge) and into a sand bed, in which it solidifies and from which it is afterward taken out to the dump. The slag was of nice clean appearance, and said to assay less than 0.5 per cent of lead. The kettle rim is built up except for a space about eight inches. Through the space thus left, the slag flows off into the sand bed.

DETAILS OF THE LEAD-FURNACE WORK

The furnaceman's experience has to guide him in this work, if he sees that the metal is so great in quantity that some foul slag will overflow into the sand bed, the furnace is stopped and one or two pigs of metal ladled out of the kettle, then the furnace allowed to flow again. The charge is rabbled during its melting down, the rabble used being apparently out of all proportion to the furnace, but its use is not onerous to the furnaceman as it is hung by long chains from an overhead support, and apparently its size is of advantage in shortening the time of the rabbling operation. About 2300 lb. of metal are produced per charge, about 250 lb. foul slag, which goes back into the next charge, and about 250 lb. of clean slag.

The metal from this dross furnace is sent to a refining furnace of similar construction, the dross from which goes back to the dross furnace, and the metal to three small melting kettles of about 1½ tons capacity. Here, if necessary, tin is added, and the metal cast as solder. The great bulk of the lead is sent out in this form. Occasional casts of pure lead are made into small size pigs or bars suitable for plumbers' use. There is a five-ton kettle for this purpose, used also to fill car-load lot orders for special alloys. While antimonial lead dross is usually avoided, small quantities are occasionally taken which are worked into babbitt.

As a rule the small kettles are placed two by two in brick settings, an arrangement which cuts out radiation loss from one wall whenever two kettles can be run simultaneously. The moulds are, as a rule, water-cooled, either being elaborate with false bottoms connected through the trunnions or else simple iron moulds set in a large tank of water. A possible economy is the use of fuel oil instead of coal for firing reverberatories, in which case both oil and air should be preheated with waste heat. The desire to avoid blowing or compressing apparatus probably accounts for the preference for coal.

---

[4] Courtesy of the American Machinist.

Zinc Treatment

A typical eastern city zinc plant treats only zinc scrap. This is simply melted in a 2500-lb. kettle, and the pure metal cast into market spelter. The skimmings are sold to other plants for final treatment. The zinc kettles are, like the lead kettles, coal fired, and usually efficiently hooded with sheet iron.

The zinc-oxide skimmings are sold either to chemical plants for the manufacture of soldering salt, or to zinc smelters for the production of spelter. Few junk smelters work up their own skimmings. The latter, when done, is more the Western practice, as zinc metallurgists and workers are more common out there. A retort furnace is used in which the retorts are cylindrical, about 4 ft. long and 9 in. in diameter, with walls 1 in. thick.

In this connection the quality of metal turned out by the scrap smelters may be taken up. There is, in general, a prejudice against the output of the junk men, which is, to a large degree, without foundation as far as lead and spelter are concerned. I have seen the junk smelter's scrap-lead extruded into pipe of first-class quality without difficulty while much of their spelter is a higher quality than first-hand goods. The reason for this is obvious.

When scrap zinc alone is melted down, the impurities remain in the skimmings, and even in the treatment of the scrap melters' residues, the distiller works on a comparatively pure material, the result being a spelter that is much like the redistilled grades so highly recommended. What can be done with absolutely clean copper wire scrap has been noted, although for the general run of low grade material it is cheaper to use a blast furnace and turn out a pig needing electrolytic refining, rather than to attempt sorting into grades.

Two plants once attempted to make complete recovery of zinc-bearing flue dust from brass smelting, a bag house being used for this purpose. This flue dust was subsequently leached with sulphuric acid, with intent to make lithopone. The process was unsuccessful, the resulting pigment being of poor color, but it is by no means certain that the solutions could not be purified[5] and the process made a success.

Clean Tin Dross Treated Largely Abroad

Apart from the electrolytic and dry-chlorine treatment of old tin cans and scrap tin, giving tin, tin oxide, and tin chlorides as end products, there is an extensive metallurgy. Clean scrap and pure oxides find their ultimate outlet in this country with the enamel makers. It is a reflection on American metallurgy, that I was told that only the enamel makers could compete with the English smelters in their offers on the highest grade of tin dross. The lower grades go to the various white-metal makers, as spoken of under lead. Certain large users of tin have also attempted resmelting their own drosses to metallic tin in small blast furnaces. However, it was found that the resulting metal drossed so fast that it paid better to buy new Straits tin and sell the drosses to white-metal makers.

These white-metal makers, I am told, first matte out the copper, adding lead at the same time, the result being a copper matte, nearly free from tin, a speiss, and a lead-tin alloy, free from undesirable impurities. The speiss is simply circulated, I understand, remaining about a constant quantity. The metallurgy of tin is somewhat complicated by its readiness to act either as base or acid, an apparent high volatility, and its speiss-forming tendencies. However, the formation of undesirable and highly stable silicates can be somewhat avoided by raising the temperature slowly when smelting oxides.

Typical Lead Furnace

Smelting tin drosses with lead in blast furnaces is also practiced, the tin losses in this case figuring out about 12% of the contents. Of interest, also, especially around large canneries and packing houses, is the fact that tin dross, when heated in contact with a fat and metallic tin, is reduced to tin. This process was patented by Dr. C. Glaser of Baltimore.

Precious Metal Treatment

Upon this subject it is difficult to acquire much that is specific. The refiners of gold, silver and platinum, bar themselves off from visitors with great care, conversation usually being conducted through a 6-in. aperture in a bolted door. This is done not so much through fear of theft, as for fear the precious refining secrets will get away.

In former times when everything in the sweeps of the big jewellers' establishments was barreled indiscriminately, it was practically impossible to sample the sweeps, and they were usually treated as a lot, the sweep smelter charging a certain toll per pound, sometimes as high as 12c., and returning the recovered metal to the jeweller. This had the disadvantage of leaving the jeweller at the mercy both of the smelters' metallurgy (good or bad recovery) and his honesty.

The larger jewellers are now carefully screening their sweepings, and larger pieces are melted at once into sampleable bars, or into bars which can be used again (in the case of silversmiths who do not work in gold). The fine material which passes the screen is then coned, sampled, and sold on an assay basis. For this screening the sweeps are usually pulverized in a ball mill, and screened over about 60- to 80-mesh screens. In the mint an Elspass mill is used for this grinding.

These screened sweeps are usually incinerated, briquetted with litharge and smelted either in shaft or reverberatory furnaces, the resulting bullion cupelled, and the litharge used again. The sweep smelter also meets old cyanide-plating solutions, from which potassium or sodium sulphide will throw down the precious metals. There is also a certain amount of silver recovered from old stripping solutions, either where junk has been stripped before resmelting, or where worn plated ware is stripped before replating, but this recovery is, of course, a mere matter of elementary chemistry with salt and zinc.

I wish to thank the Union Smelting & Refining Co., Kahn Bros., and the Columbia Smelting & Refining Co., of New York, for their especial courtesy in assisting in the preparation of this article; as well as to acknowledge my indebtedness to the Great Western Smelting & Refining Co., the Loraine Smelting & Refining Co., of Chicago, and the Aurora Metal Co., for information furnished me in regard to Western practice. Thanks are also due a number of other individuals and firms who desire to remain anonymous.

---

[5] Eng. and Min. Journ., Dec. 16, 1911, p. 1159.

The California Gold Dredge—III

By Robert E. Cranston *

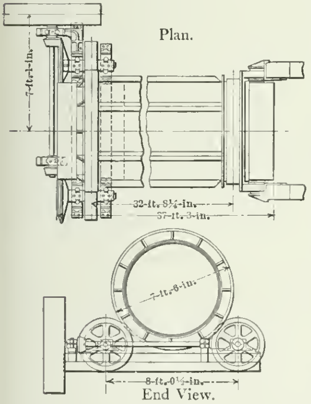
The design of screens, tailings stacker and hoisting and pumping apparatus is considered. Revolving and shaking screens are used according to material handled. Lattice-girder stackers are general. Winches, which are motor-driven, are equipped with both friction and jaw clutches and band brakes.

Two types of screen are in common use, the revolving and the shaking. The first dredges used the revolving screen, then the shaking type was introduced at Oroville and for a time most of the dredges were built in this way. On the Yuba it was found that these did not break up the clay in a satisfactory manner and revolving screens were introduced. This type proved better for this district, and since then many have gone back to the revolving screen even in other districts.

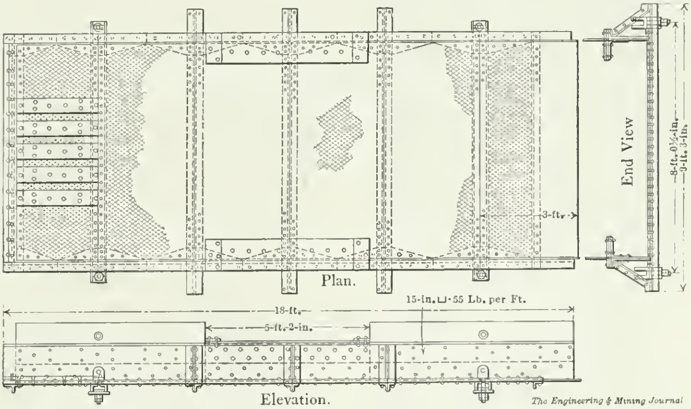
Revolving Screen for Clayey Material

The object of a screen is not only to size the material passing through it, but also to disintegrate and wash it. This the revolving screen does more thoroughly than the shaking screen where clay or cemented gravel is present. The shaking screen gives a more even distribution of the fines, requires less power to operate, and its plates last longer and are more easily replaced. For easily washed material I prefer the shaking screen, but for gravel hard to wash, the revolving type is decidedly preferable.

The design of the revolving screen shown in the accompanying engraving, has been well worked out and little trouble is experienced with this part of the dredge. Most of the delays in its operation are caused by the necessary replacement of worn plates. These plates should be put in so as to be readily removable and not too close a fit made; rather leave considerable space between them, since if this is not done they will spread and be hard to take out. Bolts with countersunk heads on the inside and split washers under the nuts on the outside are used in preference to rivets. They hold as well and can be removed more readily. The screens are built up in sections usually with cast-steel ribs at intervals to retard the movement of the gravel. These steel ribs also serve as a framework, to which are fastened the perforated plates. The size of perforations depends on the conditions and varies from ⅜ to ¾ in.



Revolving Screen for 9-Cu. Ft. Dredge.



Upper Shaking Screen, 7.5-Cu. Ft. Dredge.

Around each end of the screen is a steel ring or tire preferably made in halves so as to be readily removable. Two drive rollers on which the ring at the upper end of the screen rests are used on most of the older dredges, but a single-drive roller under the center with two side guide rollers is coming into use on the newer boats. The rollers driving the screen are themselves driven by beveled gears and pinions. Owing to the difficulty of keeping grit out of these gears they are made of manganese steel, with a soft-iron core cast in the hub. Rollers are used at the lower end to support the screen and a pair of manganese-steel thrust rollers are provided to keep the screen from moving toward the stern. The bevel gears are driven from a countershaft above the screen, the driving motor also being situated there. The countershaft is used in order to reduce the speed properly, so that excessively large gears or pulleys need not be used.

At the lower end of the screen is a hopper which directs the coarse gravel on to a belt conveyor. In order to prevent clogging at this point the hopper should be placed on a grade of not less than 30 deg. and should be raised on the side on which the revolving screen moves upward, the gravel being carried up on this side of the screen.

The Shaking Screen

The shaking screen, shown in the accompanying illustration, is built with channel-iron sides. The bottom is formed of angle-iron cross-pieces, to which are bolted the perforated plates. The angles should extend beyond the sides so that the top of the channels may be braced from their ends. The screens are built in pairs and mounted tandem so as to balance each other, one moving forward when the other moves aft. They are suspended from the timbers above, some using adjustable, others nonadjustable rods. The upper and lower bearings for these rods should be made of ample size, since they wear surprisingly fast considering the small movement. The lower end of the after screen is constructed so as to direct the coarse material to the short discharge chute on to the conveyor. This part of the screen is not perforated. The size of screen perforations depends on conditions and as in the revolving screen varies from ⅜ to ¾ in.

The shaking screens are driven by means of four connecting rods, operated either by cranks or eccentrics on a

---

*Mine manager, Ashburton Mining Co., Sacramento, Calif.

Note—An article entitled "Design and Mechanical Features of the California Gold Dredge," published in the Journ. A. S. M. E., February, 1912.

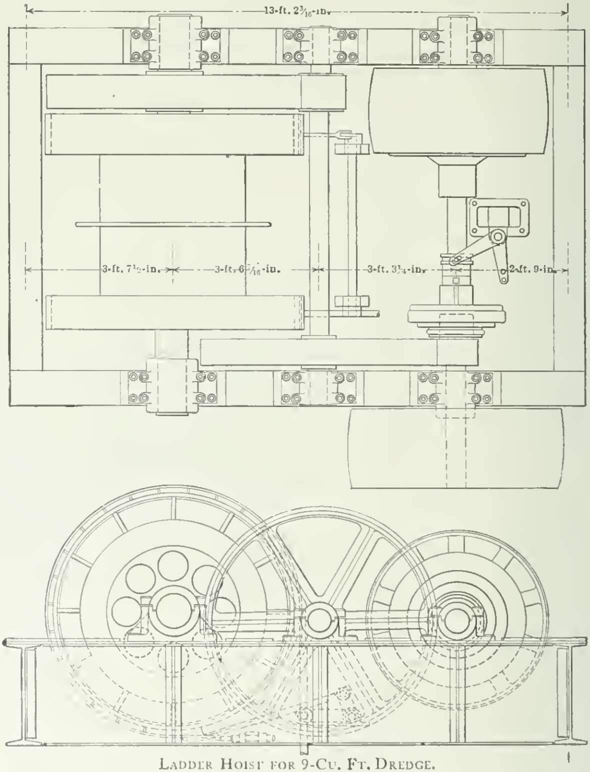
thwartship shaft. I am inclined to favor the eccentric drive owing to its larger wearing surface. If eccentrics are used they should have long hubs and double keyways; otherwise they are likely to work loose under the constant pounding. The drive shaft may be placed at any convenient point, but a central position between the two screens is perhaps the best. The bearings for this shaft are placed outside the screens, and as near as possible to the cranks or eccentrics, and should be long enough so that they will not beat out under the constant hammering. Buffer springs are sometimes used to take up the strain at the end of each stroke, but this practice is not common. The connecting rods are usually made adjustable and any of the standard methods of fastening rod ends may be employed.

The ordinary form of spray for washing the gravel as it passes down the screen is a perforated pipe or pipes. The water from the high-pressure pump is used, and the holes vary from ¼ to ¾ in. diameter. These holes are so placed as to direct the water where most needed. The spray pipes should have quick-opening valves at their lower ends so that they may be flushed out when the holes become clogged with roots, grass and other small particles of matter. Where much clay has to be washed some of the dredges are using large-sized nozzles set in groups at each end of the screen. It is thought that the large streams break up the clay in a more satisfactory manner than the greater number of smaller-sized streams furnished by the perforated pipes.

Lattice-girder Stacker

The design of a stacker ladder is a simple matter, since the loads and conditions are fairly constant. The lattice girder is the most common type and the strains in each member may be readily ascertained by graphic methods. I use a factor of safety of eight for this ladder. The lower end is supported near the stern of the boat and should be so designed as to allow the ladder to move up and down and also to allow the ladder to swing from side to side. The upper portion is supported by a bridle near the end and one near the middle. The ends of a wire rope are made fast to these bridles, its middle portion passing over a sheave which is in turn attached to the stacker-ladder hoisting blocks. Instead of a single-loop arrangement I prefer to fasten one end of the rope to the ladder hoist block, from thence passing it around a sheave at the upper bridle, then over another at the ladder hoist block, fastening the end to the middle bridle. This puts nearly double the supporting power at the upper end and prevents the buckling upward of the ladder when the dredge is surging badly.

The common method of driving the belt conveyor is by means of a motor set on supports above the ladder, 15 ft. or so back from its upper end. The motor is belted to a pulley shaft mounted near the end of the ladder, on to which is keyed a pinion with cut teeth which meshes into a cut gear on the conveyor-belt pulley shaft. I recommend a large-size drive pulley covered with rubber belting. In order to make the belt contact greater an idler is placed near this pulley which brings the belt up and in contact with it for a large proportion of its circumference. By mounting the motor inside the ladder near the upper end a direct gear drive may be used, but this method has not been found as satisfactory as the belt drive described above. A silent chain drive is now being used a great deal. It allows the motor to be set nearer the drive and is said to work well. Rubber conveyor belts are used and should have an extra thickness of rubber on the wearing side. The most important point is to select rubber of the very best quality.



Ladder Hoist for 9-Cu. Ft. Dredge.

The Engineering & Mining Journal

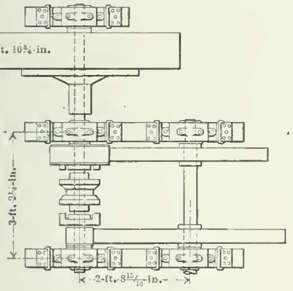
Distributor and Gold-saving Tables

Below the screen is a hopper or distributor which is used to distribute the screened material to the gold-saving tables. Here the ingenuity of the engineer may have full sway. The main object is to get the screened gravel evenly distributed on the gold-saving tables, and the way that it is accomplished makes little difference. The distributor should be designed so that a certain amount of adjustment will be allowed to meet varying conditions. Where a shaking screen is used the problem is simpler than for a revolving screen.

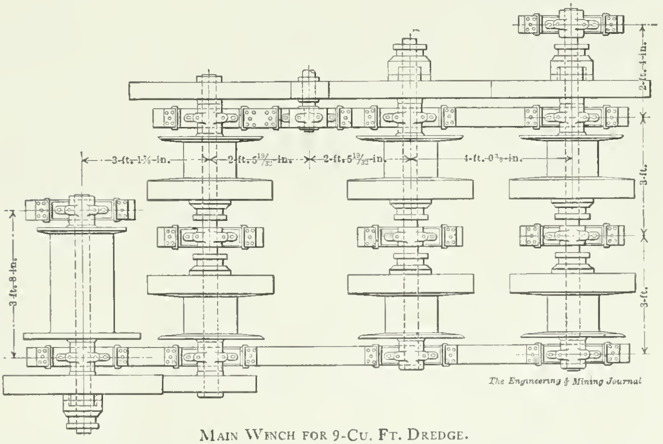
The gold-saving tables belong more to the province of the mining than the mechanical engineer, so they will not be discussed at any length in this paper. Suffice it to say that the gold-saving tables should be specially designed to meet each different set of conditions. They occupy the greater portion of the dredge back of the main gantry and may be built either of plate steel or wood. I prefer steel. The tables are covered with riffles made of angle iron or strips of wood covered with strap iron. The fine material is discharged either at the stern or some distance aft, according to conditions.

The ladder hoist is now usually driven by the digging motor from a countershaft situated on the main deck. In a few cases it is driven from the bucket-drive pulley shaft on the main gantry. Owing to the load it has to carry it is made very heavy. A structural or cast-steel base is provided, on which are mounted the bearings. Single gearing is used and ordinarily the teeth are not cut. A friction clutch is provided on the pulley shaft to connect this part of the dredge machinery. From the standpoint of rope efficiency, the drums should be made much larger than is common practice, but excessively large drums are not warranted, unless the sheaves through which the same rope passes are made of corresponding dimensions. This entails increased construction cost, but I am inclined to the opinion that it would reduce operating costs sufficiently to warrant some increase in this direction beyond common practice.

The brakes on the ladder hoist must be adequate in capacity and made so that there may be no possible danger of their giving way. If the brakes on the main winch should give way, little damage is likely to occur, but if they fail on the ladder winch a broken digging ladder is the probable result, if nothing worse. The following arrangement has been found very satisfactory. Two band brakes are used, one being operated by hand from the pilot house, the fixed end of which instead of being fastened to the deck is attached to a lever arm, which through a cross-shaft operates the other brake, thus giving almost unlimited power with little effort.



Magnetic Clutch and Drive for Main Winch.



Main Winch for 9-Cu. Ft. Dredge.

On most ladder hoists the drum-shaft gear is keyed to the drum shaft and it is nearly always situated close to the drum. It is a much better plan to design the side of the drum in such a way that the gear rim can be bolted to it, thus doing away with the gear spokes, making a much stronger job and taking all driving strain off the drum shaft.

Main Winch

The main winch operates the swinging lines, both bow and stern, raises the spuds, and is usually fitted with one or two headline drums for wrecking and repair work and to step up with when one spud has been broken. The winch is driven by a variable-speed motor which, together with the levers actuating the clutches, is operated from the pilot house. Some form of friction clutch is commonly used on each drum. I have for some time been using an electromagnet clutch on the pulley shaft of the winch similar to the one described for the bucket drive, and jaw clutches for each drum. The jaw clutches are extremely simple and require no attention, whereas a friction clutch is likely to get out of adjustment. Also each winchman wants his clutch set differently, and unless great vigilance is exercised, they will be constantly adjusting these clutches, which means lost time. The friction clutches on each drum are easier to operate, but with a little practice the jaw clutches give perfect satisfaction.

A good many dredges have a separate drum mounted on the after part of the dredge driven from the countershaft of the screen drive. It is used to raise and lower the stack ladder. The drum is driven by a worm gear of such pitch that it will not run backwards from the weight of the ladder. Other dredges have an extra drum mounted with the main winch for this purpose. It is kept from reversing by a pawl and ratchet. Considering the little use this drum gets, its situation and design seem to be of little moment, but a worm drive and separate drum mounted aft are preferable.

On deep ground and for the larger dredges the bow swinging lines pass from the drum to a sheave or combination of sheaves situated near the bow, then to a sheave on the shore, and from there to the lower end of the ladder. By this method of rigging, little side strain is put on the digging ladder or well hole. The disadvantage of this method is the necessity of a shore sheave and the consequent wear and time lost in moving and handling it. Where the ground is not too deep, a single line, which is simple to operate, but which puts a large side-bending strain on the ladder and well hole, is used. If the ladder and hull are built strong enough, this is not an objection. For the 13- and 16-ft. dredges a single line would have to be very large and would hardly be advisable.

All winch drums are provided with band brakes operated from the pilot house. The connections between brakes and clutches and pilot house are made through bell cranks, rods, etc. Flexible wire rope running over sheaves is used in several instances for the brakes.

Cast iron, cast steel, structural steel and wood are used for foundations. I have been using wood in recent designs, on account of its producing less noise and vibration than metal foundations.

Wire Rope Short-lived

Wire rope is used on the dredges for hoisting the digging and stack ladder, spuds, for all the swinging lines and for guying the gantries. On account of the small-diameter sheaves, the necessity of the ropes being under water part of the time and the general hard service they get, their life is short as compared with ropes used for most other purposes.

Some dredge constructors use the regular open and closed sockets for their guy-rope ends, and others think this practice is dangerous and use clips. I have never had any trouble with standard rope sockets if properly attached to the rope end. This may be done by first spreading the wire strands, treating them with dilute hydrochloric acid, inserting in the socket with the strands spread broom-fashion, and then filling with melted zinc. The ends of the wires should not be turned over, but left straight. If turned over some are likely to get more strain than others, and to break and cause trouble.

Different makes and types of wire rope are used. My experience points to standard $^6/_{19}$ plow-steel hoisting rope for ladder, spud and side lines and $^6/_7$ crucible cast-steel standing rope for the guys. Hot Stockholm tar makes a good dressing, also most of the rope greases to be had on the market. Whatever dressing is employed it should be used freely.

The sheaves used for the various purposes are made of cast steel in preference to cast iron. They are bushed with bronze or cast iron and their hubs made as long as possible. When long hubs cannot well be used, as in multiple blocks, the pins should be made of large diameter, so that the pressure will not be too great on each unit of resisting surface.

Centrifugal Pumps Used

Three centrifugal pumps are ordinarily used on the gold dredge. The high-pressure pump should be designed to have a working head of at least 60 ft.; more is better if the gravel is at all hard to wash. This pump furnishes the water for the spray pipes or jets in the screens and is direct-connected to its motor.

The low-pressure pump is likewise driven by a direct-connected motor and should have a head of 20 to 30 ft. This water is piped to the tables where needed, depending on the nature of the gravel and the arrangement of the gold-saving tables.

The priming or fire pump is usually a two-step pump with a working head of 100 ft. or more. This pump is used in case of fire, for washing down decks, in cleaning up, for pumping out the bilge, and for priming the larger pumps.

All pumps should be fitted with both foot and check valves. Bypass piping equipped with the requisite valves should be put in to be used for priming. The foot valves are provided with a grating, and the suction should be still further protected by a wire-netting box attached to the side of the dredge. If this box be made of ample dimensions, say, 8 ft. by 15 ft., a ⅜-in. mesh will work well. If a smaller box be used, ½- or ⅝-in. screen will have to be used; otherwise it is liable to get stopped up.

Three-phase Induction Motors Used

Three-phase induction motors are used on all standard California dredges, variable speed for the digging and winch motors and constant speed for the other pieces of machinery. Lately a form of variable-speed motor has been used for the stacker and screen drive, which gives a better starting torque for getting these parts under way and is particularly useful when it is necessary to start under full or overload. Any of the standard types of motor give most excellent results if the proper sizes are provided.

It is customary to bring the current on to the dredge at 2200 or 4400 v., then transform down on the dredge with three oil-cooled transformers to 440 v. Many of the later boats are using 2200-v. motors, thus avoiding the use of transformers altogether. Beside the three main transformers, another small one reduces the current to 110 v. for lighting purposes. All of the transformers are mounted in steel or asbestos-lined compartments opening to the outside of the dredge. They have pipe connections which allow the oil to be drained off and conveyed overboard to a point some distance from the transformers. These precautions are necessary in order to secure the best insurance rates and are to be recommended as a safeguard against fire. Another precaution which might prove useful is to provide the transformer housings with plate-steel doors hung from the top with an automatic latch at the bottom and so constructed as to be readily dropped and latched in case of fire.

The electric current is brought on board the dredge on floats in a three-conductor armored cable at a point near the stern, this part of the hull having the least movement. An oil switch is situated near this point and is often so arranged that it may be instantly thrown out from the pilot house. From this switch the current is conveyed to the transformers in case low-voltage motors are used and from there the secondary is distributed to the different switchboards. The latest boats use conduits and condulets for all the wiring. If open wiring is used the conductors should not be stretched too tightly and they should all be stranded. The single wires are likely to break under the severe vibration of digging and the movement of the hull and superstructures. I would recommend stranded conductors even with the conduit wiring. For the motors situated on the lower deck their wiring connections can be made through the hold. For the other motors the best method must be determined according to the conditions.

(To be concluded)

Aluminum for Transmission Lines

Aluminum is now extensively used in Europe for electric transmission lines. Many of the principal lines on the coast of the Mediterranean are of that metal; and the Société d' Electricité is about to use it exclusively in the valley of the Rhône. The advantage of aluminum over copper is one of the first cost, and, therefore, depends entirely on the relative price of the metals. For an equal electrical resistance, the weight of an aluminum line is half that of copper (1 to 1.98). If, therefore, an aluminum cable is used instead of a copper one, when the cost of the former per pound is, relatively to the latter, as 3 to 2, a saving of 25% will be effected.

The usual formula for distance between supports, according to the *Boletin de l'Industrie Minerale*, allows a longer stretch for aluminum than for copper wire, a condition which suggests a further saving in supports. But it is pointed out that when wind pressure is taken account of, the distance for aluminum works out as only nine-tenths of that which is suitable for copper. Where an expensive form of support is adopted this disadvantage may go far to neutralize the gain in the cost of the conductor. A small saving in first cost would not be a sufficient set-off against the more careful work and special points required for an aluminum line. Moreover, aluminum is easily corroded by both acids and bases.

Kentucky Barytes and Calcite

Prof. C. J. Norwood in his recently published biennial report of the Kentucky Geological Survey summarizes the results of barytes and calcite investigations as follows:

"Study of the barytes deposits of central Kentucky has been completed and the report is nearing completion. This work is in the hands of F. Julius Fohs. The Survey has proved this to be the greatest barytes district in the United States with an enormous available tonnage. There are nearly 150 veins, some of which have a linear extent of three to five miles, the average length being one mile, and the workable barytes extends to an average depth of about 250 ft. Until the Survey undertook this investigation, comparatively little was known concerning the value of our barytes deposits; indeed, Kentucky was not even mentioned as a source of commercial barytes in publications dealing with the mineral. Some mining was done years ago in one of the veins in Henry and Owen Counties, and in Franklin County, but it was solely for the purpose of obtaining lead, and results were not, upon the whole, remunerative. Mining primarily for the barytes, with lead and zinc as a byproduct, is now carried on in a number of localities. Two plants for preparing the mineral for market are in operation, and there is reason to expect that an additional one will be built at an early day. The writer believes that these are merely the pioneers of what will eventually prove to be a great Kentucky industry founded on these deposits.

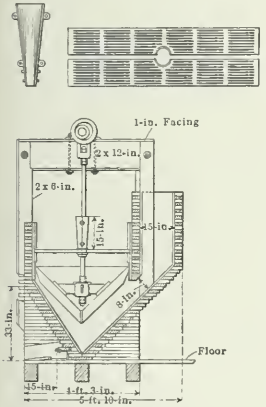
"Investigations of the calcite deposits were carried on simultaneously with the work on barytes. As one result of the investigation a profitable industry has been established, in the production of a high grade of calcite whiting."

Ore Dressing in the Joplin District—II

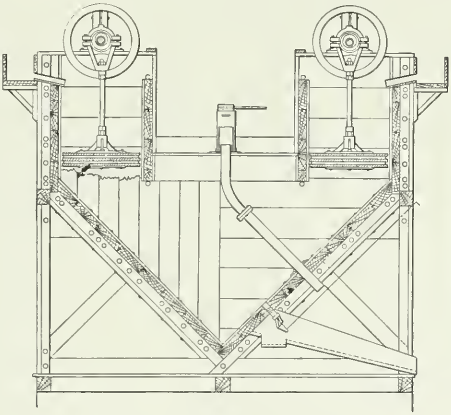
By James L. Bruce*

Coarse concentration is accomplished on jigs, three types of which are in general use. The sands are dewatered, sized, classified in some mills and sent to concentrating tables. Methods for treating jig and table middlings vary. The tailings are handled by elevators.

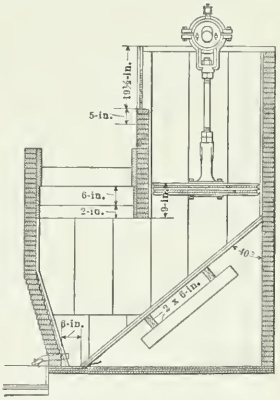
The methods of concentration in use at Joplin originated, I believe, in this district and are not practiced so far as I know in any of the older districts in the world though they have been copied in some of the newer mining districts in the United States and Mexico. With hardly any exceptions concentration is performed in two stages, the first concentration of about 5: 1 of the entire unsized mill feed being done on large 5- or 6-cell rougher jigs operated with a strong suction stroke caused by the hutches being run continually open. This allows the fine ore and sand to be drawn through the jig beds into the hutches. This first unclean concentrate, called "smiddem" is then ready after elevating, for a second concentration on the cleaner jig which makes a concentration of from 5 to 10:1 and separates the feed into lead ore and zinc ore ready for marketing, middlings and tailings, the two latter usually being given subsequent treatment. The treatment of the middlings or "chats" from both the roughers and cleaners, the treatment of sand recovered from the rougher-jig tailings by screening, classifying or spitzkasten, and from various dewatering boxes throughout the mill, and the treatment of the tailings from the cleaner jigs, completes the milling operations and gives rise to many diversified methods of recovering this part of the metallic content.



DEE CONCENTRATOR



FOUST JIG



COOLEY JIG

The Engineering & Mining Journal

THREE TYPES OF JIGS USED

There are three types of jigs in use: the Cooley, the Foust and the Dee concentrator; the oldest and most generally used being known as the Cooley type. This is built in a great diversity of sizes, uniting any number from three to seven cells all of which are set end to end. These cells vary in size from 20x24 in. to 36x48 in. and occasionally larger. The jig is constructed by laying a floor of three thicknesses of 1-in. material, nailing them together and building up the entire jig and partitions between cells, with strips of 2x4 finished lumber nailed one upon the other with two strips of cotton wicking laid between to assist in making it watertight. The front of the hutch is stepped out as the building progresses, until advanced about 8 or 10 in. After building the entire jig up 36 to 48 in. in this manner, a central longitudinal partition is started to form the wall between the screen and the plunger compartments. The plunger compartment is built up from 2 to 3 ft. higher than the screen compartment to give stable support to the jig-shaft journal boxes and to prevent splashing of water. Each cell is lined as high as the top of the plunger with 1-in. lumber, and slope boards are put in at the bottom so that the ore may all be drawn out at the front of the hutch. This leaves a "throat" from 20 to 30 in. deep between the longitudinal partition and the slope boards for the water to pass from the plunger compartment to the screen compartment.

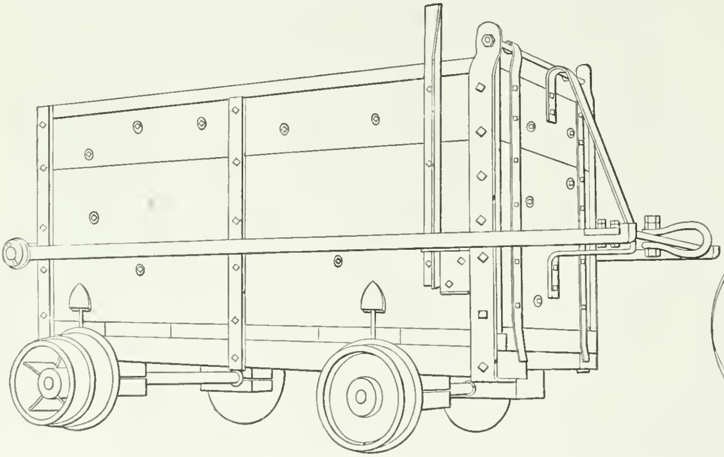
The Foust automatic jig is the recent invention of Henry Foust of Joplin and its success is evidenced by the large number of installations which have been made in the Joplin district (about 50 up to the present) and in other widely scattered fields. The main result sought in designing this jig was to secure a uniform action of the water upon all parts of the under side of the screen in a jig of large size and capacity, whereby a thinner and lighter bed could be carried on the jig and correspondingly less wash water, with its attendant losses of ore, used. These results seem to have been satisfactorily accomplished at only a slight increase in the inconvenience of handling and maintaining. The jig employs eccentrics, plungers and jig screens or grates similar to those used in the Cooley type. It also is divided longitudinally into four or more cells as is the Cooley but is divided laterally into three instead of two compartments, a central screen compartment and on either side a plunger compartment. The partitions between the plunger compartments and the screen compartment extend about 18 in. below the screen and the combined areas of the plunger compartments are about 10% greater than that of the screen compartment. The two eccentric shafts are rigidly connected at their ends by a link or connecting rod which insures exactly parallel motion of the plungers on each side of any cell. An automatic draw off is provided for each cell. This consists of a pipe extending downward through the screen and outward through the side of the jig. A hollow cylinder somewhat larger than the pipe and supported at a variable distance above the screen, surrounds the top part of the pipe and extends above the surface of the water. Within it a conical valve rests upon the bed and allows the ore to discharge through the pipe when the weight of ore on the bed is sufficient to overcome the weight of the valve and raise it. This keeps the thickness of the jig bed practically constant.

---

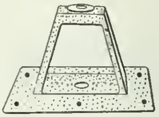
*General manager, Continental Zinc Co., Joplin, Mo.

The Dee concentrator, shown in an accompanying cut, is intended to secure the same results as the Foust jig, that is, more uniform action on the bed and less wash water, and at the same time to economize on mill space and head room. The jig consists essentially of a number of screen compartments with the eccentric shaft set directly over them and the plunger rods passing through a loose sleeve in the center of each screen and connecting to hopper-shaped plungers which work directly under the screen. These catch the ore and allow it to pass downward through a hole in the center to the jig hutch below. The inconvenience and mechanical disadvantages of this type of jig are considerable and its advantages have not yet proven attractive enough to secure its installation in many instances.

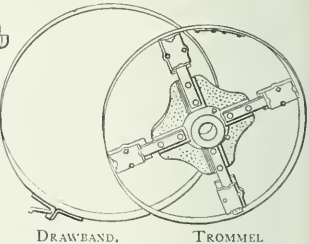
The Richards pulsator jig has been tried out at three different plants and has been removed from each after an unsuccessful attempt to concentrate the ores. Lack of flexibility to take care of the varying rates and richness of the feed, owing to the small size of the cells, seems to be the chief objection.



Wood-Body Steel-Lined Dump Car.



Jig Plunger Stand.



Drawband. Trommel Screen Spider.

The Engineering & Mining Journal

Jig Beds and Plungers

Two methods are used for supporting jig beds, that in most common use consisting of a number of iron grates about 6 in. wide and of a length equal to the width of the compartment. These grates consist of several prismatic cast-iron bars set from $\frac{1}{16}$ to $\frac{3}{16}$ in. apart with one of the flat sides uppermost and united by joining them every six inches or thereabouts. These grates have less waterway than cloth, but have the advantage of being much more rigid and easier to clean. Similar grates made of *bois d'arc* or Osage-orange wood are used, especially in places where the water is acidulous enough to be quickly destructive to iron grates. These wear well and last from six to 12 months under hard service. The second method is to use either a wire cloth or perforated sheet steel supported by a wooden frame. The perforated sheet steel has practically all of the advantages of the cast-iron grates as it is rigid and easily cleaned, without the disadvantage of the cloth which is hard to keep clean and which is not rigid except where it is attached to the wooden frame. The sheet has a greater waterway than the cast-iron grates and not much less than the cloth when it is considered that the supports in the framing do not have to be so close together as they do for cloth. In spite of these advantages there are few perforated sheets used. I have found the most suitable perforation to be $\frac{1}{16}$ to $\frac{3}{16}$ in. by $\frac{5}{8}$ to $\frac{3}{4}$ in. hit-and-miss endways with the long dimension of the slot placed across the jig. These do not choke up as much as round perforations and offer less resistance to the water for a given area of water opening. They are more rigid than wire-cloth sheets and allow a better action of the water on the bedding material.

Jig plungers, which operate in compartments lined with 1-in. boards, are made by nailing together five layers of 1-in. boards with the grain of the wood running in different directions in alternate layers. It is well to use the half of a 4x4-in. timber split diagonally and spiked to the under side of the plunger at its edges so as to catch the water better on the down stroke. Plunger rods are attached to the plunger by passing through them and tightening with nuts and lock nuts on to square plates above and below the plunger which may or may not be supported by diagonal bracing. Cast-iron plunger stands are also used and are made as shown in the accompanying figure. This type is especially well adapted for acid water as it keeps the plunger rod entirely out of the water; thus avoiding undue corrosion.

Jig eccentrics are made of cast iron, the hub and yoke fitting as a ball and socket which allows side play of the plunger without binding the eccentric. Eccentrics are made solid to slip over the end of the shaft, or split, so that they may be replaced without disturbing adjoining eccentrics. The amount of throw is made adjustable in various ways on the different types. The split eccentric is a decided advantage on account of the time saved when making a change.

"Perfection" molasses gates 1½ or 2 in. in diameter are almost always used for hutch draw offs and their convenience renders them satisfactory except in acid water which soon cuts out their thin castings. For acid water or where the abrasion is severe an excellent substitute, Clark's patent jack gate, has been devised. This exposes to abrasion only two cheap cast-iron disks which slide upon one another with notches that match to form the discharge opening.

Methods of Handling Middlings

The methods used for handling the "chats" or middlings are various but none of them seem to fill the requirements in an entirely satisfactory way. Middlings from a jig or table consist of two types of material: (1) Mixed particles of free ore and gangue which, owing to their size, shape, weight or the imperfection of the jigging operation, have been drawn off together; (2) particles of gangue which contain unseparated particles of ore in appreciable quantities.

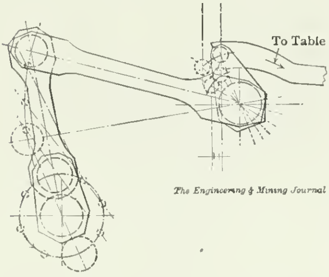
Each of these types needs further crushing either to alter the size or shape, or to free the particles of ore from the particles of gangue, but too much crushing causes sliming of a large part of the ore. In the Joplin district it is the practice of a great many mills to unite the middlings or chats from roughers, cleaner, and tables, sending them to an elevator which delivers to a trommel of from 2-mm. to 3-mm. mesh, the oversize going to the chat or regrind rolls and back to the elevator. In most mills the undersize goes back to the rougher jigs, in some others it is classified, the coarser part going back to the roughers and the fines to the settling tanks and in still others all the undersize goes to the settling tanks and from these to the fine-sand concentrating department.

In many cases I think the most logical course to pursue would be to keep the jig middlings separate from the table middlings and sand, and regrind their oversize from about a 2½- or 3-mm. screen, the undersize going to a 1½- or 2-mm. screen from which its oversize goes back to the rougher jig, while the undersize goes to the concentrating tables. In this system the effort already expended to enrich the middlings, instead of being wasted by returning them to mix with the leaner mill feed, is further assisted by the regrinding, which causes the more friable ore to be crushed finer than the gangue, and the classifying, which delivers only the coarser ore and gangue to the roughers and sends the finer sands and ore to the tables. The table middlings should be reground in separate rolls or other fine-grinding machinery and returned to the classified tables without screening. Sand jigs are used in some plants for handling the coarser sizes of fine sands, but in my experience tables are preferable for sand ranging from 2½ mm. down.

Fine Concentration

For dewatering or settling the fine sand two general types of settling boxes are used: Those having an intermittent draw off; those with a continuous draw off. The former is usually built in the shape of a rectangular box situated outside the mill building, with a partition dividing it into two parts one of which is used for settling while the feed is being drawn from the other. The floor of each compartment should slope diagonally toward that end of the partition nearest the mill, as by this means the small stream of water used for washing the sand to the discharge at the mill end of the partition, can always be kept against the bank of sand insuring a flow of sand as long as the stream of water is kept running. At the same time the water to be settled is fed into the other compartment near the mill end of the partition and overflows at the far end. The advantages of this type of settling box are: Simplicity and freedom from choke-ups, small amount of water withdrawn with the sand; lack of height; accessibility. The disadvantages are: eddying currents; small peripheral overflow and consequent high velocity; inconstant settling areas, the latter decreasing as the tank fills up.

Tanks with a continuous draw-off are usually made either conical or pyramidal with the inflow in the center of round or square tanks or in a trough running down the middle of rectangular tanks, and with an overflow around the entire periphery. The round or square tanks are preferable when sufficient height is available to give the proper peripheral discharge, as all the contents can be removed from one spigot consequently with less water. The sides should slope about 60° from the horizontal otherwise the contents will bank up and occasionally slide off and choke the discharge. An air vent should be made on each side of the inflow to allow the entrained air to escape without disturbing the surface of the water. Continuous draw-off tanks have the advantage of compactness, uniform settling area, large peripheral discharge and slow velocity, but present the disadvantages in many cases of discharging more water with the sand, requiring greater height, choking more frequently and being less easily accessible.



Head Motion of Ford Concentrator

Several Types of Screens Used

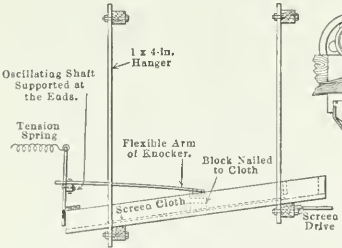
Several types of screens are used for the fine sand. In some mills the tailings at the end of the rougher jigs instead of being dewatered by the customary classifier, mentioned heretofore, are discharged on the outside of a 1½- or 2-mm. cylindrical trommel revolving in the direction of the current. The water going through carries a great deal of fine sand with it and drops into a pan inside the trommel from whence it runs to the settling tanks for the table feed. The tailings are discharged from the outside of the trommel nearly dry. Similar trommels fed from either the outside or the inside, or octagonal ones which are fed from the outside are used in several mills for screening the mill sands, the undersize constituting the table feed, which in many cases is concentrated without classification, and in others after classification in any one of various types of classifiers.

The oversize from the screen or trommel in some mills goes to a four-cell sand jigs in others to the regrind or chat rolls or in still others is returned to the system to again pass over the rougher jig. For screening the mill sands a common type, and owing to its simplicity, low cost, compactness and saving of mill height, a satisfactory one is the ordinary shaking screen. Perforated sheet steel is usually used and choking or fouling of the screen may be prevented in a large measure by fastening a small wooden block on top of the sheet near the center and rigging up a "knocker" to be driven by the motion of the screen as shown in the accompanying sketch. For making three sizes of product I have used one shaking screen mounted above another and sloping in opposite directions with a shield under the upper screen to convey the undersize to the head end of the lower screen. Both screens are driven from one shaft, the throw of the eccentrics being set 180° apart to prevent vibration as much as possible. Shaking screens are supported by four 1x4-in. pieces of wood about 3 or 4 ft. long which are bolted rigidly to timbers above and to the frame of the screen and have sufficient spring to allow of the necessary motion. I have found the best results at speeds of about 300 r.p.m. and slopes varying from 2 in. per ft. to 2½ in. per foot.

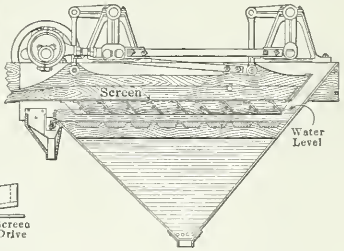
The Henry sizing screen has been used in several mills with satisfactory results. The Henry screen, as shown, consists of a shaker screen which is given an upward forward movement on one-half of the revolution and a downward backward movement on the other half and is contained in a framework which supports the driving mechanism. The shaker-screen jacket rests on blades which incline at their lower edge toward the feed end of the screen and these blades dip into the surface of the water in a tank just below the screen. The motion of the screen forces air and water up through the feed and washes the fines down into the hopper-shaped tank below, where they are drawn off by a spigot. The motion at the same time serves to carry the oversize forward. The dash of water against the under side of the screen frees the meshes of particles of sand which are just too large to pass through and prevents clogging of the screen, at the same time washing the fines out of the feed and through the screen.

The Ford decagonal outside-feed screen, shown in the accompanying cut, is made up of ten flat-bottomed trays covered with wire cloth and attached to the screen frame independently. The screen, which revolves slowly, is fed from the outside, allowing the fines to wash through into an inside pan. The oversize drops off into a launder below the screen which is washed clean by a spray pipe inside. The cost of repairs and maintenance is light, the screen seldom chokes up and the screening is satisfactorily done.

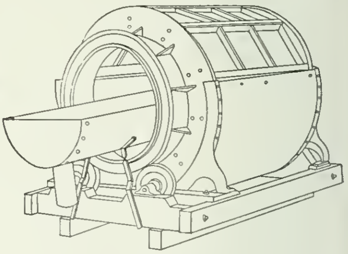
Quite a number of the larger mills and nearly all of the smaller ones furnish an unclassified feed to the concentrating tables, especially as many mills have, if any, only one table. There are, however, quite a number of mills that classify the table feed, but in most cases the classification is exceedingly imperfect owing to lack of care in designing the classifiers. In some cases ordinary inverted pyramids or cones are used with or without a rising current of water. In but few types is a sorting column provided, and most are so constructed that the velocity of the current of water which should raise the finer particles to the point of overflow, decreases greatly as it rises, allowing the particles to come to rest and finally bunch together in masses which settle back and form irregular currents of water in the classifier.



Shaking Screen and Knocker.



Henry Ore Sizing Screen.



Ford Outside Feed Screen.

The Engineering & Mining Journal

Concentrating Tables

There are a great many concentrating tables in use and as a natural result quite a variety of types. The first concentrating devices to be used for handling the fine sand were known as sweeps and consisted essentially of a stationary surface over which the wet sand flowed while a moving arm above the surface dragged a cloth of ducking or other heavy material over the sand. This had the effect of loosening the coarser sand and allowing it to be washed further down by the flow of water while the heavier and finer particles of ore settled into the bed. The partially concentrated product thus formed, after accumulating for a time, was shoveled to one side and re-treated until the percentage of metal contents was raised to a satisfactory degree for marketing or for final treatment on a table. The surface of the sweep was made in various shapes, one of them being similar to a "buddle" top with the feed at the center and the sweep arm extending radially from the same and rotating over the surface. An improvement over this form was effected when the feed was delivered at one end of a wide rectangular trough, which was mounted on pivots so that the contents could be discharged without shoveling, by turning the box upside down. This later form has been used quite recently to rough the sand and produce a richer and less bulky feed for the tables.

The principal tables in use at present are the Wilfley, Ford, Dunham, Kirk, Arbuthnot, Theurer, Standard and James. The Ford, Dunham, Kirk, Arbuthnot and Theurer are of local manufacture and of somewhat similar design, especially the decks, which are made of specially treated wood with riffles cut in them of various cross-sectional shapes, tapering from their greatest depth at the feed end to a feather edge at the discharge end and running the full length of the deck. The Dunham concentrator has four check riffles provided for the purpose of checking the feed from being washed off the table when an irregular feed makes an extra rush of material on the table. It is also provided with a strip running diagonally across the table just below the tailings line for the purpose of saving any ore which might escape the check riffles, and returning it to the system. This would otherwise have to take chances of working its way under all the heavier sand to reach the discharge end. The Ford No. 4 table top and the Dunham No. 1 top are supported on rollers, the Dunham No. 2 on balls, the Kirk, Arbuthnot and Theurer on upright links and the Ford No. 5 is hung on links.

The head motions on some of these tables are extremely smooth running and free from vibration. An accompanying diagram shows the adjustments of the Ford head motion for two different lengths of stroke. All the tables manufactured locally have riffles which extend the full length of the deck and consequently discharge wide bands of mineral which permits of a good classification of different minerals when carefully attended. In my opinion, however, irregularities of feed or feed water cause the lines between bands to shift a great deal more than they do on the Wilfley or Standard tables, requiring careful attendance to secure any advantage from the wide banding. With the large tonnages per hour usually handled in the district I think speeds should be somewhat higher than recommended by manufacturers. I prefer speeds ranging from 250 for the coarser sizes of sand to 280 for the finest sizes. Many tables are operated with much too large a quantity of wash water, especially near the discharge end.

Tailings Handled by Elevators

In this district the problem of disposing of the tailings is not in many instances a serious one, owing to the relatively short life and consequently small tonnage produced by most plants. Tailings elevators as high as 80 ft. between centers of top and bottom pulleys operate satisfactorily. These can be made to cover an area of about 180,000 sq.ft. on level ground; estimating the height of the elevator dump box above ground at 70 ft., the average fall is 2 in. per ft., and the tailings pile must lie within an angular range of about 120° from the tailings elevator. Estimating a 30° slope from the top of the pile to the foot of the elevator, the height of the pile will be about 54 ft. This would show room for about 3,240,000 cu.ft. or about 150,000 tons of tailings. As the average slope is often less than 2 in. per ft. the tonnage that may be handled from the mill elevator will run up to 200,000 or more on level ground. When all the tailings possible have been piled in this way the usual custom is to erect a "dummy" tailings elevator at some point on the flume from the mill tailings elevator and re-elevate the material. These elevators are from 20 to 40 ft. high and are driven by a wire-rope drive from the lineshaft of the mill or by an independent engine or motor. This will give a uniform depth of tailings over two-thirds of the first pile and will cover a large additional area besides. Few mills produce a large enough tonnage to require any further means for disposing of the tailings although a few have a second "dummy" which elevates again from the flume of the first "dummy."

In a number of cases where mills are not making a good saving the tailings are run direct to tailings mills which rehandle them at a profit. The cost of this remilling is in many cases extraordinarily low, reaching 10c. per ton or less irrespective of amortization charges for plant. A large amount of such tailings as are conveniently situated are sold to and loaded by the railways or gravel companies which use them for ballast or ship them to cities and towns for concrete or other commercial purposes. The prices paid for them will run from 1 to 3c. per cu.yd. after deducting the costs of loading.

Power is comparatively cheap and a choice of several types is afforded. Steam engines grade in efficiency from the simple slide-valve engine to the Corliss condensing engine, with steam furnished by boilers, some with and some without feed-water heaters, fired with natural gas, fuel oil or coal. Gas engines, usually either Bessemer, Miller or Foos, are used in sizes ranging up to 150 hp., and are usually quite satisfactory if chosen of a capacity above the demands to be made upon them. The excellent service rendered by the Empire District Electric Co. makes the use of electric power a favorite one in many instances. Slack coal costs $1.60 per ton and mine run $2.10@2.25 delivered on nearest railroad switch; natural gas, 12½@15c. per 1000 cu.ft. for boiler use or 25c. per 1000 cu.ft. for gas engines. Electric power ranges upward from about 0.9c. per horsepower-hour.

(*To be concluded*)

Gage for Sheet Zinc

Sheet zinc is measured by a distinct gage known as the zinc gage (*Metal Industry*, Feb. 1912). The sizes in this gage are given in the accompanying table.

Gage No.	Decimal Equivalent	Pounds per Square Feet
1	0.002	0.07
2	0.004	0.15
3	0.006	0.22
4	0.008	0.30
5	0.010+	0.37
6	0.012	0.45
7	0.014	0.52
8	0.016	0.60
9	0.018	0.67
10	0.020	0.75
11	0.024	0.90
12	0.028	1.05
13	0.032	1.20
14	0.036	1.35
15	0.040+	1.50
16	0.045	1.68
17	0.050	1.87
18	0.055	2.06
19	0.060	2.25
20	0.070	2.62
21	0.080	3.00
22	0.090	3.37
23	0.100+	3.75
24	0.125+	4.70
25	0.250+	9.40
26	0.375+	14.00
27	0.500+	18.75
28	1.000+	37.50

Compensation to Injured Workmen in Michigan

By P. B. McDonald*

The State Employers' Liability and Workmen's Compensation Committee of Michigan has made its report to the governor, and it is likely that the legislature will enact a law based upon the findings of the committee. The report is of especial interest to the mining corporations of the upper peninsula.

The recommendations contained in the report are briefly as follows:

(1) That the state should take charge of damages paid to employees.

(2) That any such compensation law passed should be optional to the employer, at least until it has been thoroughly tried in practice.

(3) That employees shall not contribute to the funds, but that the physical injury and suffering of the workman shall constitute his proportion of the burden.

(4) That total disability should entitle the workmen to 50% of what his wages would amount to in eight years, or a maximum of $4000. The damages due for a fatal accident would be 50% of six years' wages, or a maximum of $3000. Partial disability, 50% of wages after two weeks. If disabled more than eight weeks, compensation from date of injury.

(5) That employers be given four options (A) to carry their own risks if they can satisfy the board of their financial ability to do so (B) to insure in any authorized company (C) to insure in an employers mutual association (D) to request the commissioner of insurance to assume the administration of the collection and disbursement of industrial accident funds.

(6) That employers mutual associations may be formed by not less than five employers engaged in the same general industry and having not less than 10,000 employees.

(7) That an industrial accident board should be appointed by the governor, consisting of three members, one being appointed every second year after the initial appointment. For the chairman designated by the governor, a salary of $5000 per year is provided. The board may employ assistants and clerical help as necessary.

(8) That a committee of arbitration of three members to investigate accidents, shall consist of one member of the industrial accident board, and two others appointed respectively by the parties in dispute. Either party may demand a review by the board.

(9) That domestic service and agriculture be excluded from the terms of the bill.

(10) That all injuries except such as result from misconduct of the workmen shall be under the terms of the law. While the law shall be optional to all private employers and public-service corporations including contractors doing work for the state or municipalities, it shall be compulsory as to the state and counties, cities, incorporated villages, townships and school districts.

The commission found that plaintiff's attorney fees averaged 40% in one year's damage suits brought by injured workmen against employers. Also of 22 workmen who sued for damage in Wayne County Circuit Court in 1909, 54½% got nothing, while the average recovery was only $884 for partial disablement for life. In 14 fatal accidents in the state at large, the average recovery was only $1248.

Under the present Michigan law injured workmen can recover damages only when it can be proved that the injury resulted through negligence on the part of the employer, with no negligence on the part of the employee or on the part of a fellow servant. Large sums are at present expended by employers as a protection against damages arising from industrial accidents, but only a very small percentage of the sums so expended result in any benefit to the injured.

---

*Mining engineer, Negaunee, Mich.

Hillside Houses for Working Men

The problems of the lack of comfortable homes for working men, and the unoccupied hillsides around Pittsburgh, have been attacked by the Pittsburgh Civic Commission. In the November *Civic Bulletin* the solution of them as worked out after two years' study is published. Streets with 6 to 8% grades are to be built along the sides of the hills, forming a series of terraces up the hillside, spaced 32 ft. apart for single houses and 92 ft. apart for the blocks of four houses. This bulletin might contain valuable suggestions for certain of the big mining companies.

Conservation of Natural Gas

The much discussed waste of natural gas is stated by the United States Geological Survey to be rapidly decreasing. The problem of conserving the natural-gas supply may be considered as having been satisfactorily solved in Pennsylvania, throughout the Appalachian and the Lima-Indiana fields, and in Kansas. The greatest waste is in Oklahoma and in the Caddo field of Louisiana, owing in Oklahoma to probable looseness in enforcement of the laws and in Louisiana to lack of a market. It is noteworthy that one of the two wild wells in Louisiana that have been sensational examples of waste have been successfully closed and the gas thus conserved for future use.

The Mining Index

A Classified Bibliography of the Current Literature of Mining and Metallurgy

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print), in the original language, for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COAL AND COKE

17,999 — ACCIDENTS — American vs. English Mine Fatalities. J. T. Beard. (Coal Age, Jan. 6, 1912; 1¼ pp.) 20c.

18,000—ACCOUNTING—Cost Sheets and Daily Reports. John A. Garcia. (Coal Age, Jan. 13, 1912; 2⅓ pp.) 20c.

18,001 — ATMOSPHERES — Pathogenic Mine Atmospheres. Edwin M. Chance. (Coal Age, Dec. 30, Jan. 13 and 20, 1912; 6½ pp.) 60c.

18,002—AUSTRIA—Das Rossitz-Zbeschau-Oslawaner Steinkohlenrevier. Eduard Panek. (Oest. Zeit. f. B. u. H., July 29, Aug. 5, 12, 19, 1911, and Jan. 20, 27 and Feb. 3, 1912; 25 pp., illus.) The Rossitz-Zbeschau-Oslawa coal mining district. $1.

18,003—BRIQUETTING—Die Beleuchtung der Braunkohlenbrikettfabriken. Reuss. (Preuss. Zeit. f. B., H. u. Salinenwesen, Vol. 59, Part 5, 1911; 12 pp., illus.) The lighting of brown-coal briquet factories.

18,004—BRITISH COLUMBIA COAL INDUSTRY in 1911. (Coal Age, Jan. 13, 1912; ½ p.) 20c.

18,005—CHRONOLOGY of Coal Mining for 1911. (Coal Age, Jan. 6, 1912; 1⅓ pp.) 20c.

18,006—COKE—Electrical Equipment of Coke Plant of the Indiana Steel Co. at Gary. (Iron Age, Dec. 28, 1911; 3¾ pp., illus.) 20c.

18,007—COKE—Moderne Kokereien mit Gewinnung der Nebenprodukte. Wagner. (Bergbau, Jan. 4, 11, 18 and 25, 1912; 20 pp., illus.) Modern coke-oven plants with extraction of byproducts. 80c.

18,008—DUST—Discussion of Sir Henry Hall's "Comments on Recent British Continental and American Coal-Dust Experiments. (Trans. Manchester Geol. and Min. Soc., Vol. XXXII, Parts 7, 8 and 9, 5 pp.)

18,009—ELECTRICALLY OPERATED WEST VIRGINIA MINES. F. C. Perkins. (Coal Age, Jan. 20, 1912.) 20c.

18,010—ELECTRIC POWER—Discussion of Eustace E. Baker's Paper on "The Protection of Electrical Installations in Mines by the Winhey Leakage Detector." (Trans. Manchester Geol. and Min. Soc., Vol. XXXII, Parts 7, 8 and 9, 7 pp.)

18,011 — EXPLOSION — Bottom Creek Mine Explosion, Vivian, W. Va. (Mines and Minerals, Jan., 1912, 2 pp., illus.) Conditions existing at the time of the explosion when 18 men were killed. 20c.

18,012—EXPLOSION—Die Explosion auf der Steinkohlenzeche Radbod I—II bei Hamm in W. am 12ten November, 1908. Hollender. (Preuss. Zeit. f. B., H. u. S., Vol. 59, Part 5, 1911; 60 pp., illus.) Explosion at Radbod colliery, near Hamm, Westphalia, on Nov. 12, 1908.

18,013—EXPLOSIONS—Causes of Iowa Mine Explosions. John Vernier. (Coal Age, Feb. 3, 1912; 2½ pp.) 20c.

18,014—EXPLOSIONS—List of Fatal and Nonfatal Explosions of Fire-Damp or Coal Dust and Barometer, Thermometer, etc. Readings for the Year 1910. Percy Strzelecki. (Trans. N. Eng. Inst. Min. and Mech. Eng., Sept., 1911, 11 pp.)

18,015—GAS—Die plötzlichen Gasausbrüche in den Belgischen Kohlengruben während der Jahre 1892-1908. W. Schulz. (Glückauf, Jan. 13, 20 and 27, 1912; 26½ pp., illus.) Sudden outbursts of gas in the Belgian coal mines during 1892 to 1908. 40c.

18,016—GAS—Ignition of Gas by Electric Lamps. (Coal Age, Jan. 20, 1912; 3 pp.) From "Ann. des Mines de Belgique." 20c.

18,017—GAS DETECTION—The Holmes-Ralph Gas-Detecting Portable Electric Lamp. George J. Ralph. (Trans. N. Eng. Inst. Min. and Mech. Eng., Dec., 1911; 8 pp., illus.)

18,018—GASES—Methods for Testing Mine Gases. W. R. Crane. (Coal Age, Dec. 30, 1911; 1 p., illus.) Abstract of paper before the Coal Min. Inst. of America, Dec. 20, 1911. 20c.

18,019 — GERMANY — Die Betriebserweiterung im rheinisch-westfälischen Steinkohlenbergbau. Ernst Jüngst. (Glückauf, Dec. 23 and 30, 1911; 3 pp., illus.) The expansion of coal mining in Rhineland-Westphalia. 60c.

18,020—GREAT BRITAIN—Die Kohlenausfuhr Grossbritanniens im Jahre 1911. (Glückauf, Jan. 27, 1912; 3 pp.) Great Britain's coal export in 1911. 40c.

18,021 — HAULAGE — A Compressor Plant for Mine Haulage. (Coal Age, Jan. 13, 1912; 2½ pp., illus.) 20c.

18,022—HAULAGE—Air, Electric and Mule Haulage. C. B. Hodge. (Coal Age, Feb. 3, 1912; 2⅔ pp., illus.) 20c.

18,023—HAULAGE—Erfahrungen bei der maschinellen Strukenförderung auf den Steinkohlenbergwerken Oberschlesiens. Wendriner. (Preuss. Zeit. f. B., H. u. S., Vol. 59, Part 5, 1911; 22½ pp.) Records of experience in underground haulage by machinery in the collieries of Upper Silesia.

18,024—ILLINOIS—Mine No. 3, Saline County Coal Co. Oscar Cartlidge. (Mines and Minerals, Feb., 1912; 2½ pp., illus.) Method of fireproof construction of shaft; handling of cars; method of mining. 20c.

18,025—KENTUCKY—The Black Mountain Coal District, Kentucky. J. B. Dilworth. (Bull. A. I. M. E., Feb., 1912, 28 pp.)

18,026—LIGNITE FIELDS of Colorado. R. A. Pierce. (Coal Age., Feb. 8, 1912; 4 pp., illus.) 20c.

18,027—LOW-GRADE FUEL—Ausnutzung minderwertiger Brennstoffe auf Zechen des Oberbergamtsbezirks, Dortmund. XIII. Bütow and Dobbelstein. (Glückauf, Jan. 6, 1912; 14 pp., illus.) Utilization of low-grade fuel at collieries of Dortmund district. 40c.

18,028—MICROSCOPICAL EXAMINATION of Coal, and Its Use in Determining the Inflammable Constituents Present Therein. James Lomax. (Trans. Manchester Geol. and Min. Soc., Vol. XXXII, Parts 7, 8 and 9; 20 pp.)

18,029 — MINERS — Efficiency of the Bituminous Coal Mine Employee. W. J. Lauck. (Min. and Eng. Wld., Jan. 20, 1912; 2 pp.) 20c.

18,030—PARAFFINS from a Yorkshire Coal Seam. J. B. Cohen. (Journ. Soc. Chem. Ind., Jan. 15, 1912; 3 pp.)

18,031—PLANT—Anthracite Plant of the Lehigh & Wilkesbarre Coal Co., Hazleton, Penn. (Coal Age, Dec. 16, 1911, 1⅝ pp., illus.) 20c.

18,032—RAILROAD TRACKS for Soft Coal Mines. M. L. Hyde. (Coal Age, Jan. 20, 1912; 2 pp., illus.) 20c.

18,033—RESCUE APPARATUS—Self-Contained Breathing Apparatus. (Coal Age, Jan. 27, 1912; 1¼ pp.) 20c.

18,034—RESCUE WORK—First Aid in the Coal Industry. Charles Lynch. (Coal Age, Jan. 13, 1912; 1 p., illus.) 20c.

18,035—SHAFT SIGNALLING—Luminous Electric Mine-Shaft Signalling. J. C. Eadie. (Trans. Manchester Geol. and Min. Soc., Vol. XXXII, Parts 7, 8 and 9; 10 pp., illus.)

18,036—STEAM PIPES—Colliery Steam Piping Suggestions. H. H. Lawrence. (Coal Age, Jan. 27, 1912; 1½ pp., illus.) 20c.

18,037 — STEAM-SHOVEL MINING — Mining of Shallow Deposits with Steam Shovels by the Hartshorn & Patterson Coal Co. C. A. Tupper. (Min. and Eng. Wld., Jan. 13, 1912; 1¼ pp., illus.) 20c.

18,038 — STRIKE — Anthracite Coal Strike Situation. E. L. Cole. (Coal Age, Feb. 17, 1912; 3 pp., illus.) 20c.

18,039—THICKNESS—Determination of Coal Thickness. R. Dawson Hall. (Coal Age, Feb. 10, 1912; 2 pp., illus.) 20c.

18,040 — VENTILATION — The Water Gage as Used in Mines. Frank Lynde. (Coal Age, Jan. 13, 1912; 1⅓ pp., illus.) 20c.

18,041—WASHING—Coal Washing at Lahausage, Ala. Day Allen Willey. (Mines and Minerals, Feb., 1912; ½ p., illus.) 20c.

COPPER

18,042—LAKE SUPERIOR—Review of Lake Superior Copper Mining in 1911. Robert H. Maurer. (Min. and Sci. Press, Jan. 13, 1912; 2½ pp., illus.) 20c.

18,043—LEACHING Applied to Copper Ore. W. L. Austin. (Mines and Methods, Jan., 1912; 3 pp.) Fourteenth article reviewing results accomplished, with special reference to leaching rock without mining. 20c.

18,044—METALLURGY of Copper During 1911. Thomas T. Read. (Min. and Sci. Press, Jan. 6, 1912; 4 pp.) 40c.

18,045—SMELTING—Problems in Modern Copper Smelting. S. E. Bretherton. (Min. and Sci. Press, Feb. 10, 1912; 3½ pp., illus.) Address before the Min. Assn. of the Univ. of Calif., Jan. 24. 20c.

GOLD DREDGING

18,046—ACCIDENTS—Righting Overturned Gold Dredges. Lewis H. Eddy. (Eng. and Min. Journ., Feb. 10, 1912; 1 p., illus.) 20c.

18,047—ALASKA AND YUKON—Gold Dredging in Alaska and the Yukon. Charles Janin. (Min. Mag., Jan., 1912, 4 pp., illus.) 40c.

18,048—CALIFORNIA—A New Gold Dredge at Oroville. Lewis H. Eddy. (Eng. and Min. Journ., Feb. 10, 1912; ⅜ p.) 20c.

18,049 — CALIFORNIA — Evolution of the California Dredge. A. H. Martin. (Mines and Methods, Jan., 1912; 2 pp., illus.) 20c.

18,050—CALIFORNIA—The Design and Mechanical Features of the California Gold Dredge. Robert E. Cranston. (Journ. A. S. M. E., Feb., 1912; 57 pp., illus.)

18,051—RECOVERY OF GOLD in Dredging. Charles Janin. (Eng. and Min. Journ., Jan. 27, 1912; 1 p.) 20c.

GOLD AND SILVER—CYANIDATION

18,052 — ALASKA TREADWELL PLANT—The Cyanide Plant at the Treadwell Mines, Alaska. W. P. Lass. (Bull. A. I. M. E., Feb., 1912; 34 pp.)

18,053—ELECTROLYTIC OXYGEN in Cyanide Solutions. T. H. Aldrich, Jr. (Bull. A. I. M. E., Feb., 1912, 6 pp.) 40c.

18,054—FILTRATION—A Gravity Filter Plant. C. J. Stone. (Eng. and Min. Journ., Feb. 17, 1912; 1⅜ pp., illus.) 20c.

18,055 — FILTRATION — The Use of Dorr Thickeners as an Accessory to Vacuum Filters for the Separation of the Rich Solutions from the Residues. J. Leslie Mennell. Informes y Memorias del Inst. Mex. de Minas y Metalurgia, Vol. II, Part 5, 1910-1911; 7 pp., illus.)

18,056—PROGRESS in Cyanidation of Gold and Silver Ores During 1911. Alfred James. (Min. and Sci. Press. Jan. 6, 1912; 6 pp.) 40c.

18,057—PULP MEASUREMENT—Practical Applications of the Specific Gravity or Moisture Flask. H. Stadler. (Journ. Chem., Met. and Min. Soc. of South Africa, Nov., 1911; 4¼ pp.) 60c.

GOLD AND SILVER—GENERAL

18,058—ALASKA—The Sitka Mining District, Alaska. Adolph Knopf. (U. S. Geol. Surv., Bull. 504, 1912; 32 pp., illus.)

18,059—AMALGAMATION of Gold in Banket Ore. W. R. Dowling. (Journ. Chem., Met. and Min. Soc. of South Africa, Nov., 1911; 4¼ pp.) Author's reply to discussion. 80c.

18,060 — BRITISH COLUMBIA — The Standard Mine, Silverton, B. C. John Vallance. (Bull. Can. Min. Inst., Oct., 1911; 3 pp.)

18,061—CALIFORNIA—Mineral Deposits of the Sierra Nevada, California. William H. Storms. (Min. and Eng. Wld., Jan. 20, 1912; 1 p.) 20c.

18,062 — CHIHUAHUA — Mineral District of Rayon. Henry D. Boddington. (Mex. Min. Journ., Feb., 1912; 1¾ pp., illus.) 20c.

18,063 — COLORADO — Cripple Creek Drainage. W. Weston. (Eng. and Min. Journ., Feb. 10, 1912; ¾ p.) 20c.

18,064 — CONCENTRATION — Rotary Tray Concentration by the Darrow-Hambrie System. A. H. Martin. (Mines and Minerals, Feb., 1912; 1 p., illus.) 20c.

18,065 — CRUSHING — Tube-Mill Practice and Liners. F. C. Brown. (Min. and Sci. Press, Feb. 3, 1912; 1½ pp., illus.) 20c.

18,066—HISTORY OF GOLD MINING in the United States. R. A. F. Penrose, Jr. (Popular Science Monthly, Feb., 1912; 17 pp.) 40c.

18,067—HYDRAULIC MINING—A New Design of Undercurrent Grizzly. F. H. Hazard. (Eng. and Min. Journ., Jan. 27, 1912; 1¼ pp., illus. 20c.

18,068—IDAHO—The Yellow Jacket Mine, Idaho. G. L. Sheldon. (Eng. and Min. Journ., Jan. 27, 1912; 1⅔ pp.) 20c.

18,069—INDIA—Gold Mines of Mysore. Herbert A. Carter. (Min. and Sci. Press, Feb. 3, 1912; ¾ p., illus.) 20c.

18,070—MILL—The Nevada Hills Mill. W. A. Scott. (Min. and Sci. Press, Jan. 20, 1912; ¾ p.) 20c.

18,071 — MILLING COSTS — Operating Costs at the Goldfield Consolidated Mill. (Min. and Sci. Press, Jan. 20, 1912; 4 pp., illus.) 20c.

18,072—NEVADA—Geology of the Jarbidge Mining District, Nevada. E. R. Buckley. (Min. and Eng. Wld., Dec. 16, 1911; 3⅔ pp., illus.) 20c.

18,073 — NEVADA — Goldfield Consolidated Report. (Eng. and Min. Journ., Feb. 10, 1912; 2 pp.) 20c.

18,074 — ONTARIO — Northern Ontario Silver Mines in 1911. Alexander Gray. (Min. Journ., Jan. 6, 1912; 1½ pp.) 20c.

18,075 — ORE DEPOSITS — Minerals Common to Silver Deposits. W. G. Matteson. (Mines and Minerals, Feb., 1912; 3 pp., illus.) 20c.

18,076 — PLACER MINING — A Submerged Flexible-Joint Main. Frank Reed. (I. M. M., Bull. 88, 1912; 9 pp., illus.) Describes how a submerged flexible-joint main was carried across 650 ft. of river bed in Westland, New Zealand.

18,077—PLACERS—Solution of Placer Gold and Silver. Will H. Coghill. (Min. and Sci. Press, Jan. 20, 1912; 1 p.) 20c.

18,078—PORCUPINE—The Lucky Cross Mines—Swastika. (Can. Min. Journ., Jan. 1, 1912; 2 pp., illus.) 20c.

18,079—QUEENSLAND—The Oaks and Eastern Portion of the Etheridge Goldfields. E. O. Marks. (Queensland Geol. Surv., Pub. 234, 1911; 30 pp., illus.)

18,080—RAND—Failure of Ore Yield at East Rand Proprietary. (Min. and Eng. Wld., Dec. 30, 1911; 1¾ pp., illus.) 20c.

18,081—RAND—Mines of the Witwatersrand. Vl. Meyer & Charlton G. M. Co. (South African Min. Journ., Jan. 13, 1912; 2 pp., illus.) 40c.

18,082—REDUCTION PLANTS—Future Economies in Rand Reduction Plants. C. O. Schmitt. (I. M. M., Bull. 88, 1912; 15 pp.) Author's reply to discussion.

18,083—SAMPLING AND ASSAYING—Behelfe zur vollständigen Fallung des Goldes. E. Prziwoznik. (Oest. Zeit. f. B. u. H., Nov. 25, 1911; 2½ pp.) Hints for the complete precipitation of gold. 40c.

18,084—SIBERIA—Winter Gold Mining in Siberia. C. W. Purington. (Min. Mag., Jan., 1912; 4¾ pp., illus.) 40c.

18,085—SINALOA MINING DISTRICT. G. L. Sheldon. (Min. and Sci. Press. Dec. 23, 1911; 1 p., illus.) 20c.

18,086—SONORA—The Noria District. E. B. Holt. (Mex. Min. Journ., Feb., 1912; 2½ pp., illus.) 20c.

18,087—SOUTH DAKOTA GOLD and Tin Mines. R. L. Daugherty. (Min. and Sci. Press, Jan. 6, 1912; ½ p.) 20c.

18,088—STAMP MILLS—Notes on Cams for Stamp Batteries. C. M. Adams. (Journ. South African Inst. of Eng., Jan., 1912; 5 pp., illus.) Discussion on paper previously indexed. 60c.

18,089—STAMP MILLS—Notes on High Duty Gravity Stamp Mills. Peter N. Nissen. (Journ. Chem., Met. and Min. Soc. of South Africa, Nov., 1911; 4½ pp.) Discussion on paper previously indexed. 80c.

18,090 — TRANSVAAL — The Outlying Gold Mines of the Transvaal. Owen Letcher. (Min. and Eng. Wld., Jan. 13, 1912; 1 p.) 20c.

18091 — WASHINGTON — Geology and Ore Deposits of the Oroville-Nighthawk Mining District. Joseph B. Umpleby. (Wash. Geol. Surv., Bull. 5, 1911; 53 pp., illus.)

IRON MINING

18,092—MICHIGAN—Iron River District, Michigan. P. B. McDonald. (Eng. and Min. Journ., Jan. 27, 1912; 1⅔ pp., illus.) 20c.

18,093 — MINNESOTA — Description of Mines on the Menominee Range. The Oliver Iron Mining Co. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 24 pp.)

18,094—NOVA SCOTIA—Western Portion of the Torbrook Iron Ore Deposits. Howells Frechette. (Can. Dept. of Mines, Bull. 7. 1912; 25 pp., illus.)

IRON AND STEEL—METALLURGY

18,095—BLAST-FURNACE GAS—Ueber Staubbestimmungen im Gichtgas. O. Johannsen. (Stahl u. Eisen, Jan. 4, 1912; 4 pp., illus.) On dust determinations in the waste gases of blast furnaces. 40c.

18,096—BLAST-FURNACE PRACTICE—Untersuchungen über die Zusammensetzung des Gasstromes im Hochofen. M. Levin and H. Niedt. (Stahl u. Eisen, Dec. 28, 1911; 5½ pp., illus.) Investigations on the composition of the gas current in the blast furnace. 40c.

18,097—BRIQUETTING—Brikettieranlagen zur Herstellung von Eisen- und Metallspäne-Briketts der Hochdruckbrikettierung G. m. b. H. in Berlin. J. Mehrtens. (Stahl u. Eisen, Jan. 25, 1912; 8 pp., illus.) 40c.

18,098—CASTINGS—Oil-Firing for the Production of Small Size Steel Castings. (Eng. Rev., Jan. 15, 1912; 3 pp., illus.) 40c.

18,099 — CEMENTATION — Ueber den gegenwärtigen Stand von Theorie und Praxis des Zementationsprozesses. (Stahl u. Eisen, Jan. 11 and Feb. 1, 1912; 9 pp., illus.) On the present status of theory and practice of the cementation process. 40c.

18,100 — ELECTRIC SMELTING in Sweden. C. Van Langendonck. (Eng. News, Jan. 11, 1912; 2⅔ pp., illus.) 20c.

18,101—FOUNDRY—Aus der Praxis in- und ausländischer Eisen- und Stahlgiessereien. (Stahl u. Eisen, Nov. 30, 1911; 2 pp., illus.) 40c.

18,102 — IRON-CARBON ALLOYS — Ueber die Polyederstruktur in Eisen-Kohlenstoff-Legierungen. N. J. Wark. (Metallurgie, Dec. 8, 1911; 5½ pp., illus.) On the polyedric structure of iron-carbon alloys. 40c.

18,103—MARTIN FURNACE—Ueber die Verwendung von Koksofengas im Martinofen. Oskar Simmersbach. (Stahl u. Eisen, Dec. 7 and 21, 1911; 13½ pp., illus.) 60c.

18,104—METALLURGY—Das Eisenhüttenwesen im Jahre 1910. B. Neumann. (Glückauf, Dec. 2 and 9, 1911; 12¾ pp.) 40c.

18,105—MIXERS—Roheisenmischer und ihre Anwendung im Eisenhüttenwesen. Simmersbach. (B. u. H. Rundschau, Dec. 20, 1911, and Jan. 5, 1912; 17 pp., illus.)

18,106—NICKEL- AND MANGANESE-STEELS—Ueber die magnetischen Eigenschaften von Nickel- und Manganstählen. S. Hilpert, E. Colver-Glauert and W. Mathesius. (Stahl u. Eisen, Jan. 18, 1912; 8 pp., illus.) On the magnetic properties of nickel- and manganese-steels. 40c.

18,107—POWER IN IRON WORKS—Gas- oder Dampfbetrieb auf Hüttenwerken. M. Langer. (Stahl u. Eisen, Dec. 21, 1911; 5¾ pp.) Should gas or steam be used as motive power at iron works?

18,108 — REHEATING — Ueber Untersuchungen an Warmöfen. M. Philips. (Stahl u. Eisen, Jan. 4, 1912; 3 pp., illus.) Investigations on reheating furnaces. 40c.

18,109—ROASTING of Fine Iron Ores in the United States. L. R. Ugglas (Bihang Jernkontorets Annaler, Dec., 1911, 5 pp., illus.)

18,110—ROLLING MILLS—Energieverbrauch von Walzwerksanlagen. Falkenburg. (B. u. H. Rundschau, Dec. 5, 1911; 3 pp.) Consumption of power in rolling mills.

18,111—RUSSIA—Die russische Eisenindustrie. B. Simmersbach. (Oest. Zeit. f. B. u. H., Dec. 23 and 30, 1911; 4¾ pp.) 60c.

LEAD AND ZINC

18,112 — BLAST ROASTING — Sinter-Roasting with Dwight-Lloyd Machines at Salida, Colo. (Met. and Chem. Eng., Feb., 1912; 3½ pp., illus.) 40c.

18,113 — INDIA AND CHINA — Ueber indisches und chinesisches Zink. Hommel. (Zeit. f. angew. Chem., Jan. 19, 1912; 3¾ pp., illus.) Historical. 40c.

18,114—LEAD DETERMINATION—The Electrolytic Determination of Lead in Large and Small Amounts, Using a Gauze Cylinder Anode. Brund Woisiechowski. (Met. and Chem. Eng., Feb., 1912; ½ p.) 40c.

18,115—ROLLED ZINC—An Investigation of the Strength of Rolled Zinc. Herbert F. Moore. (Univ. of Ill., Bull. 52, 1911; 24 pp., illus.)

18,116 — SMELTING — Untersuchungen ueber die Erstarrungstemperatur und den Gefügeaufbau einiger wichtiger Produkte der Hochofenbleiarbeit. G. Komorowski. (Metallurgie, Dec. 8, 1911; 1¼ pp., illus.) Investigations on the temperature of solidification and the development of texture of some important products of lead smelting in the blast furnace. 60c.

18,117—ZINC ORE DRESSING—Recent Developments in Zinc Ore Dressing. James M. McClave. (Min. Sci., Jan. 25, 1912; 1½ pp.) 20c.

18,118—ZINC SMELTING at Trollhättan. (Eng. and Min. Journ., Feb. 10, 1912, 1½ pp.) 20c.

18,119—ZINC SULPHATE—Ueber das Verhalten des Zinksulfats bei hohen Temperaturen. Wl. Mostowitsch. (Metallurgie, Dec. 22, 1911; 28 pp., illus.) On the behavior of zinc sulphate at high temperatures. 40c.

OTHER METALS

18,120—MANGANESE—The Bismuthate Method for Manganese. D. J. Demorest. (Journ. Ind. and Eng. Chem.; Jan., 1912; ½ p.) 80c.

18,121 — MOLYBDENITE — Concentration of Molybdenite Ores. Henry E. Wood. (Eng. and Min. Journ., Jan. 27, 1911; 2 pp., illus.) 20c.

18,122 — QUICKSILVER WORKS in Austria. (Mines and Minerals, Feb., 1912; 1½ pp., illus.) 20c.

18,123 — RARE MINERALS — The Growth of the Rare Mineral Industry, A. B. Frenzel. (Min. Sci., Jan. 25, 1912; 1¾ pp., illus.) 20c.

18,124 — TANTALUM — Strüverite, a Rare Tantalum Mineral from the Federated Malay States. (Bull. Imp. Inst., Vol. IX, No. 4, 1911; 1½ pp.) 40c.

18,125—TIN—Electric Smelting and Reduction of Ore in England. J. Härden. (Electrician, Dec. 29, 1911; 1¼ pp.) 40c.

18,126—TIN—South Dakota Gold and Tin Mines. R. L. Daugherty (Min. and Sci. Press, Jan. 6, 1912; ½ p.) 20c.

18,127 — TIN MINING in Northern Nigeria, West Africa. A. Warner Hooke. (Austral. Min. and Eng. Rev., Jan. 5, 1912; 4½ pp., illus.) 40c.

18,128 — VANADIUM — Ueber reines Vanadin. Ruff and Martin. (Zeit. f. angew. Chem., Jan. 12, 1912; 7¾ pp., illus.)

NONMETALLIC MINERALS

18,129—ALUNITE—A Newly Discovered Deposit near Marysvale, Utah. H. S. Butler and H. S. Gale. (U. S. Geol. Surv., Bull. 511, 1912; 64 pp., illus.)

18,130—BAUXITE MINING in the State of Tennessee. George H. Ashley. (Min. Sci., Jan. 4, 1912; 1½ pp., illus.) 20c.

18,131—CLAY—The Geology and Mining of Clay. Edgar K. Soper. (Eng. and Min. Journ., Feb. 3, 1912; 4⅔ pp.) 20c.

18,132 — DIAMONDS — A Hydrocarbon Found in the Diamond and Carbonado

District of Bahia, Brazil. J. C. Branner. (Am. Journ. of Sci., Jan., 1912; 2 pp.) 40c.

18,133—DIAMONDS in the Belgian Congo. Sydney H. Ball. (Eng. and Min. Journ., Feb. 3, 1912; 2 pp., illus.) 20c.

18,134—NITRATE OF SODA in 1911. (Chem. Trade Journ., Jan. 20, 1912; 3½ pp.) 40c.

18,135—PHOSPHATE—Die Phosphatlagerstätten bei Es-Salt im Ost Jordanlande. Krusch. (Zeit. f. prakt. Geol., Dec., 1911; 10 pp., illus.) 40c.

18,136—POTASH—The Occurrence of Potash Salts in the Bitterns of the Eastern United States. W. C. Phalen. (Bull. 530-B, U. S. Geological Survey, 1911; 19 pp.)

18,137—POTASH-BEARING ROCKS of the Leucite Hills, Sweetwater County, Wyoming. Alfred R. Schultz and Whitman Cross. (U. S. Geol. Surv., Bull. 512, 1911; 39 pp., illus.)

18,138—QUARTZ—Die Betriebs- und Wirtschaftsverhältnisse der Quartzitbrüche im Westerwald. Schulze Höing. (Glückauf, Jan. 27, 1912; 3 pp.) Operation and economics of the quartzite quarries of the Westerwald. 40c.

18,139—SALT—Das Salinenwesen der Schweiz. (Oest. Zeit. f. B. u. H., Dec. 23, 1911; 2 pp.) Salt extraction in Switzerland. 40c.

18,140—SALT—Salzerzeugung Deutschlands in den Jahren 1906 bis 1910. (Oest. Zeit. f. B. u. H., Feb. 3, 1912; 6 pp.) Germany's salt production from 1906 to 1910. 40c.

18,141—RUSSIAN CHEMICAL RESOURCES. W. Jacob. (Chem. Trade Journ., Jan. 20, 1912; 3 pp.) Deals with sulphur, pyrites, salt, timber, phosphorites, coal and petroleum. 40c.

18,142—SULPHUR—Geology of the Sulphur and Sulphur Oil Deposits of the Coastal Plain. A. F. Lucas. (Journ. Ind. and Eng. Chem., Feb., 1912; 2¾ pp.) 80c.

18,143—SULPHUR MINES of the Union Sulphur Company in Louisiana. F. H. Pough. (Journ. Ind. and Eng. Chem., Feb., 1912; 4¼ pp., illus. 80c.

18,144—VARISCITE—Crystallized Variscite from Utah. Waldemar T. Schaller. (From Proc. of the U. S. Nat. Museum, Vol. 41, pp. 413-430, illus.)

PETROLEUM AND NATURAL GAS

18,145—ALABAMA—The Fayette Gas Field, Alabama. M. J. Munn. (U. S. Geol. Surv., Bull. 471-A, 1912; 30 pp., illus.)

18,146—CALIFORNIA—Production and Prices in the California Oilfields. J. H. G. Wolf. (Min. and Sci. Press, Jan. 6, 1912; 3½ pp., illus.) 20c.

18,147—DRILLING BOILERS in the California Oil Fields. A. L. Menzin. (Journ. Electricity, Power and Gas, Jan. 20, 1912; 1¼ pp., illus.) 40c.

18,148—KENTUCKY—The Campton Oil Pool, Kentucky. M. J. Munn. (U. S. Geol. Surv., Bull. 471-A, 1912; 10 pp., illus.)

18,149—NATURAL GAS—The Production of Natural Gas in 1910. B. Hill. (Extract from Mineral Resources of the U. S., 1910; 28 pp.)

18,150—TENNESSEE—Explorations for Natural Gas and Oil at Memphis, Tenn. W. J. Munn. (Resources of Tenn., Feb., 1912; 22 pp., illus.)

18,151—UTAH—Marsh Gas Along Grand River, near Moab, Utah. E. G. Woodruff. (U. S. Geol. Surv., Bull. 471-A, 1912; 1 p.)

18,152—WYOMING—The Spring Valley Oilfield in Southwestern Wyoming. F. J. H. Merrill. (Min. and Sci. Press, Jan. 27, 1912; 2 pp., illus.) 20c.

ECONOMIC GEOLOGY—GENERAL

18,153—AFRICA—Ergebnisse bergmännischgeologischer Forschungen im französischen Kongogebiet und in dem an Deutschland abgetretenen Teil. Liesegang. (Glückauf, Dec. 30, 1911; 3 pp., illus.) Results of mining and geological explorations in the French Congo territory and in the part ceded to Germany. 40c.

18,154—APPLIED GEOLOGY. Alfred H. Brooks. (Journ. Wash. Academy of Sciences, Jan. 19, 1912; 30 pp.)

18,155—GERMANY—Bleiglanz und Blende in den Gängen am Nordrande des Rheinischen Schiefergebirges. Friedensburg. (Glückauf, Nov. 25, 1911; 7 pp., illus.) Galenite and sphalerite in the lodes on the northern rim of the Rhenish schist formation. 40c.

18,156—ORE DEPOSITION—Modern Theories of Ore Deposition. E. K. Soper. (Mex. Min. Journ., Feb., 1912; 4 pp.) 20c.

18,157—ORE DEPOSITS—Literature of Ore Deposits in 1911. Walter Harvey Weed. (Min. and Sci. Press, Jan. 6, 1912; 1½ pp.) 40c.

18,158—RADIOACTIVITY—The Bearings of Radioactivity on Geology. T. C. Chamberlain. (Journ. Geol., Nov.-Dec., 1911; 23 pp.) 60c.

18,159—SECONDARY SULPHIDE ENRICHMENT. Horace V. Winchell. (Eng. and Min. Journ., Feb. 17. 1912; 3½ pp.) 20c.

18,160—SILESIA—The Geology of Coal and Ore Deposits in Upper Silesia. Karl Sidenwall. (Bihang Jernkontorets Annaler, Dec., 1911; 7 pp., illus.)

MINING—GENERAL

18,161—ACCIDENTS in Transvaal Mines, with Special Reference to Falls of Ground. James Chilton. (Journ. Chem., Met. and Min. Soc. of South Africa, Nov., 1911; 8 pp.) 80c.

18,162—AFRICA—Mining in the Belgian Congo, West Africa, for 1911. Sydney H. Ball. (Min. and Sci. Press, Jan. 20, 1912; 4½ pp., illus.) 20c.

18,163—AUSTRALASIAN MINING in 1911. (Min. and Sci. Press, Jan. 6, 1912; 2 pp., illus.) 40c.

18,164—BELGIUM—Die Bergwerks und Hüttenindustrie Belgiens im Jahre 1910. (Preuss. Zeit. f. B., H. u. S., Vol. 59, Part 5, 1911; 5¾ pp.)

18,165—BLASTING—The Rate of Burning of Fuse as Influenced by Temperature and Pressure. Walter O. Snelling and Willard C. Cope. (Bureau of Mines, Tech. Paper 6, 1912; 28 pp.)

18,166—BRAZIL—Die Bergwerks- und Metallindustrie in Brasilien. (Chem. Ztg., Jan. 9, 1912; 1 p.) 20c.

18,167—BRITISH COLUMBIA in 1911. E. Jacobs. (Can. Min. Journ., Jan. 1, 1912; 3¾ pp.) 20c.

18,168—CANADA—Mining in Eastern Canada in 1911. (Min. and Sci. Press, Jan. 6, 1912; 1 p., illus.) 20c.

18,169—CHRONOLOGY of Mining for 1911. (Eng. and Min. Journ., Jan. 6, 1912; 2¼ pp.) 20c.

18,170—DIAMOND DRILLING—Some Practical Suggestions for Diamond Drill Explorations. A. H. Meuche. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 5 pp., illus.)

18,171—DRILLING—The Prevention of Dust in Development Drives of Mines During Drilling Operations. C. J. N. Jourdan. (Journ. of South African Inst. of Eng., Jan., 1912; 8 pp.) Discussion of paper previously indexed. 60c.

18,172—EXPLOSIVES—Accidents in the Transportation, Storage and Use of Explosives. Charles S. Hurter. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 34 pp.)

18,173—EXPLOSIVES—Recent Developments in Explosives. A. E. Anderson. (Eng. and Min. Journ., Feb. 3, 1912; 4 pp.) 20c.

18,174—FILING ENGINEERING NOTES for Ready Reference. S. F. Shaw. (Min. and Eng. Wld., Jan. 13, 1912; 1⅝ pp.) 20c.

18,175—FIRE—The Giroux Mine Fire. H. H. Sanderson. (Mines and Minerals, Feb., 1912; 1¾ pp., illus.) 20c.

18,176—FLOW OF WATER—Measuring the Flow of Water in Large Pipe Lines. R. M. Hosea. (Journ. Soc. of Engrs., Jan., 1912; 14 pp., illus.) 60c.

18,177—FRANCE—Die Eisen- und Metallhüttenindustrie Frankreichs im Jahre 1909. (Glückauf, Nov. 25, 1911; 3 pp.)

18,178—FRANCE AND ALGERIA—Die Bergwerksindustrie in Frankreich und Algier in dem Jahre 1908 und 1909. (Preuss. Zeit. f. B., H. u. S., Vol. 59, Part 5, 1911; 12 pp.) From the official statistics of the French ministry of public works.

18,179—GASES—The Composition of Some Mine Gases, and a Description of a Simple Methane. G. A. Burrell. (Journ. Ind. and Eng. Chem., Feb., 1912; 3½ pp., illus.) 60c.

18,180—HOISTING—Electrical Hoisting Plants on the Witwatersrand. Rowland Gascoyne. (Min. and Eng. Wld., Feb. 10, 1912; 3½ pp.) 20c.

18,181—HOISTING—Wirtschaftliche Schachtförderung aus grossen Teufen. Moldenhauer. (Glückauf, Dec. 16 and 23, 1911, 24½ pp., illus.) Economic hoisting through shafts from great depths. 60c.

18,182—HYGIENE—Das Augenzittern der Bergleute. W. Hanauer. (Oest. Zeit. f. B. u. H., Dec. 23, 1911; 1¼ pp.) Oscillation of the eyeballs (nystagmus), a miners' disease. 40c.

18,183—IDAHO in 1911. W. A. Scott. (Min. and Sci. Press, Jan. 6, 1912; 1 p., illus.) 20c.

18,184—ITALY—Mining Industry in Italy in 1911. Charles W. Wright. (Min. and Sci. Press, Jan. 6, 1912; 1½ pp.) 20c.

18,185—JAPAN—The Mining Industry of Japan. Ketjero Nishio. Bull. A. I. M. E., Jan., 1912; 45 pp., illus.)

18,186—LAMPS—Die Lampenwirtschaft auf der Schachtanlage Oberschuir der Zeche Consolidation in Gelsenkirchen. Höh. (Glückauf, Feb. 3, 1912; 1½ pp., illus.) The lamp-room and repair shop at the Oberschuir shaft of Consolidation colliery, Gelsenkirchen. 40c.

18,187—LAWS—Proposed Revision of Alaskan Mining Laws. F. Lynwood Garrison. (Min. and Sci. Press, Jan. 6, 1912; 2½ pp.) 20c.

18,188—LAWS—The Mineral Land Laws and Their Defects. George Otis Smith. (Min. and Sci. Press, Jan. 13, 1912; 3 pp.) From annual report of the director of the U. S. Geol. Survey. 20c.

18,189—MANAGEMENT—The Science of Management in Practice—I. Frederic A. Parkhurst. (Eng. Digest, Jan., 1912; 3 pp.) 40c.

18,190—MEXICO in 1911. (Min. and Sci. Press, Jan. 6, 1912; 2 pp., illus.) 20c.

18,191—MINE CARS—Steel vs. Wooden Mine Cars. D. T. Evans. (Coal Age, Dec. 30, 1911; 2 pp.) 20c.

18,192—MINE CHUTE GATE at the Baltic Mine. Claude T. Rice. (Eng. and Min. Journ., Feb. 17. 1912; ½ p., illus.) 20c.

18,193—MINERS—The Metal Miners of the Butte District, Montana. W. J. Lauck. (Min. and Eng. Wld., Feb. 3, 1912; 1½ pp.) 20c.

18,194—MINING METHOD—Block Caving and Sub Stope System at the Tobin Mine, Crystal Falls, Mich. Fred C. Roberts. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 9 pp., illus.)

18,195—MONTANA—The Barker District, Montana. J. R. Villars. (Eng. and Min. Journ., Feb. 3, 1912; ½ p.) 20c.

18,196—NEVADA—The Year Among Nevada Mines and Mills. L. F. Adamson. (Min. and Sci. Press, Jan. 6, 1912; 2½ pp., illus.) 20c.

18,197—NEW ZEALAND—The West Coast Sounds of New Zealand. A. C. Buckland. (Austral. Min. and Eng. Rev., Jan. 5, 1912; 2½ pp., illus.) 40c.

18,198—PRODUCTION—Summary of the Mineral Production of the United States in 1910. Compiled by W. T. Thom. (Extract from Mineral Resources of the U. S., 1910; 62 pp.)

18,199—PRUSSIA—Die Bergwerksindustrie und Bergverwaltung Preussens im Jahre 1910. (Zeit. f. B. H. u. S., Vol. 59, Part 4, 1911; 43 pp.; also Oest. Zeit. f. B. u. H., Dec. 30, 1911; 3 pp.) 40c.

18,200—QUEENSLAND—The Burketown Mineral Field. (Silver-Lead and Zinc Mines.) Lionel C. Ball. (Geol. Surv. of Queensland, Pub. 232, 1911; 57 pp., illus.)

18,201—RESCUE WORK—First-Aid Work and First-Aid Contests. E. D. Burkhard. (Mines and Minerals, Jan., 1912; 1½ pp.)

18,205—SHAFT STATION in Inclined (Min. and Sci. Press, Jan. 13, 1912; 1¼ pp.) 20c.

18,203—SHAFT—Raising Shaft on Timber in Hard Rock at the Armenia Mine. S. J. Goodney. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 6 pp., illus.)

18,204—SHAFT SINKING—Discussion of W. B. Wilson's Paper on "The Advantages of Freezing as a Method of Sinking Through Heavily Watered or Difficult Ground." (Trans. N. Eng. Inst. Min. and Mech. Eng., Dec., 1911; 9 pp.)

18,205—SHAFT STATION in Inclined Foot-Wall Shaft. Claude T. Rice. (Eng. and Min. Journ., Jan. 27, 1912; ½ p., illus.) 20c.

18,206—SONORA—Alamos District, Sonora, Mexico. G. L. Sheldon. (Min. and Sci. Press, Feb. 3, 1912; 2 pp., illus.) 20c.

18,207—STOPING at the Calamon Mine. C. P. Corbett Sullivan. (I. M. M. Bull. 88, 1912; 8 pp., illus.)

18,208—SURVEYS—Note Keeping in the Making of Mine Surveys. E. P. Arthur, Jr. (Min. Sci., Jan. 11, 1912; 1½ pp.) 20c.

18,209—TIMBERING—Battery Method of Stull Timbering. Claude T. Rice. (Eng. and Min. Journ., Feb. 3, 1912; 1 p., illus.) 20c.

18,210—TIMBERING—Combination Post and Set Timbering in Shafts. Claude T. Rice. (Eng. and Min. Journ., Feb. 10, 1912; 1¼ pp., illus.) 20c.

18,211—TIME-KEEPING SYSTEM and Labor Distribution at the Newport Mine. G. L. Olson. (Proc. Lake Superior Min. Inst., Vol. XVI, Aug., 1911; 17 pp., illus.)

18,212 — UNWATERING Tresavean Mine. Cyril Brackenbury. (I. M. M. Bull. 88, 1912; 40 pp., illus.)

18,213—UTAH in 1911. W. A. Scott. (Min. and Sci. Press, Jan. 6, 1912; 1½ pp.) 20c.

18,214 — VENTILATION — The Water Gage as Used in Mines. Frank Lynde. (Coal Age, Jan. 13, 1912; 1⅓ pp., illus.) 20c.

18,215 — WASH HOUSE — European Wash House Practice. (Coal Age, Jan. 27, 1912; 3⅜ pp., illus.) 20c.

18,216—WIRE-ROPE SPLICING. F. L. Johnson. (Power, Jan. 30, 1912; 2 pp., illus.) 20c.

ORE DRESSING—GENERAL

18,217—CONVEYING—Link-Belt Elevators. Benedict Shubart. (Eng. and Min. Journ., Feb. 10, 1912; ¾ p., illus.) 20c.

18,218—CRUSHING—Improvements in Crushing Rolls. C. Q. Payne. (Eng. and Min. Journ., Feb. 17, 1912; 1½ pp.) Paper before A. I. M. E., Oct., 1911. 20c.

18,219—CRUSHING—The Slow Speed Chilean Mill. J. P. Empson. (Eng. and Min. Journ., Feb. 3, 1912; 3 pp.) From a paper before the Mex. Inst. of Min. and Met., Dec., 1911. 20c.

18,220 — SAND LAUNDERS — Capacity of Sand Launders. Gustaf G. Bring. (Jernkontorets Annaler, Dec., 1911; 56 pp.) Report on investigation carried on partly in Salt Lake City with G. A. Overstrom and partly in Falun, Sweden.

METALLURGY—GENERAL

18,221—ALLOYS—A Method for Measuring the Compressive Strength of Alloys. J. R. Huber. (Met. and Chem. Eng., Feb., 1912; 1 p., illus.) 40c.

18,222—BRITISH COLUMBIA—Metallurgy in British Columbia. E. Jacobs. (Met. and Chem. Eng., Feb., 1912; 1½ pp., illus.) 40c.

18,223—CHIMNEY-STACK of Reinforced Concrete. (Engineering, Dec. 22, 1911; 1½ pp., illus.) 40c.

18,224 — ELECTRIC SMELTING — The Thermal Insulation of Furnace Walls. Carl Hering. (Met. and Chem. Eng., Feb., 1912; 5 pp., illus.) 40c.

18,225—FURNACE CHARGES—Calculation of Furnace Charges.—II. Regis Chauvenet. (Met. and Chem. Eng., Feb., 1912; 4¼ pp., illus.) 40c.

18,226 — METALLOGRAPHY — Apparatus for Metallography. Carle R. Hayward. (Bull. A. I. M. E., Dec., 1911; 7 pp., illus.) 40c.

18,227—METALLOGRAPHY—Zur Kenntniss der Erstarrungsdiagramme der binären Systeme Schwefelsilber-Schwefeleisen und Mangan-Arsen. P. Schoen. (Metallurgie, Dec. 8, 1911; 4 pp., illus.) Contributions to the knowledge of the solidification diagrams of the binary systems silver sulphide-iron sulphide and manganese arsenide. 40c.

18,228—OIL BURNING—Industrial Applications of Oil Burning in Lime and Cement Burning and Smelting. E. N. Percy. (Journ. of Electricity, Power and Gas, Jan., 1912; 6 pp., illus.) 40c.

18,229 — PHYSICO-CHEMICAL PRINCIPLES—Ueber die physikalisch-chemischen Grundlagen des Hüttenwesens. R. Schenck. (Stahl u. Eisen, Oct. 26, 1911; 7 pp., illus.) On the physico-chemical principles of metallurgy. 40c.

18,230—WELDING—Arc Welding. C. B. Auell. (Journ. A. S. M. E., Jan., 1912; 21 pp., illus.)

MINING AND METALLURGICAL MACHINERY

18,231 — AERIAL TRAMWAYS and Loading Docks for Iron Ore on Elba. A. G. Petersen. (Bihang Jernkontorets Annaler, Dec., 1911; 10 pp.)

18,232 — BOILER WATER — Versuche mit Kesselspeisewassermessern. O. Dobbelstein. (Glückauf, Jan. 27, 1912; 2¼ pp., illus.) Tests with boiler feed-water meters.

18,233—COAL HANDLING—Transport der Kesselheizkohle mit Robins-Gurtförderer am Valerie-Schachte in Schwaz. G. Ryba. (Oest. Zeit. f. B. u. H., Dec. 2, 9 and 16, 1911; 13 pp., illus.) Transportation of coal to the boilers by Robins belt conveyors at the Valerie shaft, Schwaz, Tyrol. $1.

18,234 — ELECTRIC EQUIPMENT — Electrical Symbols for Mine Maps. H. H. Clark. (Coal Age, Dec. 30, 1911; 3¾ pp., illus.) 20c.

18,235—ELECTRIC FURNACE—Ueber einen neuen elektrischen Widerstandsofen mit Heizwiderstand unedlen Metallen. (Chem. Ztg., Jan. 25, 1912; ¾ p., illus.) 20c.

18,236—ELECTRIC POWER in the Iron Mines and Mills of Witherbee, Sherman & Co., Mineville, N. Y. John Liston. (General Electric Rev., Feb., 1912; 10¾ pp., illus.) 40c.

18,237 — ELECTRICITY — Earthing, Earth-Plates and Leakage Detectors. Chris. Jones. (Iron and Coal Tr. Rev., Dec. 8, 1911; 1¾ pp., illus.) 40c.

18,238—ELECTRICITY—The Electrification of Randfontein Central. T. P. E. Butt. (Journ. South African Inst. of Eng., Jan., 1912; 4 pp.) Discussion on paper previously indexed. 60c.

18,239 — ELECTRICITY — The General Application of Electricity to Rand Mines. R. G. Mackie. (Journ. South African Inst. of Eng., Jan., 1912; 6½ pp.) Author's reply to discussion. 60c.

18,240—FIRST AID to Mining Machinery—VI and VII. Henry M. Lane. (Eng. and Min. Journ., Jan. 27 and Feb. 10, 1912; 6 pp., illus.) 20c.

18,241—GAS ENGINES—Methods of Driving by Gas Engines for Collieries. Alan E. L. Chorlton. (Eng. Rev., Jan. 15, 1912; 5 pp., illus.) 40c.

18,242—GAS PRODUCERS—Die Dampfzersetzungsfähigkeit der Gaserzeuger. D. J. Hudler. (Glückauf, Dec. 30, 1911; 2¾ pp.) The capability of gas producers to decompose steam. 40c.

18,243 — GAS PRODUCERS — Gasification of Solid Fuel. Charles E. Lucke. (Eng. Mag., Jan., 1912; 7½ pp., illus.) 40c.

18,244 — HAULAGE — A Compressor Plant for Mine Haulage. (Coal Age, Jan. 13, 1912; 3 pp., illus.) 20c.

18,245—HOISTING ENGINES—Untersuchungen an elektrisch und mit Dampf betriebenen Fördermaschinen. (Glückauf, Dec. 30, 1911; 10 pp.) Conclusion of article previously indexed. 40c.

18,246—HOISTING MACHINERY — Die neuere Entwicklung der Fördermaschinenantriebe und der Sicherheitsvorrichtungen. A. Wallichs. (Zeit. des Vereines deutscher Ing., Dec. 2 and 9, 1911; 12¼ pp., illus.) Latest development of safety appliances on hoisting machinery.

18,247—HYDRO-ELECTRIC INSTALLATION in the Cœur d'Alenes. George Huston. (Min. and Eng. Wld., Feb. 3, 1912; 4⅓ pp., illus.) 20c.

18,248—LOCOMOTIVE—Die elektrische Lokomotivförderung mit einphasigen Wechelstrom auf der zeche Rosenblumendelle. G. Siemens. (Glückauf, Dec. 9 and 16, 1911; 11½ pp., illus.) 60c.

18,249—LOCOMOTIVES — Erfahrungen mit Grubenlokomotiven beim Steinkohlenbergbau im Oberbergamtsbezirk. Dortmund. Paehr. (Preuss. Zeit. f. B., H. u. S., Vol. 59, Part 5, 1911; 26 pp., illus.)

18,250—LOCOMOTIVES—Versuche mit Motorlokomotiven auf der Grube Dechen im Saarrevier. Otte. (Preuss. Zeit. f. B., H. u. S., Vol. 59, Part 5, 1911; 30 pp., illus.)

18,251 — LUBRICATION — Needless Waste of Grease and Oil. E. L. Cole. (Coal Age, Feb. 10, 1912; 1¾ pp., illus.) 20c.

18,252—MECHANICAL STOKERS at the Mines de Dourges Co.'s Works, France. (Engineering, Dec. 23, 1911; 1⅓ pp., illus.) 40c.

18,253—MELTING FURNACE—A New Form of Electric Furnace for Melting Drosses, Brasses, Bronzes, Scrap Metals, Silver and Other Non-Ferrous Metals and Alloys. (Brass Wld., Jan., 1912; 5½ pp., illus.) 20c.

18,254—MINE CARS—Steel vs. Wooden Mine Cars. D. T. Evans. (Coal Age, Dec. 30, 1911; 2 pp.) Paper before Kanawha Coal Operators' Assn. 20c.

18,255 — MOTORS — European Explosion-Proof Motors for Mines. E. W. Jansen. (Elec. Rev., Dec. 23, 1911; 2 pp., illus.) 20c.

18,256—POWER PLANTS—Cost Data of Power-Plant Installation and Operation. W. H. Weston. (Eng. Mag., Jan., 1912; 7 pp.) 40c.

18,257—POWER SYSTEM of Cleveland Cliffs Iron Co. C. A. Tupper. (Eng. and Min. Journ., Feb. 3, 1912; 1⅓ pp., illus.) 20c.

18,258—POWER TRANSMISSION—The Generating and Transmission System of the Telluride Power Co. (Elec. Wld., Nov. 18, 25, Dec. 9, 16 and 23, 1911; 15½ pp., illus.) $1.

18,259 — PUMPS — Hints on Buying Pumps. John S. Leese. (Eng. and Min. Journ., Feb. 17, 1912; ½ p.) 20c.

18,260—PUMPS—The Testing of Electric Pumps. W. R. Judson. (Mex. Min. Journ., Jan., 1912; 3 pp., illus.) 20c.

18,261—QUARRY EQUIPMENT—Electrical Plant at the Buxton Lime Firms' Quarries. (Electrical Rev., Jan. 12, 1912; 4¼ pp., illus.) 40c.

18,262 — SAFETY APPLIANCES in Mines of the Republic Iron & Steel Co. Lee L. Wilcox. (Eng. and Min. Journ., Jan. 27, 1912; ⅝ p.) 20c.

18,263—SKIP-LOADING BINS, Gate for. J. Nelson Nevius. (Eng. and Min. Journ., Feb. 3, 1912; 1¼ pp., illus.) 20c.

18,264 — STEAM SHOVEL — 130-Ton Steam Shovel for Rock Work. (Eng. News, Jan. 25, 1912; 2⅓ pp., illus.) 20c.

18,265 — STEAM SHOVELS — Keeping Shovels at Work at Panama. Fred H. Colvin. (Am. Machinist, Jan. 25, 1912; 5½ pp., illus.) 20c.

18,266—STEAM TURBINES—Use of Low-Pressure Turbines in Mining Work. George E. Edwards. (Min. and Eng. Wld., Jan. 13, 1912; 4 pp., illus.) 20c.

SAMPLING AND ASSAYING

18,267 — ELECTROANALYSES — Zur Verwendung des Edison Akkumulators in der Elektroanalyse. Thiel. (Zeit. f. angew. chemie, Jan. 12, 1912; 2¾ pp.) 40c.

18,268—MANGANESE—Rascke Methode zur Bestimmung des Mangans im Ferrowolfram. Slawik. (Chem. Ztg., Jan. 27, 1912; ½ p.) A quick method for determining manganese in ferro-tungsten.

18,269—NITER ASSAY, The. A. D. Banfield. (Eng. and Min. Journ., Feb. 17. 1912; ¾ p., illus.) Comments on a previous article by P. D. Wilson. 20c.

18,270—RAPID METHODS of Technical Analysis. Frank D. Aller. (Colo. School of Mines Mag., Feb., 1912; ¾ p.) Continuation of article previously indexed.

18,271—SAMPLING—Ueber die Probenahme von Rohstoffen und Zwischenerzeugnissen auf dem Hüttenwerken. (Stahl u. Eisen, Jan. 11, 1912; 5¼ pp.) On the sampling of raw material and intermediate products at metallurgical works. 40c.

18,272—SPECIFIC GRAVITY DETERMINATION—Practical Applications of the Specific Gravity or Moisture Flask. H. Stadler. (Journ. Chem., Met. and Min. Soc. of South Africa, Nov., 1911; 4¼ pp.) 60c.

INDUSTRIAL CHEMISTRY

18,273—CALCIUM CARBIDE INDUSTRY. (Am. Fertilizer, Feb. 10, 1912; 1½ pp.) 20c.

18,274 — LEAD POISONING — Death from Industrial Lead Poisoning (Actually Reported) in New York State in 1909 and 1910. John B. Andrews. (Bull U. S. Bureau of Labor, July, 1911; 23 pp.)

18,275—LEAD POISONING—Industrial Lead Poisoning, with Descriptions of Lead Processes in Certain Industries in Great Britain and the Western States of Europe. Thomas Oliver. (Bull. U. S. Bureau of Labor, July, 1911; 190 pp., illus.)

18,276 — PIGMENTS — Manufacture of Chemical Colors with Mineral Bases. III. The Green Pigments. (Oil, Paint and Drug Reporter, Jan. 8, 1912; ¾ p.) 20c.

18,277 — SULPHATE OF AMMONIA. Plants for Making. C. G. Atwater. (Progressive Age, Jan. 1, 1912; 6¼ pp., illus.) 40c.

18,278—SULPHATE OF AMMONIA—Production and Market for Sulphate of Ammonia. W. N. McIlravy. (Progressive Age, Jan. 15, 1912; 5¼ pp., illus.) 20c

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

E. A. C. Smith is in Europe, but will sail shortly for Chile.

Kirby Thomas, of New York, has been in northern Mexico on professional business.

A. Van Zwaluwenburg has been at Fresnillo, Mexico, and is now at San Antonio.

J. P. Hutchins is at Bogoslawski in the Urals, Russia, examining platinum deposits.

O. V. Waggoner, of San Luis Potosi, Mexico, expects soon to go to Argentina on mining business.

H. G. Wellman, vice-president of the Northern California Mining Co., is at Cleveland, O., for the present.

G. E. Drewitt, who returned to London from the Gold Coast on Feb. 5, will proceed on Mar. 8 to Melbourne, Australia.

John Knox, Jr., general superintendent of the Calumet & Hecla and subsidiary companies, has been in New York on a brief visit.

A. L. von Rosen, of Ciudad Victoria, Tampico, Mexico, is in Jalisco, making investigations of mining properties for American interests.

Cyrus Robinson of New York is at Fresnillo, Zacatecas, Mexico, installing an improved cyaniding plant for the Robert S. Towne interests.

F. M. Kurie left Philadelphia, Feb. 25, for Chloride, Ariz., where he will inspect mining property which is being developed by Philadelphia people.

Wilbur F. McClure, who succeeds Nat. Ellery as State engineer of California, assumed the formal duties of the office on Feb. 13 at Sacramento.

Persifor G. Spilsbury, general manager of the Aguacate mines, sailed from New York, Feb. 24, for Costa Rica, by way of the Panama Canal.

Fritz Cirkel, of Montreal, passed through New York last week on his way to Germany and Italy, where he will remain about two months. His address will be care Koenigliche Technische Hochschule, Aachen, Germany.

Chester B. Allen, manager for the United Gold Mining & Milling Co. in California, is in New York, to meet and confer with T. C. Crawford, president of the company, who sailed from London, Feb. 17. Mr. Crawford will return to London about the middle of March, while Mr. Allen will reach San Francisco about the same time.

The British Government has been officially advised of the treatment inflicted on James William Hambleton, a British agent and a fellow of the Royal Geographical Society, and his family at their home in Parral, Mexico, by rebels or bandits. Ten men entered the house and attacked Hambleton with knives, severely wounding him. His wife was also injured. The raiders forced Mr. Hambleton to go to the office of the Torreon Smelting Co., which he represents, and open the safe, from which they took $6000 in money.

OBITUARY

A correspondent calls attention to the deaths of two scientific men, employed by the government, during the troubles in Mexico. Dr. Pehr Olsson-Seffer, formerly professor of botany at Leland Stanford University, and at the time of his death special government commissioner for investigation of economic products of Mexico, and later appointed professor of botany at the University of Mexico. He was murdered on a train coming from Cuernavaca, in a most cold-blooded manner during the revolution of 1911. Telegraphic reports just at hand from Vera Cruz state that Ernest Hans Angerman, the owner of a plantation called "El Porvenir," situated near Canton de las Tuxtlas, on Feb. 11 was called to his door and attacked by 20 men who overpowered him. After a struggle he managed to escape for some time from his assailants who afterward cut off his retreat from his house, captured and tied him and then literally hacked him to pieces with machetes and knives. Dr. Angerman was a graduate of the University of Munich, spent one year at Frieberg, one at Klausthal and one year at South Kensington, London; studied field-geology at the Ecole des Beaux Arts in Paris, and was then engaged on the Geological Survey in Mexico in 1899 as geologist and continued as such until 1906. His particular work is well known at Mapimi and other limestone districts, in which he made a specialty. While not a member of any American engineering society, he did important work for American and foreign mining companies. Both of the deceased men stood high in their profession and had after many years of work accumulated a competency that enabled them to purchase a ranch in which they took a great deal of pleasure during their spare times.

Societies and Technical Schools

Franklin Institute—The Franklin Institute, of Philadelphia, acting through its Committee on Science and the Arts, recently awarded the Elliott Cresson gold medal, the highest in the gift of the institute, to the following gentlemen: Alexander Graham Bell, of Washington, D. C.; Samuel Wesley Stratton, of Washington, D. C.; Albert A. Michelson, of Chicago, Ill.; Alfred Noble, of New York; Elihu Thomson, of Swampscott, Mass.; Edward Williams Morley, of West Hartford, Conn.; Johann Friedrich Adolph von Baeyer, of Munich, Germany; Sir William Crookes, of London, England; Sir Henry Enfield Roscoe, of London, England.

University of Idaho—R. S. McCaffery, professor of mining at the University of Idaho and president of the Spokane local section of A. I. M. E., presided at the meetings held in Spokane, Feb. 17. Of the University men that attended the following gave papers: D. C. Livingston, assistant professor in mining, on "Mining Methods in Nacozari, Sonora, Mexico"; H. Maguire, on "Replaceable Lips for Elevator Buckets"; C. H. Loux, on "Surveying under Difficulties." At the Northwest Mining Convention held Feb. 15, 16 and 17, in Spokane, Prof. C. A. Stewart, head of Mineralogy and Geology at the University, gave a discussion on the needs of a State Geological Survey for Idaho. To this end resolutions of endorsement were passed. At this meeting, also, J. W. Strohecker gave a paper on "Relations of Mining Schools to the Mining Industry."

International Technical Congress for the Prevention of Industrial Accidents and for Industrial Hygiene—The new American idea of the safety engineer, an accident-prevention specialist, will be brought to the notice of the world industrialists at an International Safety Congress, to be held in Milan, Italy, for five days, beginning May 27, 1912. This congress, the first of its kind of international scope ever held, will be for the purpose of setting in motion a world-wide movement for the conservation of human life in industry. The American Museum of Safety, 29 West Thirty-ninth St., New York, is making preparations so that the United States will be well represented. An American national committee has been selected by the American Museum to coöperate with the International body and to promote American ideas and views at the congress. Dr. W. H. Tolman, director of the American Museum of Safety, and other members of the committee, will attend the congress.

The following are some of the papers which will be read at the Milan congress: "The Safety Engineer on a Large Transportation System," by Dr. W. H. Tolman, chairman, American National Committee; "How the New York Edison Safeguards the Lives and Limbs of its Employees," by Arthur Williams; "The Work of the Safety Committee of the United States Steel Corporation"; "Safeguarding the Traveling Public and Protecting the Employees of the Electric Street Railway Association"; "Proper Illumination and Accident Prevention," by J. V. Lansingh, president of the Illuminating Engineering Society.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Feb. 21—Louis R. Glavis, secretary of the State Conservation Commission, states that the speculative holders of water-power appropriations, referred to in the JOURNAL of Jan. 27, did not receive permits from the commission, but that these appropriations were made before the law creating the commission became effective. He further states that the law does not give the commission the proper machinery for the enforcement of the provisions; that the aid of the courts would have to be invoked in order to provide against improper application of the permission to appropriate water for power and electrical purposes. There have been issued by the commission about 20 permits to persons applying for the right to appropriate water for mining-power purposes since the commission has been in operation.

An investigation into the conditions, causes and possible cure of the damage being done in the oil fields from the infiltration of water, will be undertaken by State Mineralogist Storms in a personal visit to the fields. He will make an inspection to acquaint himself with the conditions and will confer with operators and ask their suggestions as to methods of controlling the water and the proper procedure to prevent a continuance of the evil. The subject has attracted a good deal of attention and laws have been enacted which permitted each county to provide means and appropriate moneys for the regulation of the wells that cause the damage; but the counties have not been alive to the necessity of spending the money required. While it may not be within the power of the state mineralogist to control or regulate the operation of oil wells, the information and suggestions obtained will enable him to act in such way as the law or his position may provide; if the matter can be successfully dealt with under a state law greater consideration will be given it by the Governor and the Legislature when the recommendation comes from an official whose office is concerned with the betterment of the mining industry than when offered by persons directly interested in saving their own property from the invasion of water from the wells of careless owners.

The Southern Pacific Land Co. is a new incorporation, with railroad officials as directors, organized for the reported purpose of handling all lands owned by the railroad. This management, it is said, will extend to the oil lands in Kern and Fresno Counties, now operated by the Kern Trading & Oil Co., and some valuable holdings on the west side of the Kern River field and in the Lost Hills. The report is also current that the new company is preparing to have these latter holdings operated under lease. The railroad is evidently arranging its affairs to meet the requirements of the Federal laws and governmental regulations respecting the actions of corporations, and to be ready to meet any of the possible demands the Government may make.

Denver

Feb. 23—Thomas B. Crawford, of Denver, has organized the Brown Mountain Smelting Co., and has purchased the Hill smeltery, just below the town of Ouray; this will be operated with present equipment as a pyritic smeltery in a few months, there being an abundance of the ores in the district, which are best adapted for this method of what may be termed a "fusion concentration," the product being a copper matte containing the silver and gold of the ore. The chief local ore supply will come from the Wanakah company, and from the Indian group in Red Mountain, which is under lease to the Brown Mountain company. John T. Roberts, Jr., of Ouray, is manager of the Wanakah company, and he states in his report that in 1911, 400 cars of concentrates, valued at $100,000, were shipped from the mill.

Just now some of the Denver papers contain accounts of fabulous shipments from a camp called High Grade, somewhere in California, but from a district which is so deep under snow that it cannot be examined till spring; there are also published photographs and offers of old-time miners who are willing to go there and stake the whole country if Denver men will provide the money. Colorado camps as a rule do not look to San Francisco for money or for grubstakes, and why California should come to Denver is not apparent.

At the annual meeting of the Elkton Consolidated Mining Co., Feb. 12, the following directors were elected: E. P. Shove, president; E. M. De La Vergne, vice-president and general manager; M. F. Stark, J. W. Graham, A. E. Carlton, James F. Burns and J. Arthur Connell. Sherwood Aldrich retired as president, owing to pressure of other duties.

Butte

Feb. 21—The improved price of copper is beginning to stimulate mining in various parts of the state and preparations are being made to open up numerous properties, where considerable prospecting has been done. Among others, the Cooke City district, in Carbon County, is beginning to revive. A number of years ago this camp was one of the busiest spots in the state, hundreds of claims were staked and a large amount of work done there, showing that the district was primarily noteworthy for its copper deposits. It is in an almost inaccessible region, however, and although much effort has been made to have a railroad built to the district, it has not yet been accomplished, owing to the almost prohibitive cost of construction and the steepness of grades that would be necessary. There is scarcely a doubt that the region would become a great mining center with proper transportation facilities, but it has been shown that ore shipments by wagon over a rough, steep road, 60 or more miles long, were not profitable, except for the highest-grade ore.

At the slime pond at Anaconda, a new system of centrifugal concentration is being tested, which, if as successful on the large scale necessary at that immense plant as it is proving to be on the small scale of the tests, promises to improve the concentration of slimes.

In the mines of Butte opportunity is being taken of the present price of copper to work over much material which in former years was regarded as waste, and which now pays well to mine again. Much of the filling of old stopes is thus made to yield a second profit and the mining of this material helps to lengthen the life of the mines. The average grade of ore being mined at present is about 3.5%, which is considered a good grade, and it is the company's policy to mine the low-grade ore while copper is at a good price and to leave the high-class ore for times of lower prices. When the price of the metal is up it is often found profitable to mine first the orebody and in after years to remine the filling, which in the meantime has become enriched, not only by the inevitable escape of part of the ore into the waste material, but also by seeping, copper-bearing waters, and there have been cases where the waste filling of stopes has been reworked several times at a profit.

Salt Lake City

Feb. 22—The lead furnaces of the International Smelting & Refining Co.'s Tooele plant are being warmed up, and it is probable that operations will begin the middle of next week. It is expected that E. P. Mathewson, general manager, and other officials will be present at the ceremony of blowing in.

The results of development work at the Utah Apex during the last eight or nine months have been remarkable. During that period two important orebodies have been opened, one containing 40,000 tons of high-grade lead ore, and the other 60,000 tons of 15 per cent. lead ore containing a high iron content, but as yet the limits of the orebodies have not been determined. One stope shows the ore to be 100 ft. thick. There is a good tonnage of probable ore. The orebodies are being steadily added to and the reserves increased.

The U. S. Geological Survey report on the San Juan oil field in the southeastern part of Utah, made by E. G. Woodruff, gives the past history and present status of the field. The first location was made in 1892, but no drilling was done until 1907, when the first well, Crossing No. 1, was begun. Oil was encountered Mar. 4, 1908, the well turning out to be a gusher. There was considerable excitement, and other wells were found in rapid succession. Little real work was done, however, until 1910, by the summer of which year there was one standard rig in operation, and others reported to have been ordered; there were 10 portable deep-well rigs in the field, and several more on the way to it. On Feb. 1, 1911, 27 drilling rigs were in the field, and equipment for more was on the way. Two oil wells were brought in during that winter. A small town had been built near Mexican Hat and the roads improved.

There is little doubt but that transportation can be arranged; a pipe line to the nearest railroad could be built. Two railroad lines, both of which are pronounced practicable by engineers, have been under consideration. It remains for prospectors to show that there is enough oil to warrant the expense of the pipe line or railroad.

The areas which are regarded as offering the most favorable conditions are as follows: T. 41 S.—R. 18 E., sections 23, 24, 25, 26, 35, 36; T. 41 S.—R. 19 E., sections 19, 20, 21, 28, 29, 30, 31, 32; T. 42 S. R. 18 E., sections 1, 2, 11, 12, 13, 14, 24; T. 42 S.—R. 19 E., sections 5, 6, 7, 8, 17, 19, 20. As all wells containing more than a good "showing" are in the syncline, it is believed that the basin structure probably contains the most oil. Practically all geological conditions point to the conclusion that few flowing wells will be obtained. No adequate explanation has been offered for the one gusher reported.

Negaunee, Mich.

Feb. 23—It is reported that the Chicago, Milwaukee & St. Paul Ry. will build an extension from Crystal Falls to Iron River. Surveys have been made in the past and several possible routes mapped out. The proposed extension will be about 20 miles in length. At present the only road at Iron River is the Chicago & Northwestern Ry. over which road all the ore shipments are made. The C. M. & St. P. Ry. is making extensive repairs to one ore dock at Escanaba. At the same place the C. & N. W. Ry. is placing new tops on two docks and tearing down its old No. 1 dock. Some of the timber from No. 1 dock is being resawed for use in the work on No. 6 dock.

The new Jones furnaces erected at the Kloman mine at Republic are preparing to start work on the new process for metallizing low-grade iron ore. The results will be watched with interest by mining men in the Lake Superior region.

A partial walkout occurred at the Chapin mine of the Oliver Iron Mining Co. at Iron Mountain because of a demand by the men that operations be restored to a full-time basis. Half-time work has been in force since last spring. Gen. Supt. O. C. Davidson took the matter up with the company's officials at Duluth and was instructed to put the mine on a 6-day basis but not to increase production; the stockpiles at the mine are already large and there is no call for the ore. The men participating in the walkout are still out, and the others now have work on every day but Sunday.

The plant of the Lake Superior Iron & Chemical Co. at Newberry is now in operation. Extensive improvements and additions have recently been made, including a central power house, a new chemical plant, sawmill, retort plant and an enlargement to the stack. Water is pumped from the Taquamenon River by an electric pump.

Cobalt

Feb. 23—C. W. Knight, of the Provincial geological staff, is collecting data for the publication of another report on Cobalt. It is understood that evidence has lately come to light, which tends to upset the former theories of geologists regarding the origin of the Cobalt ore deposits. This fact, combined with some recent important discoveries, may have an important bearing on the future of the camp. It was reported recently that vein No. 9, at the Coniagas mine, extended into the Keewatin formation. Mr. Knight made a careful inspection of the formation underground and confirmed the reports of the discovery, pronouncing the formation in which the vein occurs to be undoubtedly Keewatin. The vein has widened to 5 in. and an assay taken of the ore shows 2622 oz. silver per ton. The vein has been followed for 85 feet.

Trethewey shareholders are greatly exercised over the publication of the annual report, which presented many disappointing features. A stockholders' commission is being formed, which will try and bring about various reforms. The stockholders advocate the cancellation of the recent $1,000,000 increase in capital, the employment of a consulting engineer to supervise the management of the mill and the mine, the publication of monthly statements of production, and quarterly financial statements. Last, but not least, the decapitation of Col. A. M. Hay, president, is desired. The report for 1911, showed a loss of $50,000 in gross receipts, and a decrease of $77,494 in the net returns, from the preceding year. The cost of production amounted to 27.67c. per oz., which is about 10c. higher than for any previous year.

Toronto

Feb. 23—The Ontario government has introduced a bill into the provincial legislature, providing that no miner shall be employed underground for more than eight hours in any 24 hours, including in such eight hours the time occupied in descending and ascending from the mine. For every violation of this provision, the person owning or controlling the operation of the mine and the manager or superintendent are liable to a penalty not exceeding $50.

It is officially announced that the Elk Lake branch of the Temiskaming & Northern Ontario Ry. will run from Earlton, a point 25 miles north of Cobalt, westward for 30 miles through a country well suited for agriculture. The Charlton route, at first proposed, was abandoned on account of the superior character of the country for farming purposes to be opened by the route selected. Tenders will be called for immediately.

Porcupine

Feb. 23—At the monthly meeting of the Porcupine branch of the Canadian Mining Institute, held a few days ago, two interesting papers relating to conditions in the district, were read. One paper dealt with the development and recording of sampling results, as applied to the Hollinger, while the other took up the question of determining the dip of diamond-drill holes. In the discussion which followed, it was stated that in the sampling done at the Hollinger, the pulp, which was ground to 80 and 100 mesh, did not, in any case, show metallics on the screen. This is rather remarkable considering the fact that the occurrences of coarse gold are frequent, and that over 3000 samples were taken. It was also shown that while in Porcupine the gold is found associated with the pyrites, it is in a free state, and that there is no chemical combination.

The Mining News

The Current History of Mining

Alaska

Alaska-Mexican—During December, the mill crushed 18,858 tons of ore, yielding $58,809 gross and net $30,856. Operating expenses were $24,161; construction, $3791; grade of ore, $3.15; development work, 209 feet.

Alaska United—During December, the Ready Bullion and 700-ft. Claim mills crushed 37,793 tons of ore yielding $90,376 gross and net $13,836. Operating expenses were $74,773; construction, $1766. The ore at the Ready Bullion mill averaged $2.20 per ton; 700-ft. Claim, $2.55. Development work totaled 256 ft. The operating expenses include $15,000 as a portion of the cost of settling the Mexican powder explosion of Mar. 2, 1910.

Red Wing—A vein is being opened about 250 ft. back of the present workings and parallel to them. A shipment of ore was recently sent to Seattle and Mrs. Tola Wyman, owner and superintendent, will go to Seattle to look after the details.

Arizona

GILA COUNTY

Summit—A statement has been issued by the directors to the shareholders of the company, which recently surrendered its lease and option on the Gibson mine, 16 miles west of Globe. The report shows that $164,000 were derived from the sale of stock and $28,000 from the sale of ore. The sum of $141,000 was expended at the mine in its development, and $46,000 were paid on the property. The report states further that in the opinion of the directors a sufficient tonnage has not been developed to warrant further expenditure on the property. The directors have secured an interest in a gold prospect in the Radersburg district, Mont., and offer to holders of the Summit company stock, two shares in the Summit Gold Mining Co. for every five shares in the Summit Copper Company.

Black Warrior—P. S. Tate and the Lyle brothers, who are leasing on the 100-ft. level of this mine, are shipping a car of copper-silicate ore to the smeltery at El Paso.

Gibson—The mine, recently relinquished by the Summit Copper Co., is being worked in a small way by the Gibson Copper Co., to whom the mine reverted. Ten men are at work under the supervision of T. Henderson, one of the original owners of the mine, and a small amount of high-grade chalcopyrite ore is being taken out from the fourth level. Ore is being hauled to Miami, preparatory to making a shipment to the El Paso smeltery.

Copper & Silver Zone—Another car of silver-lead ore was shipped from this group recently. Four parties of lessees are at work in ore. The ore is coming from near the surface, there being as yet no deep workings on these claims. The silver occurs as the chloride, or hornsilver, and the lead as the carbonate and galena.

Old Dominion—The concreting of the Kingdon shaft of the United Globe is progressing satisfactorily under the supervision of contractor Paul Michaelson and C. H. Weideman, construction engineer. The first section of 160 ft. has been completed and the work has been proceeding about 12 ft. per day. Work on the second section will begin soon. C. B. Eades is concrete inspector for the company.

Duquesne—From this group, 15 miles west of Globe, there has been shipped another car of gold-lead ore. The last shipment of 39 tons, a few weeks ago, netted about $18 per ton and this shipment is expected to run better. The ore is peculiar in that it contains gold and lead, but no silver. John F. Shaw is manager.

Miami—The three 8-ft. Hardinge pebble mills for the sixth and last unit have arrived, and the sixth unit is running. The type of skip known as the Original Consolidated Mines Co.'s skip has been discarded in favor of the old Kimberly type, which is reported to be giving better satisfaction with less repair cost. Exploration of the company's ground northeast of the present developed orebody, continues by means of churn-drilling.

Southwestern Miami—Hole No. 2 is down 780 ft., and is in iron-stained, silicified schist. Two more churn drills are to be added soon. F. W. Hoar, of Globe, is manager.

Barney—The churn-drill hole in the 400-ft. shaft is 1030 ft. deep and is still in the dacite formation. The hole encountered a large flow of water at 965 ft. and water is now flowing out of the top of the hole.

Live Oak—Enlargement of No. 2 shaft to three compartments is progressing rapidly under the management of the contractor, Jack McIvor. The boilers are being bricked in and the double-drum hoist is being treated. A small amount of development work is being done from No. 1 shaft.

Keystone—One churn drill is in operation on the property, northwest of the shaft. The hole is being drilled through the granite formation that caps the ore in this vicinity. E. B. Tinker is superintendent.

Inspiration Consolidated—Construction work will not be started until a jury in the district court has awarded a compensation to the property owners along the proposed railroad right-of-way from the town of Miami to the Inspiration and Live Oak mines. This will not occur for at least 30 days. In the meantime, construction of the dam across Pinal Creek, sinking of the well on the Inspiration ranch and operation of the experimental mill continue.

California

AMADOR COUNTY

The following number of stamps are dropping at properties on the Mother lode in this county; Zeila, 40; Argonaut, 40; South Eureka, 80; Central Eureka, 40; Original Amador, 20; Bunker Hill, 40; Fremont, 60; Kennedy, 100. The following are hung up: Oneida, 60; Keystone, 60. Twenty stamps are being installed at the Rose, L. R. Poundstone, manager.

Hardenberg—The new vertical shaft is down 670 ft. and will be sunk to a total depth of 1000 ft. before crosscutting. The old inclined shaft was sunk to 900 ft. and on the footwall; the dip of the vein is 62½° E. The present owners are doing practical work by modern methods, with new machinery. The electric hoist has a capacity for 2000 ft. The mine is three miles south of Jackson. N. S. Kelsey is superintendent.

KERN COUNTY

Pioneer Midway—The Superior Court of San Francisco has decided that I. Straussberger, general manager of this company, is entitled to $50,000 already received and $100,000 due from the company as commission for making a sale of 640 acres of oil land upon the authority of the board of directors. The payment of the commission was contested on the ground that the directors had no authority to fix and pay the commission. The court held that the agreement was made in legal form and good faith.

PLACER COUNTY

L. C. Cooper, of Winnemucca, Nev., has been notified by the General Land Office that a protest against the patenting of lands at Dutch Flat, which Cooper claims are mineral lands, will be considered by the Land Office. The mineral claims are situated on a railroad section of land.

SANTA BARBARA COUNTY

The recent suspension of operations at 16 wells in the Santa Maria field was in most instances due to necessary delay awaiting the cement work and for other similar causes. Only four of the wells have been indefinitely shut down.

SIERRA COUNTY

Dodson—A pump and hoist are about to be installed at this gravel mine on the Little North Fork by James F. Hunt, who is taking out rich gravel.

Gray Eagle—New grinding pans have been installed and the mill is ready to begin crushing ore.

Tightner—At this Alleghany mine another shoot of rich ore has just been encountered. The vein is 8 ft. wide and shows good ore across the entire width. The 10-stamp mill is running continuously on this ore.

Mexican—C. J. York and brothers, owners of this quartz property at Downieville, are erecting a new stamp mill to be operated by electric power from the Downieville plant.

TUOLUMNE COUNTY

Stanislaus Gravel Mining Co.—This is a new incorporation organized to operate the If I Can mine, near Jamestown. Capital stock is $400,000. The directors are V. D. Knupp, N. M. Ball, W. B. Phillips, E. E. Graham and E. R. Abidee, of Porterville.

VENTURA COUNTY

Union—A refinery of six stills is to be installed at Santa Paula to top the light oils. There has been found a loss from shipping the light oils to Oleum. There is a market for the gasoline and distillates in the small towns and ranches in the neighborhood of Santa Paula. The residue will be shipped by pipeline and steamer.

YUBA COUNTY

Manzanita—A 10-stamp mill of modern type and 2000 ft. of pipeline will be installed immediately at this mine, three miles from Rackerby. A 7-ft. vein has been developed at 265 ft. depth and enough ore is said to be blocked out to warrant the installation of a mill for practical development. The property is owned by the Manzanita Mining Co., Boston, Mass.

Colorado

CRIPPLE CREEK DISTRICT

Mary McKinney—The company, in its annual report, shows: Net earnings for 1911, $120,725; expenditures, $128,608; deficit, $7883; cash balance on hand, $43,536. The expenditures include one $13,000 dividend, and the payment for 2000 shares of the Drainage & Tunnel Co., at par. It has been an off year for the company, owing to the lower levels being submerged and because of waiting for the drainage tunnel to unwater them; this has now been accomplished. Frank Costello is president and P. J. Ryan is secretary and treasurer.

Union Leasing Co.—The Gold Sovereign, on Bull Hill, and the Husted shaft, on the Gold Dollar, of Beacon Hill, both operated by this company, sent out 68 cars in January, the ore running from $8 to $45 per ton. C. G. Jackson is manager.

Forest Queen—It is stated that since Feb. 1, nine cars of good-grade ore have been shipped by John Connor, lessee, at this mine, on Ironclad Hill.

Golden Cycle—The company is installing electric pumps to unwater the mine, and the Vindicator mine will bear its share of the expense; the water is now below the 14th level of the Golden Cycle.

Roosevelt Deep Drainage Tunnel—The deep shafts of the Elkton, Mary McKinney, El Paso, Mabel M., Cresson, Blue Bird, Portland, Granite, Strong, Stratton's Independence, El Paso and Gold King, all Beacon Hill shafts, are being drained by this tunnel with a flow from its portal of 950 gal. per min. The Vindicator and Golden Cycle are said to be the only exceptions.

Colorado Mines & Investment—This company, leasing on the American Eagles of the Stratton Estate, shipped 15 cars of ore in January, which they state yielded from $20 to $250 per ton. It is reported also that Baskett & Co., lessees, on block 206, have struck two feet of $60 ore.

CLEAR CREEK AND GILPIN COUNTIES

On the Victoria level of the Mendota vein, some good lead-zinc-silver ore is reported to have been opened.

Scott—At this property, on Republican Mountain, good lead-silver ore is being drifted on, and 50 tons are ready for shipment.

North American Smelter & Mines Co.—This company owns the smeltery at Golden, more than 400 acres of mining claims in Gilpin and Clear Creek Counties, besides 350 acres which it holds under bond and lease, and is now leasing its ground subject to the stipulation that the product be sent to its Golden smeltery. The Donaldson mine, one of these properties, has been leased to the Rockford Leasing Co., Manager Warren being in charge of the operations.

LAKE COUNTY—LEADVILLE

Ibex—High-grade ore, with free gold, continues to be produced by the Barnes & Wardell lease.

Sugarloaf—Regular shipments continue to be made from the vein of ore recently opened in the old Sherrill workings.

St. Louis—A 54-hp. electric compressor and a 37-hp. hoist are being installed at this tunnel, where a prospecting shaft will be sunk 450 ft. Power will be supplied by the Central Colorado Power Company.

Leadville Mines Pumping Co.—The directors are working hard at the framing of a coöperative plan with the claim owners for unwatering the flooded areas of East Fryer Hill, and they are receiving much encouragement.

Henriette—This and the Maid mines, belonging to the Moffat estate, have, during the last 30 years, produced millions of dollars worth of ore; the company will be reorganized at a special meeting of the stockholders on Mar. 4. In the future the destines of these properties will probably be guided by Philip Argall & Sons, of Denver.

OURAY COUNTY

Camp Bird—In this mine that part of the orebody recently opened by a drift is not being worked, but a shaft is being sunk, from which this territory can be properly explored. Meanwhile operations are confined to uncompleted work on known orebodies.

El Mahdi—Alerio & Co., leasing at this mine, in the Bachelor district, are said to have opened a streak of high-grade silver ore.

Michigan

COPPER

Franklin—The mine is sending about 650 tons of rock per day to the mill and this will be gradually increased until about 1000 tons per day are being handled. The new hoisting equipment is working satisfactorily and the underground conditions are first class, some fine ground being exposed in the drifts from the 33rd level.

Winona—The company will soon be able to double its production, as the second head in the mill is being tried out preparatory to going into regular service. The underground force is being gradually increased and preparations are being made to handle the increased tonnage. Developments in the lower levels are showing a material improvement in the mineralization of the lode.

Mayflower—Notices for the annual meeting to be held Mar. 20, in Boston, have been received by stockholders.

Proxies run to President Fay and Secretary Morrissey. No. 17 drill-hole core has been received in Boston. President Fay states that Nos. 15, 16 and 17 holes have disclosed an amygdaloid orebody 550 ft. long, 300 ft. high and over 50 ft. thick. The lode is highly mineralized, the copper being evenly distributed throughout the entire width. All the sludge from No. 17 hole was saved and assayed between the depths of 1016 and 1088 ft., showing an average of 26.25 lb. copper per ton for the vertical distance of 72 ft. The Mayflower discovery is regarded as important.

Allouez—The installation of surface equipment at No. 2 shaft is going forward satisfactorily and this shaft will be ready soon to begin production on a large scale.

St. Louis Copper Co.—The annual report for the year ended Dec. 31, 1911, shows: Total receipts, $100,688, of which $98,750 were from assessment; expenses, $23,411; balance of assets, Dec. 31, 1911, $55,329, compared with a balance of liabilities of $21,946, for the previous year. Development work included: Sinking No. 1 shaft, 165 ft.; drifting, 128.5 ft.; crosscutting, 76 ft. No. 1 shaft is 15 ft. below the first level. A geological cross-section was made by diamond drilling. The lode called the St. Louis amygdaloid was found, with an outcrop 7160 ft. east of the Kearsarge amygdaloid, and was the only lode showing rock that might carry copper in commercial quantity. The company's land comprises 800 acres.

Iron

M. A. Hanna & Co.—At the new Carpenter property, on Sec. 31, 1½ miles southwest of Crystal Falls, diamond drilling is being carried on by the Cole & McDonald Exploration Co., in order to determine a site for a shaft. A large body of ore has been indicated by drilling and the property will probably be a large mine.

Newport Mining Co.—A new mine hospital has been completed by this company at Ironwood. Another hospital is maintained in the same town by the Oliver Iron Mining Company.

Lucky Star—This property, at Negaunee, owned jointly by the Breitung interests and the Cleveland-Cliffs Iron Co., is being diamond-drilled by the Breitung company, which will operate the mine. A 12x15-ft. shaft is to be sunk near the center of the 50-acre tract; the shaft will be wood lined and of four compartments, consisting of two skiproads, a cage-way and a compartment for pipe and ladders.

Mary Charlotte—All the hoisting at this Breitung mine, in Negaunee, is now concentrated at shaft No. 2, called the Sunrise shaft. The north drift on the fourth level is being driven to connect with workings from No. 1 shaft in the same manner as the other levels are. It is planned to benefit the underground haulage system by this; the motor will then be able to make a circuit of the level. One diamond drill is in operation underground, two on surface and one at the nearby Breitung-Hematite property. The new concrete dryhouse has been completed at the Sunrise shaft.

Negaunee—The new steel headframe at shaft No. 3 has been completed. The electric hoists have been erected and under test were found to work satisfactorily.

Chapin—The large Cornish pump at the new Ludington shaft has been shut down and repaired. The Riedler pump in the Hamilton shaft is handling the mine water during the shutdown.

Wauseca—At this mine of the Mineral Mining Co., at Iron River, formerly known as the Konwinski Exploration, a new shaft is being sunk.

Oliver Iron Mining Co.—A diamond drill has begun work on the ice in Brown's Bay, on Lake Michigamme. This region is east of the old Michigamme mine. The Cole & McDonald Exploration Co. are doing the drilling on contract. Considerable drilling has been done by the Oliver company in the region south of Lake Michigamme, on the lands of the Michigan Iron & Land Co., whose extensive holdings are under option to the Oliver company.

Missouri

Neck City Mining Co.—This company has made three good drill strikes on 10 acres northwest of the Sitting Bull mine, at Thoms Station.

Wisbrod—A company operating the open pit on this land has been breaking its dirt by hydraulic mining with considerable success.

Minor Heir—This company is installing electric pumps and hoists at its mine northwest of Webb City.

Delta—A Texas centrifugal pump is being installed at this mine at Spring City.

Little Bob—Chapman & Lennan, of Webb City, who are operating this mine at Duenweg, are planning the erection of a mill.

Aberdeen—The company has completed the erection of its mill, west of Four Corners.

American—This company, operating the American Davey mines at Prosperity, has acquired the Endeavor Mining Co.'s 40-acre tract and will connect it with the ground at mill No. 1, and will operate it from there. The American company recently made a shipment of 10 cars, of 70,000 lb. each, of zinc ore from its mines at Prosperity, to the smeltery at Dearing, Kansas.

Montana

Butte District

Butte Central—The directors are reported to have approved the plans for the first unit of the new mill and to have let the contract to the Colorado Iron Works. Work is to commence about Mar. 1 on the concrete foundations.

Butte & Superior—The company is reported to have placed an order with the Nordberg company for a duplex, first-motion hoist, 32x60-in. cylinders, to be delivered within 90 days. It is expected that it will be in operation about June 1, coincidentally with the starting of the new mill and concentrator now in course of construction. This hoist will be designed for operation either by compressed air or steam, and will have a lifting capacity of 30,000 lb. from a maximum depth of 3000 ft. The company is also reported to have ordered a new sinking hoist for use at the Colonel Sellers shaft in the Butte-Milwaukee ground. This shaft is now about 700 ft. deep. The work on the concentrator is progressing rapidly and at the present rate should be in operation in May.

Anaconda—Before the close of the present year it is expected that all the principal hoists of the company will be using compressed air instead of steam for power. The central air plant near the High Ore mine is now being increased in capacity—to double that of formerly, so it is reported. It is said that two more compressors are about to be installed. The three hoists now being operated with air are the Mountain View, Diamond and High Ore. The company is reported to have instructed the Nordberg company to change over the Leonard No. 2, Tramway, Pennsylvania, West Colusa, Original and West Stewart hoists for the use of air, and to have ordered from the same company new hoists for the Leonard No. 1, Modoc and Berkely mines, all to operate with compressed air, and for nine auxiliary hoists to take the place of the chippy hoists at the Diamond, West Colusa, Mountain View, Tramway, Pennsylvania, Badger State, Mountain Con, Neversweat and St. Lawrence mines. These auxiliary hoists, it is reported, will be of the convertible type; in lowering a load, they will act as compressors, forcing air into the receivers, thus aiding the central plant. This is similar to the new hoist recently installed at the Franklin copper mine in Michigan.

East Butte—Reports credited to Robert H. Gross, president, state that the output will probably be doubled in July, when it is expected to reach 1000 tons per day. It is said that the new dust chamber and sintering plant are giving satisfaction, but some adjustments are still necessary. These improvements have been paid for from earnings and are claimed to mean a saving of about $5 per ton of flue dust handled. In increasing furnace capacity in the future, the present furnaces will be doubled in size instead of installing new ones. This work of enlarging is expected to be completed in July. The smeltery has all the custom ore it can handle at present.

LINCOLN COUNTY

Snowshoe—The vein has been crosscut on the 500-ft. level, to which point the shaft was recently sunk. Reports from the mine are to the effect that the vein shows 11 ft. of ore, much of which is of shipping grade.

Hazel T.—This company, operating the Shaughnnessy Hill properties, expects to crosscut the vein soon at a depth of 300 ft., with a tunnel. There is a good showing of silver-lead ore in the upper workings.

Nevada

COMSTOCK LODE

United Comstock Pumping Association—At the Ward shaft the No. 2 bulkhead, going toward the Gold Hill mines, was recently tapped at 175-lb. pressure, and the old workings for a distance of 1000 ft. were quickly drained. The No. 1 bulkhead, built years ago, still remains to be tapped before obtaining the real flow of water from the Gold Hill district. Several hundred feet of caved ground will have to be passed through before reaching it. The old centrifugal pump on the 2400 level has been removed and the quintuplex pumps on the 2100 and 2475 levels are now in operation. The vertical and horizontal centrifugal pumps for the C. & C. shaft and north-end workings are being installed. They are Byron Jackson pumps, driven by General Electric motors. Considerable mine work remains to be done before the pumps can be effectively operated to lower the water below the 2500 level.

Ophir—An important development was made in the west crosscut from the south drift on the 2100-ft. level last week, a strong quartz vein, fully 2 ft. in width, having been opened, car samples of the ore assaying $30 per ton. The course of the vein is a little south of west and the crosscut will follow the formation. This vein is in the Hardy vein-system, and is situated southerly of the old stopes on this level. The Hardy vein has been the mainstay of the property for two years and it looks as if further ore resources would be opened to the south.

Con. Virginia—Work has been started on cleaning out and repairing the old south drift from the east crosscut from the 2450-ft. station of the C. & C. shaft. After this has been finished, it is proposed to crosscut both east and west at various points along the drift, to the Best & Belcher line. The C. & C. shaft cuts the main Comstock vein at the 2450-ft. level and little prospecting was ever accomplished on the level, especially in the easterly vein system. Second-class ore is being saved from the 2550-ft. level, where sill-floor sets are being installed preparatory to raising to the 2450 level.

Mexican—The new mill is being gradually put into shape, and the returns last week, in tonnage treated and recovery secured, exceed any previous week's run. After a number of finishing touches have been made to the building, the structure will be thrown open to public inspection. Ore from the surface dumps is being used to keep the mill in operation, and stoping in the mine has not yet been resumed.

Crown Point—A good record was made last week, when 600 tons of ore were stoped and hoisted from the 1400-ft. level, the assay value of which was in excess of $5000. This ore was all broken down by hand drilling, the air compressor not having been completely installed. The Yellow Jacket mine is running to capacity on Crown Point ore and will continue to do so for some time to come. The management is making a success of its low-grade mining on the 1400-ft. level, and the stopes are yielding a good profit. Higher-grade ore is expected on the levels below the 1400, when the water is pumped out and development work made possible.

ESMERALDA COUNTY

Goldfield-Belmont—President Heller is reported to have said recently that the orebody on the 400-ft. level is stronger and better than in any other part of the mine. Stoping on this ore will start soon.

NYE COUNTY

Tonopah ore shipments for the week ended Feb. 15 were: Tonopah Mining, 3400 tons; Tonopah-Belmont, 2400; Tonopah Extension, 960; Montana-Tonopah, 952; West End, 770; MacNamara, 350; total, 8832 tons, of an estimated value of $220,800.

WHITE PINE COUNTY

Nevada Consolidated—The Veteran mine is now producing about 1100 tons of ore per day, and it is reported that no more than this will be required under present plans. Four steam shovels are working on overburden and one on ore in the Copper Flat pit; one is working on overburden and one on ore in the Liberty pit. Ore at the Liberty pit is said to be running unusually high in copper. A new shovel is being assembled at the machine shop at Ruth.

Giroux—The Giroux shaft is reported to be cleared of water and the dèbris cleared away. Sinking will not be resumed at present, but work will be concentrated at the Morris shaft to get the workings in shape for production before May 1, when the contract with the Steptoe plant goes into force. About 1,000,000 gal. per day are being pumped from the main shaft, and the ground between the 1200- and 1400-ft. levels is being slowly but steadily drained.

New Mexico

SOCORRO COUNTY

Socorro—During January approximately 4800 tons of ore were milled, yielding seven tons of concentrates and 28,000 oz. of gold and silver bullion. On account of a shortage of wood at the old power plant, the mill closed Jan. 30 and will start as soon as the new power plant is in commission.

Ernestine—The mine continues to yield high-grade ore, in addition to the regular tonnage of average milling ore. The limits of the oreshoot recently discovered have not yet been determined.

Oaks—The gallows frame, hoist and sundry equipment being installed at the south shaft of the Pacific mine will be placed in commission soon. The shaft will then be sunk as rapidly as possible with two shifts. During January, 162 tons of ore were taken out from development and treated in the Deadwood mill. Work continues in the main drainage and transportation tunnel.

Deep Down—Leasers will soon have the old workings in shape for production, when ore will be sent to the Deadwood mill for treatment. A gasoline hoist has been ordered.

South Dakota

Homestake—The annual report just issued covers two periods, one from June 1, 1910 to June 1, 1911, and the other from June 1 to Dec. 31, 1911. The report for the former period shows: Total income, $5,375,064, compared with $4,621,075 for 1910; disbursements, $4,462,201, compared with $3,834,075 for 1910; surplus, $912,863; deficit after dividends, $397,537; final surplus, $84,211. The account for the second period shows: Total income, $4,784,642; disbursements, $2,605,982; surplus, $1,178,660; surplus after dividends, $414,260; final profit and loss, $498,471. Assets were $22,752,805. Supt. T. J. Grier states that recent operations and developments have been satisfactory. The fiscal year hereafter will coincide with the calendar year. It is stated that there are 1,883,277 tons of ore broken in the mine and remaining in the stopes, and that there is sufficient ore blocked out, but unbroken, to supply the 1000 stamps for 20 years.

Tennessee

Tennessee Copper Co.—The annual report for the year ended Dec. 31 shows total receipts of $577,927 compared with $547,157 for the previous year. After allowing $170,878 for depreciation, there remained net profits of $407,049; after charging off $40,000 to general reserve, a surplus of $367,049 remained. Total surplus at the close of the year was

$1,688,428. According to Pres. Frederick Lewisohn, several events combined to make operations less satisfactory than had been hoped for.

Texas

Nitrate deposits are reported near Marfa, in Presidio County.

Gold in sedimentary formation is reported near San Antonio, and local men are investigating. The gold is found in a clay bed under a bed of coal. Lee Hager, mining engineer, of Houston, recently made an investigation of the property.

LLANO COUNTY

Llano Gold & Rare Metal Mining Co.—This company is said to be operating the first gold mill installed in the state at its property at Llano. The district is noted for its variety of rare metals, among which are vanadium, molybdenum and tellurium. Alexander McLaren is superintendent.

Utah

BEAVER COUNTY

Moscow—Five cars of ore have accumulated, as no shipments were made during January, owing to bad roads. The ore averages from $1100 to $1200 per car.

Beaver Gold—This property is in the Newton district near the Sheep Rock. Drifts are being driven north and west on the 70-ft. level of the main shaft. The west drift has opened quartz stringers.

JUAB COUNTY

Tintic shipments for the week ended Feb. 16 amounted to 189 cars.

May Day—The body of gold ore opened some time ago on the 400-ft. level has been found to continue to the 500. In addition to the work on the 400 and 500, drifting for this ore is being done on the 700. Seven cars of ore were shipped during the week ended Feb. 16 and there is a large amount of ore broken down. The ore averages about $22 per ton in gold.

Uncle Sam—In the Humbug section of the property an orebody is being followed toward the Richmond & Anaconda. The work is about 100 ft. below the old tunnel level in hitherto undeveloped ground. The ore carries silver and lead, and from $15 to $30 in gold.

Opohongo—On the 1000-ft. level drifting is being done for the orebody which has been mined as far as the 700; quartz showing some mineralization has been opened. It will take another 100 ft. of work before the point is reached where ore is expected.

Grand Central—A 40-ft. winze has been sunk from the 2200 in ore recently opened there and the shaft is being extended to the 2300 level.

Gemini—About 50 leasers are working on the upper levels at this property and rich silver ore is being opened in small bunches. Some of it runs several thousand ounces per ton.

Utah Consolidated—A drift to the west from the main tunnel level is following a small stringer of ore. The work is being done to get under an old stope.

Eagle & Blue Bell—The shaft, which is being sunk to connect the 1000 with the 1300 level, where a large body of ore has been opened, is 164 ft. below the former level. A new smelting contract has been made with the American Smelting & Refining Company.

Gold Chain—The company shipped 10 cars of ore during the week ended Feb. 16. Shipments for the last four weeks amounted to 50 cars.

PIUTE COUNTY

Prospectors looking for other minerals are reported to have found potash deposits in a badly broken volcanic region along the Sevier River. Marysvale is the town out of which these prospectors are working.

Bully Boy & Webster—Work on the new 100-ton mill will begin within 10 days and it is expected that the mill will be completed in May. A drift is being driven from the No. 2 tunnel to cut the vein which produced rich ore in the De Witt strike. This work is 300 ft. below the outcrop and 200 ft. below the deepest development of the oreshoot. The management is giving its main attention, however, to the developing and mining of milling ore. There is said to be a large quantity of ore of this character developed.

SALT LAKE COUNTY

Utah Mines Coalition—The winze from the tunnel level is down 150 ft. in good ore. A raise above the tunnel level, which is also called the 800, has opened galena ore. Shipments are again in progress. A snowslide occurred recently, following the path of the bad slide of a year ago, but did no damage on account of the protected position of the buildings.

Alta Consolidated—This company, which was organized in August, 1911, is paying expenses. Two cars of ore have been shipped recently, which ran 75 to 80 oz. silver and 15 to 20% lead, with some copper. Ore has been opened for about 300 ft. along the Brain fissure. The contact is the objective point. Since October, when shipments began, net smeltery returns have amounted to $15,000.

SUMMIT COUNTY

Park City shipments for the week ended Feb. 16 amounted to 4,591,480 pounds.

Daly West—Much development is being done, and weekly shipments of 900 tons of shipping ore are being made. The tonnage of milling ore is being added to, and conditions on the 900-, 1200- and 1550-ft. levels are especially encouraging. The mill has temporarily closed down, on account of lack of water, owing to the freezing of the source of supply. The annual report for the year ended Dec. 31, 1911, shows: Net earnings, $278,259; dividends paid, $162,000; surplus, $116,259; cash on hand, $310,389; ore mined, 88,141 tons; average yield per ton, $9.28.

Thompson - Quincy—The main raise from the 1700-ft. level is up 226 ft., and the contact is estimated to be from 50 to 75 ft. further up. The fissure carries quartz showing a little mineralization with copper staining. The raise looks promising.

American Fork Mining & Power—This company owns three claims near the head of American Fork Cañon, adjoining the Mineral Flat. A tunnel is being driven to prospect at greater depth a fissure outcropping on the surface. Two cars of ore were shipped during 1911 which netted $50 per ton in gold and silver. Another consignment of 15,000 lb. brought $560.

Pacific—The annual stockholders' meeting was held Feb. 6 and the board of directors elected as follows: J. L. Craig, W. A. Stevenson, H. C. Johnson, A. K. Thornton and James Chipman, Jr.

TOOELE COUNTY

Scranton—An official of the company states that the lead orebody discovered several months ago in the north workings from the Delmonte tunnel has been followed 1000 ft. along the strike, and that it is making into the bedding. A winze has been sunk on this ore a distance of 60 ft., with 6 ft. of ore in the bottom. The work is about 500 ft. from the surface. Some of the ore runs 45% lead and 4 oz. silver.

UINTAH COUNTY

A strike of oil in commercial quantity is reported to have been made in a well about 10 miles southwest of Vernal.

Canada

ONTARIO—COBALT

Cobalt shipments for the week ended Feb. 23 were: Nipissing, 186,169 lb.; Drummond, 180,000; Coniagas, 146,100; La Rose, 65,174; Right-of-Way, 61,380; Hudson Bay, 61,264; Wettlaufer, 60,030; Buffalo, 59,887; Casey Cobalt, 48,000; Provincial, 44,440; Crown Reserve, 43,705; City of Cobalt, 42,000; total, 999,149 lb. Bullion shipments were: Nipissing, 93,233 oz.; Crown Reserve, 20,000; Nova Scotia, 17,300; Trethewey, 1983; total, 132,516 ounces.

Little Nipissing—The Peterson Lake company, that took over this mine recently, will pursue a deep-mining policy in the development of the property. The old workings are being utilized and a drift is being driven on the 340-ft. level to intersect a cross vein which assayed well on the 290-ft. level. If this work results satisfactorily, the present workings will probably be abandoned and sinking continued at the Island shaft, to a depth of 340 ft., the present lowest level of the old workings.

La Rose—A depth of 210 ft. has been reached in the winze from the third level, making the total depth of the workings 450 ft., the deepest in that section of the camp. This winze will be continued until it is certain that the Keewatin formation has been reached.

McKinley-Darragh—The directors are considering the erection of an aërial tramway, to handle the Savage mine ore for treatment in the McKinley mill; coarse crushing and regrinding of oversize is meeting with success, as is also bypassing of primary fines, for independent treatment in separate units.

Mann—Good ore is being bagged from an opencut on this Gowganda property, and a small shipment will be made soon. Development on a larger scale will be undertaken.

Miller Lake-O'Brien—This company, at Gowganda, has been a steady shipper for the last year and a half. An orebody 140 ft. long has been opened. The vein at the 250-ft. level, where it has been opened for 20 ft., is of somewhat better grade than on the upper levels, running from 1½ to 6 in. of 4000-oz. ore.

Powerful—This company, at Calcite Lake, Gowganda, has struck good ore again at the 150-ft. level.

Ontario—Porcupine

Imperial—This property has been closed down until further arrangements can be made for financing it.

Bewick-Moreing—It is stated that this company has taken an option on a large block of McIntyre stock.

Wright-Hargraves—The core drill has encountered good ore a short distance below the surface. The property is near Swastika.

American Goldfields—Diamond - drill cores from the 600-ft. level are giving good assays.

Porcupine Union—This company has purchased the three Reilly claims, near Three Nations Lake.

Davidson—It is officially announced that the payments on this property by the Crown Chartered will be completed and a full title acquired. The manager has been instructed to sink to the 200-ft. level and to develop the orebody on the 100-ft. level. A force of 50 men will be employed.

McEnany—A new vein has been cut at both the 100- and 200-ft. levels. It is about 3 ft. wide on the 100-ft. level, widening slightly at depth.

Success—Work on this property has been resumed under the direction of Engineer Gardner.

Dome—The stamp mill, when in operation, will require over 250 tons of ore per day, and in order to supply this amount and maintain a reserve, the number of drills has been increased from 12 to 24.

Schumacher—On this property, lying on the south side of Pearl Lake, which is stated to be rich in surface showings, sinking has begun and development will be pushed actively.

Dome Extension—Some good finds on this property are reported. In No. 4 shaft a crosscut at the 100-ft. level is in 27 ft., showing ore all the way, the orebody being rich in places. Diamond drilling has discovered a 15-in. vein of white quartz at a depth of 227 ft., carrying good gold content. The vein outcrops on surface.

Mexico

The American Smelting & Refining Co. has made an appeal to the State Department at Washington for protection of its smelting works and other properties from robbery and destruction at the hands of the Mexican rebels. This company's plant at Asarco, State of Durango, was attacked by a force of Vasquists and after a short resistance by the Mexican employees the plant was captured and looted.

Coahuila

Panuco—The Continental Copper Co., of San Antonio, Tex., Otto Koehler, president, will soon start operations at the mine at Panuco. A copper leaching process developed by Arthur R. Tuttle, the manager, will be installed with an initial capacity of 50 tons of ore per day. The mine at one time shipped extensively but has been closed for over two years on account of the low grade of the ore and metallurgical difficulties. It is connected with the main-line of the National R.R. by a branch line built by the mining company.

Jalisco

Santo Domingo—An English syndicate is negotiating for the purchase of this property on the Santiago River, near San Pedro Analco. It is extensively developed.

Espada—This mine, in the Hostotipaquillo district, has commenced shipments of bullion and concentrates. It is controlled by A. J. Vick, of San Antonio, Tex. E. Thompson is manager. The company has leased the Virginia-Mexico mill near it and has made connection by aërial tram. The property has been under development for two years.

Mexico

Esperanza—During January the mill crushed 17,718 tons of ore. Total receipts were $139,909; expenses, $108,992; estimated profit, $30,917. Development work amounted to 1275 ft. On Dec. 31, ore reserves were estimated by the consulting engineer at 200,443 dry, metric tons, including developed and probable ore, which it was estimated will yield a profit of $638,887. The estimated profit to be derived from the retreatment of the tailings dump is $440,000, making a total of $1,078,887. The balance sheet on Dec. 31, 1911 showed: Cash and assets readily realizable after providing current liabilities and the final dividend of 1911, $700,542.

San Luis Potosi

Native platinum has been discovered south of the city of San Luis Potosi and an American engineer has made investigations recently. It is probable some explorations will be undertaken. This is the first reported discovery of platinum in Mexico.

Benito Juarez—This extensively equipped gold mine, owned by American capital represented by A. B. Carpenter, of Los Angeles, has been closed for over a year, owing to difficulties of operating during the political disturbances in the country.

Sinaloa

Choix Consolidated—A copper smelting plant, complete in all details, was recently shipped to this company from the Mill & Smelter Engineering Co., of New York.

Sonora

Penn-Sonora—J. W. Pender, of El Paso, has gone to Sonora to take charge of the development of a gold property owned by this company in the district of Magdalena, about 25 miles from Nogales. Mr. Pender has recently been in Pittsburg, Penn., to confer with the officers of the company about a proposed 100-ton mill. It is planned to use Lane mills for grinding.

Central America

Guatemala

Chiantla Mining & Smelting Co.—The Mill & Smelter Engineering Co., of New York, has recently shipped to this company, near Chiantla, a complete silver-lead smelting plant. This machinery is to be sectionalized for mule-back transportation.

Africa

Transvaal

Gold production in the Transvaal in January is reported as follows: Witwatersrand, 709,280 oz.; outside districts, 27,780 oz.; total, 737,060 oz., or $15,235,030. This is an increase of 27,152 oz. over December, and of 86,033 oz. over January, 1911. In January there were 68 mills at work, having a total of 10,195 stamps. The number of negro laborers employed Jan. 31 was 201,375, an increase of 6126 during the month.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Feb. 28—The coal trade is still in disturbed condition, owing chiefly to the delay in transportation and the shortage of cars on many lines. Current demand is now pretty well satisfied by deliveries, but the accumulation of stocks by large consumers is not making much progress. It is understood that the railroads are storing coal at many points in anticipation of trouble, and this is interfering with other trade. While the special weather demand for coal has ceased, there is a steady call for steam coal in larger quantities.

There is much talk in the East of exports in case the English miners strike, as now seems possible. Large shipments are not possible, however, unless the railroads give better service to tidewater.

The anthracite operators and miners are meeting in New York this week to discuss the mining agreement. The operators do not seem disposed to grant the miners' demands; they asked a week for consideration, and the conference was adjourned until March 5. Nothing further has been done in relation to the Western bituminous wage agreement.

British Coal Trade—Exports of fuel from Great Britain, month of January: Coal, 5,421,175; coke, 113,871; briquets, 148,932; coal sent abroad for use of steamships in foreign trade, 1,516,659; total, 7,200,637 long tons; an increase over January, 1910, of 412,958 tons.

IRON TRADE REVIEW

New York, Feb. 28—While there are no new developments of importance in the steel trade, business continues on a good scale, though there are considerable variations in different lines. Probably the most active departments are wire, sheets, plates and tinplates, in all of which buying on a good scale is reported. Prices continue at low levels, and there are no present indications of advances. Structural steel is promising well for spring business and there are large contracts in sight, as well as many small ones coming in. Rail contracts continue to be placed, although there is still much discussion over specifications, and no general agreement has been reached. Car and bridge orders have increased.

Pig iron is, perhaps, a little less active, so far as merchant furnaces are concerned. Foundry orders are numerous enough, but generally small in quantity, and there is much haggling over prices. The ore situation is usettled, and there is not much pressure to close contracts.

The very severe weather has passed and operations at mills are easier. The railroad situation is unsatisfactory still. Transportation is slow and many delays are reported in delivering material.

The Republic Iron & Steel Co. has passed the March dividend on its preferred stock. The company reports that 90 per cent. of the mill capacity is employed, but earnings have been light on account of low prices, and it is not considered policy to pay the dividend at the present time.

Railroad Rates—The Interstate Commerce Commission has found the rate of 63c. per 100 lb. on certain steel products from Mississippi River points to Denver unjust and discriminatory, and has ordered rates of 52c. per 100 lb. on iron and steel bars and of 43c. on plates, sheets and structural steel not fabricated. The Commission has also decided that the increase of present rates on iron and steel in official classification territory shall not be allowed.

Baltimore

Feb. 26—Exports for the week included 1,201,200 lb. steel rails, 684,935 lb. track and bridge material to Port Limon, Costa Rica; 2,391,880 lb. steel billets to Liverpool; 1,580,000 lb. steel rails and 116,165 lb. track material to Glasgow. Imports included 300 tons ferromanganese, 306 tons manganese ore and 340 cases aluminum from Liverpool; 4144 tons pyrites from Huelva, Spain.

Birmingham

Feb. 26—The quotations on pig iron in the Southern territory continue to stiffen around $10.50 per ton, No. 2 foundry and the manufacturers answer inquiries with the statement that the outward movement and the home consumption aggregate more than the make. There is still plenty of pig iron in furnace and warrant yards to meet any and all demands and no preparations are in hand to increase the make. The Southern manufacturers appear to be confident that the present conditions at least will prevail through the better part of the year, if there is not an improvement and as far as can be learned there is no willingness to book any quantity of business for delivery during the latter half of 1912, the present quotations being too strong to overlook prospects for better prices. Inquiries are still strong. The Southern furnace companies are right up with deliveries. Reports have been current that some of the ironmakers in this part of the country have been scaling quotations again but inquiry fails to verify these reports.

Charcoal iron is still selling above $22 per ton with the demand picking up. The scrap-iron market is showing strength with prospects of a better demand.

Furnace repairing is still on throughout the South in the expectation that there will be a strong demand for iron in the near future.

Chicago

Feb. 26—The iron market is flat as regards pig iron and quieter as regards finished products. A few sales of charcoal iron, in carload lots, have been made; coke iron, both Northern and Southern, has little beyond a record of carload sales for the week. The selling agents are not anxious to contract for the last half on the basis of present prices and the melters will not listen to higher quotations. The larger interests are well supplied up to July 1, so that the prospect for several weeks at least is of continued dulness.

Lake Superior charcoal pig iron is quoted at $16.50; Northern No. 2 coke iron at $14@14.50, and Southern No. 2 at $10.50, Birmingham, or $14.85, Chicago. Bad weather has interfered with shipments of pig iron in the last week, and arrivals of coke have been so generally delayed as to cause serious scarcity of coke in the city market.

Railway-track supplies continue to sell fairly well, but there is little new business in steel rails, though inquiries are out for some good-sized lots. An order of 2000 tons has been received by the Illinois Steel Co. from the Kansas City Terminal road. Structural-material contracts are numerous, though not for large tonnage in any one case, and prices continue at 1.28c.@1.33c. for material under 15 in. Bars are in lessened though fair demand, with bar iron 1.15@1.20c., and soft-steel bars 1.25@1.33c. Business in sheets and plates also is quieter, but still good; wire products are active. General business conditions are somewhat better, with touches of spring activity appearing.

Cleveland

Feb. 26—A few additional sales of iron ore are reported, but there is still uncertainty as to prices.

Pig Iron—The market has been quiet, so far as new business is concerned. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.10@13.25 for basic, $13.25 for No. 2 foundry and $12.50 for forge.

Finished Material—Some good contracts are reported for plates and shapes for shipbuilding. Several contracts for structural steel have been let. Railroad material has been in some demand. Prices for bars, sheets and plates are reported lower in several contracts recently let.

Philadelphia

Feb. 28—Eastern furnace interests comment favorably upon the evidences of a diminution in stocks at Southern furnaces because of the prospect of less acute competition in Eastern markets. Eastern furnaces have very little stocks and are fairly well sold up for a few weeks to come. The inquiries within a week for low-grade iron have eliminated a weakening tendency and the requirements now before makers will be filled at fractionally better terms. The pipemakers are in the way of shortly securing a great deal of additional work. Already some inquiries have been made with a view of protecting these anticipated requirements. The low rates for malleable and the known shortage of ready supplies have stimulated inquiry and sales during the week, which will probably lead to still further transactions. There are several large foundry interests in the New England states as well as in New York which are ready to contract for summer delivery but the question of ore and its price is delaying final negotiations. The usual business in forge iron is reported. No. 2 X foundry contracts average $15 and they are mostly small, with gray forge and basic close to $14.25, which is a trifle weaker than a short time ago. A fair brand of Southern gray forge is offered at $13.50 here.

Steel Billets—The activity in crude steel in Western markets is reflected here and in two instances business was closed for moderate quantities at about 50c. above some sales for the past two weeks.

Bars—Bars continue firm under a little freer distribution from mills, partly because of reviving activity from jobbing sources. The inquiries for car-building purposes constitute the backbone of the market at present. While manufacturers are anxious to keep a lot of work ahead there is an abatement of the intense competition which characterized the market during the dead of winter.

Sheets—For some reason not apparent there have been fewer large contracts for sheets, but an increase in retail distribution in both city and country stores. At present galvanized material is inquired for.

Pipes and Tubes—Inquiries for tubes were submitted to manufacturers this week and, while discounts remained where they were, consumers looked for some concessions for contracts extending over a considerable period. Merchant pipe is weak and inactive. Cast pipe is strong.

Plates—The week's business is below the average. The amount of business in sight has increased through inquiries. The mills are well filled with business and a week or two of dullness makes no difference.

Structural Material—No orders are reported for several days. Quotations are not as strong, notwithstanding the mills are well filled up.

Scrap—Dealers report continued indifference and an accumulation of stock which country supplies already arranged for will increase. The scrap market is undergoing a depression which mill necessities do not explain. The inference is that it will be necessary to shade prices on all except No. 1 railroad in order to get rid of it.

Pittsburg

Feb. 27—The tone of the iron and steel market is appreciably weaker, though the change is in the sentiment rather than in the amount of business the mills and furnaces are actually doing. While new buying continues light, and is probably lighter than 30 days ago, there is no dearth of material on which to work, as the merchant furnaces are able to ship pig iron as fast as made and the mills have specifications to maintain the increased pace of production recently attained. The difficulty is a sentimental one. There is very little idle capacity, but this little is having unprecedentedly important effect upon the tone of the market. In certain lines the majority of producers are comfortably sold up, but a few producers are cutting prices generally, apparently having no courage to await the increased demand which, in most quarters, is expected to materialize within a very short time on account of the approach of better weather conditions.

The sheet trade is probably the weakest branch of the finished-steel industry. There has been general and progressive cutting since the market firmed up to a basis of 1.90c. for black sheets, 28 gage, in December, while in the past week the market was cut wide open by one interest, a quotation being made so low that it is claimed buyers were actually frightened, and refused to make purchases when a somewhat higher price might have interested them. The open market is quotable on as low a basis as prevailed in November, when the lowest prices in the history of the sheet trade were made. The special quotation referred to is stated by authorities to be the lowest ever heard. The condition is startling when it is considered that, with the exception of a few plants long idle, the sheet mills are running at a very comfortable gait.

Shapes are fairly firm, and this is also the case with plates, although one interest, making a limited range of sizes, is cutting rather freely. The steel-bar mills are comfortably filled and there is little cutting in this line. Bars, plates and shapes are quotable at 1.10c., Pittsburg, this being an inside price in the case of shapes, but one readily done on plates.

Pig Iron—The market continues very quiet. As production by the merchant furnaces is relatively limited, and the output is comfortably sold, the quietness has not resulted in any weakness. We continue to quote: Bessemer, $14@14.25; basic, $12.25@12.50; No. 2 foundry and malleable, $13@13.25; gray forge, $12.50@12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—Sales of limited tonnages are being made at the full price, which we quote at $41, Baltimore, for prompt or forward, freight to Pittsburg being $1.95 per ton.

Steel—Most of the large mills are behind in deliveries of billets and sheet bars on their regular contracts, and there continues to be a scattering demand for small prompt lots. The mills which are well sold up comprise all the bessemer production in the immediate Pittsburg district, while at Youngstown there are one or two sellers of bessemer material. At Pittsburg, openhearth steel is not as high as bessemer, but there is little unsold tonnage in openhearth, and predictions are made that within a week or two openhearth steel will be higher, through the unsold tonnage being absorbed. We quote: Bessemer billets, Pittsburg, $20@20.50; openhearth billets, Pittsburg, $19.50@20; bessemer billets, Youngstown, $19@19.50. Sheet bars are not bringing the $1 spread above billets which formerly prevailed, and can be quoted at 50@75c. advance over billets. Wire rods are nominally $25, Pittsburg.

Sheets—As noted above, the sheet market is being badly cut by a few mills, one in particular having named some very low prices. Demand for sheets upon contracts is really very good, some mills having surprisingly heavy mails. The leading interest is operating fully 85 per cent. of its available capacity, counting out two or three small plants which will probably never again be operated, its business being good in both export and domestic markets, so that it is rarely naming competitive prices, and the low prices going are made by relatively few mills. We quote the open market on black sheets $1 a ton lower than a week ago: Black sheets, 28 gage, 1.80@1.85c.; galvanized, 2.85@2.90c.; blue annealed, 10 gage, 1.35@1.40c.; painted corrugated roofing, $1.33@1.35 per square; galvanized, $2.47@2.50.

St. Louis

Feb. 26—The pig-iron business seems to be a little better both locally and in other parts of the country. Producers are stiffening up on the price a little, to bring it up to $10.50, Birmingham, or $14.25, St. Louis, for No. 2 Southern foundry as the minimum. The majority of orders are small and for deliveries during the first half. Northern iron is slow and No. 2 is bringing $14.25@14.75, St. Louis.

The demand for foundry coke is fair and 72-hour foundry coke is being quoted around $5.20 per ton, St. Louis.

Canadian Iron

The production of pig iron in Canada in 1911, as reported to the American Iron & Steel Association, was 824,345 tons, an increase of 84,135 tons, or 11.3 per cent., over 1910. The production for 12 years past has been as follows:

1900	86,090	1906	541,957
1901	244,976	1907	581,146
1902	319,557	1908	563,672
1903	265,418	1909	677,090
1904	270,942	1910	740,210
1905	468,003	1911	824,345

The production in 1911 was much the largest in the history of the Dominion. Of the total production in 1911, 799,716 tons were made with coke and 24,629 tons with charcoal, including a small quantity made in the electric furnace.

Iron Ore Trade

Swedish Iron Ore—Exports of iron ore from the Tuollavaara mines in 1911 were 82,933 tons, an increase of 14,604 tons over 1910. Exports from the Luossavaara-Kirunavaara group were 2,469,374 tons, an increase of 423,953 tons. Ore mined from the Grangesberg group in 1911 was 848,885 tons, of which 630,455 tons were exported.

Belgian Iron Ore—Imports of iron ore in Belgium in 1911 were 5,675,207 metric tons; exports, 522,893 tons. As compared with 1910 the imports increased 491,785 tons.

METAL MARKETS

New York, Feb. 28—The metal markets show activity in copper and zinc for the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Jan. 1912..	$ 1,915,202	$ 5,165,543	Imp.	$3,250,341
" 1911..	923,676	9,540,830	Imp.	8,617,154
Year 1912..	1,915,202	5,165,543	Imp.	3,250,341
" 1911..	923,676	9,540,830	Imp.	8,617,154
Silver				
Jan. 1912..	6,027,905	4,358,009	Exp.	1,669,896
" 1911..	5,651,076	3,551,426	Exp.	2,099,650
Year 1912..	6,027,905	4,358,009	Exp.	1,669,896
" 1911..	5,651,076	3,551,426	Exp.	2,099,650

Exports from the port of New York, week ended Feb. 24: Gold, $1,950,830, chiefly to South America; silver, $1,045,572, principally to London and Paris. Imports: Gold, $172,111; silver, $269,619, largely from South America.

Gold—Prices on the open market in London continued at 77s. 9d. per oz. for bars and 76s. 4d. per oz for American coin. The chief demand was for India. In New York some gold is still going to South America.

Iridium—Prices are unchanged, $64 per oz. being asked for pure metal.

Platinum—The market is quiet, and we continue to quote $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Silver—The market has had some reaction since the sudden fall to 26¾d. and with inquiry from various quarters, the tendency looks more favorable.

SILVER AND STERLING EXCHANGE

Feb.	22	23	24	26	27	28
New York....	....	58⅝	58½	58½	58½	58⅞
London.....	27 1/16	27	26 13/16	26 13/16	26	27⅛
Sterling Ex..	....	4.8735	4.8715	4.8720	4.8715	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Feb. 15, reported by Messrs. Pixley & Abell:

	1911	1912	Changes	
India........	£1,395,300	£1,076,800	D.	£318,500
China........	406,000	400,000	D.	6,000
Total......	£1,801,300	£1,576,800	D.	£324,500

India Council bills in London averaged 16.15d. per rupee for the week.

Foreign commerce of the United States, year ended Dec. 31, as valued by the Bureau of Statistics, Department of Commerce and Labor:

Merchandise	1910	1911
Exports..................	$1,866,258,904	$2,092,373,141
Imports.................	1,562,904,151	1,532,931,861
Excess, exports	$303,354,753	$ 559,441,280
Add excess of experts, silver..........		21,918,075
Total..............................		$ 581,359,355
Deduct excess ef imports, gold.......		20,262,110
Net export balance..................		$ 561,097,245

The gold and silver movement in detail will be found in the table at the head of this column.

Copper, Tin, Lead and Zinc

Copper—The stiffening tendency referred to in our last report became pronounced right after the holiday when it developed that the quantities of electrolytic copper available at less than 14½c., delivered, usual terms, had been about exhausted. This led to the placing of large orders to cover requirements not yet contracted for and many millions of pounds were sold on Feb. 23 and 24, both for domestic and foreign shipment, and for March and April delivery, these transactions being largely at 14½c., delivered, usual terms, corresponding to 14.30@14.35c., net cash, New York. Throughout the week the demand has been freely met. Some fair sales of Lake copper at 14½c. have been reported and a few transactions as high as 14⅝c. The close is steady at 14½@14⅝c. for Lake; 14.30@14.35c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 14⅛@14¼c. as the average for the week.

NEW YORK

Feb.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
22	......	......	....	....	....	......	......
23	14½	14.25 @14.35	43	4 00	3.92½ @3.97½	6 45 @6 65	6.30 @6.50
24	14½ @14⅝	14.30 @14.35	43	4.00	3 92½ @3.97½	6 45 @6 65	6 30 @6 60
26	14½ @14⅝	14 30 @14.35	43⅛	4.00	3 92½ @3.97½	6.45 @6 75	6.30 @6 60
27	14½ @14⅝	14.30 @14.35	43⅛	4.00	3.92½ @3.97½	6.45 @6.75	6.30 @6.60
28	14½ @14⅝	14 30 @14 35	42⅞	4.00	3 92½ @3.97½	6 45 @6.75	6 30 @6.60

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Feb.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
22	63¾	64 7/16	68	196¼	192	15¾	26⅝
23	63⅝	64⅜	67¾	195	191½	15 13/16	26½
24	......	......	......	......	......	......	....
26	64⅛	64 13/16	68¼	196	191¾	15⅞	26½
27	64¼	64 15/16	68¼	195¼	191¼	15 13/16	26¾
28	64⅜	65 1/16	68¼	193¾	189¾	15 13/16	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

The London standard market has reflected the improvement in the quotation for refined copper, and has advanced gradually to £64 7s. 6d. for spot and £65 1s. 3d. for three months, which are the quotations at the close.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for smaller quantities. Copper wire has been advanced ¼c. and is now 15¼c., carload lots at mill.

Copper exports from New York for the week were 4008 long tons. Our special correspondent gives the exports from Baltimore at 1907 tons.

Tin—Transactions on the London Metal Exchange no longer reflect actual conditions in the market. The most important factors in the trade refuse to adhere to the conditions of the new contract and refrain from doing business on the exchange. Therefore, most of the buying of Straits tin has to be done outside of the Metal Exchange, and the premiums to be paid for Straits over the standard price vary continually.

The standard market ruled fairly firm all through the weak, but closes somewhat easier at £193 15s. for spot and £189 15s. for three months.

Domestic buying was confined to March deliveries, in which a satisfactory business has been done. The quotations in this market followed closely those of London, and the market closes at about 42⅞c. for March delivery.

Lead—The market is unchanged at 4c., New York, the A. S. & R. Co. continuing to supply the demand freely at that price. Some speculative orders were placed for St. Louis delivery at prices higher than the schedule of the Smelting Company, resulting in a quotation there of 3.92½@3.97½ cents.

The foreign market fluctuates within narrow limits and closes steady at £15 16s. 3d. for Spanish, and 2s. 6d. more for English lead.

Spelter—The market is exceedingly firm. Smelters have disposed of practically their entire output up to the end of April, so that the volume of business prior to May must of necessity be small. The few belated buyers who require March and April shipment have to pay varying premiums, but the quotations for deliveries beyond April have also advanced and a good business has been doing for May, while some sales have been made as far ahead as June. Smelters are quite willing to supply the demand for the latter month at reasonable prices, and this accounts for the wide range in the quotations, the close being 6.30@6.60c. St. Louis, and 6.45@6.75c. New York.

The London market is unchanged at £26 15s. for good ordinaries and £26 17s. 6d. for specials.

Base price of zinc sheets is $8.25 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Sales of prime zinc dust were made at 7⅜c. in the early part of the week and at 7¼c. in the latter part. At the close it was freely offered at 7¼c. We quote 7¼@7⅜c. for the week.

Beer, Sondheimer & Co., who have been operating the Altoona zinc works under lease, have temporarily retired from that operation, and in the meanwhile the plant is being run by the Kansas Zinc Co., its owner.

Other Metals

Aluminum—Business has been rather dull and prices remain about the same. We quote 19¼@19½c. per lb. for No. 1 ingots, New York.

It is reported that a provisional agreement has been made between the Neuhausen company and the leading French producers. Negotiations have been opened with the English and Canadian producers to put an end to the sharp competition which has prevailed for over two years. The result is uncertain.

Antimony—Business is inclined to be quiet, at unchanged prices. Cookson's is 7¼@7⅜c. per lb., Hallett's is 7⅜@7½c., while 6¾@6⅞c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—Business is fair and the market is steady at last prices. The New York quotation is $46 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $45 for domestic orders and $42.50 for export. The London price is £8 7s. 6d. per flask, while £8 5s. is quoted from second hands.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

German Metal Trade

Imports and exports of metals other than iron and steel in the German Empire, year ended Dec. 31, were, in metric tons:

	Imports	Exports	Excess	
Copper..........	213,004	86,036	Imp.	126,968
Copper, 1910....	200,774	80,691	Imp.	120,083
Tin.....	14,691	10,638	Imp.	4,053
Tin, 1910.......	14,469	10,206	Imp.	4,263
Lead............	100,730	47,187	Imp.	53,543
Lead, 1910......	81,851	44,981	Imp.	36,870
Zinc.............	51,289	120,917	Exp.	69,678
Zinc, 1910......	41,633	118,721	Exp.	77,088
Nickel...........	2,704	2,495	Imp.	209
Nickel, 1910....	4,693	1,709	Imp	2,984
Aluminum.......	10,573	3,415	Imp.	7,158
Aluminum, '10.	9,980	2,377	Imp.	7,603
Minor metals....	1,790	16,337	Exp.	14,547
Minor, 1910....	1,519	13,294	Exp.	11,775

The figures include alloys and manufactures of the different metals. The imports and exports of ores for the nine months were, in metric tons:

Ores:	Imports	Exports	Excess	
Gold ore....	250	....	Imp.	250
Gold ore, 1910.	139	1	Imp.	138
Silver ore........	2,695	8	Imp.	2,687
Silver ore, '10..	2,091	....	Imp.	2,091
Copper ore......	23,327	27,396	Exp.	4,069
Copper ore, '10.	22,194	23,729	Exp.	1,535
Tin ore...	17,971	72	Imp.	17,899
Tin ore, 1910...	17,343	25	Imp.	17,318
Lead ore.........	143,598	3,746	Imp.	139,852
Lead ore, 1910 .	112,151	2,361	Imp.	109,790
Zinc ore..........	262,399	48,998	Imp.	213,401
Zinc ore, 1910..	240,584	59,440	Imp.	181,144
Nickel ore......	14,897	....	Imp.	14,897
Nickel ore, '10.	9,937	....	Imp.	9,937
Miscellaneous...	10,828	900	Imp.	9,928
Miscellan's, '10	6,468	747	Imp.	5,721
Chrome ore... ..	16,022	1,795	Imp.	14,227
Chrome ore, '10	24,470	386	Imp.	24,084
Pyrites...........	862,214	11,015	Imp.	851,199
Pyrites, 1910. .	792,235	9,871	Imp.	782,364

Miscellaneous includes ores of tungsten, molybdenum and other rare metals.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, month of January, figures in long tons, except quicksilver, which is in pounds:

Metals	Imports	Exports	Excess	
Copper, long tons	13,854	5,910	Imp.	7,944
Copper, 1910....	14,124	6,658	Imp.	7,466
Tin, long tons....	4,753	4,673	Imp.	80
Tin, 1910........	3,158	3,472	Exp.	314
Lead, long tons..	14,095	3,572	Imp.	10,523
Lead, 1910......	23,501	4,022	Imp.	19,479
Spelter, l'g tons..	13,486	663	Imp.	12,823
Spelter, 1910....	10,771	754	Imp.	10,017
Quicksilver, lb...	469,650	180,675	Imp.	288,975
Quicksilver, '10	54,197	350,525	Exp.	296,328
Minor met's, tons	604	2,406	Exp.	1,802
Minor, 1910.....	374	1,496	Exp.	1,122
Ores				
Tin ore and con.	2,335	....	Imp.	2,335
Tin ore, 1910...	2,053	....	Imp.	2,053
Pyrites..........	90,340	....	Imp.	90,340
Pyrites, 1910...	97,867	....	Imp.	97,867

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Miscellaneous metals include nickel, aluminum and the minor metals and alloys.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 24—The high price of zinc sulphide ore was $51; the basis, per ton of 60 per cent. zinc, was $45@48. Zinc silicate sold on a base of $25@27 per ton of 40% zinc. The average price, all grades, was $43.84. Lead was reported sold as high as $54.50 per ton for next week's delivery. The highest settling price of this week was $54, and the average, all grades of lead, was $53.64 per ton.

SHIPMENTS, WEEK ENDED FEB. 24

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville.	3,149,340	.....	805,710	$ 92,613
Joplin........	907,920	......	32,610	21,725
Carl Junction	684,260	......	......	14,600
Jackson......	582,700	.....	12,730	12,815
Duenweg....	396,600	......	67,620	10,749
Alba-Neck....	416,120	......	......	9,778
Miami........	470,720	......	......	8,470
Galena........	294,560	......	19,350	6,980
Cave Springs.	344,060	......	......	6,535
Oronogo......	250,590	......	......	5,665
Carthage	236,790	......	......	6,208
Lawton	196,980	......	......	4,520
Spurgeon . ..	59,480	198,500	3,590	4,000
Springfield ..	145,230	.....	......	3,400
Stott City....	132,310	......	......	2,910
Aurora........	76,870	65,500	......	2,670
Granby	......	63,370	11,300	1,100
Quapaw......	54,820	......	......	986
Totals......	8,299,350	327,370	952,910	$214,725
2 mos......	72,152,210	4,361,790	11,206,640	$1,965,369

Blende val., the week, $184,562; 2 mos., $1,691,503
Calamine, the week, 4,610; 2 mos., 59,414
Lead value, the week, 25,553; 2 mos., 314,452

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January..	$41 85	$44 90	$40 55	$43.54	$55.68	$58.92
February .	40 21	..	39 16	......	54 46	.....
March....	39 85	.....	38.45	......	54 57	....
April......	38 88	.	37 47	......	56 37	.
May.........	38.25	..	36 79	....	65 21	
June.........	40.50	......	38.18	......	56 49	....
July.........	40 75	..	38 36	......	58 81	...
August	42 50	.	41 28	....	60 74	....
September	42 63	.....	41 29	....	69 33	.....
October.....	42.38	..	40.89	......	54.72	.....
November...	45.40	.	43.25	...	57 19	.....
December...	44.13	....	40.70	..	62 03	.....
Year. ...	$41.45	.	$39.90	.....	$56.76	.....

NOTE- Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold

Sixteen inches of snow fell over this district last Tuesday, then drifted in places, to 6 and 15 ft. in depth. It paralyzed the mining industry, except for closed in mines. Miners could not get to their work for two days at any outlying mines. It was a low temperature snow and the temperature has been above freezing ever since. Beside outlying mines those producing silicate were generally disabled most of the week. Long wagon hauls could not be made to advantage and in addition cars were scarce, the railroads being blockaded a couple of days, thus reducing the shipment as well as the output.

Platteville, Wis., Feb. 24—The highest price paid this week for zinc ore was $48; the base price, 60 per cent. zinc, was $46.50@47. The highest price paid for lead ore was $50; the base price, 80 per cent. lead, was $48@49 per ton.

SHIPMENTS, WEEK ENDED FEB. 24

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	889,320	... ...	63,900
Galena	610,200	....	....
Mineral Point	525,130	....	.. ....
Benton	461,700	....	....
Hazel Green	380,000	....	....
Dodgeville	308,680	....	....
Shullsburg	192,300	. ...	....
Harker	164,560	....	......
Rewey	142,000	....	....
Cuba City	133,700	75,310	158,200
Total	3,807,590	75,310	222,100
Year to date	27,942,290	741,390	1,920,400

Shipped during week to separating plants, 1,843,360 lb. zinc ore.

Other Ore Markets

Tungsten Ore—Ferberite, wolframite and huebnerite ores, $6.50@7 per unit per ton of 2000 lb. of ore containing 60 per cent. of tungsten trioxide. For scheelite ore, 50c.@$1.50 per unit less.

Zinc Ores—For Rocky Mountain blende of good quality, especially as to iron and lead contents, the current price is for the zinc contents, less eight units at the St. Louis price for spelter; with a deduction of $16 to $18 per 2000 lb. of ore; sellers to deliver ore at smeltery. Penalties may be charged for detrimental impurities. Blende is readily obtainable at Joplin on the basis of 87 per cent. of the zinc content at St. Louis quotation, less $16 for treatment, and less penalties for iron and lime.

Chemicals

New York, Feb. 28—The general markets are reported in fair condition, with some increase in business.

Nitrate of Soda—The market is more active, though the spring trade has not yet fairly started. Prices are again slightly firmer. Quotations are 2.25c. per lb. for spot and futures up to May, and 2.22½c. for later positions.

Arsenic—Demand is fair and spot supplies are rather scarce. White arsenic is quoted at $3 per 100 lb. for spot and $2.75 for futures. Producers are holding out of the market for the present; the price would probably break if offerings were larger.

Copper Sulphate—Business is reported good, but prices are unchanged. Current quotations are $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

MINING STOCKS

New York, Feb. 28—Feb. 22 was a holiday. On Feb. 23 trading was again light on the Exchange, but prices firm, and there were small advances in steel common and Amalgamated Copper. There was some activity on the Curb in a few of the copper stocks, but otherwise the market was dull.

On Feb. 24 the Curb reported fair sales of Ray Central, Inspiration and one or two other coppers, with some dealings in Lehigh Valley Coal Sales Co. The Exchange was again dull, but fairly strong.

Feb. 26 the Exchange remained quiet and rather dull. Steel common held its own, but Republic Iron & Steel declined. Nearly all the coppers listed on the Exchange lost a point or so. On the Curb dealing was more active, but irregular. Copper stocks were in demand, at small changes, chiefly downward. Cobalts were slow, but Porcupines active.

Feb. 27 the Exchange continued quiet and slow, with light trading and prices firm. The Curb was more active, but irregular, some stocks advancing and others declining. The copper stocks were about stationary. Lehigh Valley Coal Sales Co. was off several points. Feb. 28 the conditions were practically unchanged.

Boston, Feb. 27—The continued advancing tendency of copper has caused a maintenance of the strength in the share market, although at a minimum of business. The strength holds largely in the Lake Superior group, although the sharp fluctuations in Amalgamated in the New York market have drawn attention to a more or less extent to the entire copper share list. In fact the undertone is good enough to warrant a general improvement in prices.

Mayflower and Old Colony continue to be the active features for the drill showings from the former are by all odd the best ever seen in recent years. Added to this is the attempt to get new representation on the board of directors by banking interests which have been heavy buyers of Mayflower stock recently. Perhaps the most significant fact is the equivalent of a $37 advance in the price of Calumet & Hecla shares to $454, ex-dividend, of the $8 quarterly dividend declaration. Wolverine has advanced $5 to $105, on expectations of increased dividend. Isle Royale has also been conspicuous, both for its strength and activity.

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company	Nov.	Dec.	Jan.
Alaska shipments	1,274,655	4,995,008	3,701,010
Anaconda	20,850,000	23,500,000	26,350,000
Arizona, Ltd.	2,960,000	3,100,000	3,200,000
Balaklala	....	....	....
Copper Queen	6,946,775	8,365,265	6,748,264
Calumet & Ariz.	4,390,000	4,486,000	4,544,000
Detroit	1,941,498	1,969,313	1,941,970
East Butte	983,405	1,498,000	....
Mammoth	1,793,181	1,721,404	1,665,319
Mason Valley	....	....	600,000
Miami	2,500,000	2,500,000	2,600,000
Nevada Con	6,207,983	4,679,674	6,309,228
Old Dominion	2,082,000	2,610,000	2,044,000
Ray	2,517,000	2,660,000	... .
Shannon	1,256,000	1,255,858	1,550,000
South Utah	361,681	267,514	189,678
United Verde*	2,500,000	2,000,000	....
Utah Copper Co.	9,117,961	9,039,557	8,156,612
Lake Superior*	18,600,000	17,500,000	....
Non-rep. mines*	8,983,000	8,500,000	8,400,000
Total production	94,265,139	100,647,593	....
Imports, bars, etc.	17,224,725	21,101,256	....
Total blister	111,489,864	121,748,849	....
Imp. in ore & matte	4,767,217	5,159,997	....
Total	116,257,081	126,908,846	....
Brit. Col. Cos.:			
British Col. Copper	....	....	....
Granby	....	....	....
Mexican Cos.:			
Boleo	....	2,645,640	2,315,040
Cananea	....	3,706,000	3,552,000
Moctezuma	1,682,768	2,864,464	2,732,867
Other Foreign:			
Cape Cop., S. Africa	857,920	701,120	784,000
Kysbtim, Russia	1,170,000	1,570,000	....
Spassky, Russia	685,440	721,280	....
Famatina, Argen.	174,720	217,280	....
Tilt Cove, Newf'd.	....	....	153,257
Exports from:			
Chile	4,704,000	6,824,000	8,064,000
Australia	7,168,000	11,200,000	7,056,000
Arrivals in Europe from other count.†	12,064,640	16,331,840	13,144,320

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
II, 1911	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,684	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	....	....	....

VISIBLE STOCKS

	United States	Europe	Total
III, 1911	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,565,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	....	....	....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Trading on the Curb has been light, with the cents stocks predominating. Ely Consolidated had a sharp break of 15c. to 36c., on the levying of another 5c. assessment.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1.00
Alpha Con., Nev	Feb. 21	Mar. 13	0.05
Andes, Nev	Feb. 7	Feb. 28	0.05
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.50
Challenge, Nev	Mar. 5	Mar. 26	0 05
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev	Feb. 14	Mar. 6	0.05
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0.05
Hancock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
King David, Utah	Feb. 13	Mar. 6	0.005
Lehi Tintic, Utah	Feb. 29	....	0.01½
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
Ojibway, Mich	Jan. 10	....	1 005
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz.	Jan. 15	....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002
Swansea Con., Utah	Jan. 17	Feb. 8	0.01
Tintic Standard, Utah	Jan. 8	Feb. 5	0 00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24 154	24.865	25.887
February	51.534	52 222	......	23.794	24 081	......
March	51.454	52.745	......	23.690	24.324	......
April	53 221	53.325	......	24 483	24.595	......
May	53 870	53.308	......	24 797	24.583	......
June	53.462	53.043	......	24 651	24 486	......
July	54.150	52.630	......	25.034	24.286	......
August	52 912	52.171	......	24 428	24.082	......
September	53 295	52 440	......	24 567	24 209	......
October	55 490	53.340	......	25.596	24.594	......
November	55 635	55.719	......	25.680	25.649	......
December	54 428	54.905	......	25.160	25.349	......
Year	53.486	53.304	......	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	14.094	12 680	14.337	55.600	62.760
February	12.256	...	12 611	...	54 974	....
March	12 139	...	12 447	....	54.704	.
April	12 019	..	12.275	.	54 034	.
May	11.989		12.214	.	54.313	.
June	12.385		12.611		56.365	..
July	12 463	.	12 720	..	56 673	
August	12 405	.	12 634		56 266	.
September	12 201	....	12 508		55 253	.....
October	12 189	..	12 370		55 170	...
November	12 616	.	12 769		57 253	.....
December	13 552	.	13 768		62 068	.....
Year	12 376	..	12 634		55.973	...

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	
February	41 614		August	43 319	.
March	40 157		September	39 755	.
April	42 185		October	41 1[illegible]	..
May	43 115		November	43 125	..
June	44 [illegible]		December	44 655	..
			Av. Year	42 281	..

Prices are in cents per pound

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4.435	4 334	4.327	13 009	15.619
February	4 440	......	4 266	......	13 043	......
March	4.394	......	4 238	......	13 122	......
April	4 412	......	4 262	......	12.889	.....
May	4.373	......	4.223	......	12 984	......
June	4 435	......	4 292	......	13.260	.....
July	4.499	......	4.397	......	13 530	.....
August	4 500	......	4 406	......	14.260	......
September	4 485	.....	4 356	......	14 744	......
October	4.265	......	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	.....
December	4.450	......	4 332	......	15.648	.....
Year	4 420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	......	5 368	......	23 276	......
March	5.563	......	5.413	......	23 016	......
April	5 399	......	5.249	......	23 743	......
May	5 348	......	5.198	......	24.375	......
June	5 520	......	5 370	.....	24.612	......
July	5 695	......	5 545	......	25 006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	......	27 750	.....
October	6.102	......	5.951	......	27.256	.....
November	6.380	......	6.223	......	26.795	......
December	6 301	......	6.151	......	26.849	......
Year	5.758	......	5 608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14.75	$14.00
February	15 90	......	14 50	......	14 81	......
March	15.90	......	14 65	......	14.96	......
April	15 90	......	14 65	......	15 00	......
May	15.90	......	14 30	......	14 72	......
June	15 90	......	14 06	......	14.66	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Feb. 27

Name of Comp.	Bid.
Acacia	.06
Cripple Cr'k Con.	02¾
C. K. & N.	15
Doctor Jack Pot	05½
Elkton Con	.60
El Paso	.71
Findlay	06
Gold Dollar	15¼
Gold Sovereign	.02¼
Isabella	.12⅞
Jack Pot	.05
Jennie Sample	05
Lexington	01
Moon Anchor	01
Old Gold	03⅞
Mary McKinney	48
Pharmacist	.02
Portland	90
Vindicator	70
Work	.03

SALT LAKE Feb. 27

Name of Comp.	Bid.
Beck Tunnel	.14
Black Jack	.13
Carisa	‡ 15
Cedar Talisman	.02¼
Colorado Mining	36
Columbus Con	24
Daly-Judge	5 75
Grand Central	72
Iron Blossom	1 25
Little Bell	38
Lower Mammoth	03¼
Mason Valley	12 00
May Day	15½
Nevada Hills	2 30
New York	03½
Prince Con	1 15
Silver King Coal'n	1 55
Sioux Con.	10
Uncle Sam	28¼
Yankee	15

TORONTO Feb. 27

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6 80	Pearl Lake	20
Hudson Bay	$70 00	Porcu. Gold.	44
Temiskaming	35	Porcu. Tisdale	03
Wettlaufer-Lor	76	Preston E. D	06
Apex	06	West Dome	45
Central	3 62½	Standard	21
Doble	69	Foley O'Brien	32
Dome Exten	43	Rea	70
Hollinger	10 75	Crown Chartered	19
Imperial	05	Swastika	23

SAN FRANCISCO Feb. 27

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.09	Belmont	9.90
Belcher	60	Jim Butler	.36
Best & Belcher	.15	MacNamara	.19
Caledonia	4.00	Midway	.28
Challenge Con	.25	Mont.-Tonopah	1 10
Chollar	.16	North Star	.29
Confidence	1.10	West End Con	1 02½
Con. Virginia	.93	Atlanta	.15
Crown Point	.59	Booth	.05
Gould & Curry	07	C.O.D. Con	12
Hale & Norcross	.31	Comb. Frac	14
Mexican	3.67½	Jumbo Extension	23
Occidental	60	Pitts.-Silver Peak	1 17½
Ophir	1.57½	Silver Pick	.06
Overman	.65	St. Ives	.30
Potosi	10	Tramp Con	.01
Savage	.26	Argonaut	2.00
Sierra Nevada	.36	Bunker Hill	‡5 50
Union Con	1 25	Cent. Eureka	35
Yellow Jacket	.59	So. Eureka	5 25

N. Y. EXCH. Feb. 27

Name of Comp.	Clg.
Amalgamated	66½
Am. Agri. Chem.	58½
Am.Sm.&Ref.,com	70⅞
Am. Sm.& Ref., pf.	103½
Am. Sm. Sec., pf. B	86
Anaconda	36
Batopilas Min	‡1¼
BethlehemSteelpf	57⅞
Chino	25¼
Federal M.& S., pf.	37¾
Goldfield Con	4½
Great Nor., ore ctf.	37
Homestake	‡87¾
Miami Copper	24
Nat'nalLead,com.	53⅞
National Lead, pf.	107½
Nev. Consol	19¼
Pittsburg Coal, pf.	‡78
Ray Con	17⅛
RepublicI&S.com	16¾
Republic I & S, pf.	66⅜
SlossSheffi'd,com.	‡37
Sloss Sheffield, pf.	‡108¼
Tennessee Copper	36¼
Utah Copper	56⅝
U. S. Steel, com	60⅛
U. S. Steel, pf	108¼
Va. Car. Chem	53¼

N. Y. CURB Feb. 27

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	.47
Braden Copper	5½
B. C. Copper	4½
Buffalo Mines	1.20
Butte & Vipond	‡ 53
Butte Coalition	22⅞
Cobalt Central	‡.01
Con. Ariz Sm.	9/16
Davis-Daly	5/16
Diam'field-Daisy	‡9
Ely Con	⅜
Florence	69
Giroux	4½
Gold Hill Con	¼
Greene Cananea	7⅞
Greenwater	06
Guggen. Exp	180
Inspiration Con	18
Internat. S. & R	‡128
Kerr Lake	2 15/16
La Rose	3¾
McKinley-Dar-Sa.	1
Min. Co. of A. new	3⅜
Nev Utah M. & S	1/16
Nipissing Mines	7½
Ohio Copper	1 1/16
Pacific Sm. & M.	¼
Porcupine T'nsite	‡ 03½
Precious Metals	‡1⅜
Ray Central	2⅛
Red Warrior	‡1½
South Utah M & S	‡¼
Standard Oil (Old)	780
Stand'd Oil of N.J.	360
Stand'd Oil Subs.	335
Stewart	1 1
Tonopah	7¼
Tonopah Ex	1½
Tri-Bullion	[illegible]
Tularosa	¾
Yukon Gold	3⅛

LONDON Feb. 28

Name of Com.	Clg.
Camp Bird	£1 9s 3d
Dolores	1 10 0
El Oro	0 16 0
Esperanza	1 16 3
Mexico Mines	7 2 6
Oroville	0 5 0
Stratton'sInd.	0 3 1½
Tomboy	1 1 3

BOSTON EXCH. Feb. 27

Name of Comp.	Clg.
Adventure	6¾
Algomah	6
Allouez	41
Am. Zinc	25
Ariz. Com., ctfs.	4
Bonanza	42
Boston & Corbin	7
Butte & Balak	4¼
Calumet & Ariz	60
Calumet & Hecla	460
Centennial	21
Con. Mercur	‡.03
Copper Range	54
Daly West	5¼
East Butte	12½
Franklin	12¾
Granby	35
Hancock	34
Hedley Gold	17½
Helvetia	‡1
Indiana	14½
Island Cr'k, com.	44
Island Cr'k, pfd.	87
Isle Royale	25½
Keweenaw	1¼
Lake	36⅜
La Salle	4½
Mass	8¼
Michigan	3
Mohawk	55¾
New Arcadian	‡3⅞
New Idria Quick.	7¾
North Butte	25½
North Lake	6
Ojibway	5⅛
Old Dominion	46¼
Osceola	115
Quincy	79
Shannon	9¾
Shattuck-Ariz	19¼
Superior	26½
Superior & Bost	3⅛
Tamarack	28
Trinity	5½
Tuolumne	3⅞
U. S. Smelting	35⅞
U. S. Smelt'g, pf.	48
Utah Apex	2 11/16
Utah Con	14¾
Victoria	4½
Winona	7¾
Wolverine	104
Wyandot	2⅜

BOSTON CURB Feb. 27

Name of Comp.	Last
Ahmeek	240
Bingham Mines	3¼
Boston Ely	1¼
Boswyocolo	09
Cactus	12
Calaveras	1½
Chief Cons	95
Corbin	2 [illegible]
Cortez	1¼
Crown Reserve	2¼
First Nat. Cop	2¼
Majestic	45
Mazatan	‡1
Moneta Porc	14
Nevada-Douglas	3⅜
New Baltic	4
Oneco	2½
Raven Copper	.33
Rhode Island Coal	26
San Antonio	‡3¼
South Lake	5¼
Trethewey	.62
Union Mines	‡1
United Verde Ext.	.35
Vulture	‡5¾

‡Last quotation.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue, 9300 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Editorials:
  The Mystery of the Lead Market 483
  The British Coal Strike.......... 484
  The Situation in Mexico.......... 484
  Changes at the Lake.............. 484
Correspondence and Discussion:
  Safety Devices for Hoisting through Inclines 485
  The Geology and Mining of Clay.. 485
Osceola Report 486
February Dividends 486
Chronology of Mining for February, 1912 486
The Anglo-American Club of Freiberg, Saxony 486
January Operations at Goldfield Consolidated 487
*Iron Mining in the Urals.......... 487
Breitung Aid Fund................. 487
Foster's Amendment to Bureau of Mines Act 487
Cornish Mining Notes.............. 488
Western Branch, Canadian Mining Institute 488
Details of Practical Mining:
  *A Wagon Oil Tank....Lowering the Water in a Choked Shaft....*Powder House with Concrete Roof....*Dam for Settling Pond....Draining a Shaft through a Drill Hole....Grounding Electric Circuits....*Patching an Air Compressor Cylinder 489
A Discussion of Mining Law. H. V. Winchell 493
Byproduct Coke Ovens............. 497
*Cyaniding Tailings in Colombia. Ralph W. Perry 498
Taxation in Arizona............... 500
London Mica Market in 1911....... 500
*Ore Dressing in the Joplin District —III...............James L. Bruce 501
Hedley Gold Mining Co............ 504
*A Method of Showing Ore Reserves. N. H. Emmons, 2d 505
Removing Rust from Steel......... 506
*The California Gold Dredge—IV. Robert E. Cranston 507
Prospecting for Alunite 511
Sealing Off Water in Catskill Aqueduct Shafts.........J. F. Springer 512
Notes from Current Literature...... 513
The Determination of Platinum.... 515
The Vanadium Industry in France.. 515
Elkton Consolidated Report........ 515
Personal, Obituary and Societies.... 516
Editorial Correspondence 517
Mining News 519
Markets 525
*Illustrated.

The Engineering and Mining Journal

Vol. 93. MARCH 9, 1912. No. 10.

The Mystery of the Lead Market

Ever since we ceased to have any statistics respecting the consumption and stock of lead in the United States the market for this metal has been mysterious. The perplexity was increased not long ago when the American Smelting & Refining Co. suddenly reduced its price from 4.45c. to 4c. The reason for this unexpected action has been the subject of much surmise, including the notions that it was connected with the tariff legislation pending in Washington and that it was a blow directed against the International Smelting & Refining Co. which had accumulated a large stock of lead ore at higher prices at Tooele and was about to begin converting it into bullion. The idea that the A. S. & R. Co. merely desired to sell lead was too prosaic to meet with any great favor.

It sometimes happens that a mundane calamity coincides with an eclipse of the moon, and there is no doubt respecting the substantial coincidence of the A. S. & R. Co.'s cut and the inrush of protesting lead miners into Washington, but the cause and effect are not necessarily any more closely connected in one case than in the other. The present price of lead at London is about 3.40c. per lb. Under the terms of the proposed new tariff the cost of lead on that basis imported into the United States would be about 4¼c. per lb. The London price is now rather high and doubtless there will be some advantages in entering Mexican lead refined in this country, wherefore 4c. and 4¼c. are not true comparisons, but if, as some persons imply, the smelting company has been merely giving the producers an object lesson to lead them to fight the battle in Washington we think that the news is cold comfort to the producers, because the operation is highly expensive to them.

It is, moreover, quite unnecessary, because the ore producer will fight tooth and nail against any reduction of the tariff anyway and does not need any object lesson; and we do not believe that anyone seriously believes that any tariff legislation will be consummated this year. In passing, we may remark that if the tariff on lead should be wholly removed our producers would not be subject to competition under the old scale of prices. It would mean rather that the New York and London prices would run more nearly together.

Nor does the idea that the A. S. & R. Co. is sticking a pin into the International appeal to good sense. The International is too strong to be driven out of business, and if it be caused to lose money the A. S. & R. Co., stands to lose also, which probably it does not want to.

The fact is that the A. S. & R. Co. ever since it made the cut has been supplying lead freely to all purchasers and its market has been *the* market, the independent producers disinclined to sell at the price standing aside and allowing the business to go to the smelting company. The sales of the latter are believed to have been very large. The inference from this is that it has been desired to make lead move.

As we have remarked many times during the last year a comparison of the recent statistics of the production of lead with the probable position of consumption by analogy with the iron and copper industries has led to the conclusion that there must have been a large accumulation of lead unsold. Although this has been emphatically denied there was nevertheless hardly any escape from the logic of the situation. Our own surmise is that the recent action of the smelting company was to relieve itself of a surplus. If at the same time there was excited opposition to the proposed tariff reduction and some annoyance to the International company those may have been satisfactory incidents.

The British Coal Strike

The most important event of the last week was the inauguration of the strike by coal miners in Great Britain, on Mar. 1, upward of one million men ceasing work and all the mines of the kingdom except two small ones being compelled to close. The effect upon general commerce and trade was instantaneous. Railway operation was curtailed, steamships were tied up and factories were closed. Coal is a fundamental necessity and because of its bulky nature and other conditions, no great supply can ever be carried in stock. When it ceases to come from the mines there is bound to be immediate trouble.

Respecting the merits of this dispute between masters and men, we are not in a position to discuss it. Whatever it be, it is insignificant in comparison with the political and economic aspects of the new system of the national strike that has been introduced in France and now in Great Britain. If the men of one industry can enforce their wishes and redress their grievances by depriving a nation of its means of existence, other groups may successively do the same thing. The system becomes an attack upon society, which does not know exactly how to move. One road leads to socialism; another to collectivism; another to militarism. Which shall it be? France solved its problem by taking the last. England is less organized and less minded to take that. America will be in an even more difficult position when the same trouble, of which we had a taste in the anthracite strike, comes fully to it. The social unrest of the times, of which these national strikes are but a manifestation, is the great problem of modern civilization.

The Situation in Mexico

The gravity with which the situation in Mexico is regarded is indicated by the proclamation of the President of the United States, on Mar. 2, notifying Americans in that country to keep their hands off and by implication, at least, advising them to leave that country. An exodus had previously been in progress and it is continuing. Unfortunately there are many thousands of Americans in Mexico who cannot leave because of their property, or that in their charge, which may not be abandoned.

We do not take any stock in the fears that there may be a general massacre of foreigners in Mexico. The Mexicans are not savages, and both the government and the organized revolutionary party will treat persons and property as honorably as any civilized people will do, subject to the dangers of legitimate fighting, out of the way of which foreigners ought to keep. The Americans and other foreigners at such important places as Chihuahua, Torreon, Monterey, Aguascalientes, Guanajuato and Pachuca are probably safe enough. The alarm is for those who are working by twos and threes at remote and isolated places in the mountains, where they are exposed to the marauding of bandits.

In former years, before Diaz put things in order in Mexico, there was no sharp dividing line between the revolutionist and the bandit. The recent condition of chaos has restored that disagreeable uncertainty and conferred a quasi-respectability upon the bad men who have taken to the road for plunder. Those gentry are now roaming pretty much at will and constitute the chief danger of orderly foreingers who are trying to carry on their business.

Changes at the Lake

In the last three years, some radical changes have occurred in the mining and milling practice in the Lake Superior copper country and are worthy of note. Prior to this period the rock drill in general use was the heavy, two-man air machine of the Rand type, and this was used for all operations, drifting, stoping, sinking and raising. It was standard to such an extent that experiments were seldom if ever tried with other types to determine their worth. Recently, however, conditions have made more imperative than ever before the further reduction of the cost of breaking ground. This has led to comparative tests with other machines, including electric drills, and newer types of air drills both of the one- and two-man type. Some changes have already been made along these lines, and further results will be awaited with interest.

In the stamp mills, a departure has been made in the fine-grinding department at several plants. The chilean mill was formerly a popular machine for this work. After experiments extending over a considerable time, however, the conical pebble mill is now being used in this department at one of the largest stamp mills at the lake, and a smaller mill recently placed in commission uses this type of machine. It should be remarked that changes of this character are not of frequent occurrence in the Lake Superior district, and are never adopted until after exhaustive tests. It is customary among the larger companies to evolve a machine gradually for any particular work, starting with some standard type and removing, adding or strengthening parts where necessary. Another factor that precludes hasty action is the size of the operation at individual properties. When it happens that something new is adopted, it means a large installation; other mines are apt to follow suit, and the total outlay involved will be no small amount. It is not surprising, therefore, that the introduction of innovations is often difficult.

We are wont to read in the financial and quasi-financial papers that dabble in mining that the so-and-so company is paying only $2 per share in dividends but is earning $4, the alleged earnings being computed from the production, the market price of the product, and the assumed cost of production. As the earnings go on at the rate of $4 per share, year after year, and the dividends at only $2, our thoughts revel in the idea of the melon that some day will be cut for the stockholders. Yet how few of those melons there are! Nor does the surplus seem to pile up in the balance sheets! Is it possible that it goes back into the properties for the maintenance of production? Of course, it is much more encouraging to stockholders to talk about producing copper for 7c. per lb. than for 10c., even if hopes and realizations are two different things.

Unrest seems to be characterizing the coal-mining industry all over the world. Besides the great British strike, trouble is impending in the important Rhenish-Westphalian district in Germany, where the miners have demanded a general increase of 15 per cent. in wages. This, they claim, will only restore the price of coal mining to the level which prevailed when a general reduction was made in 1907; and they also claim that it was then promised that the cut should be only temporary. A general strike is threatened if the advance is not granted. In France also there is trouble with the miners in the Nord and the Pas-du-Calais, the chief coal-mining districts.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Safety Devices for Hoisting Through Inclines

It has occurred to me from time to time that, whereas any number of devices have been invented or are in use to prevent the dropping of a cage in a vertical shaft, should the hoisting rope break, to my knowledge no such scheme has been offered to prevent a similar occurence to a skip or man car in an inclined shaft. On the face of it, if I am correct in the belief that no such device has been advocated, this seems strange.

In the JOURNAL of Feb. 24, L. H. Eddy gives an interesting description of such an accident that occurred at the Bunker Hill mine at Amador City, Calif., on Feb. 7. It is noteworthy that with a skip of but 2½ tons capacity, 14x14-in. shaft timbering was broken and loosened for a distance of 90 ft., and the shaft for that stretch was caved, due to bad ground in that vicinity. The skip-road remained intact but the roof and sides were damaged. No lives were lost, but 68 men were imprisoned underground for 24 hours, and hoisting of ore, of course, was interrupted for that space of time. I believe I am safe in saying that the company was fortunate, both in not having had greater damage done, and in not having had heavier equipment to contend with.

In the Lake Superior copper country, while such accidents are not of daily, weekly, or even monthly occurrence, still they are not uncommon. There, however, conditions are much more severe, the chief difference in this respect being, that the skips and, therefore, the loads are of much greater weight. Skips of from 7- to 10-ton capacity are in common use, and hoisting is done at a speed of about 3500 ft. per min., and from depths of over 4000 ft. The angle of the incline varies from under 30° to over 70° from the horizontal, but the greatest speed is reached in shafts having a dip of about 37°. Under these conditions, when a skip containing say seven tons of rock, breaks away at a point a few hundred feet from surface and leaves the skip road at any point after a descent of several lifts, the resulting damage is apt to be and often is great. In many cases, of some of which I have personal knowledge, not only are the dividers and wall plates torn out and destroyed for several hundred feet, in one and sometimes two compartments, but the skiproad itself is as much demolished as would be the road bed in case of a bad railroad accident. Often the plat timbering is also damaged at one or more levels.

Such accidents are expensive in many ways, although no lives may have been lost. The battered skip, and its contents must be removed and any hoisting cable that may have stayed with the skip. New timbers must be cut and placed not only for support, but for stringers, if concrete is not used. The time consumed in these repairs is not the least important factor in the expense, as hoisting of rock must cease while repairs are in progress. This may cause inconvenience at the mill and will certainly disarrange underground work as far as the trammers are concerned and perhaps may cause cessation of mining for a shift or two. That the possibility of such accidents always exists where inclined hoisting is done, is shown by the schemes employed at the Lake to alleviate the damages. These include as perfect a skiproad as possible, well greased skips and rope and frequent inspection of both; at some of the mines the skips have been equipped with skids and guides, both made of iron and constituting an integral part of the skip. The skids are designed to slide on the rails should one or more wheels come off either in hoisting or any other way; the guides are to cause the skip to stay on the skiproad should anything happen in ordinary hoisting or in case of accidental descent. As a final precaution, a rock pentice is generally left below the bottom loading level to stop the skip in an accidental descent, thus protecting workmen in the bottom of the shaft.

It will be noticed, however, that these schemes aim simply to minimize the damage caused by a runaway skip; none of them go to the root of the evil and attempt to prevent the skip from falling, unless the inspection of the hoisting cable can be called such. The devices in use on cages in vertical shafts are designed to prevent the fall of the cage should the rope break. Why is not a similar object attainable in inclined shafts? If such a device is in use anywhere, I am not aware of it and would welcome information regarding it. I am quite certain, however, that nothing of the sort is in use in Michigan, and am of the opinion that it has never been attempted there.

Without attempting to evolve any such scheme here, it is apparent that a device of this sort, to be effective, would have to provide for stopping the skip almost simultaneously with the breaking of the rope and for securely holding it there, wherever it may be. Once any appreciable momentum is attained, the task would be doubly difficult if not impossible. This fact, together with the inconvenience that would be caused in ordinary hoisting, precludes probably the use of any apparatus that would aim to stop the skip at the level next below the point at which the accident occurred. A dog-and-tooth device would be equally objectionable if it interfered with the lowering of the skip; particularly that necessary when bringing the skip on the landing chair for loading at levels. It would seem as though some plan would have to be employed that involved the same principle as is used in vertical shafts, an action which is idle when everything is right, but which operates automatically and instantly upon the breaking of the rope. To provide for catching the skip at any point in the shaft, it would probably be necessary to place one or more notched guides parallel to the stringers, these guides to engage whatever mechanism was placed on the skip. For this reason the cost of installation would probably be less if done while the shaft was being sunk than if installed in an old shaft. In either case, however, the cost could only be measured by the amount of damage done by such an accident as it is designed to prevent.

In conclusion it may not be amiss to say that the advantages of such a safety device are so apparent as to warrant the belief that it must have occurred to others and to have been discarded for cause. As to this, however, I will reiterate that I am unaware of any such scheme having been suggested or tried out either experimentally or practically. Therefore, is it not feasible, and if not, why not?

L. E. IVES.

New York, Feb. 26, 1912.

Geology and Mining of Clay

In my article, entitled "The Geology and Mining of Clay," in the JOURNAL of Feb. 3, 1912, p. 263, reference should have been made to Dr. Heinrich Reis' book on "Clays, their Occurrence, Properties and Uses," from which valuable material was obtained.

E. K. SOPER.

Minneapolis, Minn., Mar. 2, 1912.

Osceola Report

The report of the Osceola Consolidated Mining Co., for the year ended Dec. 31, 1911, shows 1,246,596 tons of rock stamped at a cost of $1.14 per ton for mining, transportation, stamping and taxes. From this 24,452,912 lb. of mineral were obtained, which contained 75.198%, or 18,388,193 lb. of fine copper. This is equivalent to a production of 14.8 lb. of fine copper per ton of rock stamped, as compared with 15.9 lb. per ton in 1910, 16.9 lb. in 1909, and 17.1 lb. per ton in 1908. The cost per pound of refined copper produced was 9.28c. per lb., as against 9.37 in 1910, 9.47 in 1909, and 10.25c. in 1908. This figure is arrived at as follows: Cost per lb. at mine, excluding construction, 7.73c.; cost of construction per lb., 0.49c.; freight, smelting, commission and general expenses, 1.06c. The cost of stamping alone may be judged from the footnote that 63,449 tons of North Kearsarge rock was stamped at the Tamarack mills at a cost of 27.28c. per ton. Of the 18,388,193 lb. of copper produced, 17,470,124 lb. were sold at 12.72c. per lb., leaving unsold 918,069 pounds.

No sinking was done during the year in the Osceola branch, the deepest shaft still being the No. 5 Osceola, 4623 ft. from the surface. In the South Kearsarge branch, 1222 ft. of openings were made, and in the North Kearsarge 5518 ft. of openings and 306 ft. of sinking. On the Osceola branch, no mining was done during the past year, but both Nos. 5 and 6 shafts have been repaired from top to bottom. Active work will probably not be resumed here until the mill is entirely remodeled, this being called for by the decreasing content of the North Kearsarge rock. The new equipment consists of Woodbury classifiers and jigs, Wilfley tables and Hardinge mills. The results show that the new washing system gives an extraction of about 79%, as compared with about 73% formerly, or a saving of 1.1 lb. of copper per ton on the present grade of Kearsarge rock. The capacity per head is about the same, with an added cost of treatment of about 1c. per ton of rock. The grade of mineral secured is substantially the same. The decrease in the copper content of the rock stamped is due to the falling off in content of the North Kearsarge ore. The drifts north with the exception of the thirteenth and fourteenth levels of this mine have been below average. At the South Kearsarge the copper contents have been 18.22 lb. per ton, as compared with 18 lb. in 1910.

The total net profit for the year was $664,628, and, from this and the surplus, $7 per share, or $673,050 dividends were paid, the balance of assets over liabilities still remaining $1,832,184. The Osceola company owns $311,100 of Mineral Range Ry. Co.'s stock and $60,000 worth of Lake Superior Smelting Co.'s stock, the latter amounting to 15,000 of the 48,000 outstanding shares. The charges for smelting rendered by this last company have varied from $6.50 to $6.80 per ton of mineral. However, no dividend has been paid by the Lake Superior Smelting Co., as the profit has been in large part used for construction and improvement at the works.

February Dividends

The dividends paid by 29 mining and metallurgical companies, and industrials closely allied to mining, for the month of February, 1912, amount to $11,627,188, which compares favorably with $10,488,845 reported paid in February, 1911. In addition to the regular dividends disbursed in February, the Inspiration Consolidated Copper Co. has accorded its stockholders of record Feb. 1 the right to subscribe for an issue of its bonds to the amount of $6,000,000 *pro rata* for full or fractional amounts, but only in multiples of $500, payable Mar. 1, 1912; Sept. 1, 1912; Mar. 1, 1913, and Sept. 1, 1913.

UNITED STATES MINING COMPANIES	Situation	Per Share	Total
Alaska-Mexican, g	Alas.	0 20	$ 36,000
Alaska-Treadwell, g	Alas.	0 75	150,000
Alaska United, g	Alas.	0.30	54,006
Arizona Copper, com.	Ariz.	0 30	461,668
Bunker Hill & Sul., l.s	Ida.	0 20	65,400
Camp Bird, g.s.	Colo.	0 48	534,600
Cliff, g	Utah	0 10	30,000
Frontier, z.	Wis.	2 00	2,500
Elkton, g	Colo.	0.01	37,500
Hecla, l.s	Ida.	0 02	20,000
Homestake, g	S. D.	0 50	109,200
Mohawk, c	Mich.	1 00	100,000
Parrot, c.	Mont.	0 15	34,477
Quilp, g	Wash.	0 01	15,000
Tennessee, c	Tenn.	1 50	300,000

COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES	Situation	Per Share	Total
Amalgamated, c	Mont.	$0 50	$769,440
Am. Sm. Sec., pfd., A	U.S.	0 50	85,000
Am. Sm. Sec., pfd., B	U.S.	0 41⅔	125,000
Cambria Steel	Penn.	0 62½	562,500
International Nickel	U.S.	1.50	133,689
Lehigh Coal & Nav.	Penn.	1 00	482,936
National Carbon, pfd	U.S.	1 75	78,750
U. S. Steel, pfd	U.S.	1 75	6,304,919
Va.-Car. Chem., com.	U.S.	1.50	419,886

CANADIAN, MEXICAN AND CENTRAL AMERICAN COMPANIES	Situation	Per Share	Total
Amparo, g.s	Mex.	$0 03	$ 60,000
Buffalo Mines, s	Ont.	0 03	30,000
Coniagas, s	Ont.	0 45	360,000
Crown Reserve, s	Ont.	0 05	88,440
Dominion Coal	Can.	3 50	175,000

Of the amounts paid by U. S. mining companies, $1,951,556, it is noticeable that $966,306 was paid by the precious-metal mining companies. Alaska-Treadwell increased its dividend from 50c. to 75c. per share, while Camp Bird again paid over half a million. This company continues to prosper; Santa Gertrudis has developed favorably, while it is stated that the Camp Bird mine itself shows some new discoveries.

Total dividends for the first two months of 1912, as reported to the ENGINEERING AND MINING JOURNAL, amount to $25,855,833, against $24,967,454 for the corresponding period last year.

None of the above figures includes the disbursement by the Kennicott Mining Co., controlling the Bonanza copper mine in Alaska. This is a close corporation. It is understood that this company paid $1,000,000 in February, but official detailed information is not given out. As to the figure being approximately correct, there seems to be no doubt.

Chronology of Mining for February, 1912

Feb. 7—Sixty-eight miners, temporarily imprisoned in the Bunker Hill mine, California, by a falling skip which caused a blocking of the shaft.

Feb. 12—Equipment for a 100-ton mill of the Peaceful Valley company, was totally destroyed by fire, near Cuba City, Wis.—An accident in a coal mine at Antonienhütte, Prussia, reported to have killed 27 men.

Feb. 15—Smelting resumed by the Consolidated Arizona Smelting Co., at Humboldt, Arizona.

Feb. 19—Announcement of initial dividend of $1,000,000 by the Bonanza copper mine, in Alaska.

Feb. 23—Eight men reported killed and 20 injured in a fire at No. 5 mine of the Western Coal & Mining Co., at Lehigh, Okla.—Sixth section of the Miami mill was placed in operation, giving the mill its full capacity.

Feb. 26—The U. S. District Court at Trenton, N. J., decided that the Butters stationary filter was not an infringement of the Moore movable filter, in the suit of the Moore Filter Co. against the Tonopah-Belmont Development Company.

Feb. 28—Ray Consolidated stockholders voted to increase stock to 1,600,000 shares, to absorb the Ray Central company.

Feb. 29—British coal-miners strike was inaugurated, before official time, by a walkout of about 800,000 men. Tooele lead smeltery put into commission.

The Anglo-American Club of Freiberg, Saxony

The report of the Anglo-American Club at Freiberg, Saxony, for 1910-11, which has recently been received, shows that the club is doing well. The new quarters occupied have been found very satisfactory, being spacious, quiet, well lighted and comfortable. The rooms include the large club room proper, the writing room and library and the room for the mineral and geological collection. Several new members joined, and the club was able to entertain a number of visitors. The annual dinner was held in June.

The club is intended for the benefit of the English and American students at the Bergakademie at Freiberg. Its past membership includes a large number of Freiberg graduates, scattered all over the world. It has joined heartily in the movement started by Edward Hooper to organize a central association of old Freiberg graduates, having its headquarters in London.

The club desires to obtain addresses of old members, whenever possible, in order to keep in touch with them, wherever they may be.

January Operations at Goldfield Consolidated

The total production of the Goldfield Consolidated Mines Co. for January, 1912, was 28,870 tons, containing $733,344, an average of $25.40 per ton; this was milled with an average extraction of $24.14 per ton, or $95.02%. The total net realization was $471,139, or $16.32 per ton. Development work amounted to 3302 ft.; the total cost of mining, development, milling, office and general expense was $7.92 per ton.

GOLDFIELD CONSOLIDATED OPERATING COSTS

Mining:		
Development	$1.00	
Stoping	3.14	
		$4.14
Transportation		0.07
Milling		1.98
Marketing		0.50
General expenses		0.50
Bullion tax		0.21
Construction		0.52
Total cost of operation		$7.92
Miscellaneous earnings		0.10
Net cost per ton		$7.82

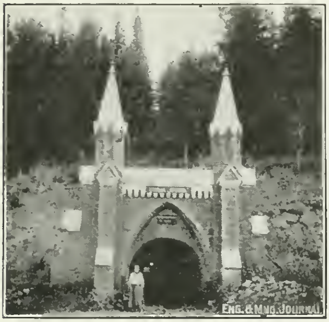
At the Clermont, Supt. J. F. Thorn reports that the 413 sill was extended and produced 722 tons of $24.18 ore. The new 428 sill between the 600- and 750-ft. levels produced 500 tons of average $41.34 ore. The 604-H raise from the 1000-ft. level, going up toward the 534 on the south end of the 900-ft. level, produced 381 tons of average average $72.06 ore. At the Mohawk, the 3-E sill on the 150-ft. level, near the old Sheets-Ish workings, was extended and produced 503 tons of average $56.43 ore. The sill in the 111-K section was extended and produced 571 tons of average $57.46 ore. The 111-M section sill produced 218 tons of average $18.19 ore. The 415-X crosscut from the 491 intermediate between the 450- and 600-ft. levels, produced 174 tons of average $38.44 ore.

At the Red Top, the 305-DX stope was extended above the second level, and the resulting sill produced 70 tons of average $22.73 ore. The 403-CX stope on the fourth level at the 442 crosscut, produced 70 tons of average $22.53 ore. The 403 sill was extended and produced 18 tons of $28.52 ore. The third level was connected with the Laguna shaft, and the station and pocket completed at this point; during the present month the Red Top surface plant will be dismantled. At the Combination, the 295-X on the fourth level south and west of the Hampton stope, produced 45 tons of average $41.34 ore.

The roasting plant at the mill was completed, and both furnaces are now in successful operation. The results from the new plant have fully justified all expectations.

Iron Mining in the Urals

The accompanying illustration shows the opening into an iron mine in the Ural Mountains. The pretentiousness of the architecture will remind our readers of some of the old Mexican works.



ENTRANCE TO RUSSIAN IRON MINE

Breitung Aid Fund

The Breitung-Kaufman interests of the Marquette Iron Range, Mich., consisting of the Mary Charlotte Mining Co., Ltd., and the Washington Iron Co., have reorganized their miners' aid fund.

In the past, the fund was supported by a 50c. monthly contribution from each man; the new arrangement provides for the same contribution from the men and also a contribution from the company equal to one-half the contribution from the men. Under the new rules, the compensation to injured miners can be much larger, and if the money on hand is at any time insufficient to pay the claims, the company will donate enough money to make up the balance.

Under the old rules, an injured man received $20 per month, for 12 months, if necessary; if partially disabled he received $240; in case of death his family or relatives received $300. By the new arrangement, an injured man will receive $30 per month, for 20 months, if necessary; if partially disabled he will receive $800 in a lump sum; if permanently disabled he will receive $1250; in case of death $1000 will be paid his family or relatives.

Foster's Amendment to Bureau of Mines Act

WASHINGTON CORRESPONDENCE

It is understood that the Foster bill to amend the Bureau of Mines Act will be passed this week or next by the House. The bill provides:

Sec. 2. That it shall be the province and duty of the Bureau of Mines, subject to the direction of the Secretary of the Interior, to conduct inquiries and scientific and technologic investigations concerning mining, and the preparation, treatment and utilization of mineral substances with a view to improving health conditions, and increasing safety, efficiency, economic development, and the prevention of waste in the mining, quarrying, metallurgical, and other mineral industries; to investigate explosives and fuels and unfinished mineral products belonging to, or for the use of, the United States, with a view to their most efficient use; and to disseminate information concerning these subjects in such manner as will best carry out the purposes of this act.

Sec. 3. That the director of said bureau shall prepare, publish and distribute, subject to the direction of the Secretary of the Interior, under the appropriations made from time to time by Congress, reports of inquiries and investigations, with appropriate recommendations of the bureau, concerning the nature, causes and prevention of accidents, and the improvement of conditions, methods and equipment, with special reference to health, safety and prevention of waste in the mining, quarrying, metallurgical and other mineral industries; the use of explosives and electricity, safety methods and appliances, and rescue and first-aid work in said industries; the causes and prevention of mine fires, and other subjects included under the provisions of this act.

Sec. 4. That nothing in this act shall be construed as authorizing the Bureau of Mines or any employee of said bureau to undertake any investigation or operation in behalf of any private party, except, with the approval of the Secretary of the Interior, for the health and safety of persons employed in the mining, quarrying, metallurgical or other mineral industries; nor shall the director or any member of said bureau have any personal or private interest in any mine or the products of any mine under investigation. Provided, that nothing herein shall be construed as preventing the employment by the Bureau of Mines, in a consulting capacity or in the temporary investigation of special subjects, of any engineer or other expert whose principal professional practice is outside of such employment by said bureau.

Sec. 5. That for tests or investigations authorized by the Secretary of the Interior under the provisions of this act, other than those performed for the Government of the United States or state governments within the United States, a reasonable fee covering the necessary expenses shall be charged, according to a schedule prepared by the director of the Bureau of Mines and approved by the Secretary of the Interior, who shall prescribe rules and regulations under which such tests and investigations may be made. All moneys received from such sources shall be paid into the Treasury to the credit of miscellaneous receipts.

Cornish Mining Notes

London Correspondence

The Levant mine has just declared a dividend for the 16 weeks of $1.75 on its 2385 shares, of which the committee owns 1400 shares, and carried forward a balance of $17,500. The profit shown was only $8000. The black tin sold for $68,000. Altogether the developments were disappointing. The tin sold for a higher price, yet the decrease was $340. Copper sales fell from $7800 to $6000; arsenic from $1460 to $900. Altogether the decreases were $3000, while the increase for labor was $2500. The lowest level, 350 fathoms, has not equaled anticipations, there being a considerable reduction in metal contents from the level above. In the palmy days it used to be said that black tin paid the costs and the copper ore the dividends. This mine was for many years the principal copper-producing mine in England, but in 1910 it had to take second place.

At Wheal Jane mine, owing to the repairs and additions to the electric pump at Giles' shaft, nearly 100 miners were discharged. The latest mishap was said to be the "burning of the motor." This mine has had a varied experience during the last six years.

Wheal Kitty and Penhalls are asking for further capital in order to sink Sara's shaft a little deeper and to extend a crosscut to the West Kitty lode. These mines made a loss during the year of $1500, the first loss for over four years. The average yield per ton for four years was 35 lb., but the second half of 1911 was less than 20 pounds.

Grenville United has just paid a dividend of 25c. per share for the six months ended Dec. 31, 1911. The dividend for the previous half year was 8c., or for the year nearly 30%. The black tin sold during the six months was 331½ tons, and the future is most encouraging. In January, 1911, these shares were quoted at 85c.; in January, 1912, $2.12. Seven of the leading producing mines during the year have appreciated in value over $1,200,000. South Crofty alone has increased in value over $500,000.

Carn Brea and Tincroft mines are certainly forging ahead, as the returns for the six months ended Dec. 31, 1911, are nearly $40,000 over the previous six months for the tin alone, not to mention wolfram and arsenic; $17,300 of the increase being due to enhanced price of metal, and $22,500 due to increased quantity of tinstone crushed. It is expected that the debt will be decreased $20,000 as the result of the six months' working.

The manager is anxious to improve the method of testing the samples. The vanning results for December show that the tinstone treated averaged 27.11 lb. of black tin per ton, or $5.50 per ton, whereas the actual yield was a little less than 24 lb., or a loss of over 75c. per ton, which, on the 6700 tons treated, represents a loss of $5000. Again, on the vanning shovel, but little, if any, of the slime tin is saved, while all the mines sell slime tin at the "ticketings." Dr. Pearce, late of the Argo Works, Denver, in 1904 wrote an interesting letter in the Engineering and Mining Journal on the losses of tin by the vanning shovel, which was much criticized in the local papers, and by some of the tin dressers. This time it is hoped that Mr. King's efforts to improve, if not abolish, the old method, will be effective.

Western Branch Canadian Mining Institute

Victoria Correspondence

The twelfth general meeting of the Western Branch of the Canadian Mining Institute was held at Vancouver, B. C., on Feb. 15 and 16. The four sessions held were presided over by Robert R. Hedley, of Vancouver, chairman of the branch. In the chairman's address, particular prominence was given to the new coal fields in the northern interior of British Columbia. One of these fields is situated on Copper River, and the headwaters of Skeena River, and the other is known as the Groundhog Mountain field.

Statistics concerning the mineral production of British Columbia for the year 1911, were presented by William Fleet Robertson, provincial mineralogist. The total value of the mineral production in 1911 is estimated at $23,211,816, as compared with $26,377,066, in 1910. Coal and coke and the metalliferous minerals, except copper, showed a decrease in value, while building stone, etc., gave an increase of about $500,000. The coal mines and coke ovens in the Crow's Nest district were closed for eight months in 1911, because of labor difficulties. A great part of the decrease in silver and lead, and practically all the decrease in zinc is accounted for by the continued crippled condition of the producers in the Slocan district. The mine and concentrating plants, railway bridges and trestles, which were destroyed by forest fires, have not yet been wholly replaced.

The cost of mining and treating a small vein of free-milling ore was presented by A. H. Gracey, of Nelson, B. C. About 14,000 tons of ore were handled, the cost being divided as follows: Mining, $5.04; milling, $0.925; cyaniding, $0.725; aërial tramming, $0.16; marketing products (concentrates and bullion), $0.135; management, general expenses, insurance, taxes, $0.675; maintenance of plant, $0.26; total cost, $7.92 per ton of ore.

W. M. Brewer gave information concerning the Marble Bay mine, on Texada Island, and the Britannia mine, on Howe Sound, within about 30 miles of Vancouver. He stated that a good grade of bornite ore is being mined down to a depth of 1360 ft. in the Marble Bay mine. In the Britannia, he said, R. H. Leach last year blocked out 400,000 tons of ore, and the mine is now shipping ore at a profit of about $50,000 per month.

E. Jacobs gave a short description of a new slag-disposal plant, put in at the Granby company's smeltery, Grand Forks, B. C. This was followed by some notes on the "Coal Resources of Western Canada." Attention was also drawn to the lower average rate of deaths from accidents in coal mines in British Columbia, as compared with an earlier period.

The following papers were also presented:

"A Brief Description of the Electrolytic Lead Refining Plant of the Consolidated Mining & Smelting Co. of Canada, Ltd." (illustrated), by J. Miller, refining superintendent, Trail, B. C.

"The Coal Fields of the United States" (illustrated), by E. W. Parker, statistician of the Division of Mineral Resources, U. S. Geological Survey.

"The Roslyn Coal Field, Kittitas County, Washington," by Prof. J. Daniels, University of Washington, Seattle, Wash.

"Recent Developments in Mining and Metallurgy on the Pacific Coast" (illustrated), by Prof. Milnor Roberts, dean of the College of Mining, University of Washington, Seattle, Wash.

"Some Work of the U. S. Bureau of Mines" (illustrated), by H. M. Wolflin, engineer in charge of mine-safety and first-aid work in the Northwest.

"Work of the St. John Ambulance Association," by Doctor McTavish.

"Earthquakes, Strains and Stresses, and their Relation to Coal-Mine Disasters," by F. Napier Denison, Dominion Meteorological Office, Victoria, B. C.

"Notes on the Groundhog Coal Basin," by G. S. Malloch.

"Notes on the Progress of Development Work on Coal Areas in Alberta and Saskatchewan," by D. B. Dowling.

Suitable resolutions were adopted concerning the death of John B. Hobson, who was active in inaugurating large-scale placer-mining operations in the Cariboo district. The next general meeting of the branch is to be held in May, at Ainsworth and Kaslo, Kootenay Lake, West Kootenay, B. C.

Kimberlite, the matrix rock of the South African diamond pipes, occurs in Elliott County, Kentucky, intruded in the horizontal sandstones and shales of the coal measures. Sporadic prospecting has been done for diamonds since the scientific determination of the character of the rock was announced about 10 years ago, and more recently by reason of the renewed interest created by the discovery of diamonds in Arkansas in a similar formation, but, so far as known, no diamonds have been found in Kentucky.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

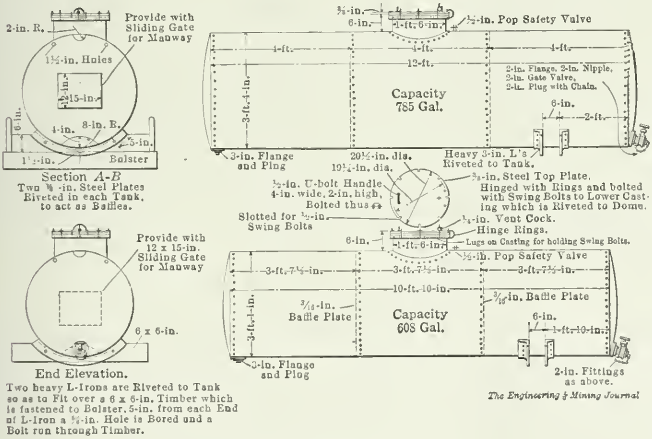
A Wagon Oil Tank

CHESTER STEINEM*

In view of the increasing use of crude oil as a fuel and for combustion in oil engines, a description of a tank designed specially for transporting crude oil may be of interest.

In the Mogollon district, oil has displaced wood as fuel for generating power, although wood is plentiful. It commends itself as being cheaper for many purposes, and to supply outlying districts a wagon-tank is often necessary.

D. Ford McCormick designed the tank shown in the accompanying illustration. It is giving good service on a 90-mile haul over rough mountain roads. An accident to the projecting outlet valve resulting in a considerable loss of oil, caused the substitution of a plug. The wagon itself is not shown in the illustration, only the tank arranged to go on the running gear just like the body of a wagon.


2-in. R.
Provide with Sliding Gate for Manway
1½-in. Holes
12-in.
15-in.
6-in.
4-in.
8-in. R.
5-in.
1½-in.
Bolster
Section *A-B*
Two ⅛-in. Steel Plates Riveted in each Tank, to act as Baffles.
Provide with 12 x 15-in. Sliding Gate for Manway
6 x 6-in.
End Elevation.
Two heavy L-Irons are Riveted to Tank so as to Fit over a 6 x 6-in. Timber which is fastened to Bolster. 5-in. from each End of L-Iron a ⅝-in. Hole is Bored and a Bolt run through Timber.
⅜-in.
6-in.
1-ft. 6-in.
½-in. Pop Safety Valve
4-ft.
4-ft.
4-ft.
12-ft.
3-ft. 4-in.
Capacity 785 Gal.
2-in. Flange, 2-in. Nipple, 2-in. Gate Valve, 2-in. Plug with Chain.
6-in.
2-ft.
3-in. Flange and Plug
20½-in. dia.
19¼-in. dia.
Heavy 3-in. L's Riveted to Tank.
½-in. U-bolt Handle 4-in. wide, 2-in. high, Bolted thus
⅜-in. Steel Top Plate, Hinged with Rings and bolted with Swing Bolts to Lower Casting which is Riveted to Dome.
Slotted for ½-in. Swing Bolts
¼-in. Vent Cock.
Hinge Rings.
6-in.
1-ft. 6-in.
Lugs on Casting for holding Swing Bolts.
½-in. Pop Safety Valve
3-ft. 7⅓-in.
3-ft. 7⅓-in.
3-ft. 7⅓-in.
10-ft. 10-in.
3/16-in. Baffle Plate
3-ft. 1-in.
3/16-in. Baffle Plate
Capacity 608 Gal.
6-in.
1-ft. 10-in.
3-in. Flange and Plug
2-in. Fittings as above.
The Engineering & Mining Journal

TANKS FOR WAGONS FOR HAULING FUEL OIL

Lowering the Water in A Choked Shaft*

By CYRIL BRACKENBURY

In unwatering the Harvey shaft of the Tresavean mine, in Cornwall, considerable difficulty was experienced in placing the suction pipe of the sinking pumps so as to draw off the water below the many places where the old shaft was choked.

The sinking pumps were not designed to handle the broken rock, gravel, crushed timber, and grit, found in all the chokes, and it was necessary to resort to special means of safeguarding to spare the sinking pump as much as possible. Sometimes the best way out of the difficulty was to put the suction pipe down through holes in the chokes whenever, by so doing, they could be put into clearer water below. Sometimes this was done by putting the suction pipe down in the old pump column, which was still standing in place in the shaft. In such cases it was occasionally necessary to blast out the sides of the old column to let the water in, after having first secured it firmly with chains and timber.

One such blast was fired, electrically, at a depth of 57 ft. below the top of the pipe, which projected two or three feet above the water level. A special strainer had been made to put down inside the column pipe, with special connections across the shaft to the pump; also, since the blast completely severed the old column pipe, it was necessary to secure and support the column above the blast with chains below each 9-ft. length. In one instance, when the old column pipe was itself choked with débris, the difficulty was overcome by driving down a 2-in. pipe through the choke, a distance of 18 ft., and then blasting out the bottom, which fortunately cleared the débris and left a clear passage for the suction pipe.

When the 162-ft. level was reached, a method was resorted to, which was subsequently found to be most satisfactory for all deep solid chokes. The method consisted in substituting for an ordinary suction pipe, a special one with a sharp point at the lower end, to enable it to be driven down through the choke, and with a connection at the upper end, through which a special valve box containing a strainer could be fitted. The conical point was made of mild steel, and could be welded or screwed on to the lower end of the suction pipe. It was found that the iron suction pipe should preferably be made in convenient lengths, to suit the distance for each lowering of the pump, that is to say, in about the same length as each section added to the rising main. Although this might have been a convenience it is not a necessity, as the suction pipe, after having been driven through the choke, could generally be raised or lowered a little without difficulty to suit the position of the pump. As the pump was lowered, and each length of suction pipe uncoupled, a screwed flange was taken off the last length which had just been removed, and screwed to the upper end of the next length remaining on the suction, in place of the coupling which was used to connect the two lengths together.

The valve box was fitted with connections, so that the bottom could be bolted to the flange at the top of the special suction, and the top bolted to the flange of the short pipe connection to the pump. Inside the box there was an ordinary clack valve at the bottom, and a strainer fastened to the top, but bent into a synclinal fold, so as to expose as large an area as possible to the inflowing water. The box was divided in the middle, and could be easily opened to examine and clean the strainer or valve. In the first instance this method was used to pump through a choke only a few feet thick, resting on doors at the 162-ft. level, and the steel pointed pipe was easily driven down through some eight feet of débris and through the wooden doors which were supporting it. After having driven the end of the pipe a few feet below the doors, the point was blasted off, the upper end was connected to the valve box, and the valve box connected to the suction end of the pump by a short length of pipe forming a reverse bend. The special suction pipe used was 4-in. diameter, and the pump worked satisfactorily with this arrangement, keeping the water well down below the top of the choke, and enabling the men to conveniently clear it away.

---

*Mining engineer, Mogollon, N. M.

*Excerpt from an article entitled "Unwatering Tresavean Mine," Bull. 88, I. M. M.

Between the 996- and the 1128-ft. level, three nearly solid chokes, each from about 10 to 15 ft. thick, were passed through. The rest of the way was partly choked, and the walls of the shaft were rotten. Fortunately, weak spots in these chokes were found, and by means of various grab hooks, it was possible to make holes in different places, through which it was possible to put down the suction pipe and so keep the water level down to or below the top of the choke. Everything possible was done to protect the strainer, which had to be cleaned constantly, sometimes with a long-handle brush used under water, but often it was necessary to raise it out of the water to clean it properly. Working through chokes in this way caused severe wear on the pump, as a certain amount of dirt would continually pass through the strainer, and up the suction pipe into the pump chambers. The thrust bearings of electrically driven turbine pumps were also liable to become heated, on account of the small cooling water pipes getting choked, and thus preventing free water circulation through the water jacket.

The extreme length of the suction lift that can be used with electrically driven turbine sinking pumps depends chiefly upon the condition of the strainer, which, of course, should be clean, and upon how near the limit of its hydrostatic head the pump is working; the nearer the limit the less the suction lift allowable. When using a long 4-in. pipe, driven through a choke, the friction of the water passing through the suction pipe had a considerable effect in reducing the actual height of the suction lift, and this was particularly the case when the quantity pumped was sufficient to cause a high velocity of the water passing through the pipe, that is to say, when the friction head in the suction pipe became an important factor. At one time, when there was 73 ft. of 4-in. suction pipe through the choke, the theoretical head, due to friction in the pipe, and entry of water into the pipe, amounted to about 11 feet.

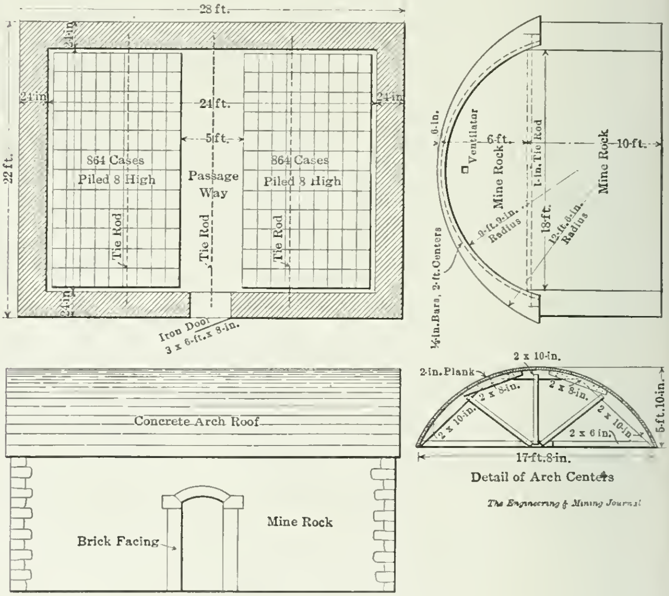
The biggest choke encountered in the shaft, below water level, was that occurring at and above the 1272-ft. level, where it was found to be over 70 ft. deep, and so compact that the water could only percolate slowly through it. When at first pumping above this choke, the water level in the shaft was continually taken down below the level of the main body of water in the mine; also, when first starting the pumps, the water level would be very rapidly reduced the first 8 or 10 ft. in the shaft, and after stopping the pumps the water would rise abnormally fast to begin with. Again, when the 4-in. pipe was first driven through this choke, and the end blasted off, although the upper end stood two or three feet above the water level in the shaft, water began to overflow from the top of it. All these phenomena proved the choke to be stopping up the shaft something like a rather porous cork in a pipe full of water.

The ladder compartments in an inclined shaft should be closely covered, preferably by a hinged door, at each level, to prevent material from falling through that compartment.

Powder House with Concrete Roof

By Claude T. Rice

A powder house with a concrete roof, such as is used by the Copper Range Co.'s mines in Michigan, is shown in the accompanying drawing. In designing the roof the weight of 150 lb. per cu.ft. of concrete and 31 lb. pressure per sq.ft. for wind, snow and other loads were taken, and the ordinary force diagram for designing arches used in proportioning the thickness. The concrete differed at the several mines; from about 1:2:4 to 1:3:5 was used. No waterproofing mixture was added, but instead the whole roof was covered with a thin, smooth layer of 1:1 cement so as to seal all pores. The concrete is reinforced with rods of ½-in. iron at 24-in. centers. Expanded metal or strands of old wire rope could have been used, but the rods proved to be more convenient.



Powder House at the Champion Mine

The side walls are of masonry built of waste rock from the mine, and are tied together at the top crosswise by three 1-in. rods. A small ventilating hole is left in the end walls near the top.

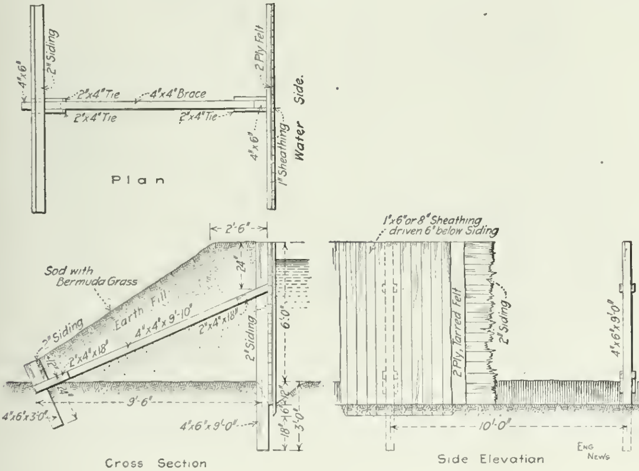
The building is not for the thawing of the dynamite, but merely for its safe storage at the surface. With such a building, there is no danger from stray bullets, and danger of accidents of all kinds is reduced to a minimum.

Dam for Settling Pond

In the Florida pebble-phosphate mining district there exists a need of dams that can be constructed cheaply and rapidly and although not having to last long, be efficient while they do last, states H. D. Mendenhall in *Engineering News*, Feb. 22, 1912. The dams are used to form ponds for settling solids from water before re-using it in hydraulic operations. As the water often contains 10% solids and 4000 gal. is added to the reservoir every minute it does not take long to silt up a large pond. The site of a new pond is rarely chosen before the need for it is felt, and as breakage of the dam may result in flooding adjoining farm land with silt, entailing lawsuits, a cheap dam that can be built in short time and yet be strong is required.

The material most readily available for building dams is the natural earth of the region. This earth, composed of loam, fine sand, and a small percentage of clay, easily "melts" when exposed to the action of the water. This "melting" is a combination of sliding down to the natural angle of repose, which for this material, wet, is approximately 2: 100, and the actual going into solution or suspension of a certain percentage of the total. The material is also more or less porous, or at least permeable, so that water ultimately seeps through it, dissolving and washing away the toe of the dam.

The solution of the problem of building a substantial dam of this material would seem to be reached by putting some sort of a core wall through the middle. But on second thought it is obvious that the "melting" would still continue on the upper face. It would be out of the question to build a dam of the material on its angle of repose.



SETTLING POND FORMED BY INEXPENSIVE EARTH DAMS

One day the necessity arose for a dam that was proof against breaking, and at the same time could be built six feet high on a ledge about 15 ft. wide. The core wall was built on the outside instead of the center of the dam.

The dam as designed and erected is simply an impermeable facing built on a timber framework and filled with earth. The framework for the typical six-foot dam consists of 4x6-in. pine posts nine feet long, sunk three feet into the ground and spaced 10 ft. apart. At a point 9 ft. 6 in. horizontally back from these posts are other posts 4x6-in.x3 ft. long, sunk two feet into the ground, and inclined away from the front posts about 30° from the vertical.

From the intersection of the short post with the ground line to a point on the long post one-third the distance from the top to the ground, is put in a 4x4-in. strut, so connected to the two posts with 2x4-in. cleats as to withstand both tension and compression. On the front face of the long posts are spiked horizontally 2-in. rough pine planks; these planks extend to one foot below the general surface of the ground.

Completely covering the water side of this facing is tacked 2-ply tarred felt roofing, and on the outside of this is nailed a facing of 1-in. plank, applied vertically, and driven into the ground six or eight inches below the bottom run of 2-in. plank. After the facing is on, the trench for the bottom run of horizontal 2-in. plank is refilled with earth. The 2-in. planking acts as a combined retaining wall and backing for the waterproofing, the tarred felt serves to prevent the water washing through the dam, and the 1-in. facing serves as a mechanical protection to the felt.

The outside sheathing driven the given distance below the ground surface also serves as a check to the water washing under too rapidly. Since it is expected that a small amount of water will percolate through, anyway, as well as quite a quantity will wash down from the top during rains, a 12-in. retaining wall is laid along the inside face of the short rear posts, the bottom edge being flush with the ground. This prevents the toe from washing, and also serves to help the short posts resist the overturning pull that they are subjected to during the earth filling period and before the water has risen.

After the structural part is completed, the back is filled as shown with ordinary earth, and sodded with Bermuda grass. Adequate spillways are of course supplied to prevent overtopping the dam.

One of these dams about 7 ft. high under a hydrostatic head of about 5½ ft. is shown in the accompanying illustration. It has fulfilled its function perfectly, and is in splendid condition even after the heavy rains of the Florida rainy season. The toe has not washed at all.

The total bill of material for a 20-ft. section of this dam six feet high is:

2 pieces rough pine	4x6	12 ft.	48 ft. B.M.
2 pieces rough pine	4x4	10 ft.	27 ft. B.M.
1 piece rough pine	2x4	12 ft.	8 ft. B.M.
	2x6 or 8	20 ft.	280 ft. B.M.
	1x6 or 8	15 ft.	150 ft. B.M.
	Total lumber		513 ft. B.M.

1.4 squares 2-ply tarred felt.
5 lb. 20d wire nails.
2 lb. 8d wire nails.
27 cu.yd. earth fill.

From this it can readily be calculated what the cost will be for any given length and locality.

A low dam of this type appears to be well suited for use in impounding tailings as well as for forming a settling pond so that the water may be re-used.

Draining a Shaft through a Drill Hole

By Lucius L. Wittich*

By installing a deep-well pump in an 8-in. drill hole, sunk seven feet from the shaft, J. M. Short, operator of the Geronimo mine, on a lease of the Connor Estate at Ellisville, west of Joplin, Mo., is able to dispense with the pump that he has been using in sinking the shaft, thus reducing the cost of sinking from $25 to $17.50 per ft., a saving of $7.50 per ft. As the shaft was 70 ft. deep when the pumping arrangements were changed and as the shaft must be sunk to a depth of 126 ft. to reach the ore, as indicated by the drill hole on which the shaft is being sunk, 56 ft. remain to be sunk. The total saving will be $420. Deducting from this, $150, the cost of sinking the 8-in. drill hole and installing the deep-well pump the net saving in money will be $270. Of course this does not include the cost of the drill rig and pump which were on hand. Had the system been adopted earlier the saving would be much greater.

---

*Joplin, Mo.

But the most important feature is not in the actual amount of money saved; it is in the saving of time in sinking. Before the drill-hole pump was placed in operation, the shaft was being sunk at the rate of five feet per week; now it is being sunk five feet in 16 hours. Previously it was necessary to remove the pump after loading each round of holes and to replace it after blasting, or, at least, it was necessary to guard the pump with heavy timbers, and even with this precaution the machinery was almost invariably damaged by the blasts. Because of this condition it was impossible to use heavy blasts when the pump was left in the ground. Now it is possible to use any amount of dynamite, and the working ability of the pump in the drill hole near-by is not impaired.

In following a system of this kind, adopted for the first time in the Joplin district by Short, it would seem necessary that the shaft should be either sunk through open ground, permitting free drainage of water to the drill hole, or that two drill holes should be sunk, one squarely in the center of the shaft and the other near-by for the pump. The latter is the system followed by the Geronimo company. The shaft is being sunk through hard limestone beneath which occurs the open ground in which the ore is found. Both holes penetrate the open ground, the deep-well pump having been installed to a depth of 150 ft. Care is taken to keep open the drill hole in the bottom of the shaft, for through it the water from the shaft seeps into the lower open ground, thence across the intervening space of seven feet to the second drill hole, whence it is pumped out. In this manner the shaft, formerly so wet that the miners were forced to wear rubber boots, is now dry and the excavated rock is handled with much greater ease.

Grounding Electric Circuits

The discussion of a paper, "Earthing, Earth Plates and Earth Detectors," by T. W. Ellis, at a recent meeting of the South Wales Branch of the Association of Mining Electrical Engineers of Great Britain, contained some interesting facts.

Sands and gravels appear to conduct principally by the moisture and damp clay in the interstices, but clays have a true conductivity, some of them giving less resistance than the water with which they are moistened. Some rocks have a conductivity depending not only on the water they contain, but also upon the nature of the rocks themselves.

These figures suggest that the excellent conductivities of clays are due to the fineness of their constituents and not so much to the conductivities of the particles themselves. Temperature is also a factor; water at 60° F., which had a resistance of 2400 ohms, fell to 1400 ohms at 150° F. Long continued action of electric current lowered the resistance of soils, while a rest raised the resistance.

RESISTANCES OF NATURAL GROUNDS

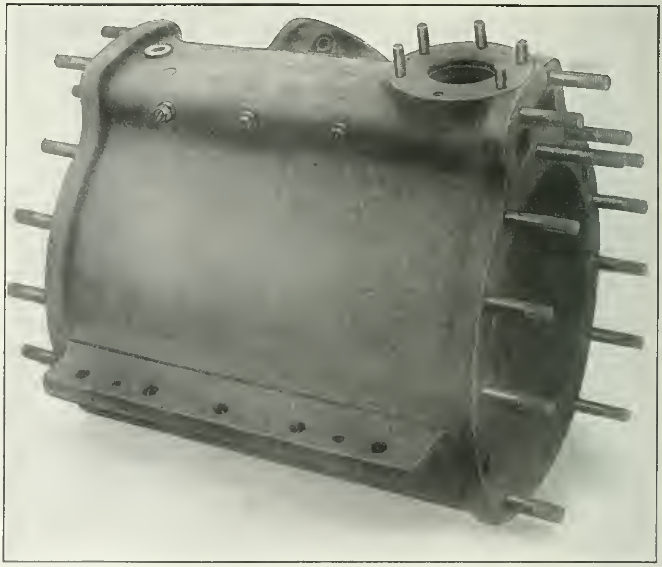
Natural conductor	Ohms per c.c.
Fresh rainwater	12,000
Stream, well and river water	2,400
Thames water (at London Bridge)	2,130
Sea water	350
Saturated solution of lime water	750
London blue clay	870
London red clay	950
Clay with sand	1,900
Plastic clay	1,900
Same clay (dry)	1,850
Ordinary river sand	19,000
Whiting (levigated chalk)	1,900

The resistance of a ground-plate 2½ ft. square is about ¾ of an ohm, if sunk in the sea, 3 ohms if buried in pure clays, 10 to 15 ohms if in mixtures of both gravels and clays, and as high as 40 ohms when sunk in some mixtures of sands and gravels or porous rocks. The least resistance of an earth connection that Mr. Ellis has yet measured was 7 ohms, and the mean resistance of a large number of measurements was between 15 and 20 ohms.

In sinking a ground-plate, it is necessary to put it sufficiently deep to insure its being surrounded the whole year with soil saturated with moisture. It should be sunk in a hollow, and, if possible, beside a constantly running stream, with the top of the plate below the level of the bed of the water course. If sunk near a drain the plate should be placed near its under surface. If there are gas and water pipes, it should, where possible, be connected to them. Of course, a connection to a gas or water main is sufficient where such pipe is not likely to be cut for repairs. The resistance of an earth connection made to a water line may be but a fraction of an ohm. A number of small plates, sunk some distance apart, are a more efficient earth connection than one large one. They are still more effectual if the conducting layer of soil is shallow.

Patching an Air Compressor Cylinder

An ingenious repair job was recently made on an air-compressor cylinder at the No. 7 colliery of the Susquehanna Coal Co., Nanticoke, Penn. For some unknown reason, water accumulated in the air-exhaust port of the cylinder and when the compressor was started the outer shell was cracked on both sides, as shown in the accompanying illustration.



STAY-BOLTS TO STRENGTHEN CRACKED EXHAUST PORT OF COMPRESSOR CYLINDER

It was a case of making a hasty but permanent repair and the master mechanic, states *Power*, decided to reinforce the fractured part through the top and sides by means of solid stay-bolts. The stay-bolts, running from the top of the air port, extended but part way through the cylinder wall. A second set was run from the side walls of the exhaust port, as shown. The crack was then dovetailed with a cold-chisel and plugged with strips of copper.

The repaired cylinder has been in use for three years and the cylinder was recently removed in order that it might be rebored, when it will again be put in service.

A Discussion of Mining Law

By H. V. Winchell[*]

The features of mining laws in general and of those in the United States in particular are critically considered. The shortcomings of existing laws are pointed out and remedies proposed.

The question of national mining laws is of special interest just now in both Canada and the United States. Attention has been widely called to the many defects and general insufficiency of existing statutes, and wherever the matter has been discussed, the need for revision has been admitted.

Agitation for New Laws in United States

In the United States during the last decade there has been frequent agitation of the subject. Public officials connected with the administration of our land and mining laws have urged legislation along certain lines; the Director of the Geological Survey, and the Secretary of the Interior have discussed it in their annual reports; and the matter has even engaged the attention of Presidents Roosevelt and Taft in messages to Congress. Associations and societies of various descriptions after due consideration have passed resolutions demanding this or that measure of relief, and in some cases committees have been appointed for the purpose of making recommendations as to the principles to be followed in new legislation. Thus, a few years ago a committee of prominent mining engineers, among whom were John Hays Hammond and James Douglas, united in a report upon this subject to the Government at Washington; but nothing came of it, and so far as I can learn, the report was never even published. More recently the matter has again been agitated and committees for its consideration have been appointed by the American Mining Congress and the Mining and Metallurgical Society of America.

We in the United States might well profit in this matter by the very sensible and systematic method which has been adopted in Canada to facilitate the proper settlement of this most important question. Here, as I am informed, a committee of engineers and attorneys has been selected by the Canadian Mining Institute to draft a bill for a Canada Mines Act, and to present the same for consideration and adoption by the Dominion Parliament. In other words you Canadians are proceeding in the best way to procure laws framed by experts; and none can doubt that statutes thus prepared are in every way superior to enactments whose subject matter is prepared by theoretical political economists on the one hand or by agitators and professional politicans on the other.

I wish, therefore, at the outset to commend the Canadian Mining Institute for its very wise procedure in this matter and admonish you not to weary in well-doing, nor to be disheartened at slow progress. When you have accomplished what you have set out to do you will not only have that pleasant sense of satisfaction which succeeds the consciousness of duty worthily performed, but you will have made an investment of time and labor which will return a thousand-fold in actual wealth and prosperity. For that country which is willing to be guided as to the handling and development of its mineral resources by the crystallized policies of its mining engineers is the country whose mining industry will be at once the best managed and the most productive of material blessings for all the people.

The mining laws of a country are those legislative enactments or customs established by precedent which control the acquisition and tenure of mining rights and property, in contradistinction to "mining regulations" which have to do with the methods and appliances used in operating mines.

Two Groups of Mining Laws

The principles underlying the mining laws of various countries have been found susceptible of classification into two groups:

(1) The "concession" system under which the state or a private owner of mining property has the right to grant concessions or leases of such mining property to individuals or corporations at discretion, or under certain general restrictions.

(2) The "claim" system, under which any individual, under certain general specified restrictions generally as to nationality and color, has the right to locate on discovery or otherwise certain limited areas of ground, and under certain conditions to hold, work and dispose of the same.[1]

Under the concession system the right to grant lies with the owner, and it is said that five-sixths of all the mining areas of the world are held under it; under the claim system the right to claim mining ground lies with the locator or discoverer. The latter is the system underlying the laws of Canada and the United States as well as South Africa and Australia; but there are fundamental differences in these countries as to the nature of the possessory right and the character of title finally obtained.

Concession System of Ancient Origin

Originating in the ancient proprietary rights of kings and feudal lords to the minerals in the ground, the concession system still prevails in more or less modified form under all the ancient civilizations of the world. Its chief advantage is in the retention by the state of the right to select and control the operations of its *concessionaires*, thus assuring proper capitalization and development, good management, economical use of raw material and the payment of rental or royalty.[2] To this system there have been objections as follows:

(1) That it places unduly large property control in the hands of a few men, and takes from the poor working man the chance of sudden wealth. (2) That by destroying competition in the sale of mines it places in the hands of the holders of large concessions the power of unlimited capitalization and speculation. (3) That it leads to the tying up of large areas of mining ground and thus restricts the employment of labor and the mineral production of the country.

To these objections it may be answered that a relatively small number of men will always have control of the money with which to buy and develop mining property no matter how it be granted; that the government may easily regulate the capitalization of its lessees; and that a large, strong corporation is usually better prepared to thoroughly prospect its territory than the unaided though far more numerous prospector. If diligent prospecting is required as a condition in the concession, the system of preference rights to explore large areas with the further right to take out leases of limited area would seem to present many practical advantages for new and unexplored countries.

Claim System Founded on Usage

The claim system grew out of conditions in early mining days in the United States and Australia. The Argonaut horde which invaded California in 1849 and a few years later rushed to Australia were in many cases allowed to make their own local rules as to size of claim, method of discovery, staking, recording and obtaining title. In the United States the usages thus established were later sanctioned by Congressional enactment which grew into our present system of

---

Note—A paper presented at the annual meeting of the Canadian Mining Institute, Toronto, Ont., Mar. 6, 1912.

[*] Mining geologist, 505 Palace Building, Minneapolis, Minn.

[1] "Mining Law of the British Empire," C. J. Alford, London, 1906; p. 1.

[2] Alford, loc. cit. p. 2.

mining law, and also served to greater or less extent as a model for Australia and other modern nations.

This system, "however necessary in the peculiar circumstances of its inception, should have been altered as soon as changing circumstances permitted," but instead it has been patched and interpreted by judical decision until the United States has today the most wretchedly inadequate and antiquated law with which a great country is anywhere afflicted. Instead of fostering the mining industry the law as it stands today and as interpreted by the judicial and executive branches of the government creates confusion, entails unnecessary expense, causes waste and retards development.

Two Universal Basic Principles

Two fundamental principles are common to the mining law of all countries: (1) The right of the mine-holder to a perfectly secure and indefeasible title to his property so long as he fulfills certain specified conditions entirely within his own control, and (2) the right of the state or other landlord to certain rents, royalties or taxes on the property or its output, and to the reasonably constant operation of the mine.

In the power of the government to fix the rate of royalty or taxes lies also the ability to promote or to discourage prospecting and mining. If the chief aim of the government is the development of national resources and the increase of general prosperity and business, its policy for the disposition and holding of its mineral lands will be most liberal. If there is a desire to enrich the public treasury directly by means of revenues from taxes upon mines the result may be a rapid decline of the mining business, and a shifting of the population to more favored communities.

It is frequently stated, and truly as I believe, that the principal factor in the growth and development of the United States and Canada has been the liberality of their policy for the distribution of their public domain. Freely, or at a nominal consideration, homesteads and mines have been offered to all who chose to come and settle, to develop and use. If during the last 50 or 75 years the policy of conservation as now advocated by its most ardent proponents had been expressed in our statutes, North America would be for the most part as little developed as Alaska. There would be a line of settlement along the Atlantic and a few fishing hamlets on the Pacific. The interior of the country would still be to a large extent bottled up and conserved; and we should perhaps be still importing the bulk of our copper and iron as we are of our tin, platinum, potash and sulphur.

To speak to an audience of mining men of the importance of a liberal mining law is like carrying silver to Cobalt or copper to Butte, but since these remarks may find a wider audience a few words upon the extent of our mining industry may not be out of place. First, with reference to the United States. The annual products of the mines of the United States now exceed $2,000,000,000 in value. They contribute 65% of the freight traffic of the country. The industry employs over a million men at the mines and twice that number in handling, transporting and manufacturing the products.[3]

Mineral Wealth of United States

The total value of our metallic products during 1907 was $900,000,000; of mineral fuels, $788,000,000; and of nonmetallic mineral products, other than fuels, more than $378,000,000. During the year we imported mineral products to the value of $255,000,000 and exported mineral products to the value of $340,000,000. From the beginning of coal mining in this country in 1814 to the close of 1907, nearly seven billion (6,865,000,000) tons were mined. Adding to this the one-half additional supposed to have been wasted in mining, gives a total of more than ten billion tons taken from the supplies originally available. The amount of easily accessible and available coal in the United States, exclusive of Alaska, is estimated as 1,400,000,000,000, while the total, including Alaskan reserves of 150,000,000,000 tons, and the coal not easily accessible, is perhaps double this amount, with the country as yet but partially explored. It may be remarked in passing that since the United States is now mining about 500,000,000 tons of coal annually we would appear to have a coal supply sufficient for about 6000 years at the present rate of consumption, even without borrowing or buying from the enormous coal bins of Canada. Can anyone doubt that the provisions of the laws governing the disposition of the 50,000,000 acres of coal land still remaining in the hands of the government is a matter of importance to a nation with an annual coal consumption of five tons per capita?

Figures are wanting as to the quantity and value of other mineral products estimated to remain within the unappropriated public domain. The land area of the United States excluding Alaska and the insular possessions, is about 3,000,000 square miles, or 1,920,000,000 acres. Of this area over half is arable, and a little less than half is occupied as farm land. About two-thirds of the land has passed into private holdings. Of the original acreage there remained on July 1, 1908, 387,000,000 acres, or about one-fifth open to entry. Nearly all of this is arid or otherwise unsuitable for settlement by families. There are also about 235,000,000 acres in national forests, national parks, and other lands reserved for public use. Of the entire area of 1,920,000,000 acres there remains unalienated about 622,000,000 acres or nearly one-third, within which valuable minerals may still be discovered. Is it not a matter of vast importance to provide most carefully for the exploration, disposition and development of this vast empire? In what direction can the fostering care of government be more profitably and properly extended? And when we take into account Alaska with its undeveloped area of about 360,000,000 acres and our island possessions with 90,000,000 acres more, is it not clearly one of the largest questions before the public today?

In Canada the percentage of unappropriated public domain is larger than in the older country lying along its southern border, and there is yet ample time to avoid the mistakes of omission and commission of the United States. With a total area of 2,118,814,000 acres, you have still in the hands of your provincial and dominion governments much the larger part of your acreage. Your annual production of minerals is valued at nearly one hundred million dollars. At the present rate of increase it may easily amount to five hundred million dollars by 1950. Can your engineers find any more truly national work than to aid in the framing and adoption of the best possible laws for the protection and encouragement of the mining industry?

Conservation by Good Mining Laws

Is it not apparent that there is a very close connection between mining laws and that conservation idea so dear to the imagination of the majority of our people today? If the true aim of conservation be "maximum use with minimum waste," is it not evident that to be consistent with this theory, mining laws must be liberal as to opportunity and inducement for the individual or corporation, and at the same time as scrupulous and exact in supervision and scientific regulation as the conditions of industry and the laws of political economy will permit? If the terms and conditions for acquiring mining property be so difficult as to materially restrict the number of prospectors or development companies, there will be far less than "maximum use"; and if no right of supervisory control is retained by the government, there will seldom be "minimum waste." The best code of mining laws will inevitably aid in the development of natural mineral resources and at the same time have a tendency toward the right species of conservation, as contradistinguished from that variety of it which seems to aim at disuse, stagnation and paralysis.

In many particulars the present mining law of the United States is admittedly a failure, and in other respects it has both its critics and defenders. I propose to mention briefly some of its defects, and some possible amendments, not because there seems to be any danger that our worst faults will be copied by others, but in the way of general illumination of a question which is not always clearly understood even by our own people.

---

[3] Report of the National Conservation Commission, Vol. 1, p. 95, Washington, 1909

PROVISIONS OF ACT OF 1872

Briefly stated, the United States mining law, known as the Act of 1872, provides for location by discovery; possession perpetuated by annual assessment work; and title in fee simple to the surface and minerals obtained after the expenditure of a certain amount of money by the payment of $5 per acre, and the observance of certain formalities as to survey, etc. The metal-mining laws do not apply to all of the states. They are made applicable to the Western states and territories with the exception of Michigan, Wisconsin, Minnesota, Missouri, Kansas and Texas.

Mining locations are not recognized in the states east of the Mississippi River, nor is there in any state legal authority permitting one man to prospect or mine beneath the surface of ground owned by another, without the latter's consent. To this statement there is one important exception, and that lies in what is called the "apex law," under which the owner of the outcrop of a vein in mining claims, has the right to follow and mine the vein on its downward course beneath the surface of a claim owned by another. "This law has proven more productive of expensive litigation than of economical mining, and in many of the more recently established and more progressive mining districts has been made inoperative either by common agreement or by compromise between adjoining owners."[4]

PLACERS LOCATED BY DISCOVERY

Placer mines are likewise located by discovery and held by annual work and acquired by purchase in fee simple forever. Known veins within placer locations must be declared and paid for separately or else they are excepted from the placer patent and can be located by others in "lode claims." All veins on placer ground not known to exist at the time of application for patent belong to the grantee, but without extralateral or apex rights. If an applicant for a placer patent can be shown to have had knowledge of a valuable lode within his lines prior to the making of his patent application, his title as to that vein may be canceled for fraud at any time upon application of a contesting locator. There is no limit to the time for such contests and they are still being brought in some cases 20 years after placer patent.

The law is very defective on this point; for it frequently happens that veins discovered today have a value by reason of improved transportation facilities or metallurgical processes, although these same veins were of no value whatever when the placer claim was located and patented. The owner of such a claim is sometimes put to the expense and annoyance of defending such contests repeatedly, since there is no limit to the number of contestants. The law should be amended so as to make it impossible to attack a placer patent on such charges after a reasonable term of years. Another absurd feature of the placer act is that providing for the location of oil, gas, iron ore and other deposits in the same manner as auriferous gravel.

Coal lands are sold by the government upon an appraised valuation, and the amount of land that may be legally acquired is limited for an individual to 160 acres and for an association to 640 acres. Tracts of such limited area do not often justify the installation of the most efficient equipment, and economical operation is therefore impossible under the terms of the very law which was expressly designed to promote economy and prevent monopoly.

Under the present United States law there is no general system of separation of surface from mineral rights, no leasing of mines from the government, no payment of rental or royalty and no federal supervision or control after location and patent. Taxes are paid to the state and county and mining regulation is attempted by many states. Unfortunately there is no uniformity of principle and practice as to these matters, nor any stability nor assurance of permanence in any state either as to methods of operation required or basis of taxation.

Although it has been successful elsewhere and has much to recommend it, the government leasing system has never met with much favor in the United States. There is not at present strong opposition to grants in perpetuity by the government, although the leasing system has been recommended by some organizations and public officials. There is a hesitancy to create more bureaus, for bureaucratic administration is not popular with those who have tried to transact business with many of them.

REMEDIES PARTICULARLY NEEDED

Aside from the generally condemned apex law, there are two or three features of our present system which should be speedily remedied. The first is that provision of the law requiring a discovery of valuable mineral before location. There is really no sense in such a requirement. What seems valuable to one man is often worthless to another; and what is of no value whatever today may be worth a million in a year or two. Moreover, it sometimes requires a year's work and a shaft several hundred feet deep before the actual discovery of ore, even though the surface indications give ample promise of its existence below. Every mining engineer and geologist knows that many ore deposits have no value whatever immediately upon the surface of the ground. Why not allow a prospector to stake out his mining claim wherever he chooses on the public domain, and hold it so long as he performs the required amount of development work?

Another defect in our present law is that permitting a prospector to locate an indefinite number of mining claims and to hold them without actually doing his assessment work. Many promising districts are kept from becoming hives of industry and producers of mineral wealth by the tying up of their territory in this way. The prospector should be restricted in the number of his locations, and real development work should be exacted.

PROVISION FOR APPEALS FROM DECISIONS NEEDED

The last important defect in the United States and Alaskan mining and land law to which I wish to call attention is the lack of any provision for appeals to the courts from the decisions of administrative officers. It is contrary to the general spirit of our institutions and an anomaly in constitutional government to take away from any citizen property rights to which he considers himself justly entitled under the law, by the mere fiat of an appointed government official who is here today and gone tomorrow. To place in the hands of such officers the final dicta in matters involving property valued at hundreds of thousands of dollars, and to provide no method of appeal to any duly constituted nonpolitical judicial tribunal is not only to subject the said officials to great and unnecessary tests of moral courage and fidelity, but to require in them the qualifications of superior judges and experience in the interpretation of the law which many of them cannot be expected to possess. Serious injustice may be done without any remedy at law to the defeated applicant. In the interests of justice, provision should be made for appeals in important cases and perhaps in all cases from decisions of the commissioner of the General Land Office or of the Secretary of the Interior to some court of competent standing and jurisdiction, whose decisions could and would be accepted by the public and the interested parties as justified by the law and the evidence. I am gratified to notice that this point has been carefully covered in the recommendations of the Canadian committee on this subject.

A comparison of the mining laws of the United States with those of other English-speaking countries will disclose a fundamental difference in the underlying theory of the proprietorship of minerals, and hence in the attitude of the courts upon the subject as reflected in their decisions. Recent publication of a report upon the "Mining Laws of Australia and New Zealand,"[5] has caused considerable discussion because of the fact that its recommendations have been to a certain extent adopted by other government officials in their annual reports and public addresses. This report apparently assumes a similarity between British laws and those of the United States in certain respects where actually a wide difference exists.

---

[4] Thirty-second Annual Report, Director U. S. Geol. Surv., p. 15. Washington, 1911.

> Neither regalian right, nor anything similar, has ever existed in or been asserted by the United States.[6] While it has sovereign authority, and the power to enact such statutes as Congress in its wisdom sees fit, within the limits of the constitution, its right is dependent upon and controlled entirely by statute.[7]

Furthermore:

> A distinction exists, and should be observed between ultimate ownership and right to govern on the one hand, and the exercise of regalian right, after possession and title are parted with, on the other. The former exists in the United States, and the latter does not. The ownership, as well as the manner of exercising control, of mineral lands is regulated in the United States by statute.[8]
>
> The fundamental principles of the common law of England were to a certain extent ingrafted into our legal system when we separated from the mother country and was and still is the rule of action in the absence of legislation. As a general rule, under the common law minerals were the property of the owner of the land, the property in the surface carrying with it the ownership of everything beneath and above it.[9] Wherefore the ownership of the surface was the best prima facie title to the ownership also of the mines.[10] This prima facie ownership continued until rebutted by showing: (1) That the land contained "royal mines"; or (2) that it was subject to some particular custom that defeated the prima facie ownership, as in the case of the tin mines of Cornwall and Devon and the lead mines of Derbyshire; or (3) that the ownership of the mines and minerals had become in fact, from divers causes, several and distinct from the ownership of the soil and surface.[11]

GOLD AND SILVER MINES TERMED ROYAL

By the term "royal mines" was meant mines of gold and silver. These belonged exclusively to the crown, by prerogative, although in lands of subjects. In this respect the rule was the same as under the civil law. It was at one time contended that mines or mineral deposits containing the baser metals in combination with either gold or silver were royal mines. This contention, however, was set at rest by statutes enacted during the reign of William and Mary,[12] wherein it was declared that no mine should be deemed royal by reason of its containing tin, copper, iron or lead in association with gold or silver. Thus, those mines only came to be classed as royal in which were found the precious metals in the pure state. Briefly stated, the regalian right to mines, as recognized in England, was confined to those of the precious metals, gold and silver. The baser substances belonged to the owner of the soil except in certain localities where immemorial custom had modified the rule.[13]

At the present time "England has no general mining laws. Legal questions governing the ownership of mines and minerals have been determined on the general principles of the common law."[14]

As distinguished from the common law the theory of the civil law is thus clearly stated by H. W. Halleck:

> All continental publicists who have written upon the subject lay down the fundamental rule, that mines, from their very nature, are not a dependence of the ownership of the soil; that they ought not to become private property in the same sense as the soil is private property; but that they should be held and worked with the understanding that they are by nature public and that they are to be used and regulated in such a way as to conduce most to the general interest of society.[15]

CONFLICTING OPINIONS AS TO GOVERNMENT'S RIGHT TO PRECIOUS METALS

C. H. Lindley has presented concisely the theory of our leading mining lawyers as to governmental control after patent, as follows:[16]

> The government of the United States does not concern itself with mining lands or the mining industry after it parts with the title. This title vests in the patentee absolutely to the extent of the property granted. No royalties are reserved; nor is any governmental supervision (except perhaps in the isolated case of hydraulic mines in California) attempted. Upon the issuance of the deed of the government the mineral land becomes private property subject to the same rules as other property in the state with reference to the transfer, devolution by descent, and all other incidents of private ownership prescribed by the laws of the state. Briefly stated, property in mines, once vested absolutely in the individual, becomes subject to the same rules of law as other real property within the state.

But lately we are told that the United States "has never waived its right to the precious metals,"[17] and that "in all states where the federal government has never owned the land, and there are 19 such states, the ownership of the precious metals lies with the state government," and "that in states where the ownership of the land has been vested in the federal government the ownership of the precious metals in like manner, lies with the nation, and that as against the government no person has a right to gold and silver in any lands in the United States unless this right has been specifically granted to him in the deed of conveyance.[18]

Here is a most radical difference of theory. Mr. Veatch would have the government resume dominion and control of gold and silver and by implication of other metals beneath the surface of all lands except those in which minerals were specifically conveyed. He thinks the government has the right to grant prospecting permits beneath private property and the power to collect royalties on minerals produced as a result of such explorations. In other words he insists upon it that the United States is in possession of a regalian right, but does not know it or has forgotten it. He would have the people wake up and seize what is theirs from all mine operators who are thus wrongfully removing from the ground valuable minerals never specifically granted to them by the government.

HAS UNITED STATES REGALIAN RIGHTS?

It can readily be seen that it is a matter of no small moment to ascertain whether such a thing is possible. Here is proposed mining-law revision with a vengeance. I have not at hand the figures to show the relative proportion of lands patented as mineral lands and in all other classes; but have no doubt that the lands granted under the homestead, preëmption, desert land act, private entry, town site, timber and stone, railroad grants and all other laws exceed in the aggregate the lands patented under the mining laws four to one.

Now, if the minerals under three-fourths of the privately owned land west of the Mississippi, and practically all the lands east of it, really belong to the government it is high time for the government to assert its right and to exercise some sort of control over its vast possessions. This is either a nebulous and iridescent dream or a very important discovery. If the former, the bubbles should be punctured and the mist dispelled before arousing too many false hopes; if the latter, the work of mining-law revision at once assumes paramount importance. Fortunately, we have some illuminating opinions of the United States Supreme Court, as a guide and cloud dispeller

---

[5] Bull. 505, U. S. Geol. Surv., by A. C. Veatch with a preface by Walter L. Fisher, Washington, 1911.

[6] There is a possible exception to this statement in the case of lands owned by some of the original thirteen states and never controlled by the federal government.

[7] Synder on Mines, Vol. 1, p. 15.

[8] Lindley on Mines, First edition, Vol. 1, p. 4.

[9] Blackstone's Comm., p. 18; Arundel on Mines, p. 3.

[10] Bainbridge on Mines, 4th ed. p. 118; MacSwinney on Mines, p. 27; Rogers on Mines, p. 247

[11] Bainbridge on Mines, Fourth edition, p. 27

[12] William and Mary C. 30; 5 William and Mary C. 6.

[13] Lindley on Mines, First Edition, Vol. 1, p. 4.

[14] Lindley on Mines, Loc. Cit.

[15] Introduction to De Iooz on the Law of Mines, p. x; Lindley on Mines, First Edition, Vol. 1., p. 14.

[16] Lindley, loc. cit., p. 29.

[17] Bull. 505, U. S. Geol. Surv., p. 110.

[18] Bull. 505, U. S. Geol. Surv., p. 101.

COURT DECISIONS CITED

In the case of Deffeback vs. Hawke, 115 U. S., p. 400, Justice Field, after reviewing at length the various acts of Congress relating to the public lands of the United States, concludes as follows:

> It is plain, from this brief statement of the legislation of Congress, that no title from the United States to land known at the time of sale to be valuable for its minerals of gold, silver, cinnabar, or copper, can be obtained under the preemption or homestead laws or the town-site laws, or in any other way than as prescribed by the laws specially authorizing the sale of such lands, except in the States of Michigan, Wisconsin, Minnesota, Missouri, Kansas. We say "land known at the time to be valuable for its minerals," as there are vast tracts of public land in which minerals of various kinds are found, but not in such quantity as to justify expenditures in the effort to extract them. It is not to such lands that the term "mineral" in the sense of the statute is applicable. In the first section of the act of 1866 no designation is given the character of mineral lands which are free and open to exploration. But in the act of 1872, which repealed that section and reenacted one of broader import, it is "valuable mineral deposits" which are declared to be free and open to exploration and purchase. The same term is carried into the Revised Statutes. It is there enacted that "lands valuable for minerals" shall be reserved from the sale except as otherwise expressly directed, and that "valuable mineral deposits" in lands belonging to the United States shall be free and open to exploration and purchase. We may also say lands known at the time of their sale to be thus valuable, in order to avoid any possible conclusion against the validity of title which may be issued for other kinds of land, in which years afterward, rich deposits of mineral may be discovered. It is quite possible that lands settled upon as suitable only for agricultural purposes, entered by the settler and patented by the government under the preemption laws, may be found, years after patent has been issued, to contain valuable minerals. Indeed this has often happened. We therefore use the term "known" to be valuable at the time of sale, to prevent any doubt being cast upon titles to lands afterward found to be different in their mineral character from what was supposed when the entry of them was made and the patent issued.

And in the case of the Colorado Coal Co. vs. the United States, 123 U. S., p. 328, Justice Matthews uses the following language:

> A change in the conditions occurring subsequently to the sale, whereby new discoveries are made or by means whereof it may be profitable to work the veins as mines, cannot affect the title as it passed at the time of the sale. The question must be determined according to the facts in existence at the time of the sale. If upon the premises at the time there were not actual "known mines" capable of being profitably worked for their product, so as to make the land more valuable for mining than for agriculture, a title to them acquired under the preemption act cannot be successfully assailed.

Since these are the opinions of the highest court in our land it is probable that although the advocates of radical revision of our mining law may be able to change the form of its superstructure they will hardly be able to mine deep enough to disrupt its solid-rock foundations. It will continue to present fundamental differences from the mining law of Canada on the north, and from that of Mexico on the south, but rights already granted will not easily be set aside.

Summarizing these somewhat disjointed remarks, it appears in general that:

(1) The development and prosperity of all countries are vitally affected by the provisions of their laws relating to mines.

(2) Greater inducements and more liberal rewards should be offered in unsettled countries than in districts of denser population.

(3) Continuous development work should be required and rigidly enforced, but (4) no narrow limit should be placed on the amount of property held by an individual or corporation so long as the aggregate amount of work equals the product of the net units of area held multiplied by the amount of development required for each unit area.

(5) In case of any contest either between rival claimants or between a locator and the government full privilege should be given of appeal to the courts as in other matters wherein the title to property is involved.

SIX RECOMMENDATIONS

In addition to the above and with particular reference to the United States, taking into account the system of mining law there already established by long years of precedent and custom, the following recommendations are tentatively presented[19]:

(*A*) The apex law should be abolished.

(*B*) Mining claims should be locatable regardless of a "discovery" and held only so long as the specified development work is performed in good faith.

(*C*) Placer locations should be limited to deposits of loose material above solid bedrock.

(*D*) A statute of limitations should establish a reasonable term of years beyond which placer patents shall be immune from attack on the ground of misrepresentation in the patent application.

(*E*) Special statutes should be enacted providing for the location and working of oil, phosphates, rare earths, haloids and other mineral substances not specifically mentioned in the present laws.

(*F*) Existing titles should be fully recognized and confirmed and no effort should be made to create retroactive legislation.

I have purposely avoided any discussion of the relative advantages or disadvantages of permanent alienation of title as opposed to the government-leasing system. For Canada I am confident the latter system is to be preferred, and am pleased to find myself upon this point in accord with the majority of Canadian mining men.

---

[19] It should be clearly understood that for these suggestions I am alone responsible. They do not in any sense pretend to reflect the views of the Mining and Metallurgical Society of America nor its committee on mining law.

Byproduct Coke Ovens

A list of byproduct coke ovens in the United States has several times been asked for. The following (Circular No. 97, U. S. Dept. of Agriculture) gives the list as of Jan. 1, 1910, and may be of some interest.

Semet-Solvay Ovens—Solvay Process Co., Syracuse, N. Y.; Semet-Solvay Co., Pennsylvania Steel Co., Steelton, Penn., also Lebanon, Penn.; Semet-Solvay Co., National Tube Co., Benwood, W. Va.; Semet-Solvay Co., Milwaukee Coke & Gas Co., Milwaukee, Wis.; Semet-Solvay Co., Detroit, Mich., also Ensley, Ala.; By-Products Coke Corporation, South Chicago, Ill.; Semet-Solvay Co., Empire Coke Co., Geneva, N. Y.; Semet-Solvay Co., Dunbar Furnace Co., Dunbar, Penn.; Semet-Solvay Co., Central Iron & Coke Co., Tuscaloosa, Ala.; Philadelphia Suburban Gas & Electric Co., Chester, Penn.

Otto-Hoffmann Ovens—New England Gas & Coke Co., Everett, Mass.; Lackawanna Steel Co., Lebanon, Penn.; Dominion Tar & Chemical Co., Sydney, Nova Scotia; Hamilton-Otto Coke Co., Hamilton, Ohio. The following use both the Otto-Hoffmann and United Otto: Camden Coke Co., Camden, N. J.; Cambria Steel Co., Johnstown, Penn.

United Otto—Carnegie Steel Co., South Sharon, Penn.; Maryland Steel Co., Sparrows Point, Md.; Citizens Gas Co., Indianapolis, Ind.; Pittsburgh Gas & Coke Co., United Coke & Gas Co., Glassport, Penn.; Zenith Furnace Co., Duluth Minn. The Lackawanna Steel Co. at its Buffalo, N. Y., plant uses both the United Otto and the Rothberg ovens.

Koppers—Illinois Steel Co., Joliet, Ill., and Indiana Steel Co., Gary, Indiana.

South African Sulphur

It is reported that deposits of sulphur have been discovered in South Africa, which are said to contain about 65% sulphur. These deposits should prove of importance to the explosive works out there, as they at present are using large quantities of imported pyrites. (*Chem. Trade Journ.*, Feb. 3, 1912.) In addition to this, large supplies will be required by the Cape vineyards, which use considerable quantities of flowers of sulphur. E. Wykeham Hodgson, of Cape Town, is interested in the syndicate formed to exploit these deposits.

Cyaniding Tailings in Colombia

By Ralph W. Perry*

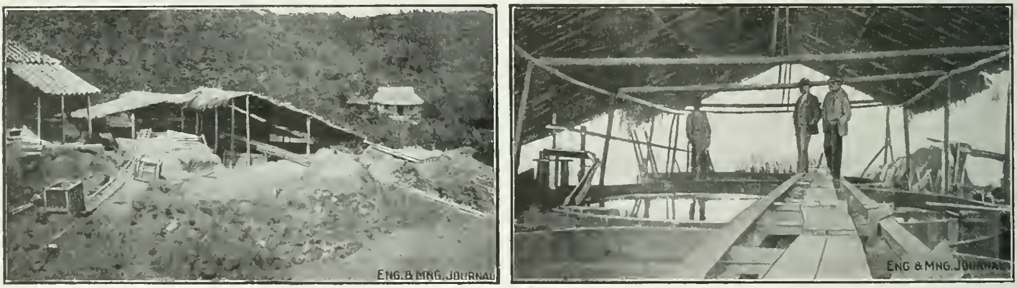
A description of the methods and costs of construction and operation of three small temporary plants for treating accumulated tailings. The process consists of leaching, zinc-shavings precipitation and melting; the bullion and slag produced were shipped to New York.

The following notes on the construction and operation of cheap temporary cyanide plants, where the quantity of tailings is not sufficient to warrant the construction of expensive works, may be of use to engineers and miners who have small mines or tailings dumps and are deterred from working them on account of the first cost of plant and the fear that a cheap plant cannot do the work.

THREE DUMPS TREATED

The tailings treated consisted of three dumps, situated within a few miles of each other in the mining district of Santa Rosa de Osos, department of Antioquia, Colombia. The district of Santa Rosa is situated about 40 miles north of Medellin, the capital of the department, and the same distance from Cisneros, at present the terminus of the Antioquia railroad.

Costs of the principal materials used in construction are given in the accompanying table. Freight charges from Medellin and Cisneros to the plants vary from $3 to $5 per *carga* (250 lb.), depending on the condition of the roads and the movement of other frieght.



TWO TEMPORARY CYANIDE PLANTS IN COLOMBIA—NATIVE CANE PUMP RAISING CYANIDE SOLUTION

PRICES OF CONSTRUCTION MATERIAL IN COLOMBIA

Lumber:	Price	Other material:	Price
6x 6 in., per ft.	$0.05	Nails, per kg.	$0.30
3x10 in., per ft.	0.05	Castings, per kg.	0.40
2x 6 in., 6 ft. long	0.20	Pipe, 2½ in., per ft.	0.90
2x10 in., 10 ft. long	0.25	White lead, per kg	0.66
1x8 in, 8 ft. long	0.16	Tar, per keg	0 50
3x3 in., 10 ft. long	0.15	Rope, 1 in., per ft	0 10
Other material;		Filter cloth, per yd.	0 40
Round iron, per kg	0 16	Cocoa matting, per yd.	0.20
Flat iron, per kg.	0.22		

The prices given are Medellin prices. Much of this material can be purchased abroad if time allows, from three to four months being necessary to fill an order.

All lumber was whipsawed and carried on men's backs for a distance of two to five miles. Laurel was used almost entirely in the construction of the tanks although many other kinds of wood were also employed. No timber is found there free from worm holes and much trouble was encountered in finding these and plugging them, but after once being fixed, no more difficulty was experienced from this cause. Carpenters received from $0.60 to $1 per day, none of them having had previous experience in constructing tanks. They learned rapidly and their work improved much with the experience gained.

The first plant was completed within five months from the time of cutting the first timber, so that it was impossible to season it. The green timber caused no difficulty if kept moistened and protected from the direct rays of the sun, but shrunk quickly if allowed to become dry for a short time. The zinc boxes were the only part of the plant inclosed and this was done with the cheapest of material.

METHOD OF CONSTRUCTING TANKS

The bottoms of the tanks were nailed to 6x6-in. timbers, spaced with 36-in. centers, which were laid on 3x10-in. mud sills. These mud sills were laid on ground levelled off and well tamped; where necessary stone work without lime was employed in getting a level surface. Through leakage from the new tanks considerable settling took place, but the tanks remained in good condition during their term of service. Some of these tanks were knocked down at the end of a year and erected on another dump and were found still to be in excellent condition.

The staves were dressed on the outside only and were 1⅝ in. thick. The bottoms were of the same thickness but dressed on both sides and grooved for tongues. The croze in the staves was ⅜ in. deep and 1½ in. wide, the bottoms of the tanks being slightly beveled around their circumference. The hoops were made of ⅞-in. round iron and were fastened with cast-iron lugs made in Medellin and weighing 2 kg. each.

The leaching tanks were provided with wooden side discharge doors 10 in. square. These doors were made by cutting an opening, slightly beveled, at the level of the filters, through which projected a box cut to fit the opening. In the interior of this box grooves were cut to receive a sliding door, which could be wedged in the groove to form a tight joint. This door consisted simply of a 2-in. plank. It was easily removed and caused no trouble from leaking. Both rectangular and circular zinc boxes were used, the latter proving much more satisfactory, both in cost of construction and convenience in cleaning up. The costs of construction of each of the plants is shown in the table.

CONSTRUCTION COSTS OF TAILINGS CYANIDE MILLS, COLOMBIA

	San Francisco	San Ramon	Pastora Mira
Administration	$363.26	$363 26	$261.12
Timber	562.12	410.47	175.37
Carpenters	766.08	586.77	500.42
Iron	416.20	347.00	207.96
Blacksmiths	171.19	142.00	56.61
Excavating, roofs, etc.	233 81	176 63	216.18
Assay office	67.89	67 90	67 90
Trails	14 00	11.00	11 00
Filters	300.00	250.00	207 97
Pipe, pumps, lathe, cars, etc.	358.00	65.53	22.16
Total	$3252 55	$2421.56	$2029.69

---

*Mining engineer, Medellin, Antioquia, Colombia.

The San Francisco plant, shown in the accompanying cut, consisted of the following tanks and accessories; 4 leaching tanks, 20x6 ft.; 1 sump, 18x5 ft.; zinc boxes; one 24-in. pelton wheel driving a 2½-in. rotary pump and a small lathe which cuts the zinc for the three plants. The San Ramon had 3 leaching tanks 20x6 ft.; 1 sump 18x4 ft.; 5 circular zinc boxes, 2½ ft. high by 2½ ft. in diameter; and a native cane pump shown in the accompanying engraving. The Pastora Mira was the same as San Ramon except that all the tanks were 22x4 ft. The assay office was equipped with a pulp scale and a button balance, a muffle furnace and a bullion furnace to take No. 30 graphite crucibles. The cost of the assay outfit was charged equally to the three plants. Thatched roofs were erected over the tanks both as a protection against the sun and the heavy rains. No permanent buildings were constructed, a house in the vicinity being rented which served as a dwelling house and assay office. The three plants as run had a daily capacity of 69 tons per day.

MATERIAL LEACHED IN THREE COLOMBIAN MILLS

	+40 mesh	+100 mesh	+200 mesh	— 200 mesh
San Francisco	7	20	35	38
San Ramon	7	20	35	38
Pastora Mira	9	13	32	46

RECORD OF THREE MILLS TREATING TAILINGS

					Chemicals Used per Ton		
Mill	Tons	Head Assay	Tail Assay	Extractions, Per Cent.	Cyanide, Lb.	Zinc, Lb.	Lime, Lb.
San Francisco	8892	$4.63	$1.05	77.4	0.79	0.30	13.8
San Ramon	8565	4.75	1.21	74.5	0.72	0.26	22.2
Pastora Mira	3750	5.88	2.34	60.2	0.99	0.35	27.0

Tailings the Accumulation of 70 Years

The tailings treated had been accumulating for the last 70 years and were in great part derived from sulphide ores. They were well oxidized and gave an extremely high extraction if the sand and slime were separated. Owing to the high cost of installing a power plant for slime treatment no attempt was made to separate them, although as seen from the screen analysis, it was hardly ideal material to leach.

The sand and slime from the San Francisco and San Ramon dumps had been well mixed when placed on the dumps and gave a fair extraction by leaching, but the sand and slime from Pastora Mira had been kept well separated and while the extraction was satisfactory in the dry season when the sand and slime could be well mixed while charging, in the rainy season it was nearly impossible to mix a charge so that it would leach. The extraction in the dry season averaged 80% and dropped to less than 50% when the rains started.

They all contained a large amount of soluble and insoluble iron and aluminum salts and the consumption of lime was high. Without using a large excess of lime it was impossible to keep the efficient solutions alkaline for the first few days, after which they became more alkaline. This was probably caused by the lime being retained by the slime in the charge. After receiving water washes before discharging, the solutions became much more alkaline and their cyanide strength was also greater than at any previous time.

Extraction seemed to be higher if the solutions were neutral or even slightly acid, but the results were erratic and much trouble was caused in the zinc boxes. This, of course, applies to the effluent solutions and not to the solutions used on the charges. The higher extraction is probably accounted for by the acid solutions being more effective in removing dissolved gold from the charge. Caustic soda, costing 14c. per lb. was used for a short time to replace the lime, but did not prove satisfactory on account of the iron and zinc salts precipitated in the zinc boxes, although the precipitation was not bad even when the boxes were so full of these salts as to render the zinc nearly invisible.

It is possible that the use of an extra tank for the alkaline washes would have lessened the trouble with the precipitate in the boxes, but it is more likely that the charge when transfered would have packed so hard that leaching would have been interfered with. Owing to the poor quality of lime used, one pound of caustic soda would replace six pounds of lime. The greater part of the cyanide consumption was caused by the retention of the cyanide in the charge, and the extraction suffered from the same cause. The solutions at the time of discharging a tank carried from 20c. to $1 per ton, but the percolation became so slow at the end of 7 or 8 days treatment that nothing was gained by prolonging the treatment.

Treatment by Leaching Only

All three plants were run in practically the same manner, filling being done in the day with wooden cars at the San Francisco and San Ramon plants and with wheel barrows at the Pastora Mira plant, the required amount of lime being added to the cars.

The charges first received several water washes and as a rule no cyanide was added until the solutions showed an alkaline reaction, when a weak solution from the sump was run on. This was followed by two solutions from the sump at intervals of eight hours to which were added 10 lb. of cyanide on top of the charge, then two solutions with five pounds of cyanide. The rest of the treatment consisted of giving washes from the sump every eight hours and two water washes before discharging. The charges at the time of discharging carried 28% moisture after draining 24 hours. The tanks at San Francisco were discharged by one peon in six hours by sluicing with water under a 50-ft. head. At the other two plants two peons aided by a stream of water not under pressure could discharge a tank with shovels in six hours.

The sump solutions used as a weak solution varied in strength from 0.02 to 0.05% total cyanide, and the strong solutions from 0.05 to 0.1%. Precipitation was fairly good if the strength of the solutions did not fall below 0.03% KCN, but at times was interfered with by the large quantity of iron and aluminum salts in the boxes.

Much short zinc was produced and many times it was richer in gold than the precipitate. Most of this zinc was removed from the boxes at the regular cleanups, roasted and melted with 40% of its weight of borax, 30 of bicarbonate, and 20 of sand. The slag from these melts was exceedingly rich and was crushed in a stamp battery and panned for the shot, after which it ran from 50c. to $1 per pound. This slag was shipped to New York at a cost including freight, treatment charges, and smelter deductions of $200 per ton.

No filter presses being available, all precipitate was filtered through a piece of canvas stretched over a frame. Except for the delay no difficulty was experienced, even residues from acid treatment being filtered in the same manner. A great deal of short zinc was destroyed by the use of strong cyanide solutions which saved much time and fuel in melting and of course the expense of shipping an excessive quantity of slag was avoided. All of the zinc was dedissolved in acid at the final cleanup. Native coke of good quality and costing at the plants $60 per ton was used for melting. This coke was packed from Amaga, a distance of 80 miles.

Bullion Shipped to New York

The bullion produced ran 550 fine in gold and 280 in silver, after being melted a second time. This was sold to the U. S. Assay Office in New York. The bars were assayed by public assayers in Medellin and the royalties to the owners of the dumps paid on their returns. The owners of San Francisco and San Ramon received 25% of the gross production and of Pastora Mira 30 per cent.

Lime was brought from Yarumal, San Andres and Amalfi, all about 50 miles distant, on pack animals and was of poor quality, having been slaked a long time before using; the packers refusing to pack unslaked lime. Lime cost 5c. per kg. at the mill. Peons received 40c. per day and a man at $2 per day was employed as superintendent at two of the plants. Two peons at $1 each per day were employed as shift bosses at each of the plants. An American at $150 per month assisted in the melting. Most of the material used was imported from the United States, but at times it was necessary to purchase small quantities of supplies in Medellin. The comparative costs of these are given laid down at the plants. The results obtained and the operating costs are given in the accompanying tables, no account being taken of the small amount of silver in the tailings.

OPERATING COSTS FOR CYANIDING TAILINGS IN COLOMBIA

	San Francisco	San Ramon	Pastora Mira
Administration	$0.133	$0.133	$0.133
Superintendence	0.000	0.098	0.14
Labor on tanks	0.067	0.068	0.0709
Filling tanks	0.0859	0.132	0.119
Discharging	0.0039	0.0109	012
Lime	0.386	0.587	0.718
Cyanide	0.179	0.162	0.222
Zinc	0.047	0.04	0.0538
Assaying and melting	0.10	0.10	0.10
Marketing bullion and slag	0.161	0.161	0.161
Depreciation	0.36	0.28	0.53
Royalties	0.865	0.835	1.00
Total, per ton	$2.3878	$2.6069	$3.2597

COMPARATIVE COSTS OF MATERIALS PURCHASED LOCALLY AND IMPORTED

	Purchased in Medellin	Imported
Cyanide, potassium, per kg.	$0.70	$0.50
Zinc, per kg.	0.40	0.37
Borax, per kg	0.46	0.28
Soda, per kg	0.46	0.22
20-gram crucibles, each	0.25	0.05
Graphite crucibles, No. 30, each	8.00	4.00
Litharge, per kg	0.60	0.35

Dividends were declared and paid by 18 mining companies in Utah, during 1911, amounting to $8,973,856, as compared to a total distribution by 19 companies of $8,758,873 during the preceding year.

Taxation in Arizona

Phoenix Correspondence

Certain rather disturbing reports as to prospective radical mining legislation by the legislature of the new State of Arizona, have been current recently in New York and other mining centers. In this connection the new executive, Gov. G. W. P. Hunt, who is a business man from Globe, and whose interests are closely identified with the mining industry of that important camp, has denied that there was any real foundation for such rumors and has given assurance of his personal desire to foster and encourage the mining industry of the state in every way. He said:

> The new state government will cost about $200,000 more annually to maintain than did the territorial government. This additional cost must, of course, be distributed on the taxable property of the state and, of course, the mining industry will have to bear its proportionate and fair share of this increase. Certainly I have no intention of encouraging any discrimination against mining or of seeking to impose any unfair tax burdens upon it. The general increase in the agricultural operations in the state and the rapid extension of its railroads and general business are such that in fact the necessary increase of state expenses resulting from statehood will be hardly felt by any of the interests of the state.

Increase Assessable Valuation

Attorney-General Bullard stated that a suggestion had been made to place the basis of the assessable valuation of the mines, for taxation, at 50% of the annual gross output, instead of 25%, as under the present law. This, of course, would result in an increase of the taxes on the operating mines, but not necessarily an increase in the proportion of 50: 25, as the actual tax would be determined by the rate of taxation, which would be automatically lowered by the act of an increase in the assessable valuation; the fairness of such an increase on mining would also be directly contingent on the action with regard to the valuation of other taxable property in the state.

The Territorial Law of 1907

The present enactment in Arizona relating to mine taxation is of interest in itself, and by way of explaining the application of the suggested increase in the assessment basis. The law was enacted in 1907 by the legislative assembly of the territory. It provides that for the purposes of taxation all mines and mining claims in the territory shall be divided into two classes, (1) productive and (2) nonproductive. The first includes all claims that have produced $3750 or more per claim during the year and groups of claims belonging to the same owner that have produced $3750 or more per claim. The owner is required to make statement under oath of the tonnage, character and yield of the ore produced, and the assessor "shall compute the value thereof on the average market quotation of each such metal in New York City, as evidenced by some established authority or market report, such as the ENGINEERING AND MINING JOURNAL, of New York, or any other standard paper giving the market reports, and 25% of the gross value in money shall constitute the total amount from which the levy of taxes for the current year shall be made and fixed."[1]

The second class, including all mines and mining claims not in the first class and designated as nonproductive, is valued for taxation by the assessor the same as other property, and is taxed the same. It is provided also that all nonproductive, unpatented mines or mining claims shall be free from taxation, except for the improvements thereon, such as machinery, plants and equipment.

The tax, as above provided, constitutes the full tax on mining property, except that the machinery, equipment and personal property of all mining companies shall be separately valued and taxed as other property, and also where the surface ground of any mining claim is used for farming or townsite or other productive purposes, this surface property shall be separately valued and taxed. In default of the mine owner making statements required by law, the assessed valuation is by penalty fixed at the full gross value of the output.

Generally, the law has been considered fair and reasonable, although, as is the case with any application of the gross output for a taxation standard, the low-grade mines pay out of proportion to the high-grade mines, considering net earnings as the actual value standard of any operation. Apparently the mine owners are not dissatisfied with the form or substance of the present law. It remains to be seen whether any change as suggested will be considered by all of them as fair and equitable.

London Mica Market in 1911

The supplies of all grades of block mica fell short of the demand in 1911 and closing prices in London showed a full 25% advance. India furnished the bulk of the supply, while Canada, Africa and South America also contributed. European demand has been brisk, and American trade improving. Stocks of unsold mica at the close of the year were light, and consisted chiefly of Bengal splittings. Including purchases uncleared, the warehouse stocks, Dec. 31, 1911, were 750,200 lb. (*Min. Journ.*, Jan. 13, 1912). African amber mica has been more in evidence during the last year, and has sold at steady rates.

---

[1] Chapter 20, Laws 1907, Territory of Arizona.

Ore Dressing in the Joplin District—III

By James L. Bruce*

The features of the general practice are critically considered; compact plants, long lineshafts and centrifugal pumps for raising water being characteristic. Flow sheets of typical mills are given.

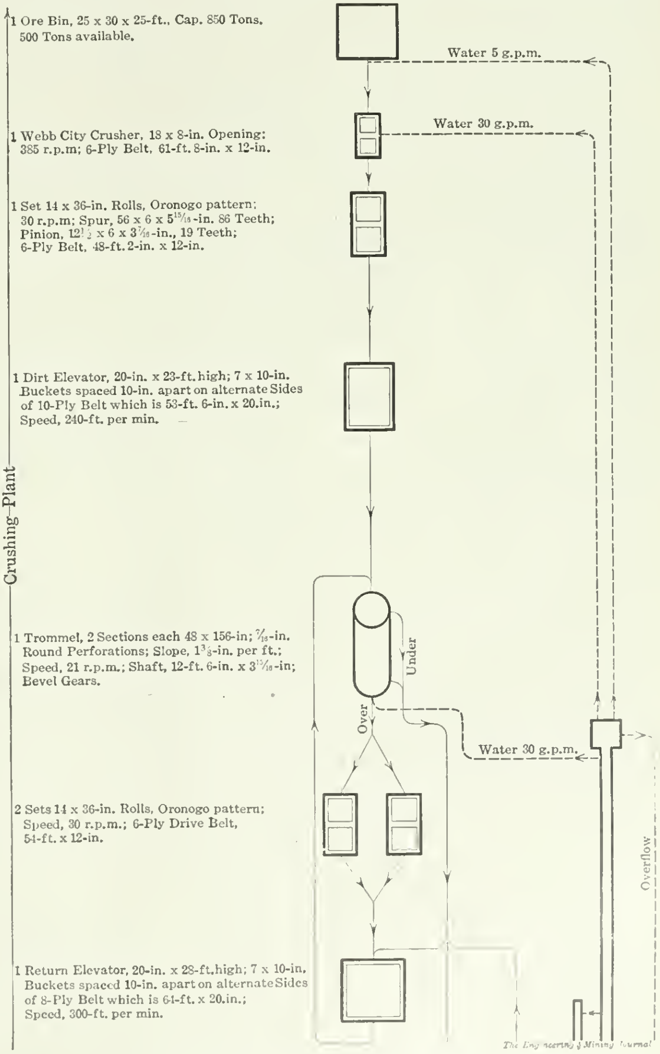
The favorite practice of the district and I think a commendable one is to keep the plant as compact as possible so as to save labor, surface space, heat losses by long steam line, and housing, at the expense of a slight increase in the insurance rates. Power is usually required for milling, hoisting, pumping and air compressing and it is customary to have the mill engine and compressor under the same roof as the boilers with only a partition separating them so that the engineer can with the least labor attend properly to both, and so that radiation losses will be as small as possible.

Mill Near Hoisting Shaft

The mill is usually built immediately adjoining one of the hoisting shafts so that the ore bin or mill hopper will serve as a joint storage bin for both. Ore from other shafts within a distance of about 500 ft. is conveyed to this hopper in cars on an incline tramway as already described. The crushing, coarse concentration and fine concentration are usually all done in the same building and on the same floor, and are driven off the same lineshaft. This often calls for a long lineshaft with its consequent disadvantages and it is probable that in some large mills, especially if electric power is used, it would be advisable to drive the heavier and more variable load such as the crushing department, with a separate engine or motor. This would cut down the lineshaft friction losses and at the same time give a steadier speed for the concentrating plant.

The favorite lineshaft speed is about 180 r.p.m., some running as high as 200 r.p.m. With the latter speed however, smaller pulleys have to be used on the lineshaft with greater tension on belts and consequently greater friction losses and more severe belt service. Drive pulleys for the heaviest loads are placed as near the lineshaft bearings as possible so as to avoid springing the shafting. Where heavy loads have to be driven from a point midway between bearings an extra bearing should be built in to reinforce the shafting. This may be done with three timbers two of which run parallel to the lineshaft from mill bent to mill bent while the third reaches between them and supports the extra bearing. Much of the expense for drive belts can be saved by removing the belts from the heavier service before they are completely worn out and utilizing them for the lighter or steadier service.

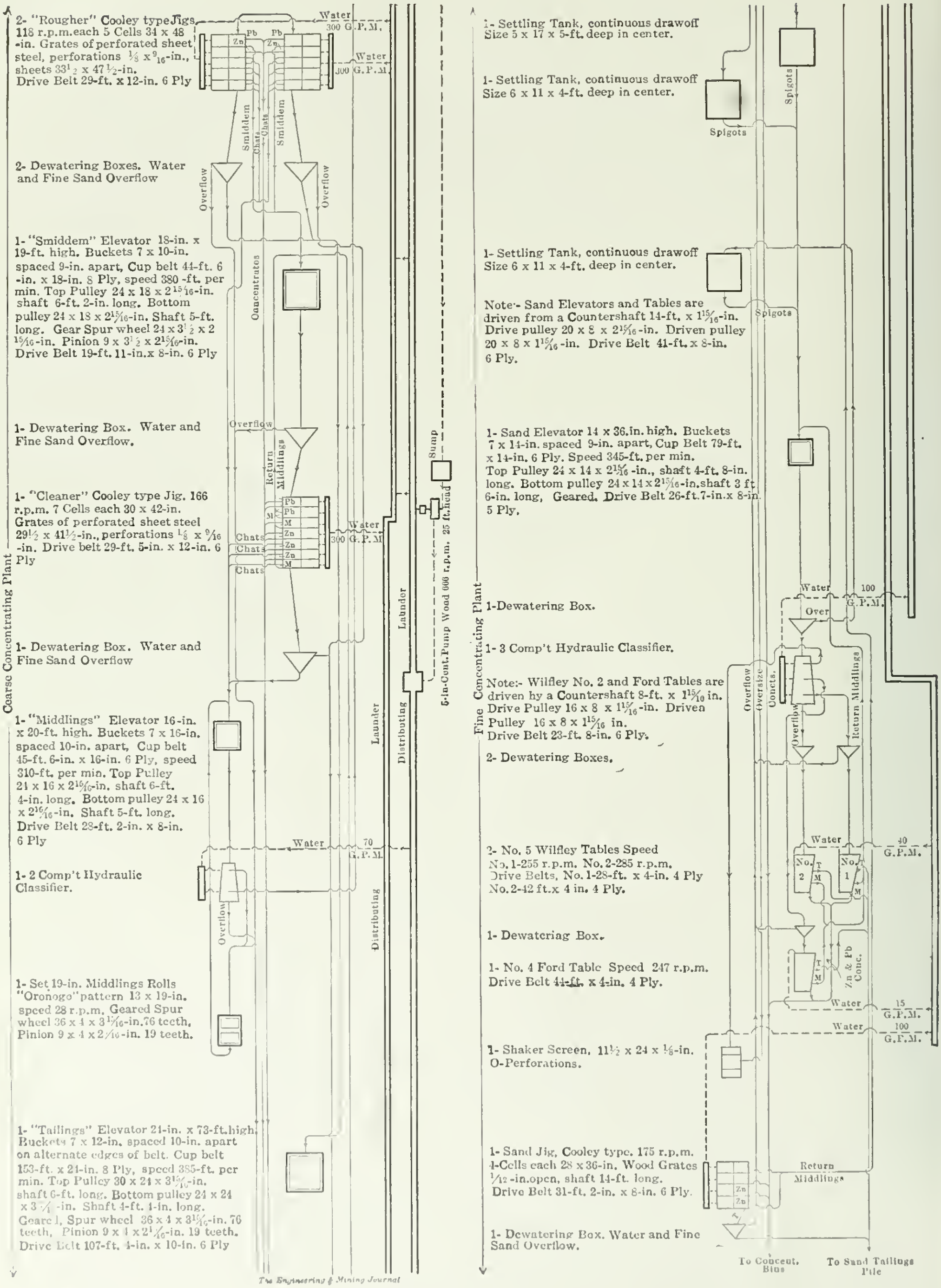
None of the mill designers seem to have appreciated the quantity of power required to run the centrifugal pumps for elevating the supply of mill water, nor do they seem to have made any effort to cut it down. In every case known to me all of the water used is elevated several feet higher than the highest point at which any of it is required. As a matter of fact less than one-fourth of the total water is required at a higher elevation than the jigs, and is needed only for the screens, crusher and classifiers. At least one-third of the power required for pumping, which often reaches 30 or 35 hp. could be saved by using one large pump to elevate water just high enough for the jig and table


1 Ore Bin, 25 x 30 x 25-ft., Cap. 850 Tons. 500 Tons available.
1 Webb City Crusher, 18 x 8-in. Opening: 385 r.p.m; 6-Ply Belt, 61-ft. 8-in. x 12-in.
1 Set 14 x 36-in. Rolls, Oronogo pattern; 30 r.p.m; Spur, 56 x 6 x 5 15/16-in. 86 Teeth; Pinion, 12½ x 6 x 3 7/16-in., 19 Teeth; 6-Ply Belt, 48-ft. 2-in. x 12-in.
1 Dirt Elevator, 20-in. x 23-ft. high; 7 x 10-in. Buckets spaced 10-in. apart on alternate Sides of 10-Ply Belt which is 53-ft. 6-in. x 20.in.; Speed, 240-ft. per min.
1 Trommel, 2 Sections each 48 x 156-in; 7/16-in. Round Perforations; Slope, 1 3/8-in. per ft.; Speed, 21 r.p.m.; Shaft, 12-ft. 6-in. x 3 15/16-in; Bevel Gears.
2 Sets 14 x 36-in. Rolls, Oronogo pattern; Speed, 30 r.p.m.; 6-Ply Drive Belt, 54-ft. x 12-in.
1 Return Elevator, 20-in. x 28-ft. high; 7 x 10-in. Buckets spaced 10-in. apart on alternate Sides of 8-Ply Belt which is 64-ft. x 20.in.; Speed, 300-ft. per min.
Crushing Plant
Water 5 g.p.m.
Water 30 g.p.m.
Under
Over
Water 30 g.p.m.
Overflow
The Engineering & Mining Journal

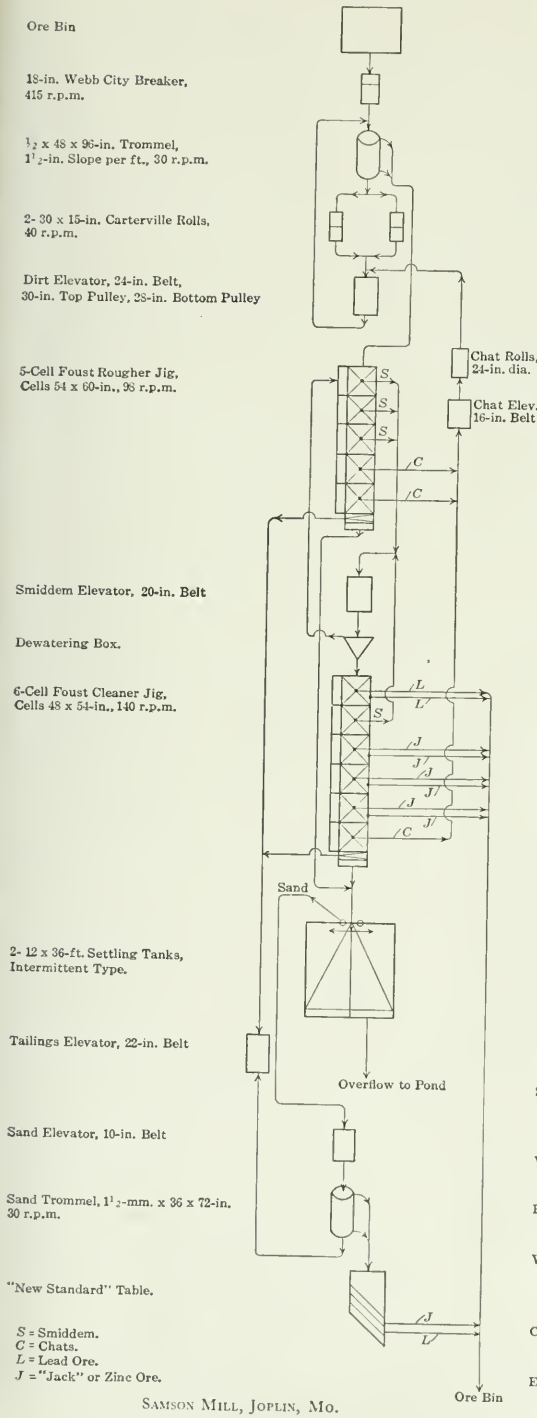
Crushing Plant, Litteral Mill, Continental Zinc Co.

---

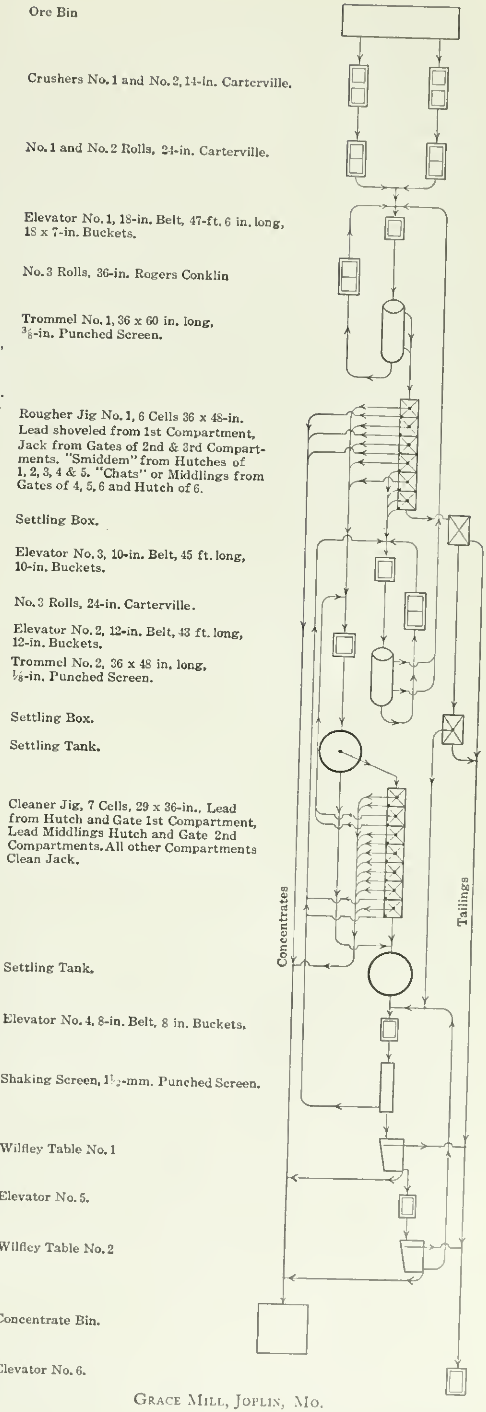
*General manager, Continental Zinc Co., Joplin, Mo.


Coarse Concentrating Plant
2- "Rougher" Cooley type Jigs, 118 r.p.m. each 5 Cells 34 x 48-in. Grates of perforated sheet steel, perforations 1/8 x 9/16-in., sheets 33 1/2 x 47 1/2-in. Drive Belt 29-ft. x 12-in. 6 Ply
Water 300 G.P.M.
Water 300 G.P.M.
Pb
Pb
Zn
Zn
Smiddem
Chats
Chats
Smiddem
2- Dewatering Boxes. Water and Fine Sand Overflow
Overflow
Overflow
1- "Smiddem" Elevator 18-in. x 19-ft. high. Buckets 7 x 10-in. spaced 9-in. apart, Cup belt 44-ft. 6-in. x 18-in. 8 Ply, speed 380-ft. per min. Top Pulley 24 x 18 x 2 15/16-in. shaft 6-ft. 2-in. long. Bottom pulley 24 x 18 x 2 15/16-in. Shaft 5-ft. long. Gear Spur wheel 24 x 3 1/2 x 2 15/16-in. Pinion 9 x 3 1/2 x 2 15/16-in. Drive Belt 19-ft. 11-in. x 8-in. 6 Ply
Concentrates
1- Dewatering Box. Water and Fine Sand Overflow.
Overflow
Return Middlings
1- "Cleaner" Cooley type Jig. 166 r.p.m. 7 Cells each 30 x 42-in. Grates of perforated sheet steel 29 1/2 x 41 1/2-in., perforations 1/8 x 9/16-in. Drive belt 29-ft. 5-in. x 12-in. 6 Ply
Pb
Pb
M
M
Zn
Zn
Zn
M
Chats
Chats
Chats
Water 300 G.P.M.
Sump
6-in-Cont. Pump Wood 600 r.p.m. 25 ft. head
Launder
Distributing
Launder
Distributing
1- Dewatering Box. Water and Fine Sand Overflow
1- "Middlings" Elevator 16-in. x 20-ft. high. Buckets 7 x 16-in. spaced 10-in. apart, Cup belt 45-ft. 6-in. x 16-in. 6 Ply, speed 310-ft. per min. Top Pulley 24 x 16 x 2 15/16-in. shaft 6-ft. 4-in. long. Bottom pulley 24 x 16 x 2 15/16-in. Shaft 5-ft. long. Drive Belt 28-ft. 2-in. x 8-in. 6 Ply
Water 70 G.P.M.
1- 2 Comp't Hydraulic Classifier.
Overflow
1- Set 19-in. Middlings Rolls "Oronogo" pattern 13 x 19-in. speed 28 r.p.m. Geared Spur wheel 36 x 4 x 3 15/16-in. 76 teeth, Pinion 9 x 4 x 2 15/16-in. 19 teeth.
1- "Tailings" Elevator 24-in. x 73-ft. high. Buckets 7 x 12-in. spaced 10-in. apart on alternate edges of belt. Cup belt 153-ft. x 24-in. 8 Ply, speed 385-ft. per min. Top Pulley 30 x 24 x 3 15/16-in. shaft 6-ft. long. Bottom pulley 24 x 24 x 3 7/16-in. Shaft 4-ft. 1-in. long. Geared, Spur wheel 36 x 4 x 3 15/16-in. 76 teeth, Pinion 9 x 4 x 2 15/16-in. 19 teeth. Drive Belt 107-ft. 4-in. x 10-in. 6 Ply
The Engineering & Mining Journal
Fine Concentrating Plant
1- Settling Tank, continuous drawoff Size 5 x 17 x 5-ft. deep in center.
Spigots
1- Settling Tank, continuous drawoff Size 6 x 11 x 4-ft. deep in center.
Spigots
1- Settling Tank, continuous drawoff Size 6 x 11 x 4-ft. deep in center.
Spigots
Note:- Sand Elevators and Tables are driven from a Countershaft 14-ft. x 1 15/16-in. Drive pulley 20 x 8 x 2 15/16-in. Driven pulley 20 x 8 x 1 15/16-in. Drive Belt 41-ft. x 8-in. 6 Ply.
1- Sand Elevator 14 x 36-in. high. Buckets 7 x 14-in. spaced 9-in. apart, Cup Belt 79-ft. x 14-in. 6 Ply. Speed 345-ft. per min. Top Pulley 24 x 14 x 2 15/16-in., shaft 4-ft. 8-in. long. Bottom pulley 24 x 14 x 2 15/16-in. shaft 3 ft 6-in. long, Geared. Drive Belt 26-ft. 7-in. x 8-in. 5 Ply.
Water 100 G.P.M.
1-Dewatering Box.
Over
1- 3 Comp't Hydraulic Classifier.
Overflow
Oversize
Concts.
Overflow
Return Middlings
Note:- Wilfley No. 2 and Ford Tables are driven by a Countershaft 8-ft. x 1 15/16 in. Drive Pulley 16 x 8 x 1 15/16-in. Driven Pulley 16 x 8 x 1 15/16 in. Drive Belt 23-ft. 8-in. 6 Ply.
2- Dewatering Boxes.
2- No. 5 Wilfley Tables Speed No. 1-255 r.p.m. No. 2-285 r.p.m. Drive Belts, No. 1-28-ft. x 4-in. 4 Ply No. 2-42 ft. x 4 in. 4 Ply.
Water 40 G.P.M.
No. 2
T
M
No. 1
T
M
1- Dewatering Box.
1- No. 4 Ford Table Speed 247 r.p.m. Drive Belt 44-ft. x 4-in. 4 Ply.
T
M
Zn & Pb Conc.
Water 15 G.P.M.
Water 100 G.P.M.
1- Shaker Screen, 11 1/2 x 24 x 1/8-in. O-Perforations.
1- Sand Jig, Cooley type. 175 r.p.m. 4-Cells each 28 x 36-in. Wood Grates 1/12-in. open, shaft 14-ft. long. Drive Belt 31-ft. 2-in. x 8-in. 6 Ply.
Zn
Zn
Return Middlings
1- Dewatering Box. Water and Fine Sand Overflow.
To Concent. Bins
To Sand Tailings Pile

FLOW SHEET OF COARSE AND FINE CONCENTRATING PLANT OF LITTERAL MILL OF THE CONTINENTAL ZINC CO., JOPLIN


Ore Bin
18-in. Webb City Breaker, 415 r.p.m.
½ x 48 x 96-in. Trommel, 1½-in. Slope per ft., 30 r.p.m.
2- 30 x 15-in. Carterville Rolls, 40 r.p.m.
Dirt Elevator, 24-in. Belt, 30-in. Top Pulley, 28-in. Bottom Pulley
5-Cell Foust Rougher Jig, Cells 54 x 60-in., 98 r.p.m.
Smiddem Elevator, 20-in. Belt
Dewatering Box.
6-Cell Foust Cleaner Jig, Cells 48 x 54-in., 140 r.p.m.
2- 12 x 36-ft. Settling Tanks, Intermittent Type.
Tailings Elevator, 22-in. Belt
Sand Elevator, 10-in. Belt
Sand Trommel, 1½-mm. x 36 x 72-in. 30 r.p.m.
"New Standard" Table.
S = Smiddem.
C = Chats.
L = Lead Ore.
J = "Jack" or Zinc Ore.
Chat Rolls, 24-in. dia.
Chat Elev. 16-in. Belt
S
S
S
C
C
L
L′
S
J
J′
J
J′
J
J′
C
Sand
Overflow to Pond
J
L
Ore Bin

Samson Mill, Joplin, Mo.


Ore Bin
Crushers No. 1 and No. 2, 14-in. Carterville.
No. 1 and No. 2 Rolls, 24-in. Carterville.
Elevator No. 1, 18-in. Belt, 47-ft. 6 in. long, 18 x 7-in. Buckets.
No. 3 Rolls, 36-in. Rogers Conklin
Trommel No. 1, 36 x 60 in. long, ⅜-in. Punched Screen.
Rougher Jig No. 1, 6 Cells 36 x 48-in. Lead shoveled from 1st Compartment, Jack from Gates of 2nd & 3rd Compartments. "Smiddem" from Hutches of 1, 2, 3, 4 & 5. "Chats" or Middlings from Gates of 4, 5, 6 and Hutch of 6.
Settling Box.
Elevator No. 3, 10-in. Belt, 45 ft. long, 10-in. Buckets.
No. 3 Rolls, 24-in. Carterville.
Elevator No. 2, 12-in. Belt, 43 ft. long, 12-in. Buckets.
Trommel No. 2, 36 x 48 in. long, ⅛-in. Punched Screen.
Settling Box.
Settling Tank.
Cleaner Jig, 7 Cells, 29 x 36-in., Lead from Hutch and Gate 1st Compartment, Lead Middlings Hutch and Gate 2nd Compartments. All other Compartments Clean Jack.
Settling Tank.
Elevator No. 4, 8-in. Belt, 8 in. Buckets.
Shaking Screen, 1½-mm. Punched Screen.
Wilfley Table No. 1
Elevator No. 5.
Wilfley Table No. 2
Concentrate Bin.
Elevator No. 6.
Concentrates
Tailings

Grace Mill, Joplin, Mo.

The Engineering & Mining Journal

wash water and a smaller pump to elevate water to the top of the mill for the screens, crusher and classifiers.

Accurate Sampling Difficult

Few of the mills in the district place any dependence in the sampling of mill feed or tailings nor does it appeal to me as being of any practical value when done in the desultory and unmethodical way sometimes practiced. Without automatic and continuous sampling and the averages of numbers of analyses, such results are more apt to be misleading than otherwise. If anyone is not convinced of this let him divide such samples into two or three parts for a few times and note the differences in the results reported on parts of the same sample sent to different analysts. Even with automatic and continuous sampling of the mill feed and the tailings, which would be expensive; and with reliable analyses, which are hard to secure on low-grade feed or tailings, the results would only show the percentage of saving, without showing where the principal losses were, or the difficulties of overcoming them. I am thoroughly convinced that careful and unabating visual inspection of the various waste products of the mill with occasional sizing tests and analyses of the same, will do much more to improve the milling practice than the most careful sampling and analyzing of the mill heads and tailings alone would without such inspection. Of course this statement would not be true except for such ores as show the metals in a distinctly visible and readily recognized form.

The opinions of operators differ regarding the relative situation of tailings piles and mill settling ponds. A few prefer to turn the tailings to the lowest ground adjacent to the mill in order to permit of a larger pile, trusting to the mine water, natural drainage, or an auxiliary pump to supply the mill pond, which must in that case be situated on higher ground. The majority, however, prefer to place the ponds on the lowest ground from which the mill pump can readily draw its water, and to turn the tailings to the higher ground so that the ponds may catch the water with the least loss by evaporation or leakage. Natural drainage conditions and the amount of mine water, are variable and uncertain quantities and the amount of leakage and evaporation incurred by using an auxiliary pump is surprisingly large, so that it seems self evident that the lowest ground should be kept clear for settling ponds.

Sorting Costs 2c. per Ton

The cost of "culling out" the waste rock is about 2c. per ton of dirt, most of which is for labor, and as only 5 to 10% of the material is removed as waste there is some question as to whether it would not be advisable to install a crusher large enough to handle the largest pieces of rock from the mine, thereby dispensing with the culling entirely. It must be borne in mind, however, that when culling is practiced the mill capacity is increased by the amount removed in this manner, also that the passage of this extra material through the mill would increase the losses. Another method which suggests itself, especially on sheet-ground ores, which are clean and not disseminated, is to crush every thing to about 3 in., and handpick the oversize from about 1½-in. screen. This would create quite an expense for picking and disposing of the waste which might or might not be offset by the saving effected in milling a considerably decreased tonnage and in the resulting betterment of the mill saving. I think this experiment would certainly be worth trying at some plant which was suffering from lack of milling capacity, although I believe ordinary conditions would show no economy.

Callow Tanks for Settling

For settling facilities I think the best arrangement would be to run the fine sand including the finest part of the reground chats, to one or two good-sized Callow tanks, with just enough clear water added to the spigot to overflow the slimes, classify the spigot product of these for the tables and run the overflow from the Callow tanks, together with any other mill water containing slime, to an intermittent settling tank such as heretofore described. The settlings from this tank should be pumped or elevated without further classifying to one or more tables for treatment.

I would prefer one or two large cone tanks to the intermittent tank, were it not for the lack of elevation at practically all of the mills, and the consequent impracticability of installing a cone tank of the requisite size and depth without pumping the feed up to it. It might be suggested here that six or eight smaller cone tanks be used in lieu of the larger ones, because they would not require so much height. I think, however, that the intermittent tank would be preferable as the table feed would have to be drawn from six or eight spigots with the cone tanks and would be too dilute. The use of goosenecks to thicken the pulp has never in my experience proved satisfactory on account of frequent choke-ups.

German Sizing Methods Tried

The German sizing system of milling, although tried in a number of instances, has met with little success in the district. In most cases its failure was not due to the system but to the unsuitability of the equipment utilized and to poor arrangement of the same. For instance, rigid rolls have been used for grinding the oversize from the head trommel. These proved to be unsatisfactory on account of the lack of a uniform rate of feed which caused them to choke down frequently. Small Harz jigs, which without doubt would be suitable for handling small tonnages of certain classes of comparatively rich ore, have been used with poor results on account of their small capacity and lack of flexibility. Complicated screen sizing and classifying has been attempted and has failed because the increased cost of attendance and operation has exceeded the value of any possible increase in saving that could be hoped for. The only two sizing plants that I know of which have met with any considerable measure of success have stuck religiously to the type of machinery and equipment in common use in the district. Even these were not an unqualified success as they lacked the flexibility and ability to handle irregular tonnages of dirt from the mine as readily as the ordinary type, and therefore increased the cost of mining by delaying its operations unduly at times.

Flow sheets of the Grace mill of the Grace Zinc Co. made in 1908, of the Litteral mill of the Continental Zinc Co. made in August, 1910 and of the Samson mill of the Samson Mining Co. made in November, 1911 are shown herewith as illustrations of types of mills used in the district. Some changes have been made in some of these plants since that time and the flow sheets are not exactly representative of the present practice but will serve to show types of mills used here.

(To be concluded)

Hedley Gold Mining Co.

The report of the Hedley Gold Mining Co. operating at Hedley, B. C., for the year, 1911, shows a net profit for the year of $318,152, out of which $300,000 or 25% was paid in dividends, leaving a net undivided profit account of $200,961. All expenditures of every kind during 1911 were charged to operating expenses.

The mill was operated continuously and 57,815 tons of ore treated, of an average value of $11.99 per ton, from which an extraction of 94% was made. A reserve of about 10,000 tons of broken ore in the stopes has been maintained throughout the year. It is also stated that there is now a tonnage of ore in sight equal to the ore reserve at the time the property was purchased. During the year, 1315 ft. of development work was done and 3160 ft. of diamond drilling.

A Method of Showing Ore Reserves

By N. H. Emmons, 2d*

Ore reserve statements kept on modified mine plans show at a glance the progress of development and rate of removal of ore by stoping, forming an index to the condition of the mine of value to manager and owner.

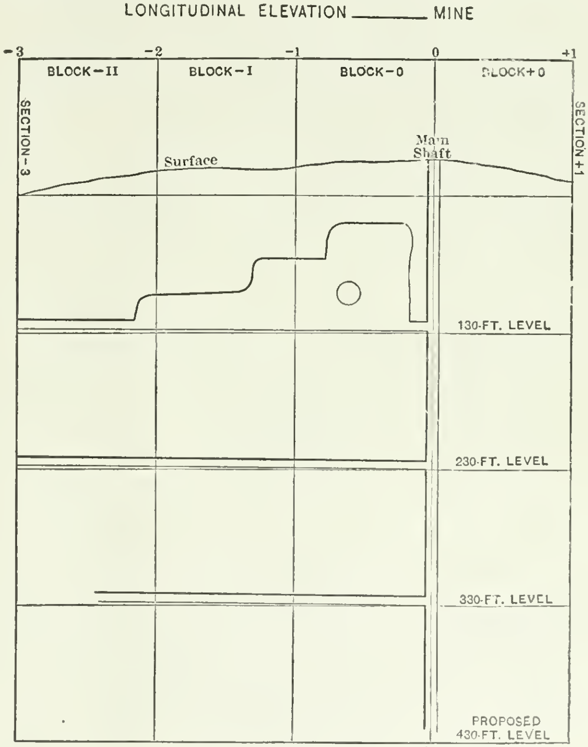
The work of a consulting engineer or manager, when controlling mining operations, requires that he have all the information concerning the mine is as concise a form as possible, and as the ore reserves and their depletion and enlargement are the vital points to be studied, it is well to have them kept up to date and in some convenient form.

This article describes a method that I have adopted, which shows in a clear manner the ore reserves in a mine. The case illustrated is that of a vein near enough to the vertical for the vertical elevation of the mine to be the main working map. A flat orebody would be represented on a similar plat, but instead of the horizontal thickness of the vein being shown in the circles, the vertical thickness would be inserted.

Diagrams Show Development

An ideal longitudinal elevation of a mine, plotted in the ordinary way, using 100-ft. blocks and section-lines, is represented by Fig. 1. In a mine where the block-numbers are posted by the engineer underground, the system of keeping the ore tonnages extracted from the different blocks is easily maintained, and the actual tonnages of ore extracted can be kept so that the surveyor can have a check on his estimate from time to time.

The ore-reserve sheet, Fig. 2, should be the same size as the map it is to accompany. Each square is used for the description of the ore reserve in the block it corresponds to on the elevation. Where the section lines cross the levels, a circle is drawn, in which are written the widths of ore at that point, these widths being used in the calculations of each block cornering in the circle. It has been found convenient to show the figures in black in the lower half of the circle when the actual widths of ore are known, and, when it is necessary to make up the figures of probable ore, as at the time of making annual or semi-annual reports, red figures are written in the upper half of the circle to represent the probable thickness of the ore; and later on, when the development warrants it, the black figures are inserted underneath. The same color scheme may be used for ore actually developed and probable ore, red figures representing the probable ore being first inserted in the column headed "Developed," and when the ore is developed the black figures should be inserted in the time space when the development is completed.



ENG.& MNG.JOURNAL

Fig. 1.—Ideal Longitudinal Elevation of a Mine.

There should be an ore-reserve sheet for each year, and the space between the levels divided into four spaces if quarterly estimates are made, as shown on the 130-ft. level, or into 12 spaces if the figures are worked up monthly, as shown on the 230-ft. level. Then there should be a sheet kept to enter the ore developed and extracted each year, 10 spaces being a convenient number, thereby covering 10 years, so that the record of the development and extraction by years can be seen at a glance.

In mines where the value of the ore is kept it is convenient to insert in one lower quarter of the circles the width of the ore, and in the second lower quarter the value of the ore. The idea can be carried a little further by using squares instead of circles at the corners, in which the widths and values are written, and making a circle in the center of each large block in which to insert the average value of the block of ore.

Recovery of Ore Indicated

As it is always well to have the figuring in some permanent form, so that it can be readily checked, a sheet, as shown in the accompanying table, should be kept for each level, showing clearly how the tonnages were calculated.

If the ore-reserve sheet is posted monthly, a great deal of information can be gleaned, a splendid record of operations is obtained, and the work for the future is planned to the best advantage. Another important point is that the percentage of ore recovered, when a stope or block is worked out, can be readily seen, and estimates of the available ore in other blocks can be made with greater accuracy. Each problem may require a different form of reserve sheet, and the sheet can be varied to suit any mine map.

---

*Mining engineer, Knoxville, Tenn.

Note—From an advance proof of a paper read at the New York meeting of the American Institute of Mining Engineers, Feb., 1912.

One of the main advantages of the sheet is that it will teach the mining engineer to make careful estimates of ore reserves, and not, as in many cases is done now, allow the mine foreman to say that there are so many tons in such and such a stope that will require so many months to take out.

The development of the mine is so clearly shown, if the sheet is kept properly posted, that the management can tell at any time whether the development is running behind the extraction, or just what is going on. There is no reason why a mine should not have its ore-reserve book balanced every month in as careful a manner as are the accounts, if such a system as the above is kept, and at the end of the year it will save many disappointments at the small amount of new ore developed if the question has been kept continually before those in charge.

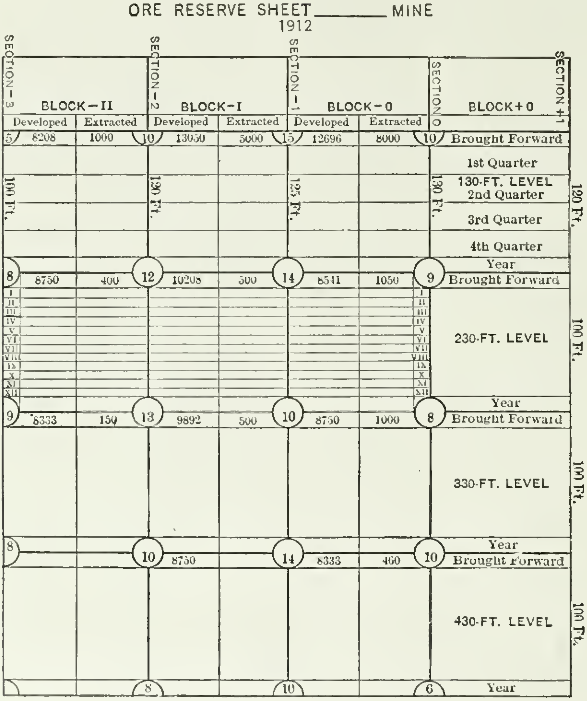


FIG. 2.—ORE-RESERVE SHEET TO ACCOMPANY ELEVATION, FIG. 1.

ORE-RESERVE CALCULATION-SHEET —— MINE

First Level. January 1, 1912.

Block No.	Section No.	Average width of ore at section	Depth of ore, feet	End area or area at section	Average end areas	Length of block	Volume cubic feet in each block	Developed ore, tons. 12 cu.ft. = 1 ton	Probable ore, tons. 12 cu.ft. = 1 ton	Remarks
	0	$\frac{10+9}{2}$	130	1235						All ore developed previous to Jan. 1, 1912.
0					$\frac{3017}{2}$	100	152,350	12,696		
	−1	$\frac{15+14}{2}$	125	1812						
I					$\frac{3132}{2}$	100	156,600	13,050		
	−2	$\frac{10+12}{2}$	120	1320						
II					$\frac{1970}{2}$	100	98,500	8,208		
	−3	$\frac{5+8}{2}$	100	650						

CALCULATIONS PRESERVED

Another point that is so often handled in a dilatory way at mines is the method used for figuring an estimate, and the keeping of this information regarding widths of ores, values of ore, and estimates of orebodies on various slips of paper or in numerous note-books. If the reserve sheet is being kept, there will be definite methods and exact figures needed at least once a month or a quarter, and as these figures are obtained if there is a place to put them, they will be entered on the final sheet as soon as obtained.

Take, for instance, a drift in ore of varying width and assay. If the method of estimating ore in use at the mine is to sample and assay every 10 ft., then the average width and assay of the 50 ft. on each side of the circle or corner is made up and inserted in the circle, the amount of ore in the four blocks contiguous to the circle worked out, and posted in the month when the actual figures are made up.

If ore reserves are classified, then a separate sheet should be used for each class of ore. Many mines produce smelting-ore and concentrating- or milling-ore from the same block. A smelting-ore sheet should be kept and the width of this class of ore alone be entered on one sheet, and that of the concentrating-ore on another.

Another far reaching point in favor of such a record is that it can be seen at a glance if the high-grade stopes are being pushed too rapidly and the low-grade being neglected.

It is the custom of many companies to have maps of the mines sent in with annual reports, with the intention of keeping the directors posted regarding the development of their property. How much better would it be to send in an ore-reserve sheet as outlined above, that would convey the exact information about what was actually being done at the property, and be easily understood.

Removing Rust from Steel

Iron or steel from which rust is to be removed is made the cathode in a 0.25 to 5% solution of sodium sulphate in water. Carbon plates are used for the anodes. The hydrogen gas evolved at the cathode loosens the rust so that it may be removed entirely. A weak current is used and the article allowed to remain in the solution over night. It is stated (*Chem. Zeit.*, XXXV, 1911) that the removal of rust is so complete and the iron or steel so free from attack that the method may be used for the accurate determination of the rust.

The California Gold Dredge—IV

By Robert E. Cranston*

The design of spuds, hull, gantries and housing is considered. Wooden spuds, formerly used exclusively, are being displaced by those made of steel. Hulls are made of Douglas fir. Average construction costs, dimensions and other data are given.

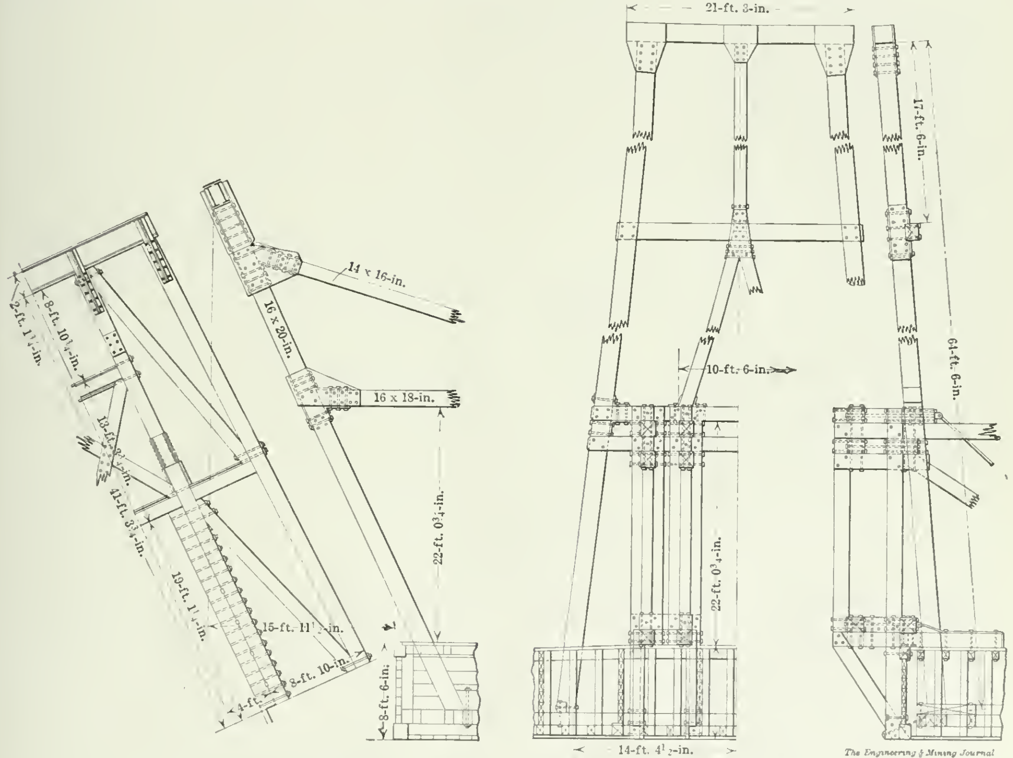
The early California dredges used a head line to dig on and even after the spud system was introduced it was a mooted question which was the better. The standard California-type dredge uses the spud system exclusively, the head line being abandoned except in a few cases where the nature of the gravel or other conditions are unusual.

Steel Spuds Best

At first, wooden spuds were used, then one wooden and one steel, the wooden spud being used to step up with and the steel one to dig on. Now both spuds are often made of steel. This plan is by far the best, since if one breaks the other may be used to dig on, using the head line to step up with. If only one steel spud is provided and a break occurs, the dredge must be shut down at once and the broken spud taken out, repaired and put in again before any digging can be done. Several forms of spud are used, and their make-up can best be understood by referring to the accompanying illustration, which shows views and cross-sections of a common design. An extra cover plate riveted to the tension side of that portion of the spud having the greatest strain adds strength with comparatively little increased weight.

The lower ends of the spuds are protected by cast-steel points, which extend far enough into the structural part to give ample riveting area. The later designs are made longer than the older ones. At the bottom they are acorn-shaped and change gradually from a circular to a rectangular cross-section at the point where they enter the structural portion of the spud, and they often extend 8 or 10 ft. below this point.

Heavy car springs are often used in the spud frames to reduce the shocks of digging and those using them think that they lessen the danger of breaking very much. This is doubtless true, but I am of the opinion that it also reduces the digging capacity of the dredge and that the best remedy for broken spuds is to build them stronger.



Bow and Stern Gantries of a 9-cu.ft. Dredge

The modern dredges are provided with traveling or boom cranes covering the heavy machinery so that repairs and replacements may be made expeditiously and without calling in more men than the regular dredge crew. A thwartship I-beam with traveler, or a swinging boom covering the forward portion of the dredge and bucket line, is used for chang-

Note—An article entitled "Design and Mechanical Features of the California Gold Dredge," published in Journ. A. S. M. E., February, 1912.

*Mine manager, Ashburton Mining Co., Sacramento, Calif.

ing buckets. Brackets are riveted to the ladder, into which chains are hooked to hold the bucket line after parting. It is well to have an I-beam or at least an eye or hook well secured above the ladder hoist, main winch, pumps, transformers and screen. Over the bucket line a thwartship traveling crane is most useful. It should be of sufficient capacity to lift the upper tumbler, shaft and gears and should extend far enough so that these parts may be lowered over the side of the dredge. If a hatchway is provided through the upper deck on each side of the bucket drive this crane may also prove useful for handling parts on the lower deck.

HULL OF DOUGLAS FIR

The hull is built of Douglas fir and is proportioned to accommodate properly the machinery which it supports. Before designing the hull the general dimensions and weights of all machinery should be determined and the hull built accordingly. The depth largely depends on the weight to be supported, the beam on the gold-saving area desired, the length and width of well on the dimensions of the digging ladder, and the digging ladder in turn on the depth of gravel to be dug. The distance from well to stern is determined by the length of screen and the general distribution of machinery fore and aft. The hull rides on an even keel when digging at an average depth and should have a free board of not less than one-fourth its total depth.

The cross-section is rectangular, with the deck slightly crowned. Thwartship frames are used, the bottom planking being spiked to the bottom thwartship timbers, the decking to the upper timbers or deck beams, and the side planking bolted to the upright side posts. Besides these, two or more pairs of posts are put in each frame and to these the well planking and bulkheads, or fore-and-aft trusses are bolted. Clamps or fore-and-aft strengthening timbers are bolted inside the frames at the corners where the posts join the deck beams and bottom thwartship timbers. The size of these clamps depends on the size of the hull. Drift bolts are driven in the side planking and bulkheads, each bolt passing through 2½ planks. They may be put in as thickly as desired, and add considerable strength to the planking and bulkheads. Four-inch deck and bottom and 6-in. side planking is commonly used. The stern is often planked with the same size as the sides, put edgeways instead of flat. At the point where the spuds are situated a short bulkhead or extra bracing is often used. Just aft of the well and below the bucket drive, one or more vertical cross trusses are often used, likewise horizontal cross bracing is put in on top of the thwartship frame timbers

GENERAL DATA ON CALIFORNIA GOLD DREDGES

Name of Maker	Risdon	Bucyrus	Link Belt	Risdon	Marion	Marysville Dredging Co.
Date built	September 1897	1907		1910	1905	1911
Capacity bucket, cu.ft.	3.2	5	5	5.6	7.5	9
Depth to dig below water line, ft.	20	38	35	30	65	65
Depth to dig above water line, ft.	8	10	12	10	10	10
Nature of digging	Loose	Medium hard	Hard	Medium	Medium	Medium
Hull:						
Draft with all machinery	3 ft. 6 in.	5 ft. 9 in.	5 ft. 8 in.	5 ft. 3 in.	6 ft. 6 in.	6 ft. 2 in.
Length, ft.	70	102	106½	88	115	115
Depth, ft.	5	7 ft. 9 in.	7 ft. 10½ in.	7 ft. 6 in.	8	8½
Width, ft.	29	36	40	36	40	50
Overhang on each side, ft	0	2	..	0	2½	4
Length of well, ft.	42	56 (approx.)	51 ft. 1 in.	48	63	63
Free board, ft	1½ (approx.)	2 ft. 3 in.	2 ft. 2½ in.	2 ft. 3 in.	1½	2 ft. 4 in.
Side planking, ft.	3	4	4	4	4	6
Bottom planking, ft.	3	4	4	4	4	4
Height of bow gantry above deck, ft.	22	36	34 ft. 6 in.	34	39 ft. 6½ in.	37
Height of stern gantry above deck, ft.	24	50	61 ft. 8 in.	36	58 ft. 9 in.	58
Height of main gantry above deck, ft.	16	23	21 ft. 8 in.	21 ft. 6 in.	20 ft. 2 in.	22
Total amount of lumber in hull, gantries, housing, etc., ft.	75,000	136,000	263,600	156,000	300,000	400,000
Digging ladder:						
Weight, lb.	14,000 (approx.)	48,400 (approx.)	53,575	33,000	79,000	94,400
Distance between centers ft.	40	87	84½	71 ft. 6 in.	114 ft. 1 in.	115
Extension beyond bow, ft.	12 (approx.)	25½	26	18	38	43
Width, ft.	3	4½	5 ft. 8 in.	3 ft. 8 in.	4 ft. 7½ in.	4 ft. 7½ in.
Maximum depth girder, ft.		7	5 ft. 6 in.		8	8
How upper end is supported	Fixed hanger-shaft with telescope bearing	Concentric	Steel pin, 8 in.	Fixed hanger-shaft with telescope bearing	Concentric	Concentric
General design	Plate girder	Plate girder	Plate girder	Plate girder	Lattice girder	Lattice girder
Stacker:	Bucket elevator	Belt conveyor	Belt conveyor	Bucket elevator	Belt conveyor	Belt conveyor
Length ladder, ft.	42	90	106	72	136	139
Width ladder, ft.	3 ft. 2 in.	4	3 ft. 8¾ in.	3 ft. 8 in.	3 ft. 8 in.	4 ft. 4 in.
Depth ladder, in.	15	5	4	15	8	7
Weight ladder, lb.	12,000	18,000	15,000	19,365	22,500	24,000
General design	2 I-beams	Lattice girder	Lattice girder	2 I-beams	Lattice girder	Lattice girder
Width belt, in.	Buckets 15 in. pitch	30	30	Buckets 15 in. pitch	32	32
Speed belt	48 buckets per min.	350 ft. per min.	Variable	54 buckets per min.	350 ft. per min.	400 ft. per min.
Horsepower motor	Driven by main engine	15	20	10	25	35
Maximum height of discharge, ft.	20	30	35	30	50	54
Bucket line:	Open connected	Close connected	Close connected	Open connected	Close connected	Close connected
Number in line	30	82	93	40	93	84
Maximum speed of buckets per min	16	22	22	14	19	50
Weight bucket complete, base, hood, lip, pin, bushing, lb.	570	1300	1490	1200	2187	2268
Pitch of bucket, in.	24	28$\frac{5}{16}$	24½	25	32¼	36
Number front eyes	2	2	2	2	3	2
Number back eyes	2	1	1	2	2	1
Length back eye, in.	4	16	19⅜	6	8¼	16¾
Width front eye, in.	4	3⅝	6½	6	3¾	4
Diameter pin, in.	1⅞	4⅛	1½	2¾	4⅜	5¼
Length pin, in	10½	23¼	30⅞	12½	2 ft. 3$\frac{5}{16}$ in.	24⅞
Ladder roller:						
Number on ladder	6	12	19	10	17	17
Diameter, in	8	14	12	12	14	14
Diameter, shaft in roller, in	2	3$\frac{11}{16}$	3$\frac{5}{16}$	3½	4½	5$\frac{1}{16}$
Diameter shaft in bearing, in	2	3⅜	3$\frac{7}{16}$	3½	3$\frac{11}{16}$	5
Length shaft in bearing, in	6	11⅛	....	8	12	11⅞
Material used	White iron	High carbon and manganese steel	Semi-steel	Manganese steel	High-carbon steel	Chrome steel
Weight roller and shaft, lb.	280	1030	1008	778	1160	1140
Upper tumbler:						
Diameter shaft in tumbler, in	8	14	14	11	17	17
Diameter shaft in bearing, in	8	12	12	11	14	14
Span between bearing	4 ft. 6 in.	6 ft. 6 in.	...	5 ft. 2 in.	9 ft. 3$\frac{3}{16}$ in.	9 ft. 3$\frac{3}{16}$ in
Weight complete with shaft and plates, lb.	3010	11,200	10,185	6,200	18,750	21,310
Lower tumbler						
Diameter shaft in tumbler, in	6	10¼	11¾	10	11¼	12
Diameter shaft in bearings, in	6	9	7¾	10	10	10

GENERAL DATA ON CALIFORNIA GOLD DREDGES—*Continued*

Name of Maker	Risdon	Bucyrus	Link Belt	Risdon	Marion	Marysville Dredging Co.
Length of shaft	4 ft. 2 in.	4 ft. 9¼ in.	6 ft. 5⅜ in.	5 ft. 3 in.	4 ft. 11¾ in.	5 ft. 3½ in.
Maximum height side flanges at corners above wearing plates, in	7¼	6⅜	9½	11	12½	11¼
Thickness side flanges at top and bottom, in	1–2¼	1⅜–3⅛	2¼–3	1½–3¼	1–1⅜	2
Inside flare of side flanges	....	2 in. in 12 in.	Curved	....	$\frac{33}{32}$-in. in 12 in.	Straight
Weight complete with shaft and plates, lb	4,176	10,000	8,355	7,746	11,340	12,758
Ladder hoist:						
Total weight, lb	Part of mainwinch	14,800	20,000	5,660	....	39,000
Diameter of drum, in		18	30	18	20	3 ft. 6 in.
Diameter of drum shaft, in		6½	6$\frac{7}{16}$	....	8	9½
Speed of drum, r.p.m		19.2	9.6	....	12.8	7.6
Maximum speed ladder line, ft. per min	....	...	...	10	67	100
Horsepower required to raise ladder at above speed	....	...	...	35	....	120
Diameter of sheaves, in	....	30	30	36	30	42
Main winch:						
Total weight, lb	10,385	23,700	32,500	24,200	....	23,275
Horsepower of motor	12	20	35	25	25	25
Diameter of drums, in	15	16	18	18 and 24	18	16
Diameter of drum-shaft, in	3½	4⅞	4$\frac{15}{16}$	5⅛ and 7	4$\frac{15}{16}$	4$\frac{15}{16}$
Maximum number r.p.m. drum	....	14	20.5	2	9	16
Minimum number r.p.m. drum	....	2.6	....	....	2.5	4.7
Maximum speed of side swing at end of digging ladder, ft	....	62	....	....	17.5	38
Minimum speed of side swing at end of digging ladder, ft	....	11.5	....	....	5	11
Speed of raising spud, ft	....	10	....	....	4.5	9.5
Horsepower necessary to raise spud at above speed	....	10	....	....	6	15
Bucket drive:						
Horsepower digging motor	50 h.p. steam	100	100	100	150	200
Diameter and face engine pulley, in	66	96x24	86x21	96	96x24	96x25½
Pitch diameter and face pulley shaft pin	....	10.82x7 in.	11.52x 6½ in.	....	11.936x 8 in.	11.936x 8¼ in.
Speed pulley shaft, r.p.m	....	160	143	156	113	115
Speed intermediate shaft, r.p.m	....	44	22.5	56	21	21
Pitch diameter and face intermediate shaft gears	....	39.67x7 in.	74.49x6 in.	47¾x6 in.	62.87x8 in.	62.87x 10 in.
Pitch diameter and face intermediate shaft pinions	....	13.5x8 in.	14.32x 10 in.	....	20.136x 10 in.	20.136x 10 in.
Speed tumbler shaft r.p.m	8	4½	4.5	7	3.1	3
Height tumbler shaft above deck	....	23 ft.	25 ft. 2½ in.	....	22 ft. 5¼ in.	24 ft. 6 in.
Pitch diameter and face tumbler shaft gears (bull wheels)	....	119x8 in.	71.62x9 in.	....	143.55x 10 in.	143.55x 10 in.
Weight bull wheels, lb	2,100	5,500	3,110	3,200	8,985	10,200
Spuds:						
Total weight including all castings, lb	....	20,400	43,800	...	32,000	36,000
Total length, ft	....	50	58 ft. 10 in.	....	60	61
Width, in	....	24	26	....	24	24
Depth, in	....	36	36	....	36	36⅞
Type of construction	....	Box type	Box girder	...	Center web	Center web
Screen:						
Type	Revolving	Revolving	Shaking	Revolving	Revolving	Revolving
Total length, ft	20	25½	32	24	30	36 ft. 3 in.
Width or diameter	3 ft. 6 in. diameter	6 ft.	7 ft. 4 in. upper 7 ft. 11 in. lower	4 ft. 6 in. diameter	6 ft. diameter	6 ft. diameter
Size of holes	⅜ in. dia.	⅜ to ½ in.	⅜ in.	⅜ in. dia.	½ to ⅝ in.	½ in.
Grade	1½ in. in 12 in.	2 in. in 12 in.	1⅞ in. in 12 in.	1½ in. in 12 in.	2 in. in 12 in.	2 in. in 12 in.
Horsepower of motor	Driven by main engine	20	20	15	35	50
Number r.p.m. or strokes per min	12	7	....	9	7	8
Gold-saving tables:						
Total area, sq.ft	160	800	....	370	1600	2400
Grade	1¾ in. in 12 in.	1$\frac{7}{16}$ in. in 12 in.	1¼ in. in 12 in.	1¾ in. in 12 in.	1⅜ in. in 12 in.	1⅜ in. in 12 in.
Wood or steel	Steel	Wood	Steel	Steel	Wood	Steel
Width of bays, in	28	36	30	32	33	36
Dimension of riffles	Cocoa matting and expanded metal	1$\frac{1}{16}$x1¼ in. wood	1x1x$\frac{3}{16}$ in. L.	Cocoa matting and expanded metal	1¼x1¼x$\frac{5}{16}$ in. L.	1¼x1¼x$\frac{5}{16}$ in. L.
High-pressure pump:						
Horsepower of motor	....	15	100	30	50	100
Head, ft	18	65	70	31	50	68

along the compartments adjacent to the well and extending some distance aft from the well throat.

The bow is made narrower than the rest of the barge, the frames being shortened and the side planking steamed and bent around them. How much this portion of the hull should be narrowed down will depend on the width of cut it is desired to make, together with the distance the digging ladder projects beyond the bow. Using one spud as a center and drawing the outline of the hull, digging ladder and cut to scale, will graphically illustrate how much to bring in the bows so that the dredge may dig its way along any desired width of cut.

STRONGER CONSTRUCTION SOMETIMES USED

The above is a general description of the most common type of hull construction. I have been using what I consider a somewhat stronger construction, but one which is more expensive. Fore-and-aft stringers are laid below the thwartship timbers. The posts are bolted to both the fore-and-aft and the thwartship timbers, the bottom planking being laid athwartships. Clamps are used above the thwartship timbers the same as in the other form of construction, the difference being that there is an extra set of fore-and-aft timbers, to which the bottom planking is spiked, this planking running athwartships instead of fore and aft. This construction requires more lumber and labor, but is stronger, and by using thwartship planking full lengths can be used, doing away with all butt joints. The tendency of dredge hulls is to sag along the fore-and-aft center line. Where fore-and-aft planking is used this movement of the hull tends to open up the seams, but where thwartship planking is used the strain is lengthways of the planking. When a hull is new these weaknesses do not show, but after years of service all such little things count, and since the life of a hull determines the life of a dredge, it pays in the long run to use every precaution possible to add to the stability and length of life of the hull. Solid fore-and-aft bulkheads are recommended, also the use of well plates made up of 6x14-in. planking (for the 7- to 9-cu.ft. dredge), laid horizontally below the deck beams and filling the roof of the first compartment on each side of the well for 30 ft. each way fore and aft from the throat of the well. These well plates are particularly useful in dredges having long well holes.

Another plan which will add strength at small cost is to put in diagonal wooden braces from the fore-and-aft timbers near the bottom of the intermediate bulkhead to the clamp near the top of the well hole. This will aid materially in preventing sag toward the well hole.

GENERAL DATA ON CALIFORNIA GOLD DREDGES—*Continued*

Name of Maker	Risdon	Bucyrus	Link Belt	Risdon	Marion	Marysville Dredging Co.
Quantity of water, gal. per min....	3000	500	2800	2400	....	3200
Size suction pipe, in	.	4	12	14	10	12
Size discharge pipe, in			10	9	8	10
Make of pump......	Risdon	Yuba Con. Co.	Worthington	Risdon	Worthington	Abner Doble
Low-pressure pump:						
Horsepower of motor...	No low-pressure pump	50	No low-pressure pump		25	35
Head, ft...........		60		18 6	25	25
Quantity of water, gal. per min............	.	2000	....	2200	....	3800
Size suction pipe, in.....	.	8	....	....	10	12
Size discharge pipe, in...			..	9	8	12
Make of pump.........		Yuba Con. Co.	.	Risdon	Worthington	Abner Doble
Fire pump:						
Horsepower of motor...		Use high pressure	5	5	10	10
Head, ft...........			65	40	90	100
Quantity of water, gal per min...............	....		150			.
Size suction pipe, in.....	...		3	3	4	2½
Size discharge pipe, in...	...		2½	2½	3	2
Make of pump.........	....		Worthington	Krogh	Worthington	Abner Doble
Lines:						
Size ladder hoist, in.....	⅝ in.—	⅞ to 1	1	⅞ in. diameter	1	1⅛
Size stacker hoist, in....		¾	¾	1½ in. diam.	¾	¾
Size spud hoist, in.....	....	¾	¾	.	⅞ and ¾	¾
Size swinging lines, in...	½-in. rope 300 ft.	¾ to ⅞	¾ to ⅞	⅞ and ¾	1 and ¾	1
Total weight machinery, tons..........	90	260	305	220	300	400

Still another form of strengthening construction being used, particularly on the larger boats, is an overhead thwartship truss with heavy hog rods running diagonally from the upper chord near the sides of the dredge to the bottom of the hull at the well, thus preventing sag at this point.

The bottom, sides, bow, stern and deck are all calked with oakum and the seams pitched or similarly treated. The inside is treated with carbolinium, Stockholm tar, painted or left without any treatment whatever. On the outside below the water line the planking may be painted or not as desired. Above the water line all timber work is thoroughly painted. Before putting timbers together all joints are painted with white lead, mineral paint, or coated with tar or carbolinium.

The deck beams are extended beyond the sides of the barge at the after portion of the dredge. Braces are put under these in order to support the housing uprights. This gives extra room for gold-saving area or passageways. Hatchways are provided for entrance into each compartment, also a system of ventilation should be installed, using either mechanically driven fans or natural ventilation induced by cowled ventilators. Proper ventilation will do much towards prolonging the life of the hull. Sea cocks are often installed in order to sink the dredge in case of a fire which has gone beyond hope of being extinguished. If sea cocks are used they should be placed near the bows where a hot fire in the housing will not prevent their being approached and quickly opened.

Main Truss and Gantries

A large proportion of the California dredges have a truss along the sides of the well and extending from bow to stern gantry, with wooden chords, posts and braces and steel hog rods. This truss is made 15 to 25 ft. high, the upper chord often being used to support the upper-tumbler bearings and the upper end of the digging ladder. In the earlier dredges there was a tendency for the hulls to go down at bow and stern and hump up near the throat of the well. This truss assists in preventing this condition, strengthens all the gantries and spud frame, and makes an excellent support for the housing, screens, etc. It should be designed as a truss supported at the middle with weights suspended at each end.

At the bow is a gantry which supports the forward end of the digging ladder, the details varying in the different dredges. A steel cap of box or double I-beam section on four posts is a common type. In some dredges the four posts are parallel; others have two posts parallel to the well sides and two sloping inward joining the first at the cap. Still others have the four posts parallel for half their length, the two outside ones being cut at this point, and from here diagonal braces run to the intersection of cap and inside posts. The whole gantry is inclined forward in order that it may have a more direct pull on the digging ladder. In a good many of the California dredges the gantry posts go through the deck and are stepped on heavy foundation timbers or castings near the bottom of the hull. A few dredges have rigid foundations for these posts on the deck, and at least one uses a socket casting into which the posts fit loosely.

This gantry has thwartship bracing and is guyed by ropes or tie rods to the main gantry, hull timbers or both. The top chord of the main truss runs to the middle portion of this gantry and is fastened to it by means of steel plates. It is also customary to run a brace diagonally from near the cap to the top of the first truss post. Some form of pin and plate clamp is provided for the bow-gantry cap, to which is attached the ladder hoist blocks and gantry guys.

The main gantry is a support for the bucket drive and the after end of the digging ladder. It has a very severe duty to perform and should be built in a most substantial manner. I prefer to place a post under each bearing and use heavy lattice bracing between the posts. Too many plates should not be used to tie the timbers together, and arrange matters if possible so that all bolts will be accessible. Where many plates are used it is extremely difficult to assemble the parts and in case of repairs the delay is great in taking apart and re-assembling, owing to the difficulty of lining up the holes in the different plates.

The stern gantry supports the spuds and the stack ladder and must be made high enough to raise the spuds so that they will nearly clear the bottom of the hull. It is inclined slightly aft so that the spud hoist blocks will be vertically above the center of the spuds. The design is simple, two, three or four posts being used with a wooden or steel cap. Clamps are used for the spud hoist blocks, ladder support and guy ropes. The posts may rest on foundation timbers or castings situated near the bottom of the hull or on the deck.

Spud Housing

At the stern of the dredge the two spuds are inclosed in a housing which allows them to slide up and down but holds them in a vertical position. At some point above the deck, usually at the elevation of the upper chord of the main truss, heavy timbers are framed around the spud, with tie-rod connections to the hull or main gantry. This framing together with the tie-rod connections resists the tendency of the upper part of the spud to move backward as the buckets engage the gravel and thrust the hull toward the rear. This clamp must be made strong enough to withstand the full digging power of the dredge, increased to some extent by the slight fore-and-aft movement of the hull and the consequent momentum of the full weight of hull and machinery. I do not approve of running the tie rods to the main gantry, since no matter how strong this part is made the constant pulling and jerking on one side will tend after a time to throw the bucket-line shafting out of line.

The guy rods should be run into the hold or to some other part which does not support shafting.

Many different spud-housing designs are used, but the present tendency seems to be to use heavy castings covering a large area of the stern to resist the forward pressure of the spud and a structural or cast-steel clamp 20 ft. or so above the deck. In order to keep the spud from moving backward heavy steel keepers are used which can quickly be removed when it is necessary to change spuds. The timber construction will work well enough, but it is likely to get loose in time, and it is difficult to design a wooden structure so that it will be at the same time strong and easily removable. Whatever form of spud housing is used it should be so inclosed that small rocks can not lodge where they will be caught between the spud and its guide..

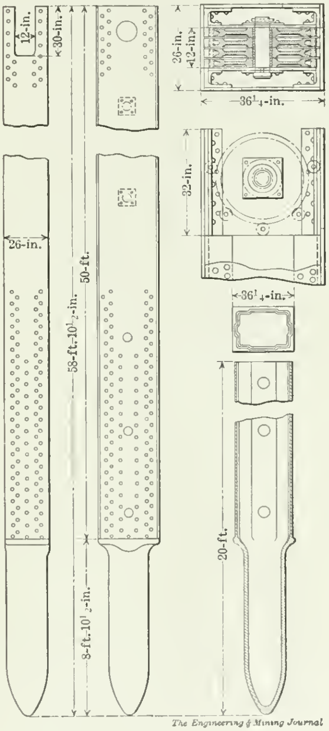
Housing of Dredge

The after portion of the dredge is housed in, this housing covering the gold-saving tables, pumps, main winch, ladder hoist and transformers. The after central portion is extended up and covers the screen and screen drive. A covering should also be provided for the bucket drive, but this is not essential. The roof of the housing is made with a slight crown or slope to the sides and covered with painted canvas, ship fashion. The roof joists should be made heavy enough to support a considerable weight, since in repairing it is often convenient to lay down one of the big gears or the like, and for this reason the flooring should be at least 1¼ in. thick, or made of two thicknesses of planking. The stern and sides along the gold-saving tables are not usually boarded up. It is thought that an unobstructed view lessens the danger of amalgam stealing.

The pilot house from which the digging motor and winches are handled is usually situated on the starboard side of the upper deck above the main winch and a little forward of the bucket drive. This is the common situation, but the pilot house on the central line of the dredge above the bucket line and just forward of the bucket drive seems preferable. The only objection to this situation is that the lever connections to the winches are a little more complicated. This situation gives an excellent view in all directions around the dredge and down the bucket line. By proper arrangement of gratings the main winch may be seen. The bucket drive, stacker and spuds are also within sight of the winchman. In my opinion there is no question as to the proper situation for the pilot house, and all my dredge designs have their pilot houses well up in the center of the boat.

In the tables on pp. 508-510 the more important dimensions and some other data of several California gold dredges built at different times, of different sizes, and for different conditions are given. Most of the data were kindly furnished by the makers, and will serve to give a general idea of typical dimensions. In checking over the figures furnished several discrepancies were noted, but on the whole the figures are no doubt approximately correct.

Construction Costs



The Engineering & Mining Journal

Spud for 5-cu.ft. Dredge

The construction costs vary greatly, of course, according to the quality of workmanship and material desired, facilities of the builders in the way of properly equipped shops and foundries, and the geographical situation of the ground on which the dredge is to be built. The following may be considered a fair average of many cost records in California, for rough estimating purposes:

For all the machinery, including motors, pumps, wire rope, electric supplies, etc., 12½c. per lb., delivered on the ground; for installing, 4½c.; or a total of 17c. per lb. for the machinery installed. The lumber costs about $30 per 1000 ft. at Portland, and this together with freight, bolts, nails, hog rods, steel plates, oakum, paint, etc., will make the hull material cost about $50 per 1000 ft. of lumber used; labor of building costs about $40 per 1000 ft., giving $90 per 1000 ft. as a total cost of the completed hull. In addition the direct costs chargeable to hull or machinery, insurance, traveling, superintendence, camp equipment, temporary buildings, shop, derrick, office expense, design, etc., amount to between $10,000 and $25,000, depending on whether new designs have to be gotten out, what construction tools and equipment are on hand, the size of the dredge, and situation of the ground on which it is to be built. For a complete dredge, $180 per ton, on a basis of its displacement, is a fair average.

Prospecting for Alunite

Owing to the fact that alunite is associated with the rich gold ores of Goldfield, Nev., and owing to the fact that it may have some commercial value of its own, the following suggestions (Bull. 511, U. S. Geol. Survey) as to its occurrence are of interest. Alunite deposits may be formed by the action of descending acid solutions, derived from the oxidation of sulphides, on potassium-aluminum silicate. Several occurrences have been noted where the mineral is thus associated with oxidized ore, usually in or close to feldspathic rock, and a more careful examination of material that has been called kaolin or talc will doubtless show some of it to be alunite.

Or the deposits may be caused by the deposition in veins from ascending thermal solutions. In connection with the alterations which produce alunite there is usually a silicification of the rock which renders it resistant to weathering, so that the outcrops are usually rugged and stand high above the surrounding rock. Pyrite will also be commonly formed in the wall rocks during the alteration, and in places the oxidation of this mineral at the surface will give an iron stain to the outcrop. The alunite in the Marysville, Utah, deposits is closely associated with metallic veins of a type widely distributed through the Western States, while in general the alunite may be expected to occur in districts with metal veins and is believed to be closely related to them in origin. The alunite deposits themselves may not contain any metals of value, as is indicated by the Marysvale deposit and the two chief Colorado deposits. As already mentioned, at Goldfield it is closely associated with workable metallic deposits.

A simple field test for alunite is suggested by W. T. Schaller. Boil the powdered rock with water or with hydrochloric acid for several minutes. After allowing the insoluble residue to settle, pour off the liquid and repeat the operation to insure the removal of all soluble sulphates. Dry the powder and heat to a dull red. Again boil in water and after settling pour off some of the clear liquid. To this solution add a little of a solution of barium chloride. If the mineral is alunite, a heavy white precipitate will form. One must make sure that the water used in this test does not contain sulphates in solution, so it should be tested with barium chloride and if it gives a marked precipitate, it cannot be used. For this test all that is required that is not included in the ordinary miner's or prospector's outfit is a little barium chloride which can be readily carried in a small bottle. Attention is again called to the fact that the known Marysvale alunite deposits have been taken up by companies or individuals who are not in need of assistance either financial or technical, and that wide advertising for contributions or the attempt to distribute large quantities of stock should in itself be a warning to the prospective investor.

Sealing Off Water in Catskill Aqueduct Shafts

By J. F. Springer[*]

The construction work on the Catskill aqueduct is of interest to the mining engineer because of the shaft-sinking and tunnel-driving operations. This article describes how some of the problems of sealing water were solved in connection with the sinking of one of the most troublesome of the shafts.

The aqueduct for a distance parallels the Hudson River. The route cuts across tributary streams; creeks, or brooks of no especial importance so far as size goes, but some of the valleys of which are a number of miles in width. One of the largest is the valley of Rondout Creek. In making the crossing at this point the aqueduct drops far below the bottom of the creek and makes a 4½-mile passage from one side to the other. A vertical shaft at each end and a third at an intermediate point will remain permanent features. The contract for sinking these shafts was awarded to the T. A. Gillespie Co., 50 Church St., New York. In addition five other shafts were sunk to the tunnel grade in order to facilitate construction. One of these, construction shaft No. 4, is 500 ft. deep. It is 10x22 ft. in horizontal section, and 18 months were occupied in sinking. It was flooded six times. The strata passed were: Glacial drift, 6 ft.; Helderberg limestone, 226; Binnewater sandstone, 39; High Falls shale, 92; Shawangunk grit, 134; total, 497 feet.

The trouble with the water came from the sandstone and the shale, but the water made its presence felt long before these strata were reached. At the site of the shaft a 4-in. test hole had been put down. When a depth of about 80 ft. had been reached, a sudden inrush occurred through this hole, filling the shaft half full. The emergency pumping plant had not yet been delivered, so the contractors were caught unprepared. However, by the use of an air lift and sinking pumps, the water level was lowered to a point near the bottom. A nipple was driven into the hole and casing attached to it. The purpose was to grout up the hole. In order to carry this out a 1-in. pipe was put down to the level of the Shawangunk grit, that is, to the 363-ft. level. The water was then permitted to return. Pressures were thus equalized and currents prevented The 1:1 grout was poured down the 1-in. pipe, which was withdrawn as the grout was filled in.

Shaft Flooded through Bore Holes

The problem of this hole was thus solved, but fears began to be entertained as to whether the ordinary methods of shaft sinking would prove successful. It was understood that there was a large quantity of water under pressure. A special pumping chamber in the side of the shaft should have been provided before sinking below the limestone. This arrangement was made later, but the delay was the source of much trouble. However, excavation went on, and the sandstone was penetrated. At the 260-ft. level, the quantity of incoming water was only about 225 gal. per min. During the drilling of the sump, an additional 600 gal. per min. came in suddenly through one of the drill holes, with the result that the shaft was flooded again. After some trouble the shaft was unwatered, only to be flooded three additional times in as many weeks. Almost all of this water came in through bore holes, none of which was probably over two inches in diameter. When the fifth unwatering had been completed, the conditions below were known to forbid further progress without taking special precautions. In fact, it had been ascertained that there were large crevices a short distance beneath the bottom of the excavation. One of the largest of these crevices was only a foot and a half distant. The size of the crevices ran up to eight inches. As compared with the 2-in. bore holes, they promised plenty of trouble.

It was proposed to deal with the water question by means of grout. Four special machines were set up at the mouth of the shaft. A 2½-in. pipe led down the shaft to the bottom, where a 2-in. hose carried the grout to the point where it was to be used. At the beginning of operations, the grout gave trouble by leaking back. It would come in through the spaces around the pipes and through cracks in the bottom. This difficulty was successfully overcome by mixing finely ground horse manure with the grout. In this procedure a total of 2900 bags of portland cement was consumed. When the grout had hardened in the crevices a few more holes were drilled. Water under a pressure of 65 lb. was found 14 ft. below. These holes were soon grouted up, only 60 bags of cement being required.

Water-bearing Strata Grouted

But sinking was not at once resumed. It was deemed advisable to deal further with the question of the water. The grit was then about 100 ft. farther down. It was proposed to grout up the intervening water-bearing strata with more grout. Accordingly, six diamond-drill holes were put down to the grit. Half were of the size corresponding to a 1-in. core; and half to a 2-in. core. With a pressure of 275 lb. per sq.in., these holes were grouted with 175 bags of cement. It was not known whether this small quantity of cement meant that the problem was a small one or whether it had been only partially solved. It would seem that the thorough application of the method of grouting ahead of the excavation should have been employed sooner; that is, before the water-bearing strata had been penetrated.

Sinking was then resumed and continued until a depth of 320 ft. was reached. A pair of collecting-rings had been arranged, and many sinking pumps installed in the shaft. The working space was much confined. Besides, it was difficult to secure easy, certain and adequate pumping capacity by the use of sinking pumps alone. It was determined to construct a pumping chamber to one side at the 309-ft. level. This chamber was quite large, 10 ft. high, 17 ft. wide and 24 ft. long. Beneath its floor a sump 5½ ft. deep and 16x22 ft. in area was cut out. It had a capacity of 14,500 gallons.

In the special chamber were installed three Cameron horizontal condensing pumps furnished by the Cameron Pump Works, of New York. All these were of the 24x10x20-in. size and had a combined capacity of 1050 gal. per min. They were run by steam supplied by three 100-hp. boilers set up at the collar of the shaft. As the pumps were of the condensing type, this whole arrangement was a possible one. Before the installation of this powerful pumping plant, the sixth flooding of the shaft took place. Subsequently no especial difficulty was encountered from the water. More grouting was done, but none of the seams required more than 100 bags of cement, with one exception. When the grit was reached, a hole gave trouble and required 348 bags of cement. The quantity of water pumped from this one shaft was equivalent to 86,181,000,000 foot-gallons. The total quantity of portland cement consumed in the grouting operations was 971 barrels.

---

[*] 605 West One Hundred and Fortieth St., New York.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Absorption of Gold by Retorts

The absorption of gold by cast-iron retorts and amalgam trays has been investigated by G. H. Stanley, and M. P. Murray (*Journ.* Chem. Met. and Min. Soc. of South Africa, Dec., 1911). A section of a cast-iron retort, which had been used probably from one to two years, was taken. The scrapings from the inside surface showed 79.0643% of gold and silver. A slice 1/16 inch from below these scrapings showed 30.696% gold and silver. A slice ⅛ inch thick below this showed 6.388% gold and silver; the next ¼ inch, 0.016%; the next ½ inch, 0.0013%, and a section below this—nothing.

In this case there is evidently a considerable penetration of gold to a depth of over 3/16 inches. While it is not claimed that the piece examined is representative of the whole retort, it shows the presence of a valuable quantity of gold which could not be removed by mere scaling or chipping of the interior. It is believed that the graphite in the original retort iron is oxidized, which leaves minute cracks down which the gold penetrates. Although no gold was found in some of the interior sections, a section from the outer surface, after the utmost pains were taken to prevent salting, showed 0.001% of gold, which leads to the belief that it may permeate the entire interior of the retort.

Strength of Rolled Zinc

When it was proposed recently that zinc be used for the hangers of electric cables the fact was brought out that data on the strength of American zinc were lacking, and tests were made by the Materials Testing Laboratory of the University of Illinois on this subject. Thin zinc plates were found to have an ultimate tensile strength of about 24,000 lb. per sq.in. The modulus of elasticity was found to average 11,500,000 lb. per sq.in. Under the action of punches and shearing tools, zinc plates developed about 40% of the shearing resistance of mild steel and required the expenditure of about 30% of the energy required for plates of mild steel of the same thickness. No clearly defined elastic limit or yield point was found for cast or for rolled zinc. Zinc plate was found to break under pull with much less stretching than steel, but a zinc cylinder could be flattened without cracking. The result of tests of American zinc showed that its strength does not differ from that shown by European laboratories for foreign spelter. The results of these tests are published in Bull. 62 of the Engineering Experiment Station of the University of Illinois.

Effect on Steel of Oxyacetylene Cutting

In an Austrian contemporary the results of tests made to determine the effect on the metal near the cut made by oxyacetylene blowpipe are given.

Tests were made with two mild steels, a nickel steel, and a chrome-nickel steel, the latter being of the armor-plate variety, and tested in the hardened condition. Test pieces were cut out by the ordinary method and by the oxyacetylene blowpipe, and tensile tests made. It was found that in the case of the mild steels and of the nickel steel no change in the quality of the metal had occurred, but in the case of the hardened chrome-nickel steel the material had been considerably softened, the effect being greatest nearest the cut, and gradually diminishing as the test piece was farther away from the cut; the effect was noticeable even at 1⅜ in. from the cut.

A confirmation of this result was obtained by firing 38-caliber hardened-steel projectiles at a plate, the edge of which had been cut by the oxyacetylene blowpipe, and noting the depth of penetration at different distances from the edge. At 1/10 in. from the edge the penetration was 0.005 in.; at 1/3 in. the penetration was reduced to 0.003 in., and at 1 3/10 in., 0.001 in., which was also the depth of penetration over the remainder of the plate. A chemical analysis disclosed no changes, but micrograph sections plainly showed the softening of the steel.

Ankylostomiasis at Linares, Spain

There are about 200 lead mines in the district of Linares, Spain, but owing to the depressed condition of the lead industry, only about 35 of these are at work, and in 20 of them ankylostomiasis is prevalent, says *Revista Minera*. The number of persons employed underground is about 2500 to 3000 and of these it is estimated that about 10 per cent. are affected. Conditions are favorable for the propagation of the parasite, as the lodes worked are in wet granite, and most of the work is being done at a depth of about 1500 ft., the temperature varying between 80 and 86° F. All the usual symptoms of the disease are noted among the miners, and newcomers to the mines have been found to succumb to the disease within 12 months. It is stated that up to the present no sanitary precautions have been taken either to alleviate the infection or to provide against it, but *Echo des Mines*, Feb. 15, 1912, says that the Spanish government is about to take up the matter.

Fertility of Dredged Ground

That ground which has been worked over by gold dredges can be used for orchards has been known for some time. The *Australian Mining Standard* (Jan. 11, 1912) is responsible for the statement that this land is equally applicable to raising crops of grass and clover. J. D. Bromley, of Harrietville, Victoria, has been experimenting with a variety of seeds, and, according to his experience, those grasses which give the best returns are paspalum and cow grass, but red clover also gives excellent results. He states that during prolonged droughts crops on these lands which have been worked by a dredge do better than those on the undredged land.

Experiments in Pole Treatment

The San Joaquin Light & Power Corporation, of California, has been conducting experiments lately in the treatment of poles for transmission lines[1]. They were yellow pine, thoroughly seasoned, some of them receiving a brush treatment with carbolineum or creosote, the remainder being treated in an open tank with creosote, zinc chloride, or crude oil, the butt only being treated. The penetration with creosote and zinc chloride averaged three inches. The penetration with crude oil about 1¼ in. At the end of 27 months untreated check-test poles were completely rotten. Of the poles brush-treated with carbolineum or creosote, the conditions were about the same, 27% of the latter, and 29% of the former showing decay.

Of the open-tank poles, 35% of those treated with crude oil had been slightly attacked. Of the poles treated with zinc chloride, 28% showed decay. The poles treated with creosote in the open tank were all perfectly sound, and showed no signs of decay whatever. Fourteen months later, the poles which had a brush treatment only, began to fall. The difference between a creosote-treated pole and one treated with zinc chloride, is only about 75c. in cost, and it has been found that this difference did not pay where any of the poles were set in irrigated land, as the preservative salt was washed out of the poles, and the poles had to be replaced after a service of about two years.

---

[1]Abstract of a paper read before the Wood Preservers' Association, Chicago, Ill.

Blasting near Buildings

That it is occasionally necessary to consider the effect of explosives on buildings and structures some distance from the work in hand is remarked in *Engineering Record*, Jan. 27, 1912. It is sometimes found that the shock resulting from a blast may be moderate at points comparatively near the charge and serious at points so far distant as not generally to be considered. This danger to structures some distance away is particularly great when there are long ledges or tongues of rock running out from the point at which blasting is being carried on to the buildings in question. In such cases the disturbance is likely to be concentrated and carried to a long distance in just the same way that the shock of a heavy hammer blow can be transmitted through a long section of iron pipe. In case the jarring of particular buildings gives notices that there is some danger, the use of slow-burning and low-power explosives should be made compulsory. In fact, most of the dangers of blasting come from an indiscriminate use of high explosives which really need to be employed in comparatively few cases.

The Bleecker Process for Vanadium Ores

A process for the production of copper, lead or iron vanadates from vanadiferous ores has been patented by Warren F. Bleecker, of Boulder, Colo. (U. S. pat. 1,015,469). The first steps in the process consist in grinding the material fine, roasting for at least 15 min. at a heat a little above redness, and fluxing with sodium chloride and a fixed alkali, such as potassium or sodium hydroxide, or sodium or potassium carbonate, either during or after the roasting process. This converts the vanadic acid into soluble form.

The fluxed ore is then leached, either with or without agitation, with water, and the solution of alkaline vanadates removed. The residue is then leached with a dilute mineral acid (such as hydrochloric), which leaves the ore practically free from vanadium. It is neccessary to produce a neutral solution, which is then done by mixing the aqueous and the acid extracts, although either of these solutions may be taken and neutralized separately

The final step consists in precipitating the vanadium from the neutral solution by adding a soluble salt of copper, iron or lead. While other insoluble vanadates may also be produced in this way, those mentioned are the most important.

Seger Cones as Pyrometers

Numerous tests were made on the melting points of Seger cones with regard chiefly to duration of firing and variety of kilns. (*Sprechsaal*, 1911, pp. 726, 741, abstr. in *Journ. Soc. Chem. Ind.*, Jan. 31, 1912.) These cones have no definite melting-points like metals and most chemical compounds. The chief factor is the duration of firing, which may affect the apparent melting-point by 60°—100° C. Other conditions being similar, a cone will melt at a lower temperature if the firing be prolonged. But, according to the author, cones 012a —1 are an exception; they melt with more difficulty in a slow fire. Cones cannot be regarded as pyrometers for accurate measurement of temperature, but they have the advantage over optical and thermoelectric pyrometers in the burning of pottery that they are affected by the time factor as well as by the actual temperature attained. A cone that has remained unmelted in one fire cannot be reliably used in a subsequent one.

Electric Furnace for Dross Melting

A new form of electric furnace for the melting of drosses, scrap metal and cyanide precipitates is described in the *Brass World*, Jan., 1912. This furnace is the invention of Raymond S. Wile, of the Pittsburg Electric Furnace Co., and is a combination of the arc and resistance furnaces. Four carbon electrodes are used, two passing up through the bottom of the furnace and the other two down through the top. When melting is to be begun, the furnace is partly filled with broken glass and the carbon electrodes arranged so that they touch. After the current is turned on they are drawn apart and an arc is formed, which soon melts the glass in its neighborhood. As the glass melts it becomes a conductor of the electric current, where before melting it was a nonconductor. The electrodes are now drawn further apart so that the current passes through the molten glass and finally the whole charge becomes fluid, the glass being kept liquid by the resistance offered by it to the passage of the current.

When all of the glass is in a molten condition, the metal or dross to be melted is charged directly on top of it. The initial heat of the glass melts the metal, and then, on account of its greater specific gravity and the fluid condition of the glass, it sinks to the bottom of the furnace where it is completely protected from oxidation. After several months the glass becomes more or less impure and must be tapped off and replaced, but broken bottles form a cheap mixture for refilling it. The furnace is lined with chrome brick, as that is found to be the best resisting material for such work. A furnace with a capacity of 1000 lb. of brass will pour about one ton of metal per hour and, if run continuously, consumes about 68 kw. in doing so. If the current is not run continuously, and electric current costs 2c. per kilowatt-hour, it has been found that the current cost for melting 1000 lb. of brass is about $1.36. This is somewhat higher than the cost of melting with oil or coke, but the waste in melting is less and is said to more than compensate for the extra power cost.

Bat Guano in Mexico

The exportation of bat guano from Mexico through the port of Nogales during the last three fiscal years ended June 30, was as follows: 1909, 1111 tons; 1910, 2226 tons; 1911, 1893 tons. The guano is found through various caves in the state of Sonora and along the west coast of Mexico, and is gathered into sacks and carried on burros to the nearest railway station, then shipped to fertilizer works in California. (*Daily Cons. and Trade Reports*, Feb. 17, 1912.) The average of the shipments is from 12 to 15% of ammonia. The guano hunter mixes a small portion of the guano with a little unslacked lime and water in a small pan or cup and judges from the ammonia fumes which arise, whether it will pay for the handling.

Effect of Varying Zinc in Brass

Zinc alloys with copper to form brasses in all proportions from 1 to 43%. After the latter figure is passed (*Metal Industry*, Feb., 1912) the alloy becomes hard and no stronger than cast iron, and is useful only in ornaments, having a fine golden color. After the proportion of 66% of copper and 33% of zinc is passed, aluminum should be used in making the casting, for without that as a deoxidizer the alloy will be dirty in appearance and full of blow-holes.

Operating Mines in Turkey

Commercially valuable mineral deposits in Turkey are comparatively few and far between, writes Hugh Whittall in the *Levant Trade Review*. The important mines known and being worked today are the following: Argana copper mine; Sultan Tchair borocite mines; Bahlia lead mine; Thassos calamine mines; Whittall & Abbott emery mines; Karaburny mercury mines; Heraclea coal mines.

The Determination of Platinum

The usual method of determining platinum is to obtain a silver alloy by the regular fire assay, part in strong sulphuric acid, and weigh the residual metal. Realloy this with silver by a second cupellation, part in nitric acid and again weigh. The difference between the two weighings is assumed to be platinum. Frederic P. Dewey, in a paper presented at the New York meeting of the American Institute of Mining Engineers, criticizes this on the ground that other members of the platinum group may also go into solution in nitric acid and be reported as platinum. Moreover, any indirect method is always likely to be indecisive and sometimes erroneous.

Mr. Dewey suggests the following method: In the regular course of assaying for the precious metals, part the silver bead as usual by dissolving in nitric acid. If platinum is present in small amounts only, it will readily go into solution. This dissolved platinum is now collected, together with a certain amount of silver, by an extremely dilute solution of hydrogen sulphide. Dilute one portion of strong hydrogen-sulphide solution with from 10 to 20 parts of water. If the solution of silver nitrate be strongly acid, as it usually is, it should be largely diluted, or, better still, first evaporate to drive off the acid, and then dilute it. The sulphuretted-hydrogen solution should then be added very slowly to the silver-nitrate solution with constant stirring. The silver-nitrate solution is at once darkened, but there should be no immediate separation of a visible precipitate. The solution should be stirred occasionally, and in about 2 hrs. a precipitate should begin to appear. It may be filtered in from 3 to 4 hrs., but it is better to let it stand over night.

The amount of hydrogen sulphide required depends upon the amount of platinum present. If this should be roughly known or suspected, the amount used should generally be enough to precipitate the platinum and from 3 to 5 times as much silver.

On an entirely unknown ore, Dewey suggests using 1 cc. of strong hydrogen-sulphide solution diluted to 15 cc., saving the filtrates from the sulphide for retreatment, if necessary. On an unknown bullion about 2 cc. of strong solution diluted to 30 cc. would be used. However, even if it is known that only minute amounts of platinum are present, it is still necessary to use enough hydrogen sulphide for the silver bead to be large enough to handle comfortably. For this reason it is seldom advisable to use less than 1 cc. of strong solution.

The sulphuretted-hydrogen precipitate should be filtered and washed; the moist filter is transferred to a small porcelain crucible, dried at a low heat, and gently ignited. The sulphide precipitate is transformed into a metallic sponge, which is then wrapped in a small piece of lead foil and cupelled. The resulting bead is then parted in strong sulphuric acid, when the platinum will be left as a dark residue, generally collected in spongy form, even when minute in quantity. This sponge, after reboiling in fresh acid, if necessary, is washed by decantation, annealed and weighed. If any doubt as to the metal's being platinum it may be dissolved in a drop or two of *aqua regia* and evaporated. The solutions may then be tested with potassium iodide or with ammonium chloride, when the characteristic precipitate will show. As a further test this may be filtered off and ignited to produce spongy platinum. If the amount of the final metal be considerable, the platinum may be determined by the double chloride method. Any decided difference shown would indicate the presence of other members of the platinum group, for which direct tests could then be made in the solution.

It may happen that the final metal shows the yellow color of gold due to the fact that fine float gold passes over in decanting the solution of silver nitrate from the first parting. In such a case the metal must be re-alloyed with silver and the treatment repeated. When the proportion of gold to silver in the metal being parted is so small that the gold separates in a finely divided state it will often save trouble to filter the silver-nitrate solution to separate any float gold before adding the hydrogen sulphide. [It would appear that if the amount of gold were large enough to interfere with the platinum assay, that correction should be made in the original gold assay for it.—EDITOR.]

This method (the partial precipitation of silver-nitrate solution) may also be used for gathering gold where the gold occurs in minute quantities, as in high-grade silver, such as that produced in electrolytic refining. The author also suggests this method as a possible means of determining gold in metallic copper and similar material in which the gold is finely divided.

The Vanadium Industry in France

The factory of Cire les Mello, Department of Oise, France, which has a capacity of about six tons of vanadic acid monthly, has been purchased by the Santa Marta Co., to work under the patents graned to Doctor Berret. The company will make ferrovanadium and other alloys, as well as vanadic acid (*Min. Journ.*, Jan. 27, 1912). In a recent consignment delivered to the marine workshops at Ruelle, the quality was so good that other orders immediately followed, and the output of this works has been adopted as the market standard. The products of the Santa Marta Co. were awarded the Grand Prix at the Turin Exhibition. In the opinion of the *Echo des Mines*, the growing employment of vanadium steel assures the success of this company.

Elkton Consolidated Report

The report of the Elkton Consolidated Mining & Milling Co. for the year ended Dec. 31, 1911, shows that the gross value of the ore mined and shipped was $340,111; the net profit, $67,852; dividends paid during year, $225,000; dividends of $2,929,460 have been paid to date.

The recession of water in the mine was only about ¾ in. per day until an extension of the Roosevelt tunnel resulted in a largely increased flow the latter part of 1911. This additional flow allowed the sinking of the main shaft and the opening up of the tenth level, 50 ft. below the ninth level. Shaft sinking is to be continued and it is expected that a depth 150 ft. below the tenth level will be reached within the next few months. The grade and quantity of ore on the tenth level are reported as being satisfactory.

The grade of ore mined during 1911 was lower than the preceding year by about $4.50 per ton. This is because the bulk of it was taken from the depleted orebodies above the ninth level. Shipments of lessees' and company ore amounted to 21,026 dry tons of an average value of $16.28 per ton.

The 12 lessees who worked the outlying blocks of the mine and the dumps paid the company $6915 in royalties. The leasing of the dumps was discontinued with the view that a greater profit might be obtained should the company build a mill at some future time.

The report contains the following data as to company work and costs:

Hoisted, 29,565 tons; shipped, 16,951 tons; waste sorted, 42 2/3%. Cost of breaking ore and waste for labor and powder was $1.05 per ton; cost of ore hoisted for underground labor and powder, $1.36; cost of ore shipped for underground labor and powder, $2.32; sorting and sampling per ton of ore hoisted, 33.7c.; sorting, sampling and loading per ton of ore shipped, 67c. The cost of sinking an 82-ft. winze was : Labor, $10.67; powder, $1.84; total, $12.51 per ft. The cost of 82 ft. of upraising was: Labor, $3; powder, $1.62; total, $4.62 per ft. The cost of sinking the shaft 55 ft. was: Labor, $12.46; powder, $2.92; total, $15.38 per ft. The cost of drifting on company account was: Labor, $2.66; powder, $1.36; total, $4.02 per ft. The cost of drifting by contract was $5.97 per foot.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Henry W. Turner has been in New York and has left for London.

Walter G. Perkins, of London, has gone to Argentina in behalf of the Famatina Copper Co.

R. E. Schultz has been inspecting the iron works near Ekaterinburg, in the Ural district of Russia.

R. E. Smith is on his way to Eastern Siberia, to examine mines near the mouth of the Amur River.

Fred B. Reece, of the Gualcala Mines Co., at Tuquerres, Colombia, is returning to the United States.

Ralph W. Perry has returned to Medellin, Colombia, after a visit of several months in New York.

Victor G. Alderson, president of the Colorado School of Mines, spent Feb. 23 and 24 in Telluride and Ouray.

W. B. Shakelford has been elected secretary of the Southwestern Lead & Zinc chapter of the American Mining Congress.

Joseph P. Keene is on his way from San Francisco to Vladivostok and Nikolaievsk, Siberia, where he will drill placer ground.

Herman L. Schneider has opened an office for consulting work in mining and metallurgy, at No. 905 East D St., Grant's Pass, Ore.

Edward W. Rabb, of Denver, is now at Magnolia, Boulder County, Colo., conducting a series of mill and cyanide tests at the Cash mine.

H. Kenyon Burch is in Globe, Ariz., preparing preliminary plans and specifications for remodeling the Old Dominion crushing plant and concentrator.

J. R. Painter, general manager of the Salmon River Mining Co., has been spending some time in New York and Philadelphia. He leaves Mar. 10 for Idaho.

Hiram W. Hixon will leave Philadelphia shortly for La Aurora, Tezuitlan, Puebla, Mexico, and will have charge of the smelting works of the Tezuitlan Copper Co., at that place.

Theodore B. Comstock has resigned his position as engineer executive officer of the Board of Public Utilities, of Los Angeles, Calif., and is open for professional engagements.

E. P. Earle, of New York, has resigned as a director of La Rose Mines, Ltd., and La Rose Consolidated Mines Co., in consequence of differences of opinion with a majority of the board.

Dr. George H. Ashley, state geologist of Tennessee, will resign to accept a position with the U. S. Geological Survey as a member of the land classification board in charge of the coal work.

A. W. Stickney is leaving the U. S. Geological Survey on a furlough for two years. He has accepted the position of geologist for the Kyshtim Mining Co., in the government of Perm, Russia.

E. Mackay Heriot, consulting engineer and general manager of the mining department of Kittel & Co., Ltd., of London, passed through New York this week on his way from Honduras to London.

Smith, Emery & Co., Los Angeles and San Francisco, are installing for custom work a thoroughly equipped ore-testing plant. The machinery is in a separate building in the rear of their main building at Los Angeles.

E. J. Carlyle, who has been in charge of the smelting works of the Kyshtim Copper Co., has returned to America. After a brief vacation at his home in Woodstock, Ont., he intends to go to Arizona to become engaged in smelting construction there.

Charles Kirchhoff, last year president of the American Institute of Mining Engineers, and for many years editor of the *Iron Age*, was married, on Feb. 26, to Miss Erwina Diepenbrock, of New York. Mr. Kirchhoff's many friends extend him sincere congratulations.

F. W. Draper has been appointed consulting engineer for the Verk Isetz Corporation, of Ekaterinburg, Russia, and sailed for Europe Mar. 7. He will have charge of the design and construction of a copper-smelting plant at the Kalata mines, and with the complete reconstruction of the existing plant at the Pushminsky mines.

Charles H. Repath and A. G. McGregor announce that they have formed a partnership for the purpose of conducting an engineering business, making a specialty of the mechanical and electrical engineering of metallurgical and mining plants. Both have been associated with the Amalgamated Copper Co. Their offices are at Douglas, Arizona.

OBITUARY

T. Guilford Smith died at Buffalo, N. Y., Feb. 20, aged 72 years. He was born in Philadelphia, educated as a civil engineer and for a number of years was employed on the Philadelphia & Reading R.R. Later he represented the Philadelphia & Reading Coal & Iron Co., afterward becoming Buffalo representative of the Carnegie Steel Co. and then of the United States Steel Corporation. He was a regent of the University of the State of New York, a member of the American Society of Civil Engineers and the American Institute of Mining Engineers.

Societies and Technical Schools

Colorado School of Mines—The junior class made an inspection trip, Feb. 23, through the Simson mine at Lafayette.

Wisconsin Engineering Society—H. P. Conolly, of Racine, was elected president at the annual meeting held in Madison, Wis. The other officers elected are: Vice-president, Prof. J. G. F. Mack, University of Wisconsin; secretary and treasurer, J. C. White, Madison; trustees, Prof. L. S. Smith, University of Wisconsin, and J. S. McCullough, Madison.

Columbia University—Beginning with September, 1914, the Schools of Mines, Engineering and Chemistry, which comprise the faculty of applied science, will be substantially graduate schools, a baccalaureate degree being required for admission. But students will have the privilege of following a combined collegiate and professional course in engineering, as they now have in law, medicine and teaching. The strictly technical or professional course of study will be three years in length instead of four as at present.

Pacific Association of Consulting Engineers—At its December meeting this association adopted resolutions disapproving of the present practice relating to expert evidence, whereby engineers, acting nominally as advisers of the court, are employed as witnesses and compensated by the respective litigants. A wider order of procedure would extend the usefulness of the engineer to the court in technical questions and further the ends of justice. The president and secretary were directed to bring these resolutions to the notice of the judiciary and bar of California and to the attention of engineers throughout the United States.

American Society for Testing Materials—The fifteenth annual meeting will be held at the Hotel Astor, New York, on Mar. 28 and 29. Two sessions will be held each day and the meetings on Thursday afternoon and Friday morning will be devoted to the discussion of committee reports on standard specifications for coal, coke, steel, wrought iron, cast iron and finished castings. At the opening session on Mar. 28, committee reports will be submitted as follows: "Magnetic Testing of Iron and Steel," "Tempering and Testing of Steel Springs and Standard Specifications for Spring Steel," "Standard Specifications for Cold-Drawn Steel," "Hardness Tests," "Rules Governing the Form, But Not the Substance of Specifications," "Specifications for Hard-Drawn Copper Wire," "Non-Ferrous Metals and Alloys." A committee will also report on the definition of the term "modulus of elasticity" in its application to materials, including nonferrous metals and their combinations.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Feb. 28—Suits were filed at Los Angeles recently by Ralph Arnold against the Buick Oil Co., demanding 750,000 shares of stock or their equivalent. The individual defendants are D. D. Buick, J. M. Herndon, J. B. Lehigh, Stacy C. Lamb, John W. Miner and Fred Van Orman. Arnold alleges that in February, 1910, he was employed by Buick and Herndon as consulting geologist and engineer and that as a result of his examinations and reports the Buick Oil Co. was organized and successfully operated. It is alleged by the complaint that Arnold was to share equally with the others in the results of the venture, but that he had received no compensation. On Jan. 23, 1912, Arnold made formal demand for his proportion of the 3,000,000 shares of stock issued and the demand was rejected. He demands an accounting, and charges Buick with fraudulent acts in the manipulation of the stock issue.

There is a possibility that the present dry weather may continue to the detriment of the mining industry. In the early part of February there were favorable indications for rain at the lower elevations and snow in the higher mountains that would prove sufficient for the ordinary demands of the mines; however, there was only a small precipitation and the fear is now expressed that should there be even a heavy snowfall and rain in March it may come too late to be of great benefit. In the Mother Lode region, the mine operators are still hopeful, but in Nevada County there is considerable alarm expressed by the local press. This alarm is based on the belief that a sufficient snowfall would not remain on the ground long enough to be of permanent benefit. That will depend, of course, upon whether or not there may be a considerable season of cold weather. While March storms are not always dependable, they have in the past frequently given ample supply of water. However, the reservoirs and the streams are in the present season carrying less water than is usual at this time of the year. The shortage of water will not be as detrimental to general operation as in the past, for the reason that many of the mines are now equipped with electric power, and only a small proportion dependent on water for power. If the coming season is a repetition of last year's, the situation may be serious.

Denver

Mar. 1—For the last 10 days the weather has been a succession of blizzards, snowstorms and zero temperature. Trains from the East and the West have been blocked, mails behind time, and a general stagnation of business has prevailed all over the state. The snow in the mining districts of the northern part of the state has become packed by occasional short warm spells, and then frozen so that ore-hauling has been suspended. In many of the mining districts the snow is 10 ft. deep. The barometers, however, have been steadily rising for some time and there is a probability of warmer weather; meanwhile there is an unprecedented dearth of mining news from the high camps.

Cripple Creek, however, which is never much troubled with snow, being sheltered by the Pike's Peak Range, has kept up its average for February with an output of 69,089 tons, worth $1,144,535. Central City, likewise little troubled by snow, nearly all the mines being reached by rail or tram, shows an increased production, and following thereon, a demand for mills which will result in the starting of several which have been idle for years, and the dropping of more stamps than for a long time past. Such mines as the War Dance are a great incentive to increased activity. This mine has been extensively developed since the War Dance Mining Co. was organized about a year ago, and is said to have made a total production of 1624 tons of ore which gave net returns of $36,332. Occasionally, however, the ore is extremely rich, carrying from 4 to 40 oz. of gold per ton. Another property, the U. P. R., idle for years but now reopened by leasers, has just sent a gold retort of 109 oz. to a local bank. All of this is stirring up the adventurers and is producing some results.

The search for and production of vanadium ores is largely on the increase in Colorado and in Utah. From Green River, Utah, it is reported that freighters are hauling two wagonloads of 46 sacks each to that town each day from the Cameron vanadium mines, twenty men being employed and the shipments being in charge of Kirk Gregory. O. B. Willmarth, manager of the Colorado Carnotite Co., has started a car of 27½ tons of carnotite to Europe from Placerville station near Telluride. Breckenridge is exceptionally busy and three dredges will resume as soon as the season opens.

Salt Lake City

Feb. 29—The last steps have been taken in the formation of the Michigan-Utah company, the new Alta merger, which takes in the Utah Mines Coalition, City Rocks, Grizzly, Copper Prince, General May and General Monk properties. Copies of the articles of incorporation were filed with the secretary of state, Feb. 27, the originals having been filed at Wilmington, Del. The capitalization is 1,000,000 shares, par value $2.50. The directors are as follows: Duncan Mac Vichie, president; J. P. Edwards, E. G. Woolley, L. H. Farnsworth, Norman Haire, R. H. Strickland, W. S. Zehring, D. O. Hastings and J. A. Pollock. Development is being carried on through the Lake Solitude tunnel, which cuts the Utah Mines Coalition at depth, and from which there is an opening into the City Rocks. With 600 ft. of work, a crosscut from the tunnel will reach Grizzly ground.

A 10-mile branch road from St. John, on the Salt Lake route, to Ophir, will be built within two months. This will greatly reduce freight rates for the Cliff, Ophir Hills, Lion Hill and other properties of the district, which are hampered by the wagon haul to the railroad.

The International company's new lead smeltery, at Tooele, was placed in commission on Feb. 29. One furnace was blown in and is reported to be operating successfully. Reports state that the United States Smelting, Refining & Mining Co. has purchased the properties of the Castle Valley Coal Co., of Utah, and that arrangements are now being made for railway extensions and development of the property. The coal company in the past has been producing about 500 tons per day, but the deposit is said to be capable of a larger production. It is expected that this will remedy to some extent the past inability of the smelting company to obtain an adequate fuel supply.

Negaunee, Mich.

Mar. 2—In the Lake Superior iron country, where cheap electrical power is being introduced at mines, several companies have purchased electric-driven, direct-connected air compressors. At the North Lake mines of the Cleveland-Cliffs Iron Co., four miles west of Ishpeming, an 1800-cu.ft. compressor has been successfully driven by electricity for several months. The adaption of electricity, which is best employed for fast-revolving machinery, to the slow-moving compressor, was accomplished without difficulty. The problem of adjustment of compressed air to meet the varying needs of supply, is solved by the "clearance control" device which, as the air pressure in the line rises, automatically opens pockets connected with the cylinders; this has the same effect as lengthening the cylinders, so that air is compressed into the pockets and then released. There are four pockets to be opened, depending upon how much the supply of air needs to be cut down. The amperage drops during the operation so that current is economized. Peak loads result, but the costly motor-generator set is unnecessary. Several new companies in the Iron River district have ordered electric-driven air compressors of the same type; one company purchased a 2500-cu.ft. machine, and another purchased one of 2500-cu.ft. and one of 1000-cu.ft. capacity. Power will be furnished by the Peninsula Power Co., which is completing a water-power installation on the Menominee River, near Iron Mountain.

The new Carp River power plant of the Cleveland-Cliffs Iron Co., situated one mile south of the city of Marquette, is in operation. During flood periods the plant will develop nearly 8000 hp., but during dry periods its capacity may be as low as 3000 horsepower.

Tucson, Ariz.

Feb. 20—One of the problems before the new State of Arizona will be the proper provision for a state geological survey. Heretofore practically all of the public geological work has been done by the federal survey, which conducted the important work in the Bisbee and Globe districts and reconnaissance investigations in Mohave and Yuma Counties and elsewhere. The state university at Tucson, under the inspiration of the late Doctor Blake and with the assistance of Professors Tolman and Guild, has been in close touch with the scientific side of mining and is now, through its free assay department and general activities, a factor of considerable assistance to the mining industry. Recently, Professor Tolman has completed a geological map of Arizona and a general sketch of the geology of the state. This so far has not been published, although it is in the records in manuscript. It is hoped that the new legislature will provide for the publication of this and other data and for the continuation of the work of geological investigation along advanced and practical lines. It is likely that a general report on the state as to its mining and mineral resources will be provided for on the occasion of the San Francisco Exposition, and in this same connection a collection of the economic minerals of the state is proposed.

Porcupine

Feb. 29—The shortage of coal is becoming quite a serious factor both here and in Cobalt. In the latter place particularly, on account of the small amount of wood available, the shortage is causing much inconvenience, and unless the situation is relieved, some of the mines may have to cease operations. The cause of the shortage is principally on account of a blockade of 3000 cars of coal at Niagara Falls, due to the inability of the Canadian railroads to move them. The probability of the strike of coal miners in the United States makes the condition much more serious. In order to relieve the suffering in some of the southern towns, the Canadian coal dealers' association has asked the railroads to give coal the preference over all other freight.

The annual meeting of the Temiskaming company resulted in the election of the old directors, despite the efforts made by the insurgents. The fight was largely over the aquisition of the North Dome property in Porcupine to which the shareholders objected. At the meeting it was brought out, that while a few years ago the directors owned 900,000 shares, their present holdings amount to only 50,000 shares.

Attention has again been drawn to the West Shining Tree district, by the concluding of negotiations, whereby the well known Gosselin claims have been optioned to Duluth men. The deal is of considerable importance to the district, the properties being among the most promising yet found there.

Chairman Englehart, of the Temiskaming & Northern Ontario Ry. Commission, has announced that passenger service to Timmins, the end of the Porcupine branch, will be inaugurated on Mar. 13. A local service between the three towns will also be started soon.

Toronto

Mar. 2—The Dominion Metals, Ltd. company, which has been in business here for about two years, has gone into liquidation and the court has appointed Clarkson & Clarkson interim liquidators. It has a nominal capital of $500,000, of which $33,500 were paid up. The assets are estimated at about $50,000 and the liabilities to the public at $23,000. It undertook to do a smelting and refining business with a process by which silver, cobalt, nickel and arsenic could be extracted from Cobalt ore by one separation, and for some time was under the management of Prof. Charles G. Richardson, who claimed to have discovered the process. In spite of much experimenting, however, it was not a commercial success, and Prof. Richardson's connection with the company terminated last September. The enterprise was backed by a number of prominent local men, including John N. Lake, president; Hon. Thomas Crawford, W. G. Harris, president of the Canada Metal Co., S. F. Whitman and John Lowdon. It is stated that the Metals-Chemical Co., Ltd., a new concern being financed by M. E. and J. W. de Aguero, of New York, has leased the plant of the Dominion Metals Ltd. It is said to be the intention of the new company to install a complete silver refinery, to treat some of the Ontario silver ores. Members of the company are interested in mining in New Ontario.

Sir James Whitney has announced in the legislature, the terms of the boundary settlement between Ontario and Manitoba. Ontario receives a strip of territory, five miles wide and a half mile long, from the present eastern boundary of Manitoba to the Nelson River, from any point Ontario wishes to choose within 50 miles of Hudson's Bay. While neither Fort Nelson nor Fort Churchill have been awarded to Ontario, the province secures running rights over a strip 200 yd. wide through Manitoba's new territory, to connect with the Hudson's Bay Ry. This is to permit the extension of the Temiskaming & Northern Ontario Ry. to the north and to provide an outlet on Hudson's Bay.

Johannesburg

Jan. 25—The Way-Arbuckle process was adopted at the Benoni mines, where crushing was begun in November. Trouble was experienced with the screw elevators designed to remove sand and slime from the dewatering cone. Centrifugal pumps are now being employed for this purpose, and the plant is stated to be working satisfactorily.

The Brakpan mine is one of the deepest of the East Rand basin; work is being done at a depth of about 4000 ft. The vein is nearly flat, dipping at about 10°. The mine is being worked on a modified longwall system, and efforts are being made to control roof pressures by a system of waste packing. Last month 110 stamps and the tube mills crushed 49,090 tons of ore for a recovery of 28s. 3d. per ton at a cost of 18s. 3d. The costs are low, considering the conditions of work.

The output for the Rand for 1911 was 7,896,802 fine oz. of gold, valued at £33,543,479, being an increase over 1910 of £2,839,567. In December, 1911, there were 10,195 stamps at work, and 257 tube mills had been erected. The chief producers were the Randfontein Central, with 775 stamps and 25 tube mills; the Crown Mines, with 620 stamps and 19 tube mills; the East Rand Proprietary Mines, with 820 stamps and 25 tube mills; the Robinson, with 250 stamps and 6 tube mills, and the Rose Deep, with 300 stamps and 7 tube mills. The tons crushed for each mine were, respectively, 208,005, 135,100, 162,876, 48,700 and 61,600 tons.

The Mining News

The Current History of Mining

Arizona

GILA COUNTY

Miami—The concentrator is now in full operation and is handling 3000 tons of ore per day. It is reported to be running satisfactorily and making a recovery of about 75%. While some changes will be made, especially in the crushing machinery, they will be introduced gradually and without interfering with the mill's operation. The mine is easily furnishing all the ore the mill can handle and considerable development work is being done. Assembling of machinery in the power house at the town of Miami continues and should be finished in a few weeks. The ground northeast of the orebody is being explored by churn-drilling, one drill being in use; another may be added later.

Inspiration—Tests on the concentration of the ore are still in progress; they have lasted three months and constitute an elaborate series. Not only are various makes of machinery being tried but also various methods and systems of concentration. Work is progressing satisfactorily on the water-supply dam across Pinal Creek and also on the well on the Inspiration ranch.

Barney—The churn-drill hole is 1070 ft. deep and is in granite-porphyry, having passed from dacite into this formation at a depth of 1030 ft. Another drill was started this week at the eastern end of the property near the Live Oak boundary.

South Live Oak—This company will soon incorporate under Arizona laws with a capital of 50,000 shares, par $10. The plan is to explore with churn drills the Schulze group of claims, lying directly southwest of the Live Oak property and along the southwest boundary of the Southwestern Miami. The officers are George J. Lonstorf, president; Linwood D. McClure, vice-president; Clifford C. Fares, secretary; Simeon A. Dunn, treasurer. The Eastern office is 518-520 Railway Exchange Bldg., Milwaukee, Wisconsin.

PIMA COUNTY

Pioneer Smelting Co.—This company, headquarters Tucson and plant south of Tucson, expects soon to start the 150-ton oil-burning copper smeltery installed about a year ago. The company owns the Gould and Plumed Knight copper properties and will take custom ore. Probably a contract with the Twin Buttes mine will be made, as this company has until recently been shipping to El Paso. The Pioneer stack was built by the Colorado Iron Works after plans developed by experimentation at the Denver works. J. H. Waters is superintendent in charge.

MARICOPA COUNTY

Relief Gold Mining Co.—This company, operating at Glendale, north of Phoenix, will resume development extensively, under the direction of Schuyler S. Moore, of Phoenix. The main shaft is now down 400 ft. and about 50,000 tons of commercial-grade, free-milling gold ore are blocked out according to Mr. Moore.

YAVAPAI COUNTY

Columbia Consolidated—This gold-mining company operating at Columbia, George Dillard, manager, has installed a Primm crude-oil engine and will develop the property which is northeast of Hot Springs Junction.

United Verde Extension—At the recent special meeting of stockholders in New York, the necessary vote was cast approving a reorganization plan for future financing and authorizing the sale of 25,000 shares of stock for $25,000. A development shaft is down 800 ft. A winze extends to the 1200-ft. level and a drift will be driven from the bottom of the winze.

United Verde—Despatches from Prescott credit Manager Clark with a statement to the effect that plans for the new smeltery, being drawn by Repath & McGregor, of Douglas, Ariz., will be ready within three months, and will provide for a capacity of 6000 tons per day, the plant to be ready within two years. During this time the old plant at Jerome will be used.

California

AMADOR COUNTY

South Amador—This mine, about three miles south of Jackson, is being reopened by modern methods. The mine has been unwatered down to the 500-ft. level and the vein developed for a length of 800 ft. A new electrically driven compressor is being installed. The hoist will be enlarged and the water taken out to the 1100- and 1200-ft. levels. J. McSorley is superintendent.

Zeila—C. D. Porter, of San Francisco, W. D. Henry, of Pasadena, and C. H. Griffin, of Los Angeles, have made an examination of this mine, at Jackson. No information has been given out regarding the examination nor the capital that is represented, save that they are looking for a mine. This property is situated near the Moore mine, owned by W. A. Neville, and which is included in the negotiations respecting the App and the Rawhide, in Tuolumne County.

Plymouth Consolidated—The new electric hoist and air pump commenced operation on Feb. 20. The property is being unwatered and will be developed by the California Exploration Co., a Bewick, Moreing & Co. incorporation. J. F. Parks is superintendent.

Argonaut—The short-circuiting of a 17,000-volt wire in the transformer house melted the wires, damaged the switch box and caused a brief shutdown at the mill.

Oneida—The 60-stamp mill will probably be put in commission in April. The mine is now a part of the South Eureka, and is being explored for new orebodies with satisfactory results. The two mines adjoin, and both are under the superintendency of W. H. Schmal, of Jackson.

Eagle—This is a new prospect, being developed near Jackson. An upright plunger pump has been installed. George Hambric is superintendent.

CALAVERAS COUNTY

Lightner—The 60-stamp mill is closed down temporarily for repairs, pending the deepening of the shaft.

Gold Cliff—A skip cable broke in the shaft, Feb. 17, dropping a loaded skip and causing damage to the timbering, but without injury to any of the men.

ELDORADO COUNTY

Carpendar-Kumfa—W. W. Wheeler, engineer of this mine, at Placerville, was badly burned in the hand and received a severe shock through the body while connecting the electric-power wires to the pump at the 175-ft. level.

INYO COUNTY

Skidoo—During January, 1615 tons of ore were milled, producing bullion worth $15,315. Development totaled $823; operation, $8114, and $6377 net profits.

PLACER COUNTY

Valley View—An electric plant is being installed at the mine and mill, seven miles northeast of Lincoln. The mill equipment, which is being erected consists of a Blake crusher, Graupner stamps, Challenge ore feeders, eight

Deister tables, Corliss engines and a 160-hp. boiler. The ore being developed is hauled to Lincoln and shipped to San Francisco. The new shaft is down 180 ft. The mine has been worked for the last 50 years. W. B. Hollings, of San Francisco, is the present owner.

SIERRA COUNTY

Kate Hardy—Another rich strike has been made at this mine, on the Mountain House-Goodyear Bar belt of serpentine, over $3000 having been taken out in one day in specimen rock. W. M. Beggs, of San José, and associates are the owners.

Sierra Buttes—At this mine at Sierra City a new oreshoot has been opened in the Whiskey vein. This ore will enable the mill to operate at full capacity. J. C. Folsom is superintendent.

Sovereign—Nearly a mile of flume has been built at this mine in Ladies cañon to handle tailings from the mill and cyanide plant. The mill has resumed work and the cyanide plant is said to be making an extraction of 90%. F. O. Richardson is manager.

SISKIYOU COUNTY

California-Oregon Power Co.—This is a new incorporation, organized to take over the Siskiyou Electric Power & Light Co., the Ashland Electric Power & Light Co., the Rogue River Electric Co., and the Prospect Construction Co. Water rights have been secured which will develop 160,000 hp. The directors are: J. W. Churchill, of Yreka, president; Phillip de Tustan, of San Francisco; A. J. Roseborough, of Oakland, and D. O. Welch, of San Francisco.

Freshout Bar—C. E. Winters, of San Francisco, has taken a bond on this mine near Gottville. A drift from the 60-ft. shaft disclosed gold-bearing quartz of good grade. The shaft will be deepened to 90 feet.

Colorado

CRIPPLE CREEK DISTRICT

At the deep drainage tunnel of Cripple Creek, the Mabel M. water course has been tapped, giving an additional flow of 800 gal., and a total from the portal of 11,000 gal. per min. In the deep shaft the subsidence is about 6 in. per day.

Los Angeles—Lessees Chillson and Polly, who have been running a crosscut from the 525-ft. level of this mine to tap the orebody in the Six Points, report that they have reached the vein, but will have to drift about 50 ft. before reaching the oreshoot. The output from the Six Points at a depth of 250 ft. is eight cars of ore per month, the grade being from $100 to $200 per ton.

Kittie Gold Mining Co.—This company has been incorporated with a capitalization of $2,000,000 by Harold C. Harmon, Arthur Cornforth and others, of Colorado Springs.

American Eagles—Paul Hinds, superintendent of the Colorado Mining & Investment Co., lessees, states that they will ship 20 cars of good ore in February. Sixteen machines are being worked in the mine.

Stratton's Independence—Cable advices state that during January production amounted to 2222 tons of $23.66 ore. Low-grade mine and dump ore, amounting to 4500 tons, was milled. Special development cost $1400, and net working profit was $15,700.

LAKE COUNTY-LEADVILLE

Siwatch—This tunnel has now been driven into the mountain 4400 ft. with an east and west lateral, the latter driven 700 ft.; 14 men are employed.

Sugar Loaf—Rich silver is being taken out through the tunnel of this company, most of it from the old Sherrill workings.

Dinero—Thirty-five men are employed by this company, and a drift has been started on the Buckeye Vein in addition to the work being done in the main breast of the mine. Most of the ore is coming from the No. 15 upraise.

Colonel Sellers—From this mine, in California Gulch, Manager Bargler is shipping 75 tons per day. He has just installed an electric pump.

Helena—Manager Grant has the plans perfected for the new jig mill, which he is going to erect at this mine.

OURAY COUNTY

A great deal of activity is now being shown in the high-grade silver district about four miles north of Ouray on the east side of the Uncompahgre Valley; in the Bachelor mine a strike of rich ore is reported by Luna and Harlan, lessees. This mine produced over $1,000,000 worth of ore in former days. Another strike is reported in the El Mahdi, and the force on the Calliope is to be increased soon by Manager Seaton. The Wedge is on the same vein as the Bachelor and it is thought that the shoot just discovered extends into the former's territory. These veins occur in the shales, quartzites and limestones lying underneath the later volcanics. The fissures, however, do not extend upward into the andesite.

Revenue—It is rumored that H. Platt, lessee, has decided to build a new mill on this property, the old one being entirely inadequate.

Camp Bird—Net profits for January are estimated at £38,733; London expenses, £300; £38,433 balance applicable to profit.

SAN JUAN COUNTY

On Pole Creek, Yeager and Lowe are crosscutting to encounter a vein from which some rich gold float is supposed to have come. The float is reported to have been found last autumn. The Raoul brothers, of Creede, and other prospectors have reported the discovery of rich float in the Pole Creek section for several years, but the vein from which it came has not yet been found.

Smuggler-Union—The company is preparing to cyanide the slime tailings by agitation and filtration.

Sunnyside—At this mine the recently installed Huff electrostatic separator is running commercially with three shifts per 24 hr. It is reported to be producing a rich lead-iron product and a good grade of zinc concentrate.

Gold Bug—Information has recently been received at Silverton that a cyanide plant for the mine at Bear Creek is *en route* to the property. Chicago men are interested.

Idaho

COEUR D'ALENE DISTRCT

Amy and Matchless—The orebody found on this Pine Creek property recently is steadily improving and is sufficient to warrant the construction of a mill. About 15 in. of the 4 ft. of ore are of shipping grade and this is being handsorted and sent to the smeltery. The concentrating ore is being stockpiled. The shaft on the Matchless vein is down to the 200-ft. level and a drift will be driven under Pine Creek to the Amy vein.

Rainbow—The tunnel on this property is now in 1100 ft. The work has all been done on contract and a new contract will be let to drive the tunnel the distance necessary to strike the orebody.

Mayflower—This property on Nine Mile Creek will resume work soon. A contract has been let to continue the tunnel.

Reindeer—A concentrator will be erected at this property in the spring.

Michigan

COPPER

It is reported that a new company is being formed to explore about 2000 acres near the Eastern sandstone, in the vicinity of Torch Lake. The tract is at present owned by the Quincy, Franklin, Tamarack and St. Mary's Mineral Land Company.

Hancock—The shaft is down about 3360 ft. and is bottomed in trap streaked with copper; it is momentarily expected that the Pewabic lode will be cut.

Adventure—The new vertical No. 5 shaft on this property is bottomed at a depth of 1525 ft. All activity is centered in driving a crosscut from the 1500-ft. level to cut the No. 2 lode, which is estimated to be about 450 ft. from the shaft. The crosscut has been extended over 400 ft. Drifting on No. 1 lode from the shaft did not disclose any mineralization of a consistent nature. The drill core from the No. 2 lode was heavily charged with copper.

New Baltic—A crosscut is being driven to the eastern limits of this property and drifting is also underway at the second level. Results so far have been good and the property is attracting much local interest.

Franklin—This company's shaft on the Pewabic lode is nearing the 33rd level. Production at the rate of about 700 tons per day is being maintained but will be gradually increased as conditions are met. Eighteen drillls are in operation at present and the working force is being increased.

Quincy—The annual report soon to be issued is expected to show a surplus of $60,000 above dividends for the year 1911. The $150,000 paid for new properties were taken out of surplus.

South Lake—The annual report for 1911 shows: Total receipts, $52,219, of which $44,623 were from loans; payments, $49,596; balance, Jan. 1, 1912, $2623. President Watson states that shaft sinking commenced in July, 1911, but was discontinued at a depth of 30 ft., owing to water troubles. The shaft site was moved to a point above the water level, but shaft work was discontinued in the autumn of 1911. The directors believe that the property contains the westerly extension of the Lake lode.

Houghton—This company is drifting at the second level and the ground that is being broken is well mineralized and has all the characteristics of the lode that is being mined at the Superior property. A crosscut is also being driven from this level to reach a lode that is known to lie west of the formation.

Ahmeek—The annual report for the year 1911 shows: Copper sold, 14,336,750 lb.; average price received, 12.78c. per lb.; rock stamped, 598,549 tons; refined copper per ton rock stamped, 25.4; total cost per lb. refined copper, 7.17c., total openings, 11,691 ft.; net profit, $870,272, equivalent to $17.40 per share.

Iron

Iron River Steel Co.—This company, recently organized under the laws of the State of Utah, has changed its name to the Iron County Steel Co., because J. B. Weimer, of Iron River, incorporated an Iron River Steel Co., under Michigan laws, before the articles of incorporation of the Utah company were filed at Lansing. It is reported that the capital stock will be changed to $1,000,000, par value $1 per share instead of the $300,000 specified for the Utah company, and that 500,000 shares will be sold publicly.

Mansfield—At this mine of the Oliver Iron Mining Co., in the Crystal Falls district, fire broke out on the 12th level recently. Six men who were underground were rescued, but the mules used for haulage were lost. The fire was near the shaft which was sealed.

Jones & Laughlin—A contract has been let to J. S. Wahlman, contractor, of Ishpeming, for the erection of a boiler house and engine house at the mine, north of Iron River. Several dwellings and an office building are in course of construction at the property. Two diamond drills are being operated two miles southeast of Ishpeming, on Sec. 14, betweeen Lake Ogden and Lake Sally. The Duluth Diamond Drill Co. has the contract.

Mineral Mining Co.—This company will reopen the James mine, north of Iron River, although operations will be on a small scale at first. The mine was closed down several months ago, following a partial walkout of the miners for a petty grievance.

Chapin—The annual statement of the Aid Fund of this mine, at Iron Mountain, for 1911, has been issued. During the year $2111 were paid out and the balance on hand, Dec. 31, 1911, was $13,643. No monthly collections were made from June 1 to Dec. 31. It is reported that as a result of a conference of O. C. Davidson, general superintendent, with Steel Corporation officials in Chicago, the Chapin and Aragon mines will be worked five days per week on both day and night shifts.

Wickwire—This company, operating at Iron River, has contracted to take electrical power from the Peninsula Power Co., of Iron Mountain. Two air compressors will be driven by direct-connected motors. The power company has contracted to deliver electrical power by Mar. 1.

Missouri

Joplin District

Reports state that 5000 men in the St. Francois lead district are preparing to ask for higher wages. It is rumored that the increase demanded will amount to $1 per day. A strike is feared generally, although some officials of operating companies are optimistic regarding the situation which has been more or less unsettled since the 1907 reduction of wages.

The series of storms since Jan. 1 has greatly curtailed the production of ore in the entire district and has made mining most difficult.

Point Milling & Manufacturing Co.—J. W. Wood, engineer for this company, recently returned from New York and Pennsylvania, where he inspected machinery and let contracts to the Traylor Engineering & Manufacturing Co., for tube mills, crushing rolls, classifiers and a Hendryx system of agitators.

Jungle—This mill, at Thoms Station, burned to the ground recently.

Baby Kitty—The shaft at this mine, at Lehigh, has entered the ore. The drill records on which the shaft is being sunk showed about 25% ore. Frank Nicholson, of Joplin, is manager.

Ray—The shaft of this company, on the General land at Thoms Station, has entered 14 ft. of rich lead ore.

Montana

Butte District

Tuolumne—In February, production amounted to 225,000 lb. of copper. The mine was shut down for 15 days while a new hoist was being installed. Present production is about 150 tons of ore per day, and mining is reported as being confined to first-class ore which runs about 150 lb. copper per ton.

Butte Coalition—The books of the company closed finally on Mar. 1. Fractional scrip certificates will be issued to stockholders owning fractions of Anaconda stock. Actual distribution of assets will commence in a few days and by Apr. 1 the company is expected to be dissolved.

Davis-Daly—Shaft sinking in the Colorado mine has been commenced and the 200 ft. of sinking, from the 1700-ft. to the 1900-ft. level, are expected to be completed by May 1. The ore on the 1700-ft. level is said to be increasing in width and grade. It is reported that returns from shipments to the East Butte smeltery are more than paying operating and development costs.

Anaconda—The shaft at the St. Lawrence mine is being sunk to connect at depth with the High Ore mine, to enable draining through the latter, which now has connections with all the principal mines of the company. The St. Lawrence is 2300 ft. deep and the High Ore 2800 feet.

North Butte—High-grade ore is being shipped from both the Snowball vein and the Berlin claim. The Snowball vein is opened for about 270 ft. and has 10% ore.

Butte Central—The ore going to the Washoe smeltery is from the 300- and 500-ft. levels and runs about $15 per ton with fair gold content. It is intended to maintain shipments at a rate sufficient to meet all operating expenses.

Butte & Superior—The company is shipping 550 tons of ore per day to Basin, but when the new mill is in operation the capacity will be 750 tons. Development work in the Butte-Milwaukee mine, owned by the company, is said to be showing strong copper veins at a depth of 700 feet.

Butte-Alex. Scott—It is reported that 6% copper ore is being mined on the 1200-, 1400-, 1600- and 1800-ft. levels. The company is sending 150 tons per day to the East Butte smeltery; after certain installations are completed this will probably be increased to 250 tons.

BROADWATER COUNTY

May Day—A standard double-compartment shaft is being sunk to 300 ft. An electric plant is being installed and necessary buildings erected. Surface indications are reported good.

JEFFERSON COUNTY

Robert Emmet—The equipment of this copper property at Amazon, with new machinery, is progressing. Two cars of machinery have been installed and as soon as the remainder, which has been delayed in shipment, arrives and is put in place, work will be started unwatering the mine, after which crosscutting will be commenced on the 500-ft. level.

Baltimore—A force of 35 men is now on the payroll of this mine in Boomerang Gulch and the number will be increased soon.

Nevada

COMSTOCK LODE

Mexican—The mill was brought up to further efficiency last week, 415 tons of ore being treated in six days, the average assay value of which was $22.72 per ton. The tails averaged $1.74 per ton, so that the theoretical extraction obtained was 92%. A partial cleanup was made, and five bars of bullion were shipped to the smeltery.

Union Consolidated—The west crosscut from the joint Sierra Nevada winze on the 2500-ft. level is now passing through a fractured zone on both sides of a small dike, which strikes northwest and dips about 55° east. The formation shows an intense crushing with the development of clay seams. Some mineralization by sulphides appears, together with a mixture of quartz, which gave assays of $3.90 per ton. The crosscut will be turned to connect with an east crosscut from the north drift from the Mexican side of the mine; this will give greatly improved ventilation.

Con. Virginia—Sill-floor sets are being installed in the oreshoot on the 2550-ft. level, and two sets have been put in to the south, all in ore. An opening is now being made to the north and timbers will be put in there to the extent of the mineral-bearing quartz. Ore averaging $33 and $81 per ton, was saved from this work.

Comstock-Phoenix—A report made by this company for the quarter ended Dec. 31, 1911, shows that during that period 1300 tons of first-class ore were shipped to the smeltery, the net bullion return on which was in excess of $69,000. The Phoenix is one of the recent new producers of the district.

Segregated Belcher—Work has been started reopening the main north drift on the 1100-ft. level, the object being to enter old stopes and to extract ore left during former operations at that point. The east crosscut on the 1200-ft. level is showing more quartz and the formation gives indications of becoming much stronger.

Crown Point—The ore recovery last week was 700 tons from the 1400-ft. level stopes, and 934 tons were shipped to the Yellow Jacket mill for treatment.

Combination—A new gallows frame is being erected preparatory to repairs in the shaft down to the 1700-ft. level.

ESMERALDA COUNTY

Goldfield - Belmont — The property is stated to be in a condition to maintain ore shipments at a good rate, and these will be increased in volume when the orebody is further opened on the 400-ft. level. The ore appears to be widening with depth.

Goldfield Consolidated—The estimated February production was 27,641 tons of ore; gross value recovered, $685,000; operating expenses, $210,000, and $475,000 net realization for the month.

NYE COUNTY

Tonopah ore shipments for the week ended Feb. 22 were: Tonopah Mining, 3500 tons; Tonopah Belmont, 2600; Montana-Tonopah, 952; Tonopah Extension, 980; West End, 770; McNamara, 350; total, 9152 tons, and $228,800 total estimated value.

Montana-Tonopah—The McDonald vein on the first intermediate level is showing improvement. Prospecting is still in progress on the lower levels to pick up the downward extension of orebodies opened on the upper levels.

Tonopah-Belmont — Construction work at the new mill is progressing satisfactorily. The ore-crushers are in place, the trommel screens are being set and work is in progress on the conveyor. The steel ore bins back of the crushers have been erected and are being riveted. In the main mill, the Pachuca and agitator tanks are being erected, the battery posts are being placed in position and the sides and roof of the building are being covered. The machinery is also being placed in the bullion refinery room. Five cars of machinery have been received recently as well as one car each of brick, corrugated iron and filter bars.

West End—Little ore is being stoped, most of the daily supply of 110 tons for the mill being supplied by development.

Tonopah Mining—Work has been discontinued in the Desert Queen and the latter shaft turned over to the Tonopah-Belmont company. Work will be resumed there at some future time. The machine drills have been transferred to the Red Plume shaft and operations resumed there. In the Mizpah mine work is almost entirely confined to stoping.

New Mexico

GRANT COUNTY

Gold ore is reported to have been found near Apache Creek, 55 miles northwest of Silver City. El Paso men have taken a bond and lease on 11 claims in the vicinity.

Chino—The company is reported to be considering further financing, which may take the form of an issue of 50,000 shares of stock, to be offered to the stockholders at $25. The proposed new issue will give the company an additional working capital of $1,250,000. A special meeting will be necessary to authorize the increase.

SOCORRO COUNTY

Chloride Flat—A body of good ore was opened recently on the Julia vein, and a 3-ft. vein of ore was also opened on the Francisco vein. The company has sunk a new shaft, following the latter vein at a dip of 45°, and the new oreshoot was opened at 40 ft. depth.

Ernestine—The cleanup for the first 10 days in February amounted to 10,365 oz. of gold and silver bullion and six tons of high-grade concentrates. The new oil engine are reported to be a complete success.

Deep Down—Development work is being pushed by the leasers and arrangements have been made to begin regular shipments to the Deadwood mill soon.

Oaks—The new Olds 12-hp. gasoline hoist was placed in commission recently at the south shaft and started satisfactorily. A winze has been started in the tunnel, where some good ore was found. All ore taken out in development is being treated in the Deadwood mill.

Deadwood—Good ore, 6½ ft. wide, has been cut on the 500-ft. level. The mill is running regularly.

Oklahoma

Chapman & Lennan—This company, at Miami, is installing a pumping plant of 3000 gal. capacity, and will soon start the erection of two mills on the Emma Gordon and Miami Royalty Co. leases.

Prairie Mining Co.—This company has made several deep drill strikes on the Emma Gordon lease at Miami.

Texas

WILLIAMSON COUNTY

A mica deposit of importance is reported near Georgetown. French interests have taken an option and will make an investigation. Sheet mica and mica for grinding is produced. The later product has been shipped to El Paso and treated in small lots successfully for "flour" mica.

Utah

Juab County

Tintic shipments for the week ended Feb. 23 were 200 cars.

Iron Blossom—The new electrically driven 400-hp. hoist and other equipment for the No. 1 shaft have been shipped. With the installation of the new machinery, it will be possible not only to handle the increased tonnage of the Iron Blossom and to take up prospecting on the 1900 and at a greater depth, but also to take care of the ore from the Dragon and to prospect in that mine. The output for the week ended Feb. 23 was 52 cars.

Dragon Consolidated—A body of shipping ore running 0.5% copper and from 20 to 50 oz. silver per ton has been opened on the 600-ft. level. The ore is being hoisted at the rate of 20 tons per day.

Black Jack—Development has been resumed in the Star section. The shaft here is down to the 800-ft. level and work is being done on this level and on the 300. Leasers have been shipping from this section during the last year.

Chief Consolidated—During the week ended Feb. 23, 13 cars were shipped from the 1400- and 1600-ft. levels. The orebody supplying the present output was opened in December, after a year of development work.

Crown Point—About 200 ft. from the shaft on the 500-ft. level, drifting to the southeast is being done and the face is in brecciated limestone. During the last 18 months, 1300 ft. of development have been done.

Mammoth—Regular shipments are being made from the orebody opened in a raise from the 700-ft. level. Up to Feb. 23, 38 cars were shipped for the month. The ore runs 0.66% copper and 0.9 oz. silver, with some gold.

Iron King—This property has closed down with approximately 100,000 tons of iron ore blocked out, there being at present no market for its output.

Lower Mammoth—Drifting west is being done on the 1000-ft. level and indications are reported encouraging.

Carisa—Work is being done on the 100- and 400-ft. levels and occasional shipments are being made.

Beck Tunnel—Half of the indebtedness has been paid, and the company is making expenses. The vein has been shown to continue to the 1100-ft. level, where milling ore has been opened.

Salt Lake County

Ohio Copper—The average monthly profits for November, December and January were approximately $25,000. The mill handled as high as 2400 tons in one day, with 16 Wall rolls in operation. When the 20 rolls are installed, the capacity will exceed 3000 tons per day. During November 52,243 tons were mined and milled. The ore averaged 1.142% copper, and concentrates, 26.50%. Profits were $26,412.

Utah Copper—The January production was 8,156,612 lb., as compared to 9,093,557 lb. in December. The January production in 1911 was 6,707,116 pounds.

Columbus Consolidated — Two oreshoots, 500 ft. apart, are reported on the 400-ft. level. One of these is 18 in. to 3 ft. wide.

Alta Consolidated—An 18-in. streak of first-class ore, with considerable milling ore on either side, has been opened in a raise from the west drift on the tunnel level about 500 ft. from the surface. The high-grade ore runs 761.6 oz. silver, 20c. gold, and 30.7% copper, a total of between $500 and $600 per ton.

Utah Apex—Three cars of ore were recently shipped by Kirk & Leavell, leasers on the upper levels. The leasers are employing 70 men.

Utah County

Nebo Highland—High-grade lead-silver ore has been found in the new lower tunnel, which is in 75 feet.

Eva — Four cars of ore have been shipped recently, one of which is reported to have run over 50% lead and about 20 oz. silver.

Canada

British Columbia

Shipments and receipts in tons in the Boundary district for the week ended Feb. 22 were as follows:

Mine	Week Ended Feb. 22	Year to Date
Granby	21,958	170,897
Mother Lode	8,142	61,773
Rawhide	4,416	7,534
Jack Pot	275	2,848
Athelstan	24	251
Others	272	1,441
Totals	35,087	244,744
Smelteries		
Granby	23,045	214,595
B. C. Copper Co.	13,345	79,127
Totals	36,390	293,722

Ontario

What appears to be an important strike of oil has been made at the town of Milton, Ont., by James Peat & Co., of Petrolea. An attempt to find oil was made three years ago, but proved unsuccessful. Last December, drilling was begun on the property of the Brandon Pressed Brick Co., and a good showing of oil has been encountered at a depth of 1440 ft. Pumps will be installed at once. The formation in which the oil occurs is Trenton limestone and the oil is of amber quality with an estimated specific gravity of at least 36 degrees.

Ontario—Cobalt

Cobalt ore shipments for the week ended Mar. 1 were: Nipissing, 143,728 lb.; La Rose, 129,428; Coniagas, 124,267; Drummond, 120,000; McKinley-Darragh, 117,523; Cobalt Townsite, 73,014; Temiskaming, 64,500; Beaver, 64,187; Trethewey, 60,290; Buffalo, 58,634; Chambers-Ferland, 64,000; total, 1,019,601 lb. Nipissing shipped 149,712 oz. of bullion.

Cobalt Lake—At the annual meeting held in Toronto, Feb. 29, the financial statement showed a favorable balance of $80,847, the deficit of $209,004 at the end of 1910 having been paid off. Net returns from ore production amounted to $323,793, of which $64,216 were expended on the concentrator. The outstanding capitalization had been reduced to $3,304,051, par value, by the purchase of 625,115 shares, which were retired into the treasury. The report of Manager B. R. Gordon estimates the ore reserves at 2,851,180 ounces.

Trethewey—The annual meeting was held in Toronto, on Feb. 28. The decline of the output from 865,777 in 1910 to 770,838 last year, was explained on the ground that much of the ore last year was taken from old workings. President Hayes stated that the recent finding of silver in the Keewatin at the Coniagas mine was of the utmost importance and would influence future operations. The former directorate was reëlected.

Temiskaming—At the annual meeting of shareholders, held in Toronto, on Feb. 24, 1,903,069 votes were cast, the management being sustained by a majority of 47,167. President Cartwright states that the directors have made no decision as to future plans in connection with the North Dome mine at Porcupine.

Nipissing—A forecast of the annual report, soon to be published, gives the ore reserves, as of Dec. 31, 1911, at approximately 7,800,000 oz., representing an increase of 1,300,000 oz. over the figures for Dec. 31, 1910. The gross value of the high-grade ore is expected to show a small increase and the ore on the dumps will probably contribute an additional $1,000,000. It is expected that the figures for production and costs will be approximately the same as those of 1910.

Ontario—Porcupine

McIntyre—The mill on this property is to be started in a few days. The capacity is 10 stamps and the process includes only amalgamation and concentration. Rich ore has been encountered in the drift from No. 1 shaft.

Standard—The development of recent discoveries is giving good results.

Pearl Lake—As soon as the 400-ft. level of the main shaft is reached, a crosscut will be run to the McIntyre boundary, to intercept some of the veins coming in from the latter property.

Little Pet—The management expects to have the 5-stamp mill running in about a month.

Plenaurum—Both shafts are down 200 ft. and crosscuts to intercept the veins will be started soon.

Bewick-Moreing—The development of this company's properties has been practically barren of results and little work is being done at present.

West Dome—James Reilly was killed and Matthew Ronan severely injured by an explosion, on Feb. 24, thought to have been caused by drilling into a missed hole.

Dome—An orebody 300 ft. long and 200 ft. wide has been definitely blocked out in 100-ft. blocks on the 50-ft. level, ready for the crushers. No. 7 shaft has been sunk to the 200-ft. level for exploration purposes and some high-grade ore opened up by a drift.

Ontario—Sudbury

Tough & Stobie Swack—M. T. Cockerell, representative of the Englishmen who have an option on this property, recently left Sudbury for South America, after inspecting the development work in progress.

Mond—Plans are now ready for about 70 houses, which will be started as soon as the weather will permit, on the smeltery townsite at Conniston. The company has withdrawn the diamond drills from the Cochrane and McVittie Blue property and has abandoned its option.

Dominion Nickel-Copper Co.—Dr. Gorman, of Ottawa, has taken a drilling contract with this company and now has one shot drill in operation.

Quebec

East Canada Smelting Co., Ltd.—Pres. Charles E. Force, of the Precious Metals Corporation, the holding company, with offices in the Whitehall Building, New York, informs us that in the lenticular orebody now being developed there are 39,500 tons of 5% copper ore and 26,500 tons of 2% ore blocked out on four sides, 22,750 tons blocked on two sides and 50,000 tons additional ore indicated by diamond drilling but not yet fully developed. During the half-year ended Dec. 31, 1911, the company shipped principally to the Nichols Copper Co., New York, over 12,000 tons, averaging Cu 4.73%, Au 0.01 oz., Ag 0.63 oz., S 43.98, Fe 37.20, insol. 7.65, Zn 3.65, MgO 0.10, CaO 0.25. The company is spending a liberal amount for development with highly satisfactory results. It has two shafts down to 100 and 300 ft., respectively, the latter to be the main working shaft. The company is now shipping at the rate of 40,000 tons per year and has contracted with the Trenton Iron Co. for a 3¼-mi. Bleichert tramway to be completed in June, when it is expected to cut the haulage charge from the mine to the railroad at Weedon from 75c. to 4c. per ton. Mining costs have been reduced from $4.95 in August, 1910, to $2.98 per ton in January, 1912, this figure including 88c. per ton for development work. Leland D. Adams is superintendent.

Mexico

Baja California

The means of transportation between General and La Paz have been greatly improved. The road between Triunfo and La Paz has also been improved. The establishment of a branch of the Banco de Sonora in La Paz has aided operations.

Cia. Metalúrgica de la Baja California S. A.—The cyanide plant has been running continuously and extraction has been improved by the installation of a new separator in place of the cones that were installed at first. The mines have experienced a general improvement and with the exception of a dearth of miners, the prospects are bright. During February President Felix Diaz, accompanied by Director José Verea and Celso Acosta, visited the hacienda and mines.

Progreso—This company has had the Triunfo plant and the San Antonio plant running continuously and preparations are being made to increase the output.

San Juanes—This reduction plant is in full blast and the new roasters are giving satisfaction. The plans are to increase the capacity and additional equipment is already on the way.

Chihuahua

Mary—J. E. Carnahan, of Canton, Ohio, one of the officers of this company, is at Año Nuevo with a staff of engineers making an examination of the company's extensive property. The mine is equipped with a 10-stamp mill and has been closed for over a year. It is in western Chihuahua and is reached via Alamos, Sonora.

Durango

The fuel supply of the American Smelting & Refining Co.'s smeltery at Velardeña is running low and unless the railroads resume operations soon, a shutdown of this plant may result.

Jalisco

Como No—This property, adjoining the Santo Domingo mine on the Santiago River in the Hostotipaquillo district, is being developed by a San Antonio, Tex., company. Henry Bryan is in charge.

Oaxaca

Zopotote—This Chicago company is making small shipments from the Conejo claim at Parian on the Mexican Southern Ry. The ore yields gold. The property is partly developed but has been idle for more than two years.

San Luis Potosi

A deposit of high-grade kaolin is being developed near San Luis Potosi by O. V. Waggoner and associates, of San Luis Potosi. Samples of the material have been submitted to experts in the United States and it is believed that the product can be shipped to the States.

The sulphur deposits at Los Cerritos, east of the city of San Luis Potosi, are being regularly operated under lease from the owners, the Virginia-Carolina Chemical Co. Part of the product is sold in Mexico and some small shipments are made to Germany.

Sonora

Oil has been discovered in the northeastern part of the state in a well being drilled for water near El Plomo. The flow is small.

Cananea Consolidated—Dr. L. D. Ricketts is reported to have announced recently that the company has acquired control of the Superior-Bonanza company, formerly the Sonora-Bonanza. As soon as supplies can be freighted in, 25 men will be put to work. It is planned to sink one of the shafts 200 ft. to a depth of 650 ft. The equipment includes a steam plant with three boilers, two hoists, two pumps, air compressor and electric-light plant. Improvements include a general store, dwellings, brick plant and concentrator.

San Felipe—This lead-silver mine, about 10 miles east of Sahuaripa, is being developed under the direction of W. M. Asher, one of the owners. Shipments of high-grade ore are being made to Tonichi.

Greene-Cananea—Reports state that revolutionary troubles are not interfering with operations. The February production is expected to exceed that for January, although insufficient crane capacity is said to have limited operations somewhat in the converter department.

Zacatecas

A tin deposit near Pinos, in the southern part of the state, is being developed by E. L. Porch and associates, of San Antonio, Tex. At a depth of 150 ft. an average of 3% tin is reported. Other tin deposits west of Pinos in the State of San Luis Potosi have recently been investigated.

South America

Chile

Braden—Reports state that the tonnages being handled at the new concentrator are being increased gradually, the plant at present treating about 1200 tons per day. Considerable improvement is said to have been made in extraction, which, at present, is about 63%, but the new plant is not yet in perfect adjustment. The old mill is treating 300 tons per day, making the total tonnage treated about 1500. At the Teniente mine No. 1 tunnel has been advanced several hundred meters in commercial ore. The main crosscut on No. 3 level is being continued in 2½% ore. The new smeltery is handling concentrates and a lot of 3000 tons was recently smelted. The third and last unit of the mill is expected to be in commission by Apr. 1, giving the plant its full capacity.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Mar. 6—The coal trade has been generally affected by the strike in Great Britain and the possibilities of strikes here. These conditions have sent up prices and have stimulated the demand for storage coal to a high degree. The ability to meet demands depends largely upon the railroads, and they are not in the best condition, transportation being still slow and car supply in poor shape.

There have been no exports to Great Britain as yet, except of a few cargoes on an order for West Virginia coal placed by the British Admiralty some weeks ago. The British strike is general, no mines being in operation, and there is no prospect of immediate settlement. German miners are also preparing to strike in the important Rhenish-Westphalian district, where an increase in wages is demanded.

At the meeting on Mar. 5 the anthracite operators decided to reject all the demands made by the miners. These resolutions were adopted:

"Resolved, That J. L. Cake, Alvin Markle, Percy Maderia, E. B. Thomas, W. H. Truesdale, F. D. Underwood, L. F. Loree, Joseph Dickson, George F. Baer, and Morris Williams be appointed a committee with full power to represent the anthracite operators and with instructions to formulate a reply in writing to the anthracite mine workers declining their demands."

The first three of these are independent operators. The next step is uncertain, but there is no doubt that further conferences will be held.

There is more disposition to believe that settlements will be made, both in the anthracite and the bituminous district. While there has been no actual change in the situation, there is a more hopeful feeling.

Arguments before the Interstate Commerce Commission on the question of coal rates to Lake Erie ports have been nearly concluded.

Exports of coal from the United States in January were: Anthracite, 221,854 long tons; bituminous, 667,263; bituminous furnished to steamships in foreign trade, 552,965; total, 1,442,082 tons, a decrease of 32,503 tons from January, 1911. Exports of coke were 53,114 tons, a decrease of 34,464 tons.

Imports of coal into the United States in January were: Anthracite, 10; bituminous, 124,788; total, 124,798 long tons, a decrease of 19,659 tons from January, 1911. Imports of coke were 8862 tons, a decrease of 4295 tons.

IRON TRADE REVIEW

New York, Mar. 6—The iron and steel trades show some improvement upon the whole. Specifications on contracts for finished material are reported to be coming in well, and there is rather more new business. In most lines mills are well employed, many concerns running up to 90 per cent. of capacity, which is about as much as could be expected.

The Steel Corporation mills shipped material at a greater rate in February than in January or December. Some of the independents did the same, but others did not do as well as in those months. The whole situation is in a delicate position, for the reason that recent market experience has shown that even a slight deficit of demand from capacity is sufficient to make the market weak even when prices are near the cost level, while on the other hand there are influences, like the prospective coal strike and the opening of spring, which could easily push demand slightly above the available capacity. Rarely before has the poise been so delicate. The reason the market has gotten into such delicate position is that on account of the general nervousness of the trade, on account of political and other influences, the market was not able to work up to the position of reasonable strength which the good buying of last November and December would produce in ordinary circumstances.

Pig iron is more active than it has been. Both buyers and sellers are holding off on second-half contracts. Sellers are not seeking for this business at present prices, and buyers will not close without concessions. The uncertainty about Lake ore prices is beginning to worry the merchant furnaces. They find it hard to adjust their own quotations until some sort of settlement is reached. Foundry iron is in a little better demand this week, and there is also more call for basic pig.

An inquiry from Italy is reported for 15,000 tons of basic pig, deliveries to run over several months. Pipe iron is in demand, and the pipe foundries have abundant orders on hand or in sight.

Hearings on the new tariff bill before the Finance Committee of the Senate have about closed. A large number of witnesses have been examined, but few or no new facts have been brought out by their testimony.

Baltimore

Mar. 4—Exports for the week included 661 lb. selenium to Hamburg; 501,500 lb. car wheels, 1,353,833 lb. iron castings, 5,227,074 lb. structural steel and 2,093,141 lb. miscellaneous iron and steel to Panama. Imports included 110 casks manganese ore from Hamburg; 30,300 tons iron ore from Cuba.

Birmingham

March 4—The third month of the new year promises to be more active in the way of pig-iron buying with Southern manufacturers of metal than the previous month. The quotations for the product are $10.25@10.50 per ton, No. 2 foundry. Some large contracts have been mentioned at lower figures but as far as can be learned the manufacturers are not willing to sell. The production in Southern territory is about the same. There is still plenty of pig iron in furnace and warrant yards and all business offered will be met promptly for some time to come.

Inquiries in hand are encouraging. Some of the larger consumers throughout the country are looking this way for their probable needs, but are also inquiring for concessions. It is believed that the business will be placed during this month.

The cast-iron pipe makers are melting pig iron steadily and orders in hand call for a large tonnage, while business in prospect is of some consequence also.

A little improvement is noted in the steel industry. Small orders for steel rails are still coming in the the aggregate is good.

Brass foundrymen in the Birmingham district say that their business and inquiries indicate there is considerable furnace repairing going on.

Charcoal iron shows no change and the price also remains firm at $22@22.50 per ton. Machine shops and foundries expect a better trade this month.

Chicago

Mar. 4—Although sales of pig iron have not increased, the iron and steel market, in general, shows life and an optimistic tone. Sales of finished materials are fair and in the structural line are increasing. Prices of pig iron hold nearly firm, with a disposition on the part of foundry melters to test the market often by inquiries for the last half. The furnace agents, however, refuse to make prices on these requirements lower than the $14 for Northern and $10.25@10.50, Birmingham — $14.60@14.85, Chicago — quotations which have been current for No. 2 coke iron for the last few weeks. There are possibilities of slightly lower prices, made quietly, of course, but ostensibly the situation as regards prices is not changed. The sales of pig iron that are being made are of carload lots up to 500 or 600 tons, with a few inquiries running over the 1000-ton mark. Lake Superior charcoal iron again is quiet at $16.50@17 per ton.

Bridge and building requirements for structural material are increasing and there are those in the market who prophesy a boom with the opening of spring conditions. Material under 15 in. continues at 1.28@1.33c. Railroad supplies are in good demand. Steel bars are in light demand, with prices continuing 1.25@1.33c., and bar iron is fairly active at 1.15@1.20c. Sheets and plates are quiet, with prices firm. Wire products are in fair demand, though not so active as in previous weeks. Conditions of general business are good, with many manifestations of spring activity.

Cleveland

March 5—The question of Lake ore prices is still in the air. Reported sales of Mesabi nonbessemers at $3, Lake Erie port, have been denied. A common belief is that there will be a reduction of about 25c. from last season's schedule.

Pig Iron—Foundry is still rather slow, but there is an increased demand for basic pig. Prices are unchanged at $15.15 for bessemer, $13.10@13.25 for basic, $13.25 for No. 2 foundry and $12.50 for gray forge, all Cleveland delivery.

Finished Material—Specifications come in well, but new business is halting a little.

Philadelphia

March 6—Recent large sales of low-grade iron for near-by foundries are reported and additional inquiries within twenty-four hours have had the effect of hardening prices. The stock of pipe iron is practically exhausted. More cast-pipe business is heard of and the prospective requirements will probably appear within about a week. Basic is strong though sales are light and makers claim an advance is near at hand, especially if some export business in sight should be secured. Forge iron drags. Buyers asking for early delivery of No. 2 foundry find quotations firm. Malleable sells at full prices in small lots. The leading furnace interests are resting on their oars. Quotations are $15.25 for No. 2 X foundry, with gray forge and basic at $14.25. Offers of Southern forge are made again at $13.50 per ton.

Billets—No transactions of note are reported.

Bars—Retail business in bars has improved with more favorable weather and orders at mills remain at about the same level. More common iron is selling than refined and concessions are reported on common in answer to recent car inquiries.

Sheets—No important business has been sent to the sheet mills.

Pipes and Tubes—Tube work is increasing steadily and large shipments have recently been made from mills to this territory. The cast-pipe foundries have their hands full and report of new business has become monotonous.

Plates—This week's orders for plates refer mainly to the closing of business started a week or two ago. The lowest prices are still quoted and they offer no special inducement.

Structural Material—Nothing of importance has transpired in shapes and the latest inquiries are for only moderate amounts.

Scrap—Scrap continues dull even with some inducements offered by some dealers to unload accumulation.

Pittsburg

Mar. 5—Mixed conditions prevail this week in the iron and steel trade. There has been a distinct advance in basic pig iron, due partly to an unexpected purchase of 10,000 tons by the Jones & Laughlin Steel Co. and partly to sentimental grounds, while another stiffening influence is the realization that consumers are very poorly supplied against the probable suspension of mining in the anthracite and union bituminous districts Apr. 1, so that any prolonged suspension would undoubtedly cripple some steel-mill operations. On the other hand, specifications for steel products, while slightly better on the whole, do not show as great in improvement as the progress of the season, after a prolonged period of record cold weather, would suggest, and several producers are actively out for new business at cut prices.

Pig Iron—As noted, the Jones & Laughlin Steel Co. has bought 10,000 tons of Valley basic iron, for immediate shipment to Aliquippa. The price was a trifle under $12.50, or about $12.40, Valley, and from the delivery being prompt, it is believed that a close price was made, and that it would be difficult to make an ordinary purchase even at $12.50. It is reported that a prominent Monongahela Valley interest recently secured an option on three or four months' supply, about 50,000 tons, at $12.60, Valley, and is having difficulty keeping the option open. A sale of 300 tons was made last week at $13, Midland furnace, equivalent to $12.70, Valley. The Midland Steel Co. has served notice on the holders of its pig-iron warrants that beginning Apr. 1 a storage charge of 2¼c. per ton per month will be made, because the Pittsburg Crucible Steel Co., which bought the property, desires the room for building. The demand is being resisted, but it may result in several blocks of speculative iron coming on the market. A sale of 1000 tons of low-sulphur bessemer was made late last week at $14.25, Valley, sulphur being guaranteed 0.03% or under. Foundry is strong but quiet. We quote: Bessemer, $14@14.25; basic, $12.50@12.75; No. 2 foundry, $13@13.25; forge, $12.50@12.75; malleable, $12.75@13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market continues quiet, with prompt and forward quoted at $41, Baltimore.

Steel—The market has stiffened, particularly in bessemer, owing to occasional inquiries from consumers who are not getting good deliveries on their contracts, as several large mills are behind. We quote: Bessemer billets, $20; openhearth billets, $19.50@20; bessemer sheet bars, $20.50; openhearth sheet bars, $20@20.50, all f.o.b. maker's mill, Pittsburg. F.o.b. maker's mill, Youngstown, bessemer billets are quotable at about $19.50, and sheet bars about $20. Rods are nominally $25, Pittsburg.

Sheets—The market has been very irregular, about three mills having quoted materially below 2.80c. on galvanized and 1.80c. on black during the past 10 days. The low prices on galvanized have been withdrawn, so far as present information goes, but 1.80c. on black sheets can probably be shaded. Some of the mills, being well sold up, are quoting much higher prices. We quote: Black sheets, 28 gage, 1.80c.; galvanized, 2.80@2.85c.; blue annealed, 10 gage, 1.35@1.40c.; painted corrugated, $1.33@1.35 per square; galvanized, $2.47@2.50 per square.

St. Louis

March 4—The market for pig iron is just a trifle livelier this month and a number of inquiries for small lots of iron have been received. Some few foundries are running full, though the majority are not doing so well. A good many local buyers are holding off somewhat, owing to the coal strike which seems to be an assured thing on April 1. As business is not too brisk with any of the foundries some of them are figuring on shutting down for a few weeks until the coal situation is adjusted. The current price on Southern No. 2 foundry iron remains the same, $10@10.25 Birmingham or $13.75@14 St. Louis. No. 2 Northern foundry is quoted at $14.25@14.75 per ton.

Coke is in good demand. Most interests are stocking up some ahead owing to the anticipation of trouble in the Pennsylvania coal fields. Foundry coke is bringing $5.05@5.25 per ton St. Louis.

Iron Ore Trade

Imports and exports of iron ore in the United States, month of January, long tons:

	1911	1912	Changes	
Imports............	102,600	154,118	I.	51,518
Exports............	3,817	11,861	I.	8,044

Imports this year included 106,040 tons from Cuba, 36,956 from Sweden, 11,086 from Spain and 36 tons from other countries.

Imports of manganese ore into the United States in January were 12,585 tons in 1911, and 28,401 in 1912; increase, 15,816 tons.

Lake Freight Rates

The *Marine Review*, of Cleveland, gives average Lake rates per ton on iron ore and coal for three seasons as follows:

	1909	1910	1911
Iron ore, Duluth to L. Erie....	$0.65	$0.70	$0.60
Iron ore, Marquette to L. Erie..	0.60	0.65	0.55
Iron ore, Escanaba to L. Erie..	0.50	0.55	0.45
Soft coal, L. Erie to Milwaukee.	0.37	0.355	0.31
Soft coal, L. Erie to Duluth.....	0.31	0.32	0.32
Anthracite, Buffalo to Chicago..	0.41	0.41	0.35
Anthracite, Buffalo to Duluth..	0.32	0.315	0.30

Rates to Milwaukee and Chicago are practically the same. In 1910 and 1911 the wild rate on iron ore was the same as the contract rate; in 1909 the wild rate was 1 to 2c. above the contract rate.

Foreign Iron Trade

German Iron Production—The German Iron and Steel Union reports the production of pig iron in the German Empire in January as follows, in metric tons:

	1911	1912	Changes	
Foundry iron	272,114	245,333	D.	26,781
Forge iron........	55,368	44,971	D.	10,397
Steel pig..........	144,775	186,519	I.	41,744
Bessemer pig.....	29,031	28,555	D.	476
Thomas(basic)pig	819,397	867,371	I.	47,974
Total........ ...	1,320,685	1,372,749	I.	52,064

Steel pig includes spiegeleisen, ferromanganese and all similar alloys.

METAL MARKETS

New York, Mar. 6—The metal markets show a degree of activity, with a tendency to hardening of prices in some lines.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Jan. 1912..	$ 1,915,202	$ 5,165,543	Imp.	$3,250,341
" 1911..	923,676	9,540,830	Imp.	8,617,154
Year 1912..	1,915,202	5,165,543	Imp.	3,250,341
" 1911..	923,676	9,540,830	Imp.	8,617,154
Silver				
Jan. 1912..	6,027,905	4,358,009	Exp.	1,669,896
" 1911..	5,651,076	3,551,426	Exp.	2,099,650
Year 1912..	6,027,905	4,358,009	Exp.	1,669,896
" 1911..	5,651,076	3,551,426	Exp.	2,099,650

Exports from the port of New York, week ended March 2: Gold, $368,700; silver, $1,056,695, chiefly to London. Imports: Gold, $56,004; silver, $158,969, from the West Indies, Mexico and South America.

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Gold is still being taken for India. In New York some additional gold was taken for Argentina.

Platinum—The market remains quiet, with no change in prices. We continue to quote $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Our Russian correspondent writes that the demand from abroad is rather active. Offers of small lots by the starateli are larger than last year at this time, and are readily taken up by buyers and speculators. Prices are 10 rubles per zolotnik—$37.60 per oz.—at Ekaterinburg for crude metal, 83% platinum. The same grade brings 38,500 rubles per pood —$37.73 per oz.—at St. Petersburg.

Silver—The market has shown some steadiness, though the buying is limited, and there are no special features. Much depends upon China.

SILVER AND STERLING EXCHANGE

Feb.-Mar.	29	1	2	4	5	6
New York....	58⅝	58¾	58⅞	58⅝	58⅛	58⅜
London.....	27	27 1/16	27⅛	27	26¾	26⅞
Sterling Ex..	4.8705	4.8705	4.8715	4.8720	4.8725	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Feb. 22, reported by Messrs. Pixley & Abell:

	1911	1912	Changes	
India........	£1,482,700	£1,289,300	D.	£193,400
China........	406,000	400,000	D.	6,000
Total	£1,888,700	£1,689,300	D.	£199,400

India Council bills in London brought an average of 16.14 d. per rupee for the week.

The United States Mint has bought 200,000 oz. silver for subsidiary coinage.

Copper, Tin, Lead and Zinc

LONDON

Feb.-Mar.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
29	64 1/16	64 13/16	68¼	193¼	189¼	15¾	26½
1	64⅝	65⅜	68½	192¾	189¼	15 11/16	26½
2	....	.....	......	......	......	......	....
4	64⅜	65⅛	68¾	194½	189½	15¾	26½
5	65 1/16	65¾	69	196½	191	15¾	26½
6	64⅞	65 9/16	69	194	189	15 11/16	26½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

NEW YORK

Feb.-Mar.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
29	14½ @14⅝	14.30 @14.35	43	4.00	3 92½ @3 97½	6.45 @6 75	6.30 @6 60
1	14½ @14⅝	14.30 @14.35	43	4.00	3 92½ @3.97½	6.55 @6.85	6 40 @6.70
2	14½ @14⅝	14.30 @14.35	43	4.00	3 92½ @3.97½	6 55 @6 85	6 40 @6 70
4	14½ @14¾	14.35 @14.45	43⅜	4.00	3 92½ @3.97½	6.55 @6 85	6.40 @6 70
5	14½ @14¾	14.35 @14.45	43⅝	4.00	3.92½ @3.97½	6.55 @6.85	6.40 @6.70
6	14½ @14¾	14 35 @14 45	42⅞	4.00	3.92½ @3.97½	6 55 @6 85	6 40 @6.70

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—At the date of our last report the market for electrolytic copper had become firmly established on the basis of 14½c., delivered, usual terms, corresponding to about 14.32½c., net cash, New York, and on March 1-2 some large sales were made at that price, both for domestic and foreign shipment. On March 4 some sellers raised their price by ⅛c., while others did not go so far, but buyers have not yet seen their way to pay the full advance. Considering that they have freely supplied themselves at a lower price it is not surprising that they should await developments before committing themselves further. In the meanwhile electrolytic has been freely offered at 14.57½, delivered, usual terms, without finding takers. The business in Lake copper has been dull throughout the week. Some small sales at 14½@14⅝c. have been reported, while 14¾c. is quoted as the price asked by the leading seller. At the close the market is dull, with Lake copper quoted at 14½@14¾c., and electrolytic in cakes, ingots and wirebars at 14.35@14.45c. Casting copper is quoted nominally at 14.20@14.25c. as the average for the week.

The London standard market has been rather active throughout the week. The bear party has been dislodged from its position of a few weeks ago, and it was largely due to covering purchases that prices were quickly advanced, reaching the high point on Mar. 5, with £65 1s. 3d. for spot and £65 15s. for three months. The close is somewhat reactionary at £64 17s. 6d. for spot and £65 11s. 3d. for three months.

Tin—Like the standard market for copper, which, being influenced by speculative activity, very frequently moves independently of that for refined copper, so is the standard tin market shaping itself on the London Metal Exchange. While the latter fluctuated considerably, it is reported that the Syndicate did not shade its asking price and held Straits tin steady throughout the week. In this market buyers are naturally to a large extent guided by the London standard quotations, as the private quotations of the Syndicate are not known to them.

Sentiment was influenced by the London coal strike, which may interfere with the shipments of tin to this side and thereby create a scarcity of spot material. Prompt, March and April tin was, therefore, in good demand. The close in both markets is weak at 42⅞c. in New York, and £194 for spot and £189 for three months prompt in London.

Lead—The leading sellers are freely supplying the demand at 4c., New York, and 3.92½c., St. Louis. There has been some speculative buying of Western lead for future delivery at higher than the ruling St. Louis quotation, which would indicate that the leading sellers are not supplying the speculative demand. The close is steady at 4c., New York, and 3.92½@3.97½c., St. Louis.

The foreign market has been practically stationary throughout the week, closing firm at £15 16s. 3d. for Spanish lead and 2s. 6d. more for English.

Spelter—It is the same story over and over again, a scarcity of near-by spelter, which is becoming more and more acute and which is causing very stiff premiums to be paid for relatively small transactions, while futures go a-begging at much lower prices. We hear of as high as 6.80c., St. Louis, paid for occasional carloads for prompt delivery, but some large tonnages for May shipment are reported sold at under 6.40c. On business for March and April the market has been irregular. The close is unsettled at 6.40@6.70c., St. Louis, and 6.55@6.85c., New York.

The London market is weaker at £26 10s. for good ordinaries and £26 15s. for specials.

Zinc dust is quoted at 7⅛@7¼c. per lb., New York.

Other Metals

Aluminum—Business has not been especially active and there is little change in current prices. We quote 19¼@19½c. per lb. for No. 1 ingots, New York.

Antimony—Business is still quiet, at unchanged prices. Cookson's is 7¼@7⅜c. per lb., Hallett's is 7⅜@7½c., while 6¾@6⅞c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is rather weaker, but prices are nominally unchanged. The New York quotation is $46 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $45 for domestic orders and $42.50 for export. The London price is £8 7s. 6d. per flask, while £8 2s. 6d. is quoted from second hands.

Imports and Exports of Metals

Exports and imports of metals in the United States, month of January, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess	
Copper, long tons	32,530	20,477	Exp.	12,053
Copper, 1911....	28,954	10,730	Exp.	18,224
Tin, long tons....	34	3,305	Imp.	3,271
Tin, 1911........	40	4,140	Imp.	4,100
Lead, short tons.	3,605	9,249	Imp.	5,644
Lead, 1911......	5,467	6,861	Imp.	1,394
Zinc, short tons..	1,007	2,189	Imp.	1,182
Zinc, 1911......	418	265	Exp.	153
Nickel, lb........	1,584,986	2,758,843	Imp.	1,173,857
Nickel, 1911....	2,165,541	2,429,336	Imp.	263,795
Antimony, lb.....	....	1,283,298	Imp.	1,283,298
Antimony, 1911.	127,644	601,046	Imp.	473,402
Platinum, oz.....	....	1,532	Imp.	1,532
Platinum, 1911.	....	2,027	Imp.	2,027
Aluminum, lb....	1,690	1,301,375	Imp.	1,299,685
Aluminum, 1911	....	....	....	
Ores, etc.				
Zinc in ore, lb...	2,747,234	3,335,087	Imp.	587,853
In ore, 1911....	1,776,000	5,263,407	Imp.	3,487,407
Zinc oxide, lb. ..	2,285,837	....	Exp.	2,285,837
Zinc oxide, '11..	2,468,630	....	Exp.	2,468,330
Zinc dross, lb....	296,450	....	Exp.	296,450
Zinc dross, '11..	479,887	....	Exp.	479,887
Chrome ore, l.t..	....	96	Imp.	96
Chrome ore, '11	....	7,903	Imp.	7,903

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 5828 tons; exported, none. Imports of aluminum were not reported previous to July 1, 1911. The metal exports given above include re-exports of foreign materials.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 2—The highest price paid this week for zinc ore was $50; the base price, 60% zinc, was $47@48. The highest price paid for lead ore was $50; the base price, 80% lead, was $48@49 per ton.

SHIPMENTS, WEEK ENDED MAR. 2

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Shullsburg............	901,380	....	....
Mineral Point.........	789,800	....	....
Platteville............	642,840	... ...	301,900
Benton................	406,100	....	....
Hazel Green..........	275,100	60,000	....
Galena................	239,000	....	....
Cuba City.............	163,960	88,390	130,700
Dodgeville............	140,000	....	....
Harker................	64,170	....	....
Montfort..............	62,800	....	....
Linden................	......	....	60,000
Total..................	3,685,150	148,390	492,600
Year to date..........	31,627,440	889,780	2,413,000

Shipped during week to separating plants, 1,139,210 lb. zinc ore.

Joplin, Mo., Mar. 2—The high price is $52, the base, per ton of 60% zinc, $45@49.50, this week's delivery, with $50 offerings today on next week's delivery. Zinc silicate sold on a base of $25@28 per ton of 40% zinc. The average price, all grades of zinc, $44.80. The highest price for lead ore is $54.50 per ton and the average, all grades, $53.68 per ton.

Despite the fact the past 10 days have been the stormiest of the year, though not severely cold, very heavy shipping was done this week, hauling the ore alternately in snow and mud, as the storms came or the sun shone. There is very little unsold ore in the district, less than at any time for a number of years.

SHIPMENTS, WEEK ENDED MAR. 2

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	5,554,110	. ....	1,570,400	$172,821
Joplin........	1,649,180	......	270,460	46,880
Jackson......	1,301,990	......	8,910	28,880
Alba-Neck....	1,155,150	......	......	27,723
Duenweg.....	863,100	......	57,940	21,845
Galena.......	590,240	......	45,990	14,815
Miami.......	436,390	......	174,380	13,000
Cave Springs.	522,380	......	......	9,925
Granby	194,150	235,350	21,730	7,800
Spurgeon	117,860	211,210	22,120	6,115
Carl Junction	299,660	......	......	4,800
Oronogo......	176,390	......	68,060	4,459
Carthage	119,060	......	......	2,678
Aurora.......	54,480	56,420	......	1,935
Badger	60,900	......	......	1,340
Quapaw......	50,760	......	......	965
Totals......	13,145,800	502,980	2,239,990	$365,981
9 weeks....	85,298,010	4,864,770	13,446,630	$2,331,350

Blende val., the week, $298,653; 9 weeks, $1,890,156
Calamine, the week, 7,210; 9 weeks, 66,624
Lead value, the week, 60,118; 9 weeks, 374,570

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January.....	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February....	40.21	45.75	39.16	43.31	54 46	52.39
March.......	39.85	......	38.45	......	54.57	......
April........	38 88	......	37.47	......	56.37	......
May..........	38.25	......	36 79	......	55.21	. ....
June.........	40.50	......	38.18	......	56.49	......
July..........	40.75	......	38.36	......	58.81	......
August......	42 50	......	41 28	......	60.74	......
September ..	42 63	......	41 29	......	59 33	......
October......	42.38	......	40.89	......	54.72	......
November...	45.40	......	43.25	......	57 19	......
December...	44.13	......	40.76	......	62.03	......
Year.......	$41.45	......	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Mar. 6—The general market shows no special changes.

Copper Sulphate—A fair trade is being done at last prices, $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is steady, with no material change. Quotations are 2.22½c. per lb. for both spot and future positions.

Messrs. Mortimer & Co., New York, report the position of nitrate in the United States on March 1 as below, in long tons:

	1911	1912	Changes	
Stocks, Jan. 1...........	12,790	9,000	D.	3,790
Imports, 2 mos.........	120,322	65,400	D.	54,922
Supplies	133,112	74,400	D.	58,712
Deliveries, 2 mos	120,362	70,900	D.	49,462
Stocks, Mar. 1	12,750	3,500	D.	9,250
Afloat for U. S.	95,000	100,000	I.	5,000

Quantities afloat include all cargoes due to arrive at United States ports by June 15 next.

Sulphur—The Union Sulphur Co. has

contracted for a second steamship of 4500 tons register, to be used in transporting sulphur from Sabine, Tex., to Atlantic coast ports.

Arsenic—Supplies are rather scarce. Imports have been limited by the troubles in Mexico and by high ocean freights. Quotations are $2.75@3 per 100 lb. for white arsenic.

Sulphate of Ammonia—Messrs. Bradbury & Hirsch estimate the world's production of sulphate of ammonia in 1911 as follows: Germany, 400,000 tons; Great Britain, 378,500; United States, 127,000; France, 60,000; Belgium, 40,000; other countries, 144,500; total, 1,150,000 long tons.

Chemicals and Minerals

CURRENT WHOLESALE PRICES

Ammonium sulphate.......cwt.	3.25@3 30
Arsenic, white...............lb.	0 02¾@0 03
Barytes, ground...... ..sh. ton	12 00@13 00
" floated... .....sh. ton	16.00@17 00
Calcium acetate, gray.. ... cwt.	2.25@2.30
carbide, ton lots f.o.b. Niagara Falls..sh. ton	70 00
Carbons, good drill quality carat	50 00@75.00
Cement, Port., Am. .400-lb. bbl.	1.33
Chrome brick, f.o.b., Pittsburg M.	175.00
ore, 50%, ex-ship, N. Y., lg. ton	14 00@16.00
Copperas, bulk........ ...cwt.	0 55
bbl.............. .....cwt.	0.65@0 85
Copper sulphate......... cwt.	4.90@5 15
Fluorspar, lump, f.o.b. Pittsburg, ton	8.00@9 00
Magnesite, crude, 95%... lg. ton	7.50@8.50
calcined, powdered .	26 00@35 00
brick, dom. f.o.b. Pittsburg.......M.	160@200
Paints, litharge, Am. powd. lb.	0 05½@0 06
red lead, American ..lb.	0 06½@0 07
white lead, Am., dry..lb.	0.05¼@0 05¾
zinc white, Am., dry .lb.	0.05⅛@0 06¼
Phosphates, acid:	
*Fla., hard rock 77% .	5.75@6 25
land pebble 68%....	3 70@3.80
†Tenn., 78@80%	5 00@5.50
75%	4 75@5 00
68@72%	4.25@4.50
‡So. Car. land rock 60%.... ..	3 50@3.75
Potassium cyanide, 98@99%..lb.	0.18@0.20
Pyrite:	
Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit	0 12@0 12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines.... .	0 11½@0.12
Imported, non-arsenical, furnace size, ex-ship, per unit	0 13@0.13½
Imported, arsenical, furnace size, ex-ship, per unit..... .	0 12¾@0.13
Imported, fines, arsenical, ex-ship....................	0 11@0 12
Imported, fines non-arsenical, ex-ship, per unit.	0 12½

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

Sodium cyanide, 120 to 130% KCN lb.	0.18@0 20
nitrate 95%, spot cwt.	2 20
95% future..cwt.	2 20
Sulphur, Louisiana prime, N. Y., lg. ton	22.00@22 50
roll .... cwt.	1.85@2 15
flour .cwt.	2.00@2.40
flowers, sublimed .cwt.	2 20@2 60
pow. com., bags . .cwt.	1.50
Sicilian, crude brimstone. ...lg. ton	22 50
Zinc chloride, granular . lb.	0.04¼@0 04½

*F.o.b. Florida or Georgia ports. †F.o.b Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.

Petroleum

The monthly summary of the Oil City *Derrick* gives the number of oil wells completed in February as follows: Pennsylvania, West Virginia and southeastern Ohio, 238; Lima-Indiana, 25; Kentucky, 6; Illinois, 71; Kansas-Oklahoma, 397; Texas-Louisiana, 104. In all the divisions there were 841 wells completed, 203 more than in January. The new production was 43,525 bbl., an increase from the January report of 12,037 bbl. Of the completed wells, 129 were failures and 78 gas wells.

MINING STOCKS

New York, Mar. 6—Total sales on the New York Stock Exchange in February were 7,030,882 shares of stock and $51,686,000 in bonds. This is the lowest record since 1904. The total is less than that of January by 4,316,437 shares of stock and $53,986,600 in bonds.

Feb. 29 there was little change. Business on the Exchange was light and prices rather weak. Curb trading was more active. Cobalt and Porcupine stocks were in fair demand. The coppers were quite active but did not change in selling prices. Homestake sold at $87@87.50 per share.

Mar. 1 business on the Exchange was more active and prices stronger; but trading was chiefly professional. On the Curb there were advances, but the trading was narrow. The largest business was in the copper stocks, Inspiration being the leader.

Mar. 2 the Exchange showed larger dealings and firmer prices generally. On the Curb there was a broader market for mining stocks, especially for the coppers, which were in fair demand at slight increases in quotations.

Mar. 4 the Exchange remained steady with prices firmer. Steel common gained a point on large transactions. On the Curb mining stocks were rather irregular, but generally advanced. Coppers and Porcupine showed the heaviest dealings.

On Mar. 5 and 6 the Exchange was rather strong, but dealings were almost entirely professional. The leading point was the continued advance in Steel common. On the Curb the trading was diversified and prices firmer, but mining stocks were the slowest section of the market. Prairie Oil stock advanced sharply on the declaration of an increased dividend.

Boston, March 5—The copper share market has shown increasing activity and strength, with a number of advances. Calumet & Hecla gained to $464, the highest point for the year. Isle Royale was active and advanced to $27.25. Mayflower and Old Colony were rather quiet, at $10.75 and $7.75, respectively. North Butte was active, rising to $28, United States Smelting was also up on today's quotations. On the whole there was a substantial improvement, and the close gives promise of a broad and active market.

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	Dec.	Jan.	Feb.
Alaska shipments.	4,995,008	3,701,010	....
Anaconda..........	23,600,000	26,350,000	27,450,000
Arizona, Ltd........	3,100,000	3,200,000	....
Balaklala..........	....	....	....
Copper Queen......	8 365,266	6,748,264	6,046,864
Calumet & Ariz....	4,486,000	4,544,000	4,452,000
Detroit.............	1,969,313	1,941,970	2,008,374
East Butte..........	1,498,000	....	....
Mammoth..........	1,721,404	1,665,319	....
Mason Valley......	....	600,000	....
Miami..............	2,500,000	2,600,000	....
Nevada Con........	4,679,674	6,309,228	....
Old Dominion......	2,610,000	2,044,000	....
Ray................	2,660,000	....	....
Shannon............	1,255,858	1,550,000	1,300,000
South Utah.........	267,514	189,678	....
United Verde*.....	2,000,000	....	....
Utah Copper Co....	9,039,557	8,156,612	....
Lake Superior*....	17,500,000	....	....
Non-rep. mines*...	8,500,000	8,400,000	....
Total production.	100,647,593	....	....
Imports, bars, etc..	21,101,256	31,790,590	....
Total blister.....	121,748,849	....	....
Imp. in ore & matte	5,159,997	8,340,740	....
Total..............	126,908,846	....	....
Brit. Col. Cos.:			
British Col. Copper	....	....	....
Granby............	....	1,607,558	....
Mexican Cos.:			
Boleo.............	2,645,640	2,315,040	....
Cananea...........	3,706,000	3,552,000	....
Moctezuma........	2,864,464	2,732,867	2,687,712
Other Foreign:			
Cape Cop., S. Africa	701,120	784,000	....
Kyshtim, Russia...	1,570,000	....	....
Spassky, Russia....	721,280	795,200	....
Famatina, Argen..	217,280	172,480	....
Tilt Cove, Newf'd..	....	153,257	....
Exports from:			
Chile.............	6,824,000	8,064,000	....
Australia.........	11,200,000	7,056,000	....
Arrivals in Europe from other count.†	16,331 840	13,144,320	....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
II, 1911.........	109,828,297	50,518,998	45,111,019
III..............	130,532,080	66,080,789	59,081,127
IV........	118,085,223	52,407,650	62,129,699
V...............	126,962,544	64,543,963	61,978,567
VI..............	124,554,312	61,655,561	71,460,519
VII........ ...	112,167,934	56,982,582	74,880,658
VIII.......	125,493,667	59,935,364	69,855,660
IX.............	115,588,950	57,311,584	50,824,011
X...............	118,255,442	64,068,307	60,084,349
XI........	111,876,601	68,039,776	67,049,279
XII.............	122,896,697	65,988,474	79,238,716
Year, 1911..	1,431,938,338	709,611,605	754,902,233
I, 1912.........	119,337,753	62,343,901	80,167,904
II..............	....	....	....

VISIBLE STOCKS

	United States	Europe	Total
III, 1911........	156,637,770	233,385,600	390,023,009
IV....	162,007,934	223,014,400	385,022,434
V...............	165,555,908	212,284,800	377,840,708
VI..............	165,995,932	202,540,800	368,536,732
VII..	157,434,164	195,932,800	353,366,964
VIII...........	137,738,858	191,891,840	329,630,698
IX.............	133,441,501	191,228,800	324,670,301
X...............	140,894,856	191,945,600	332,840,456
XI..............	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912.........	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III.............	....	141,142,400	....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

On the Curb business was fairly active. Eagle & Blue Bell and Majestic sold rather freely. Rhode Island Coal was quoted at 26c. Quite a lot of Porcupine stocks have changed hands recently.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1.00
Alpha Con., Nev	Feb. 21	Mar. 13	0.05
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.50
Challenge, Nev	Mar. 5	Mar. 26	0 05
Crown Point, Nev	Mar. 28	Apr. 19	0.05
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev	Feb. 14	Mar. 6	0 05
Hancock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
King David, Utah	Feb. 13	Mar. 6	0.005
Lehi Tintic, Utah	Feb. 29	....	0.01½
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
Ojibway, Mich	Jan. 10	....	1 005
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz.	Jan. 15	....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002
Swansea Con., Utah	Jan. 17	Feb. 8	0.01
Tintic Central, Utah	Mar. 9	Mar. 27	0.005
Tintic Standard, Utah	Jan. 8	Feb. 5	0 00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Utah, Nev	Jan. 19	Feb. 9	0.05
Wabash, Utah	Mar. 19	Apr. 10	0.10
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	......	23.690	24.324	......
April	53.221	53.325	......	24 483	24.595	......
May	53.870	53.308	......	24.797	24.583	......
June	53.462	53.043	......	24.651	24.486	......
July	54 150	52.630	......	25 034	24.286	......
August	52.912	52.171	......	24 428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53 486	53.304	......	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14 094	12.680	14 337	55.600	62 760
February	12.256	14.084	12.611	14 329	54.974	62 893
March	12.139	......	12.447	......	54.704	.....
April	12.019	......	12.275	......	54.034	.....
May	11.989	......	12.214	......	54.313	.....
June	12.385	......	12.611	......	56.365	.....
July	12 463	......	12.720	......	56 673	.....
August	12 405	......	12.634	......	56.266	.....
September	12.201	......	12.508	......	55.253	.....
October	12 189	......	12.370	......	55 170	.....
November	12 616	......	12.769	......	57.253	.....
December	13 552	......	13.768	......	62.068	.....
Year	12 376	..	12.634	....	55.973	....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	......
February	41 614	42 962	August	43 319	....
March	40 157	..	September	39 755	....
April	42 185	..	October	41 185	....
May	43 115		November	43 125	..
June	44 606		December	44 655	.
			Av. Year	42 281	.. ..

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4 435	4 334	4 327	13 009	15.619
February	4 440	4 026	4 266	3 946	13 043	15 738
March	4 394	.....	4 238	......	13 122	......
April	4 412	......	4 262	......	12.889	.....
May	4 373	.....	4 223	......	12 984	.....
June	4 435	......	4 292	......	13.260	.....
July	4 499	......	4.397	......	13 530	.....
August	4 500	......	4 406	......	14.260	......
September	4 485	.....	4 356	......	14 744	......
October	4 265	......	4 139	......	15.332	......
November	4 298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	15 648	.....
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	6.499	5 368	6.349	23.276	25 661
March	5.563	.....	5.413	......	23 016	......
April	5 399	......	5.249	......	23 743	......
May	5.348	......	5 198	......	24.375	......
June	5 520	......	5 370	.....	24.612	......
July	5 695	......	5 545	......	25.006	......
August	5 953	......	5 803	......	26 801	......
September	5 859	......	5 719	......	27 750	......
October	6.102	......	5 951	......	27.255	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.508	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14.40	$13.32	$14 75	$14.00
February	15.90	15.03	14 50	13.28	14 81	14.01
March	15.90	......	14 65	......	14.96	......
April	15 90	......	14 55	......	15 00	......
May	15.90	......	14 30	......	14 72	......
June	15 90	......	14 06	......	14.56	......
July	15.90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Mar. 5

Name of Comp.	Bid.
Acacia	.06¼
Cripple Cr'k Con.	.02
C. K. & N.	.15
Doctor Jack Pot	.05¼
Elkton Con.	.55¼
El Paso	.66½
Findlay	03
Gold Dollar	.14¼
Gold Sovereign	.02¼
Isabella	.11¼
Jack Pot	07
Jennie Sample	.04
Lexington	009
Moon Anchor	.01
Old Gold	03
Mary McKinney	.52
Pharmacist	.02
Portland	.90
Vindicator	70
Work	.01

SALT LAKE Mar. 5

Name of Comp.	Bid.
Beck Tunnel	.15
Black Jack	.14
Carisa	‡ 15
Cedar Talisman	02¼
Colorado Mining	35
Columbus Con.	22
Daly-Judge	5.50
Grand Central	75
Iron Blossom	1 20
Little Bell	35
Lower Mammoth	.03¼
Mason Valley	13 00
May Day	15
Nevada Hills	2 30
New York	03
Prince Con	1 20
Silver King Coal'n	1 00
Sioux Con	09
Uncle Sam	26
Yankee	.15

TORONTO Mar. 5

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡6 80	Pearl Lake	18
Hudson Bay	‡70.00	Porcu. Gold	45½
Temiskaming	34	Porcu. Tisdale	03
Wettlaufer-Lor	74	Preston E. D.	09
Apex	06	West Dome	52
Central	3 75	Standard	18
Doble	65	Foley O'Brien	33
Dome Exten	45	Rea	90
Hollinger	11 10	Crown Chartered	18
Imperial	05¼	Swastika	23

SAN FRANCISCO Mar. 5

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.06	Belmont	.10
Belcher	50	Jim Butler	.35
Best & Belcher	.14	MacNamara	.18
Caledonia	3.85	Midway	.26
Challenge Con	.23	Mont.-Tonopah	.10
Chollar	.14	North Star	.25
Confidence	.09	West End Con	1.10
Con. Virginia	.85	Atlanta	.15
Crown Point	.47	Booth	.05
Gould & Curry	05	C.O.D. Con	.11
Hale & Norcross	.25	Comb. Frac	.15
Mexican	3.25	Jumbo Extension	.26
Occidental	60	Pitts.-Silver Peak	1.32½
Ophir	1.47½	Silver Pick	.06
Overman	1.67½	St. Ives	.30
Potosi	09	Tramp Con	.01
Savage	25	Argonaut	‡2.00
Sierra Nevada	.30	Bunker Hill	‡5 50
Union Con	1.20	Cent. Eureka	.32
Yellow Jacket	.52	So. Eureka	5 00

N. Y. EXCH. Mar. 5

Name of Comp.	Clg.
Amalgamated	68¾
Am. Agri. Chem.	60⅛
Am.Sm.&Ref.,com	74⅝
Am. Sm.& Ref., pf.	104¼
Am. Sm. Sec., pf. B	86¾
Anaconda	36¾
Batopilas Min	1¼
BethlehemSteelpf	58¾
Chino	25¾
Federal M.& S., pf.	38
Goldfield Con.	4½
Great Nor., ore ctf.	38
Homestake	85
Miami Copper	24¾
Nat'nalLead,com.	54¾
National Lead, pf.	107
Nev. Consol	20
Pittsburg Coal, pf.	80½
Ray Con	17¾
RepublicI&S.com	19½
Republic I & S. pf.	69¾
SlossSheffi'd,com.	40
Sloss Sheffield, pf	‡108¼
Tennessee Copper	38¼
Utah Copper	58
U. S. Steel, com	63½
U. S. Steel, pf.	109
Va. Car. Chem	53½

N. Y. CURB Mar. 5

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con.	.47
Braden Copper	5⅛
B. C. Copper	4⅜
Buffalo Mines	1.25
Butte & Vipond	‡ 53
Butte Coalition	23
Caledonia	.70
Con. Ariz Sm.	⁹⁄₁₆
Davis-Daly	⅝
Diam'field-Daisy	10
Ely Con	⅜
Florence	60
Giroux	4¼
Gold Hill Con.	¼
Greene Cananea	7⅞
Greenwater	07
Guggen. Exp.	190
Inspiration Con.	19⅜
Internat. S. & R	‡128
Kerr Lake	3
La Rose	3¼
McKinley-Dar-Sa	1
Min. Co of A. new	3⅜
Nev Utah M. & S	³⁄₃₂
Nipissing Mines	7½
Ohio Copper	1¹⁄₁₆
Pacific Sm. & M	⁹⁄₃₂
Porcupine T'nsite	‡ 03½
Precious Metals	‡1⅜
Ray Central	2¼
Red Warrior	‡1½
South Utah M & S	⅝
Standard Oil (Old)	825
Stand'd Oil of N J.	360
Stand'd Oil Subs.	335
Stewart	1⅛
Tonopah	7⅛
Tonopah Ex	1⅝
Tri-Bullion	¾
Tularosa	⅝
United Cop., pfd.	15
Yukon Gold	3⅛

LONDON Mar. 6

Name of Com	Clg.
Camp Bird	£1 8s 9d
Dolores	1 10 0
El Oro	0 16 6
Esperanza	1 17 0
Mexico Mines	7 2 6
Oroville	0 5 0
Stratton'sInd.	0 3 1½
Tomboy	1 0 6

BOSTON EXCH. Mar. 5

Name of Comp.	Clg.
Adventure	7¾
Algomah	6⅝
Allouez	42½
Am. Zinc	25¾
Ariz. Com., ctfs.	4⅜
Bonanza	42
Boston & Corbin	7⅞
Butte & Balak	4
Calumet & Ariz	62½
Calumet & Hecla	463
Centennial	20
Con. Mercur	08
Copper Range	56
Daly West	5⅝
East Butte	13¼
Franklin	13¼
Granby	36
Hancock	34¼
Hedley Gold	17⅜
Helvetia	1½
Indiana	16
Island Cr'k, com.	44
Island Cr'k, pfd.	87¼
Isle Royale	25⅞
Keweenaw	1¼
Lake	37⅜
La Salle	5⅛
Mass	8
Michigan	3½
Mohawk	57½
New Arcadian	4⁷⁄₁₆
New Idria Quick.	7½
North Butte	27
North Lake	6½
Ojibway	6
Old Dominion	50½
Osceola	116
Quincy	79
Shannon	12
Shattuck-Ariz.	23
Superior	30⅞
Superior & Bost.	4
Tamarack	31
Trinity	5⅞
Tuolumne	3¹⁄₁₆
U. S. Smelting	38⅝
U. S. Smelt'g. pf.	48½
Utah Apex	3
Utah Con	16⅝
Victoria	4¾
Winona	7¼
Wolverine	112
Wyandot	3⅛

BOSTON CURB Mar 5

Name of Comp.	Last
Ahmeek	250
Bingham Mines	3½
Boston Ely	1⅛
Boswyocolo	.08
Butte Central	6¼
Cactus	12
Calaveras	1⅜
Chief Cons	95
Corbin	2½
Cortez	1½
Crown Reserve	3
First Nat. Cop.	2½
Majestic	44
Mazatan	¼
Moneta Porc	15
Nevada-Douglas	3⅝
New Baltic	4½
Oneco	2½
Raven Copper	.36
Rhode Island Coal	¼
San Antonio	‡3½
S. W. Miami	6⅞
South Lake	6
Trethewey	.70
Union Mines	‡1½
United Verde Ext.	.34
Vulture	‡5½

‡Last quotation.

The Engineering and Mining Journal

Vol. 93. MARCH 16, 1912. No. 11.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue, 9300 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page

Editorials:
  The Situation in Spelter.......... 531
  Lake Mill Plans.................. 531
  Camp Bird, Ltd., in Copper........ 532
  The Coal Mining Unrest.......... 532
Correspondence and Discussion:
  Amphidizer and Amphidization ....Where the Primer Should Go ....Absorption of Gold by Retorts....Screening Ore Samples 533
New Lake Milling Plans............ 534
Legislation Affecting Mining....... 534
Guggenheim Exploration Co........ 534
The Canadian Mining Institute...... 534
Quincy Mining Co. 535
Iron Works in the Transvaal....... 535
Determining Sulphur in Sulphide Ores 535
Details of Practical Mining:
  *An Electric Signal Device.... Treatment of Copper Mine Water....*Replacing Survey Monuments....Rust Proofing Iron or Steel....*Skip for Cleaning a Choked Shaft .... Photographic Reproduction of Tracings .... *Cradle for Dumping Mine Cars ....*A Home-made Ejector.... *Another Dust Arrester....Shifting a Bucket Dredge .... *A Suggestion for Draftsmen .... *Sampler for Cyanide Plants.... Gold Absorption by Amalgamation Plates 537
Some Colorado Mining Decisions.... 542
Rice and Scheftels Guilty.......... 542
Progress in Mill Design. Frank E. Shepard 543
Smelting Chromiferous Iron Ore.... 547
The Synchron Respiration Apparatus 548
Some Observations in Butte, Mont. W. R. Ingalls 549
*Pumping Plant at Sloss Iron Mines, Alabama.............C. A. Tupper 550
Giroux Consolidated 551
Shaft Sinking by Freezing.......... 552
*Ore Dressing in the Joplin District—IV..........James L. Bruce 553
Mining in Rhodesia................ 555
Gold Dredge Installations during 1911...............John Tyssowski 555
The Messina (Transvaal) Development Co. 556
*The Practice in Blende Roasting. E. Schütz 557
Protection of Pipe from Corrosion.. 560
A New Tin Discovery............... 560
The Mineral Production of Canada. John McLeish 561
Petroleum in Peru.................. 563
Commercial Availability of Alunite 564
Phthisis among Rand Miners........ 564
New Publications 565
Personal, Obituary and Societies.... 566
Editorial Correspondence 567
Mining News 569
Markets 575
  *Illustrated.

The Situation in Spelter

During the last four months the spelter market has been in a peculiar condition. There has been an extraordinary and non-understood demand for the metal and a deficiency of supply. This has naturally produced a high level of price. The producers have, in the main, kept their books nearly filled for two to three months ahead, and buyers have been willing and eager to enter into such contracts. Belated buyers have had to pay fancy premiums to obtain prompt shipments, which have been obtainable only out of reserved supplies.

In referring to reserved supplies, it is not intended to imply the existence of stocks deliberately held back to corner the market, but rather to the smelters' safety reserves. Most smelters refrain from contracting the last pound of their expected production in any month, for the reason that some mishap may make them short and compel them to go into the market at the risk of having to pay a premium. In the course of time their safety reserves become released. Some smelters have also refrained from contracting everything in the expectation of realizing a premium later on. The quantity sold at the fancy prices is, however, relatively small, the bulk of the spelter being sold on contracts in the usual way.

It goes without saying that this condition, which has existed so long with alternating periods of amelioration and aggravation, is possible only in a market that is bare of stock. At the beginning of 1912, the statistics showed about 8000 tons on hand, but this included the spelter of other kinds than prime western, and the supplies in the hands of smelters who roll their own product, and of the remainder it was believed that substantially the whole was enumerated as stock simply because it was at the works, although in reality it had been sold and was awaiting shipment. There is probably no available stock in first hands today and we do not think there is any in speculative hands. Yet, as we have previously pointed out, it is incredible that actual consumption was going on at the rate of recent deliveries, and the only logical deduction was that consumers had been overbuying. This now seems to be generally recognized as the fact of the matter, certain of the large users having been persistent buyers and having taken more metal than there is any reason to believe to be their present rate of consumption. Accepting this premise, the reason for their action can be only their conviction that spelter is surely to continue to be a dear article, and is likely to go higher in price, either because of improvements in the galvanizing and brass business or because of shortage in spelter supply, or both. The suspicion has been expressed that the diminution of natural-gas supply is being more seriously felt at several smelting centers, with an adverse effect upon production. At certain places the reality of that situation is not disguised. This, of course, would be an adequate explanation of the recent course of the market. Whether the buyers will ultimately be correct in their diagnosis, or not, is, however, another matter.

Lake Milling Plans

The plan for the rearrangement of milling facilities at the Lake, announced by the Calumet & Hecla company, and outlined elsewhere in this issue, is a move that has been expected for some time, although perhaps not in all details, by those acquainted with conditions in that district. There can be little question that the frustration of the merger plans, so widely discussed a year ago, was a bitter disappointment to this great company, in its attempt to solve operating difficulties and to reduce mining and milling costs. The present plan to provide more adequate and cheaper milling facilities, not by the construction of independent mills for each mine, but by increases in and a better utilization of the present equipment is a logical sequence to the ill starred merger. Its successful culmination should mean much that will be of advantage to the companies involved.

As was expected, transportation costs apparently played not a small part in the working out of this plan. Two interesting features of the announcement are: (1) The inclusion of Hancock in the plans, as this is an independent property, in no way connected with the Calumet & Hecla company or subsidiaries; and (2) the expressed intention of building a recrushing plant for the Tamarack. The plan, if carried into operation, will involve the permanent treatment of rock from several mines in one mill. The success of this may mean that in the future other independent mines may unite in building mills, doing away with the old idea that each mine in that district, must, if possible, have its own mill. The results will be watched with interest.

Camp Bird, Ltd., in Copper

It is interesting to note that the progressive Camp Bird, Ltd., continues to extend its operations, this time to a copper mine in the Transvaal. A circular has recently been issued to shareholders announcing an opportunity to participate in the issue of £250,000 six per cent. debenture stock of the Messina (Transvaal) Development Company, Ltd., the interest for five years on this issue being guaranteed by Camp Bird, Ltd. Three directors of Camp Bird have been interested in Messina for several years and evidently consider the developments in the Transvaal property sufficiently favorable to warrant their company's participation.

The Messina mine, which is in the Zoutpansberg district in northern Transvaal, is opened to a depth of over 800 ft. and the ore reserves in the last report of the consulting engineer were estimated at 430,000 tons above the eighth level, of which 102,000 tons were "blocked out," the remainder being designated as "probable ore."

Funds from the debenture stock issue are to be used in equipping the mine for a production of 120,000 tons per annum. The concentrating plant is to be enlarged and the building of a smelting plant is now to be undertaken in view of the agreement for the extension of the Government railway which is expected to reach the mine by the end of this year.

It seems a little odd at first to think of Camp Bird in connection with copper mining, but perhaps this is only another manifestation of the old saying that "it takes a gold mine to make a copper mine." The Camp Bird mine was an interesting venture that has already returned to its shareholders over £1,600,000, some of which has been reinvested in the Santa Gertrudis mine in Mexico, from which favorable developments are reported, and we hope that the company's copper venture will be a fortunate one.

The Coal Mining Unrest

The coal-mining labor situation in the United States is at a critical point. A settlement of the pending troubles seems to hinge largely upon the position in the anthracite region of Pennsylvania. The operators there have decided to reject all the demands made by the miners, and, as this is written, a committee is presenting this answer to the delegates of the union. This ends the first stage, but will not necessarily be the prelude to a strike, since it is quite possible that the miners may present modified demands which will have to be considered in their turn. Thus far the negotiations have been conducted in a manner which makes further negotiations not only possible, but probable, and it is still likely that a strike may be averted, though there may be a short stoppage of mining pending a final adjustment. The opinion of men well posted in the anthracite industry is that there will be no great difficulty in settling the wage question; the hitch will come over the demands for the check-off system of paying union dues and the closed shop. It is not at all likely that the operators will abandon the open-shop principle to which they have adhered for the past 10 years. The miners have this year a certain advantage in the fact that the great consumption of anthracite due to the severe winter has prevented the accumulation of reserve stocks, and a stoppage of production will be quickly followed by a shortage of coal.

The negotiations for a wage settlement in the Central West are at a standstill. The miners there are evidently waiting for the result of the anthracite discussion, and a strike in Pennsylvania will probably be followed or accompanied by another in the West, which will leave West Virginia and Kentucky to supply the demand for coal as best they can. Such strikes will certainly be followed by a serious derangement of industry everywhere.

The mining trouble is not confined to this country. Notwithstanding daily dispatches to the effect that a settlement is at hand, the general strike in Great Britain continues, and business is almost paralyzed for the time being. The intervention of Parliament seems to be near at hand. The German strike has assumed large proportions and is accompanied by much ill feeling, apparently. Serious rioting is reported, which has provoked military intervention at several points. Never before has the unrest in the coal industry been so widespread or so formidable in its probable consequences.

Senator Poindexter's proposed amendment to the Bureau of Mines Act sets the compensation for experts that the Bureau may have occasion to employ at $10 per day. We presume when the Bureau of Mines finds it necessary to employ one of the leading members of the mining profession, it will be compelled to resort to the devious ways used when Dr. Rusby was employed to assist in the pure-food investigation. It would be interesting to learn why the government must, in certain lines, be more impecunious than its citizens, and in other lines correspondingly more profligate.

The New York auction rooms are one of the graveyards of disappointed hopes. In their reports we read of such transactions as 232,031 shares of the London-Arizona Copper Co., $500 for the lot; 10,638 shares of Poland Mining Co., $7 for the lot; 46,379 shares of Lookout Copper Co., $100 for the lot. These were but a few of the sales of Wednesday a week ago. These were bubbles that exploded. What an anticlimax from the gorgeous promises of their promoters!

If the stock of copper at American refineries becomes utterly exhausted, as recently has been vigorously prophesied, it does not necessarily follow that we shall have a runaway market. In the absence of domestic supplies we might be able to import some copper from Europe.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Amphidizer and Amphidization

In the JOURNAL of Feb. 24, 1912, p. 403, is mentioned my process for concentration of copper from its ores. In this article is the following statement:

> In A. L. Walker's paper on the "Metallurgy of Copper in 1911," on p. 47 of the Journal of Jan. 6, 1912, the terms amphidizer and amphidization are used. In the French pat. (No. 430,692) taken out by the Bradley company, an "amphigen" is defined, according to the Journ. Soc. Chem. Ind., Dec. 15, 1911, as "an element which combines with the metal to form either an acid or a base," and "amphide" is "a salt of which the acidic and basic portions each contain an "amphigen," and "amphidization" is the process of producing the amphide.
>
> It is difficult to see wherein the old terms oxygen, oxysalt, and oxidation do not meet these new demands.

This is a proper criticism and I am glad to have you bring the matter up. It was intended to introduce only the names amphidizer and amphidizing. Amphigen and amphide were only mentioned to explain the derivation of the name amphidizer and the act amphidizing.

I am quite content to fall into line on the conventional use of the terms oxygen, oxysalt and oxidation, but, in the selection of a name for the furnace, I was influenced by several considerations.

The formation of a sulphate from a sulphide deserves a specific name to distinguish it from other forms of roasting where the products of oxidation pass away as gases. The sulphur and metal remain in the solid condition and the oxygen is absorbed so that the sulphur, metal and oxygen enter into combination to form a solid substance at the working temperatures, and the sulphate of each metal forms at some minimum temperature and breaks up at some maximum temperature. These minimum and maximum temperatures occur with the different metallic sulphates with sufficient difference of temperature, so that, by maintaining a steady selected temperature, we can produce the salt of the desired metal, while the others either are not formed or are broken up; thus, by maintaining the amphidizer at 550° C., the iron and aluminum sulphates, if formed, are again broken up, and the copper, zinc and silver sulphates are formed and remain as such. Furthermore, it is not important with which metal the sulphur is combined at the start, for it will pass to those metallic sulphates which can exist at the selected temperature. Thus we have an apparatus capable of selective sulphating, a steady temperature being absolutely necessary.

The name first considered for this apparatus was "sulphater" or "sulphator." These names did not seem euphonious; then, it was my wish to have a distinct name that in time might become by use more specific and apply to a regenerative, selective sulphator.

The amphidizer, when fed with ore of constant composition, remains at constant temperature. With ore of 3% sulphur in the form of sulphides, no stoking is necessary, as the heat generated maintains the temperature; therefore, the attendance is almost nil, and a change of 10° C. in an hour is unusual. The ore leaves the amphidizer at about 120° C. higher temperature than it enters, so that anyone can calculate for himself the amount of heat units restored to the ore by regeneration of the ore, independent of the gaseous regeneration.

It is modestly hoped that the metallurgical fraternity will accept the name. It is not claimed that the amphidizing reactions are new, as the Ziervogel process with silver ores utilized the selective temperatures as early as 1841 and many workers have devoted much time to determining specific temperatures for each sulphate.

CHARLES S. BRADLEY.

New York, Feb. 28, 1912.

Where the Primer Should Go

In the JOURNAL of Mar. 2, in discussing where the primer should go, Clarence C. Semple states that "when using ordinary fuse there is but one place for the primer: the top or last cartridge to be inserted." That is generally the worst possible place for it, for the reason that, in firing a round of holes, one of the first holes to go is sure to knock the collars off several of the others, tearing out the caps and causing misfires.

In a drift round of 10 to 14 holes, average depth 5 ft., with a load of four to nine sticks of dynamite per hole, the cap should be inserted in the second cartridge placed in each hole. Then, if the cut holes knock the collars off some of the others, only the burnt portions of the fuses will be torn out, and the holes will still go in their proper order.

Similarly, in a stope round, with a charge of anything less than four sticks to the hole, the cap should be inserted in the first stick placed in each hole.

Loading in the above manner, I have repeatedly fired drift rounds of 10 to 14 holes, and got the full number of reports. In one instance I fired a round of 30 holes, average depth 3½ ft., average load three sticks of 40% powder, in a narrow stope where each pair of holes had to make room for those following; got 30 reports and found a clean break when I came back the next shift. Mr. Semple's fear of the dynamite catching fire from the fuse is unfounded. There are very few burnt holes nowadays.

His mention of the advantage of delayed-action electric caps is worth following up. They should do excellent work in drifting, but are not applicable to all phases of blasting in stopes.

HARVEY S. BROWN.

Victor, Colo., Mar. 7, 1912.

Absorption of Gold by Retorts

The reference made to the absorption of gold by cast-iron retorts in the JOURNAL of Mar. 9, 1912, recalls an observation I once made of a broken retort that had been in use for three years, and in which probably not more than 40,000 oz. of amalgam had been retorted.

The bottom of this retort had cracked off in a clean circle at a point about 2 in. above the bottom. The gold absorbed was enough to impart a distinct coloration to the inner layer of material, and this coloration was quite uniform to a depth of ⅛ in., but there were places where it extended downward almost to the outside of the cast-iron. No assays were made to determine how the gold was distributed, but it appeared to be a coating on the grains of iron.

AMALGAMATOR.

Baltimore, Md., Mar. 12, 1912.

Screening Ore Samples

In the JOURNAL of Mar. 2, 1912, an item under "Metallics," says: "An iron washer, or small weight, free to move on a laboratory screen, greatly hastens the screening operation." This will indeed hasten the screening operation, but in many cases it is an unwise proceeding. The washer or weight exerts a grinding action on the wires which wears out the screen unduly. It also displaces the wires and ruins the mesh. I have even heard of the washer being used in making screen analyses. In such a case it is absolutely fatal to accurate results.

FREDERIC P. DEWEY.

Washington, D. C., Mar. 4, 1912.

New Lake Milling Plans

The long-rumored plan for the rearrangement of milling facilities for certain of the Lake mines has been announced by the Calumet & Hecla company, simultaneously with the issuance of the annual reports for 1911 of the Isle Royale, Superior, Tamarack, Allouez and Centennial companies. Simultaneous publication is said to have been made in order that no stockholder of any of these companies should have advance information relative to the new arrangements planned.

THE PLAN

The sale of the Tamarack, 2-head mill is recommended, together with 30% of the stock of the company owning the pumping and lighting equipment of the Osceola and Tamarack mills. If this is approved. the opportunity of purchasing this equipment, millsite and stock for $230,000 will be offered to the Lake Milling, Smelting & Refining Co., the latter company being owned jointly by the Allouez and Centennial companies. It is further planned to remodel these two Tamarack heads, to erect from one to three additional heads and to remodel two or three of the old heads at the present Allouez-Centennial mill. It is stated that the present site of this mill, owned by the Lake Milling, Smelting & Refining Co., is well suited for the shipment of rock from the Superior, Isle Royale and Hancock mines.

The present stock of the Lake Milling company, 100,000 shares, all owned by Allouez and Centennial, will be increased to 250,000 shares and 108,000 will be sold from time to time to the above mines to provide funds for the purchase of a portion of the Tamarack millsite, as well as for the necessary remodeling and erection of new heads.

TRANSPORTATION COSTS

It is stated that the cost of transporting the Allouez and Centennial rock to the present mill is a large item, Allouez now paying 16c. per ton and Centennial 14c. It is expected under the proposed arrangement to reduce these to 12 and 9c., respectively. The plan reserves to these two companies a stock interest which assures the right to five stamps and involves no expense unless at some future time additional stamping capacity is required.

The Isle Royale will purchase a $140,000 stock interest in the Lake Milling company, assuring the use of two heads. This will make available in the spring one additional head for the Isle Royale company and a second one before the end of the year. It is stated that the cost of adding to Isle Royale's present mill would be more than the above and that further saving can be effected in construction and operating costs. These, with the profits from immediate increased production offset the added charge for transportation to the Lake Milling company's mill. Isle Royale's earnings for 1911 were more than sufficient to make this purchase. The Superior company will pay $240,000 for its stock in the Lake Milling company and the necessity for this company to construct a new mill is obviated. The whole scheme is stated to be a rearrangement of milling facilities which would seem to work to the advantage of all and to the disadvantage of none; that it involves a minimum cash expenditure and that it is difficult to see in what way any company is treated unfairly.

The announcement does not so state but it is evident from the foregoing, that the treatment in one mill of amygdaloid rock from more than one mine is less objectionable than formerly.

The Boston *News Bureau* summarizes the plan as follows:

(1) The sale of a portion of the Tamarack mill to the Lake Milling, Smelting & Refining Co., for $230,000.

(2) The purchase of 108,000 shares of the increased capital stock of the Lake Milling company (at present owned jointly by Allouez and Centennial) by Isle Royale, Superior and Hancock.

(3) Isle Royale secures additional mill capacity at small expense, although ore transportation costs will be somewhat higher.

(4) Superior is saved the necessity of constructing and financing its own independent mill.

(5) Allouez and Centennial secure adequate milling facilities and their ore transportation costs are materially reduced.

(6) Tamarack secures a purchaser for a portion of its mill, no longer demanded for its own use, and is provided with funds for the construction of a recrushing plant.

(7) No new financing by any of the five subsidiaries is involved and new cash requirements are comparatively insignificant.

Legislation Affecting Mining

WASHINGTON CORRESPONDENCE

Representative French has offered the following bill (H R 18,657), which was referred to the committee on mines and mining:

> That sections 2324 and 2325 of the Revised Statutes be amended so that the labor required to be performed or improvements made upon mining claims shall be regarded as coming within the provisions of the law when not to exceed one-half of the labor performed or improvements made shall be upon roads and highways leading to the mining centers in which said claims are located or to the particular claims in question from the public thoroughfare.

Senator Poindexter's bill to amend the Bureau of Mines Act was read twice and referred to the committee on mines and mining. Its provisions are practically the same as those in Representative Foster's bill, published in the JOURNAL of Mar. 9, 1912, except it is definitely stated that the compensation for the services of an engineer or expert outside the Bureau of Mines shall not exceed $10 per day.

Guggenheim Exploration Co.

In a statement sent to the stockholders of the Guggenheim Exploration Co., dated Dec. 30, 1911, the assets and liabilities were shown as in Table I. Analysis of this statement shows a surplus of $23,474,178, an increase of $8,349,589 for the year. Of this increase $6,747,149 represents the net proceeds from the sale of American Smelters Securities Co. common stock. Table II shows the increase for the last three years in the surplus, total profits per share, and profits in excess of dividends.

TABLE I. FINANCIAL STATEMENT, 1911

ASSETS	
Treasury stock	$1,206,700
American Smelters Securities Co., "A," 154,000 shares	13,860,000
American Smelters Securities Co., 6% bonds, at par	1,500,000
*Esperanza, Ltd., 3016 shares	15,094
*Utah Copper Co., 404,504 shares	9,161,767
*Yukon Gold Co., 2,769,639 shares	9,883,088
*Alaska Yukon properties and equipment	1,170,230
*Miscellaneous investments	831,179
Furniture, fixtures and equipment	2,704
Bills and accounts collectible	121,483
Cash and demand loans	7,721,933
	$45,474,178
LIABILITIES	
Capital stock	$22,000,000
Surplus	23,474,178
	$45,174,178

*Carried at cost

TABLE II.—PROFITS

Year	1909	1910	1911
Surplus	$13,857,065	$15,124,589	$23,474,178
Profit	11 0%	16.1%	17.7%*
Dividends	2,074,840	2,079 330	2,079,330
Profit in excess of dividends	213,376	1,267,524	1,602,440*

*Exclusive of sale of American Smelters Securities common stock.

Since the actual value of the shares of the company is in excess of the book value, the directors have decided, in response to inquiries from a number of stockholders as to the present value of their shares, to publish the actual number of shares of the various securities held by the company, with the exception of the comparatively small item of miscellaneous investments. thus enabling stockholders to approximate for themselves the present value of their shares, based upon the market value of the company's holdings, but exclusive of good will.

The Canadian Mining Institute

The fourteenth annual meeting, held in Toronto, was highly successful; there was a large attendance and many valuable papers were read and discussed. The Cobalt and Porcupine districts were visited.

The fourteenth annual meeting of the Canadian Mining Institute was opened at Toronto, Mar. 6, by an address from Hon. W. H. Hearst, Minister of Lands, Forests and Mines of Ontario, who spoke at some length on the mineral industry of the province, its past history and prospects. A letter from the governor-general of the Dominion, regretting his inability to attend was read by the secretary.

President's Address

Dr. F. D. Adams then delivered his presidential address, in which he expressed great satisfaction at the extraordinary progress of the mining industry and the increasing part the institute was taking in its welfare. He had to announce a slight decrease in the mineral output of the Dominion, but that could be attributed entirely to the strike of coal miners in British Columbia. The provinces of Ontario and Quebec had shown a marked increase. As they had chosen him, a geologist, as their president, Dr. Adams said he thought he could not do better in his presidential address than show the aid the geologist had given in advancing the growth of economic mining. The president then proceeded to cite instances all over the continent where the predictions of the geologist had led to exploration and the production of vast mineral wealth. In the future, he thought, the information the geologist could give to the prospector in the north of Canada would be of even greater benefit than it had been in the West in past days.

An innovation proposed was a semi-annual meeting for the Western members of the institute, who might not be able to come as far East to the annual meet. He was also pleased to notice the growth in the branch movement. The institute had played a very important part in the framing of a code of mining laws for that part of Canada, where mineral lands were still under federal control. He was pleased to announce that the membership of the institute had grown from 850 to 945 during the year.

Several amendments to the bylaws were presented and discussed. The mineral statistics for 1911 were presented by J. McLeish, of the Department of Mines at Ottawa; T. Dennis, superintendent of mines for Quebec; Thomas W. Gibson, deputy minister of mines for Ontario, and E. Jacobs, for the Province of British Columbia.

At the afternoon session several papers were presented, including the "Ore and Coal Bearing Formation of the Yukon," by D. D. Cairns; "International Coal Competition," by Allen Greenwall; "Mining and Milling of Asbestos," by J. Penhale; "Anticlinal Theory of Petroleum Deposits," by Eugene Coste; "Manganese of New Ross, N. S.," by H. F. Kramm, and "Tungsten Deposits of Nova Scotia," by Victor G. Hills.

The evening session was devoted to accident prevention and safety in mines, a paper on that subject being presented by Dr. W. H. Tolman, of New York; Dr. C. H. Hair read a paper on the "Sanitary Condition of the Mining Camps," in which he urged the supervision of location and sanitation by the provincial boards of health. The discussion took a wide range and was joined in by many members.

Thursday's Session

The papers on Thursday morning included: "Concentration of Silver-Lead Ores," by S. S. Fowler; "Concentration of Silver Ores of the Cobalt District," by Prof. Robert H. Richards; "The Evans-Stansfield Electric Furnace," by J. W. Evans; "The Concentration of Iron Ores at Moose Mountain, Ontario," by F. A. Jordon; "Recent Improvements and Additions at the Canadian Copper Co.'s Works, Copper Cliff, Ont.," by David H. Browne; "Monel Metal," By Dr. William Campbell, New York; "The Hardinge Mill," by H. W. Hardinge, New York. There were brief discussions on several of these papers.

Geology and Mining

The papers read at the Thursday afternoon session included: "Some Characteristics of the Gold Bearing Veins of Nova Scotia," by E. Percy Brown; "The Domes of Nova Scotia," by T. A. Rickard; "The Origin of the Quartz Veins of the Porcupine District," by Dr. A. E. Barlow; "The Origin of the Porcupine Gold Deposits," by Reginald E. Hore; "The Newer Diabase in Preissac and Adjoining Townships of Quebec," by Dr. J. A. Bancroft; "The Coppermine Country," by J. B. Tyrrel; "Origin of the Ores of Cobalt," by Carl Reinhardt; "Cobalt, Its Past, Present and Future," by C. A. O'Connell.

Two or three of the geological papers called out sharp discussion, the tendency to depend on geology being sharply attacked by Prof. H. E. Haultain. In the evening there was a smoking concert, which was largely attended and much enjoyed.

The Friday Sessions

At the morning session, J. Parke Channing, of New York, read a paper on the "Miami Copper Mine," giving an interesting history of the development of that mine.

Other papers were: "The Decrease in Values of Ore Shoots with Depth," by F. L. Garrison; "Industrial Education for Miners," by F. H. Sexton; "A New Departure in Mining Education," by H. G. Carmichael. There was discussion on several of these papers, especially that of Mr. Garrison.

Workmen's Compensation

This subject was brought up and after some discussion the following resolutions were adopted with regard to the proposed compensation act:

"(1) That the workmen's compensation act be placed in the hands of a commission to be appointed by the Crown.

"(2) This commission shall collect a definite amount from each mining company, based upon the monthly payroll and proportionate to the risk incident to the business.

"(3) These amounts should be contributed by the employers and should not be collected directly or indirectly from the employees.

"(4) The distribution of this fund shall be in the exclusive control of the commission, from whose decision there should be no appeal to ordinary courts.

"(5) There shall be no liability except under the act, all common-law liability to be expressly excluded. We recommend the study of the Washington act, chapter 74, of 1911, and also the New Zealand act, with the Russian schedule of payments."

At the Friday afternoon session the following papers were submitted: "Use of Geology in Iron Ore Exploitation," by Dr. C. K. Leith. "Glaciation and Its Effect on Mineral Veins," by J. B. Tyrrel. "Additional Notes on the Formation of Contact Zones in Limestones," by Dr. J. F. Kemp. "The Classication of Sudbury Ore Deposits as Affected by Faulting," by Dr. A. P. Coleman. "Conservation as Affecting Mining," by James White. "Mining Laws," by Horace V. Winchell. "Company Law," by J. M. Clark.

In the last session of the meeting, on Friday, Mar. 8, papers were also read by W. R. Ingalls and Waldemar Lindgren. Numerous members participated in the discussion of the papers read at the various sessions.

Officers Elected

At the close of the session the secretaries reported that Dr. Alfred E. Barlow, of Montreal, had been elected president, having received a majority over his opponent, G. G. S. Lindsey, of Toronto. The other officers—chosen without opposition—were: Vice-presidents, Arthur A. Cole, Cobalt; R. H. Stewart, Trail, B. C.; Councillors, H. R. De Pencier, G. Herrick Duggan, Charles Fergie, W. S. Johnson, Montreal; J. J. Penhale, Sherbrooke, Que.; W. F. Ferrier, Toronto; R. W. Brigstocke, Cobalt; Charles E. Watson, Porcupine; Robert R. Hedley, Vancouver, B. C.; D. B. Dowling, Ottawa.

Arrangements for the Meeting

The arrangements for the meeting were in the charge of W. F. Ferrier, chairman of the local committee, and, as usual at meetings of the Canadian Mining Institute, everything was well arranged in advance, and all plans were carried out in a smooth and agreeable manner. The headquarters of the meeting and all of the sessions were at the King Edward Hotel.

Among the social features were a reception at the mansion of the lieutenant-governor of Ontario, and a "smoker" at the King Edward Hotel. The leading feature of the latter was a quasi-lecture by Prof. J. F. Kemp, describing "how he discovered the North Pole." This story, which was illustrated by lantern slides, was delivered with the wealth of imagination and dry humor for which Prof. Kemp is famous. On Friday afternoon, Mrs. J. B. Tyrrel received the members at her home, and in the evening there was the annual banquet of the institute, this being at the King Edward Hotel.

The Cobalt-Porcupine Excursion

After the meeting, a party of members and guests were taken to Cobalt and Porcupine under the auspices of the institute, and by the courtesy of the Ontario government, which provided railway transportation and accommodations. This party comprised Dr. A. E. Barlow, Dr. W. G. Miller, Dr. R. W. Brock, Col. A. N. Hay, Prof. F. H. Sexton, and Messrs. A. A. Cole, Theodore C. Denis, W. F. Ferrier, H. Mortimer Lamb, E. Jacobs, W. R. Ingalls, Henry Kehoe, Alex. Smith. B. Hughes, T. A. Rickard, Theodore F. Dwight, F. Lynwood Garrison, H. W. Hardinge and R. V. Norris.

Visits were made to the properties of the Hollinger and Dome companies at Porcupine, and to the Temiskaming, Crown Reserve and Coniagas, at Cobalt. The managers and staffs of all of these mines were hospitable in their entertainment and painstaking in their efforts to assist their guests in obtaining a clear understanding of natural and technical conditions existing at the several properties that were inspected.

Quincy Mining Co.

The Quincy Mining Co. finishes its 44th consecutive year as a dividend payer, and has paid dividends in all 48 years, with a total of $19,880,000. In the year ended Dec. 31, 1911, 32,550,440 lb. of "mineral" containing 22,252,943 lb. of copper was obtained from 1,382,524 tons of "rock," or 16.1 lb. of copper per ton of rock. This copper was sold for 12.725c. per lb. or $2,831,799, profits of $23,005 were derived from silver sales, and $17,859 from miscellaneous sources. Expenses were as follows: Mining expense, $1,786,460; opening mine expense, $223,178; taxes, $50,186; smelting, transportation, etc., $198,662; construction cost, $106,581; leaving $507,597 as profit.

Development is still well ahead of stoping, and the deepest openings in the mine show rock up to the average of recent years, giving rise to the belief the good copper ground will continue to the maximum working depth. The average depth on the dip of the lode is about 5200 ft. compared with 8600 ft. in the deep workings of the Lake Superior mines.

The most notable change in methods in the Quincy mines is the substitution of small light-weight drilling machines using high-pressure air for the heavy machines previously used. About 100 of the new machines have been installed. A new compressor takes air at 60 lb. from the old machine and compresses it to 100-lb. pressure.

It is stated that Dr. R. H. Richards has been studying the concentration problem exhaustively at the stamp mills during the last year and has shown that a better saving of copper can be made by more careful hydraulic classification. To this end. No. 3 classifier is being rebuilt, from which interesting results are expected. A new small jig has also been designed and built which develops great capacity for its small size; a classifier has also been designed and is being built.

Iron Works in the Transvaal

A consular report from Johannesburg says: "The formation of the Union Steel Corporation, of South Africa, Ltd., marks an interesting stage in the industrial progress of South Africa. It is proposed to establish iron and steel works and rolling mills at Vereeniging in the Transvaal, and the company is already assured of influential support. The government of the Union of South Africa has entered into an agreement with the company whereby the corporation acquires the preferential right to purchase iron and steel scrap from the government railways and shops for 16 years, at £1 per ton, for the whole of the Transvaal, and a large district south of it, and at satisfactory prices for the remainder of South Africa. The government has also agreed during the same period to increase the railway rates on exported scrap and to grant the corporation a reduced rate for transport of their scrap to the corporation's works, and also to place their orders for such iron and steel goods as the corporation produces with the corporation. The agreement provides that the company shall erect and install the necessary works for the business, and take delivery of the scrap within the times provided by the agreement. The company is also required after the third year of its beginning manufacture to make certain experiments in smelting, working and treatment of local iron ores. The government reserves the right to nominate one director on the board."

Determination of Sulphur in Sulphide Ores

By Stuart S. McNair*

A method which does not seem to be given wide enough mention in the text-books, for the determination of sulphur in sulphide ores, such as heavy chalcocities and pyrites, is the following:

Fuse 1 gram of finely ground sample, well mixed and covered, with about eight grams of sodium peroxide in a nickel or silver crucible. Start the fusion at a low red heat and gradually increase the temperature of the fusion to the full flame of a bunsen burner. The fusion is completed when the surface is quiet, and the substance is decomposed. When cold, the fusion is leached with a weak solution of potassium chlorate to convert any sulphides, formed during fusion, to sulphates. Filter off the residues, and wash well with hot water. Discard the residues, acidulate the solution with HCl, dehydrate the silica, and proceed as in the ordinary determination for sulphur.

[The method is not widely given in English textbooks. It is referred to in Lunge's "Methods of Technical Analysis," Vol. I, p. 276. It scarcely seems necessary to oxidize with potassium chlorate after a sodium-peroxide fusion. If oxidation is necessary, the use of bromine would probably be preferable (cf. Furman's "Manual of Assaying"—Fahlberg-Ile's method). The bromine should be tested for sulphur, and the solution should be boiled after acidulating to expel any excess. It would probably be necessary often to use a diluting medium, say sodium carbonate or chloride, to prevent explosions (cf. Fresenius "Quantitative Analysis," which recommends fusion with niter and an inert sodium salt). The method as given fails when barium is present in the ore, unless some sodium carbonate is used in the fusion.—Editor.]

---

*Stanford University, Calif

Details of Practical Mining

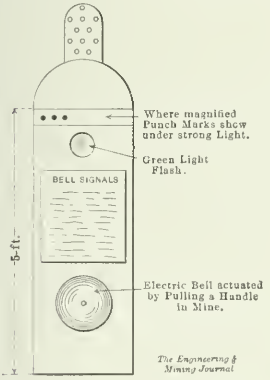
Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

An Electric Signal Device

By P. B. McDonald*

Two German signal devices for hoisting, the general scheme of operation of which is shown in the accompanying illustration, have been installed in the Negaunee mine hoist house. When a man in the mine pulls the signal handle, two things happen in the engine room. The electric bell rings and a strip of paper resembling a stock exchange ticker tape is punched with a hole. By means of a strong magnifying device and mirrors, a magnified reflection of the small hole punched in the strip of paper appears in a horizontal aperture. Thus if the hoist engineer is not sure of the number of bells which were rung, a glance at the black circles tells him, also the strip of paper serves as a permanent record in case a dispute arises as to the signals that were given. In addition to these electric signal devices the old style mechanical bell will probably be installed, for use when the electrical apparatus is out of order. The green light flashes only when the paper strip of the punch-mark mechanism is exhausted.


Where magnified Punch Marks show under strong Light.
Green Light Flash.
BELL SIGNALS
5-ft.
Electric Bell actuated by Pulling a Handle in Mine.
The Engineering & Mining Journal

A German Signaling Device

Treatment of Copper Mine Water

At the Ashio copper mine of the Furukawa Mining Co., in Japan, the mine waters[1] are run over scrap iron, precipitating most of the copper as cement copper, and leaving iron sulphate with some copper sulphate in solution. This water is then used in the concentrators, after which it is run into a river which is used for irrigating rice fields. Consequently, it is necessary to clarify the water before it is discharged. The discharge amounts to about 600 to 700 cu.ft. per min., and averages about 0.00025% of copper. The water is run through three settling ponds, in the first of which slime and sand settle. In the second and third there is a slight precipitate of metallic hydrates, carrying some copper, and slime high in silica. The copper in this deposit runs from 0.5 to 1%. In the fourth pond milk of lime is then run in, in quantaties from 10 to 20% of the amount required for complete neutralization and precipitation of the sulphate in the water. This causes a precipitate to settle which is mostly hydrated iron oxide and free from copper, since there are five to six times as much iron in the solution as there is copper. The iron precipitate also carries down down with it most of the colloidal slime in suspension, consisting mostly af alumina and silica. The water is then run into a fifth pond, where the lime necessary for complete recipitation is added. This precipitates the metallic hydrates completely, the precipitate settling in this pond and in a sixth, from which it is run over a sand filter before it is discharged. The average of three analyses on the precipitate in the fifth and sixth ponds was as follows: Cu, 5.78%; Fe, 12.91; CaO, 6.76; Al_2O_3, 4.70; Mn, 4.40; SiO_2 11.25; loss on ignition, 30.90%: This precipitate is, as can be seen, rich enough to be smelted. The process saves about 18 tons of copper per month and gives a clear waste water which is not injurious to agriculture. The method is not patented.

Replacing Survey Monuments

By James A. Seager*

It not infrequently happens that the mine surveyor has to superintend the removing and the subsequent replacing of the boundary monuments of a mining claim or concession, and it is obvious that the replacement must be made so that the monuments are in precisely their former position. A practical method of insuring this may therefore be noted by means of an example.

On one occasion it was found necessary to take up some boundary monuments which were close to a hedge, and to bury them in their old positions, as it was found necessary to do away with the hedge and level the ground for the purpose of widening the road. The method adopted can be easily understood from Fig. 1 in the accompanying sketch. Considering the method adopted for boundary monument No. 16, a peg was driven into the grass by the roadside at *A* and another peg was similarly placed at *B*. The distances from these pegs to the monument were then carefully measured and noted. The other monuments were then dealt with in a similar manner. The contractor in charge of the work was then told to remove the monuments, putting them carefully to one

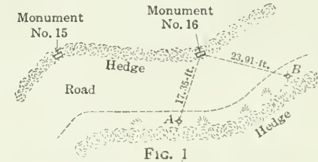


Fig. 1

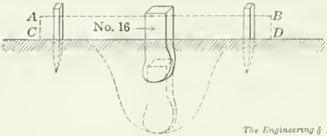


Fig. 2

Method of Lining in Survey Monuments

---

*Mining engineer, Negaunee, Mich.

[1] Abstract of paper read at the New York meeting of the A. I. M. E., February, 1912, by J. W. Richards, of Lehigh University

*67 Belmont Road, St. Andrews, Bristol, England.

side, level the hedge and sink the necessary pits, and then to let the surveyor know when the job was finished.

At the appointed time the surveyor proceeded to the spot with tapes and the necessary assistants. The tapes were then held on their respective pegs according to the measurements noted, and were stretched out to the full. The position of the monuments as standing in the pit ready to be covered up were duly verified and the work was certified to be correct. The method adopted by the contractor to get the stones into their right positions is interesting and was as follows. Long wooden pegs were driven on each side of the monument, but well clear of them so that all three should be in the same straight line. This was, of course, done before the monument was in any way moved. A plank *ABCD* (Fig. 2) was next placed in the position shown by the dotted line and the position of the pegs and monument was marked upon it. Then after this the monument was taken up and the pit excavated, the stone was placed in the bottom of the pit and it was then an easy matter by means of the pegs, the plank, and a plumb line to insure that all was correct, this being afterward verified by the surveyor's check described above.

Rust Proofing Iron or Steel

The Bradley process of rust-proofing iron and steel as described by Percy S. Brown in the *Metal Industry* consists in forming an unoxidizable coating on the surface of the metal. This is done by heating the iron or steel objects in a muffle furnace heated with coal or coke. After introduction of the objects into the furnace the doors are sealed with brick to exclude air. A jet of hydrogen, made by decomposing steam, is passed into the muffle to mingle with a stream of kerosine that is forced into the muffle under pressure. The iron or steel objects become coated with a carbon and iron compound which has a blue color when the objects are withdrawn from the furnace. When cool, a thin coating of linseed oil is applied which changes the color to deep black.

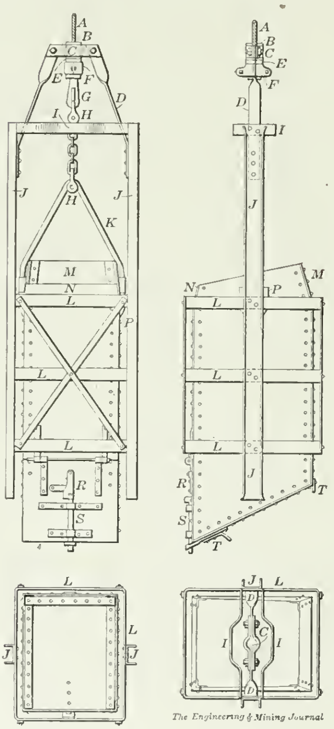
In appearance the coating much resembles that produced by the Bower-Barff process. The thickness of the coating or the depth of its penetration into the iron or steel depends upon the length of treatment in the furnace. The coating is very hard, having a hardness of about 9, and can be finished so as to have a high luster.

According to the report of the Department of Mines of Western Australia for the year 1910, there were 58 gas engines in use in mines developing 607 hp., while 2033 hp. was developed by 420 oil engines.

Skip for Cleaning a Choked Shaft*

CYRIL BRACKENBURY

The skip and rider frame shown in the accompanying illustration was designed for use in unwatering and cleaning out the Harvey shaft of the old Treasavean mine in Cornwall. It was desirable to use a small temporary compartment measuring 3 ft. by 3 ft. 2 in. in the clear and made by dividing the permanent ladder and pump-column compartment in two. The two main hoisting compartments were occupied, at the time this skip was in use, by the electrically driven turbine pumps. The shaft was choked in several places and a skip was required which could be used in raising the old timbers, broken pump-rods, and pipes found in the choked shaft.



SINKING SKIP WITH RIDER FRAME

The skip and rider frame arrangement was specially designed to fit the peculiar conditions and requirements of the case and as it was found to answer most satisfactorily from the start, it facilitated the work, and effected a saving of time and labor. The channel iron *J*, which formed the chief portion of the rider frame, acted as guide and ran on 4x2-in. guide rods, fixed in the skipway. The rectangular iron frame *L* incased the skip or any other large and heavy body which was to be raised or lowered in the shaft. The top horizontal bars *I* were used to stiffen the frame and also as a safe step on which two men could stand to ride on the frame when it was traveling in the shaft; *C*, the top connection of the rider frame, when unbolted allowed the frame to be taken off the rope; it also encased the beechwood bushing *B* in the form of a reel, through which the wire rope passed; *D*, a rubber pad fitted into the cast-iron casing *F*, and formed with it a buffer between the rope socket and the rider frame. The iron casing *F* was made a comfortable fit for *G*, the rope socket.

The sinking-skip had a capacity of 24 cu.ft., and was made with a sloping bottom, so that the contents could be easily discharged after merely knocking up the door catch. The special feature about the skip was that it had no guides of its own, but was dependent upon the rider frame to carry it safely through the skipway, and as it was rectangular in shape, it could not revolve in the frame like an ordinary sinking bucket with crossheads. For the size of the shaft compartment it was possible to make it of much larger dimensions and capacity than an ordinary sinking bucket could be, and it was more easily discharged. The skip was made to pass easily in and out of the rider frame by the suitable shape of the bail *K* with the trunnion shield *P* and the sloping top *M* and *N*. The small rings *T* at the bottom of the skip were put there to pass a rope through in case it should be needed to help in guiding the skip into the frame, when moving up from the bottom of the shaft, but it was never found necessary to use a rope for this purpose.

This particular form of skip has the following advantages over an ordinary sinking bucket:—It has a larger capacity; it is more easily discharged; it will not revolve in the frame, and hence is safer and better for men to ride on, and not so injurious to the rope. The rider frame has the following advantages over the ordinary crosshead bucket-guide:—It is a safer guide in a confined space; it has sufficient weight to travel down the shaft on the end of the rope by itself; two men can quite safely ride on it alone; it is particularly suitable for drawing up large materials, such as pump rods, column pipes, etc., in a confined space. An ordinary skip would, of course, be most inconvenient and unsuitable for working continually below the guide rods and repaired portion of the shaft, as is the case with unwatering operations, and, with a very small space left for temporary winding purposes, an ordinary bucket and crosshead guide would have been very inefficient and inadequate.

---

*Excerpt from an article entitled "Unwatering Tresavean Mine," Bulletin 88, I. M. M.

It can be easily understood how safely and conveniently other large and heavy material could be drawn up instead of the skip, providing it were possible to make one end enter the frame of the rider. By means of the rider frame and rope passing through it, it was possible to draw up the old pit work from the shaft quickly and conveniently. The combination skip and rider frame carried eight men, as follows, four inside the skip, one standing on top of the front end *N*, one on top of back end *M* and two facing each other on crossbar *I*. This number made a fairly close fit, but was quite safe for traveling in the skipway compartment of the shaft. A small bogie was used to remove the skip and rider frame from the skipway whenever the man cage was to be attached to the rope, which, however, was rarely done. The weight of the skip was about 650 and of the rider frame about 450 pounds.

Photographic Reproduction of Tracings

Engineers often find it necessary to make letter-size reproductions of tracings. A cheap and simple method of making a reproduction is given by G. W. Gilkison in *Engineering News* as follows:

The tracing should be gone over, making all lines and letters opaque. When ready, pick out a window (preferably one facing the north) that is larger than the tracing, so that no shadows will be cast on the edges, and in front of this stretch a sheet of tracing paper or cloth. Over this stretch the tracing to be reproduced, being careful to remove all wrinkles from both diffuser and drawing. If this is properly done the light should be evenly distributed and there should be no shadows.

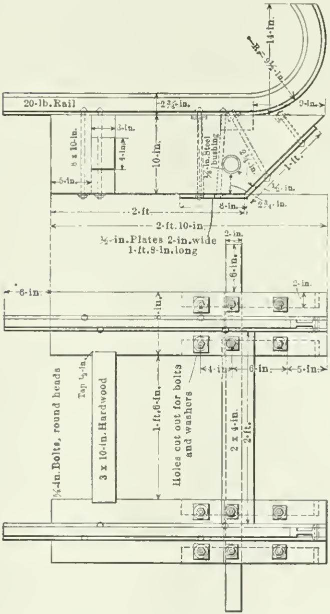
To obtain an idea of the exposure, hold an actinometer, face to the window, and note the time as per instructions. Make about four exposures on a plate by pulling the slide out different distances, using the smallest stop. When developed, if the correct exposure is not within the limits chosen, try again. After the correct exposure has been found, note the relation to the actinometer time. This relation will be a constant and can be applied to all actinometer times to find the exposure, provided the same plate and stop are used.

When a negative with contrast is desired, this may be obtained by using Cramer's contrast plates and Eastman's hydrochinone developer. Mix as directed, making the solution weaker if anything, as this tends to give contrast. With the above plate, develop until the image begins to show on the glass side, when, if properly exposed, the plate should be nearly opaque.

No special apparatus is necessary. A 10x12-in. box camera with a good lens and a few trays and bottles will do the work. It pays to get good negatives; this is all in the exposure. By using the smallest stop, good definition is obtained and the exposure is lengthened and can be more accurately timed.

Cradle for Dumping Mine Cars

At the Copper Range mines in Michigan the bodies of the mine cars are fastened tightly to the trucks so that cradles must be used to dump them at the shaft. In dumping on a level, as when filling a stope, the rails at the edge of the raise coming up from the stope below are bent down and then turned up into a hook to catch the wheels. In this way the body is allowed to drop enough so that the rock will slide out of the car.



The Engineering & Mining Journal

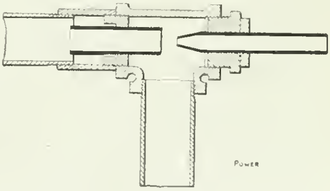
MINE-CAR DUMPING CRADLE

The details of the cradles which are made to template are shown in the accompanying drawing. Two strap-irons protect the front of the cradle timbers where they hit the floor of the station when the cars are being dumped. The axle on which the cradle turns is provided with collars to limit the side play of the cradle, while the axle is carried in strap bearings on two 6x6-in. timbers that extend back under the ties of the track so that they are securely anchored in place, and through them the cradle itself. Thimbles protect the cradle timbers from wear by the axle, and the rails on the cradle are turned up at the end so that the car cannot be pushed off into the shaft. In dumping, the front of the car either strikes the station floor or else the top of the skip if that happens to be raised a little too high, so that owing to its long body, the car cannot go over far enough to overbalance itself. Such would not be the case if the car had a short body like most mine cars used in the West.

In order to prevent accidents from men stepping on the cradles, the cradles, when installed, are always tested, even though made alike and according to template, and a cradle must be able to hold the weight of a man standing on the far edge without dumping. Otherwise a cradle might some time throw a man into the shaft when he happened to step on it. The car rests on the cradle in such a way that a little lift is necessary to dump it.

A Home Made Ejector

The accompanying sketch from *Power* illustrates the construction of a steam siphon or ejector that can be easily and cheaply made with a few common pipe fittings, and which may find application in some phases of the work about a mine. The suction pipe is 3 in. diameter while the outlet or discharge is reduced to 2½ in. The list of fittings needed is as follows: One 3-in. tee, one 3x1½-in. face bushing, one 3x1-in. bushing, one 3-in. pipe coupling, one 1-in. locknut (when a locknut is not at hand saw off a piece of a 1-in. coupling and use it as a locknut.) One 1½-in. nipple 6 in. long with the thread on one end long enough to permit it to be screwed through the face bushing to the center of the tee omitting the thread on other end, one 1-in. nipple drawn to a point with a ⅜-in. hole drilled into the small end.



SECTION SHOWING DESIGN OF EJECTOR

The 1-in. pointed nipple forms the steam nozzle and is screwed into the tee through the 3x1-in. bushing to within 1¾ in. from the 1½-in. nipple which forms the delivery nozzle. The 1-in. nipple has a long thread cut on the nozzle end to permit the adjustment of the nozzle as the siphon will not work unless it is properly adjusted. This can be done only by trying it, and when the nozzle is in the right place, the locknut is run up tight against the 3x1-in. bushing.

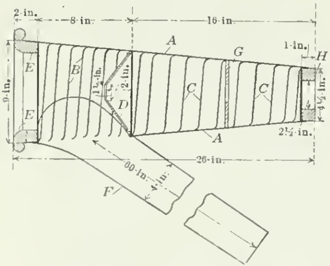
The nozzle works best when about 1¾ in. from the 1½-in. nipple, which forms the delivery nozzle. The 1½-in. nipple is screwed through the face bushing to the center of the tee.

About half the threaded part of the face bushing is screwed into the tee and the 3-in. pipe coupling is screwed on the other part. These siphons can be used for 12- or 15-ft. lifts throwing 2½-in. streams of water.

Another Dust Arrester

In discussing the schemes for allaying dust in the mines of the Rand before the South African Institution of Engineers, B. H. Lindhorst described the apparatus shown in the accompanying illustration.

The invention consists essentially of a conical canvas bag *A*, 26 in. long inclosing two separate conical springs *B* and *C*, 10 in. and 15 in. long respectively. These springs are contained in separate chambers formed by the conical partition *D*, made of hard rubber packing. *E* is a piece of felt one inch thick, four inches broad, forming a lining at the mouth of the bag and protruding two inches over the edge. This is attached to form a draft-tight joint between the edge of the apparatus and the working face. The diameter of the bag here is about nine inches. A canvas chute *F* over five feet long, leads away the dust to a bucket of water; *G* and *H* are circular wooden stays with holes in the center for allowing the drill to pass through. The other dimensions are given in the sketch. The spring *B* consists of eight rings and spring *C* of ten rings, thus making the former more powerful than the latter. The object of this will be seen later.



The Engineering & Mining Journal

A Collapsible Canvas Dust Collector

This device can only be used for the hammer type of machine drill. When the drill is about to commence work, the arrester is slipped over the steel and forced against the face. The air valve is then opened and the hole collared. If the hole is a water hole, the arrester is removed, and if a shoulder hole it is allowed to remain. As the hole deepens, the back chamber of the arrester closes up first, on account of the weaker spring, leaving the front chamber open for the free passage of the dust into the chute. As the hole advances further the fore-chamber also closes up gradually. When the starter has finished its work, the machine is turned back and the second bit inserted; the drill passing through the arrester. The same operation is again performed, until the hole is finished.

The rubber partition *D* is made conical so as to prevent the' dust from falling into the back chamber. The whole arrester when closed measures about three inches, that is to say, when it is used it takes away three inches of the depth of the hole. The total weight does not exceed 4 to 4½ lb., and the cost is slight.

Shifting a Bucket Dredge

It recently became necessary to shift the Stanthorpe Proprietary Dredging Co.'s bucket dredge about half a mile over dry land, says the *Australian Mining Standard,* Nov. 16, 1911. The work took about three months and a half. The buckets and tumblers were removed from the dredge for separate transport, but otherwise the barge was left intact. A rough track was prepared along the hillside for the dredge to travel on, it being run on hard-wood skids about 10x10 in. placed approximately two feet apart. Wire rope with suitable pulleys was fastened on the gantry framing of the dredge, taken out and passed around and connected to headers and thence back to the main hauling winch on the dredge.

Regular headers were not used at first, but the attempt was made to use trees and stumps instead, which usually pulled out as soon as the strain was put on them. The mistake was also made at first of attempting to use too light rope which constantly broke at critical moments. Later trenches were dug about 20 yd. apart and heavy headers put in. The weight of the dredge is 250 tons; the pull on the rope about 60 tons. At first, progress was slow, but toward the end of the journey an average advance of 60 ft. per day was maintained. Trouble was experienced throughout the period by the tendency of the skids to shift to one side when weight came upon them. The ground in some places also caused delay owing to its inability to stand the weight of the dredge.

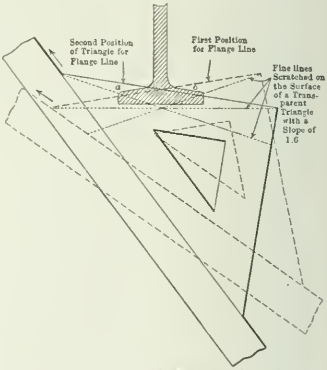
The total cost of the work was about £800 and the management claims that if it is necessary to remove the dredge again that the same method will be used. A suggested improvement is to lay a line of rails and mount the dredge on small wheels, as it is believed much work could be saved in the removing of the heavy skids.

A Suggestion for Draftsmen

By Carl Hanssen*

For drawing bevels, where much structural designing is to be done, the line scribed on a transparent triangle, as shown in the accompanying sketch, is a great time saver. It is preferable to scribe two fine lines with a slope of 1:6, leading from opposite corners of any side of the triangle.

Placing one of the bevel lines parallel to the bottom of the flange and shifting the triangle to the height required, the first flange line of I-beams or channels may be drawn; by placing the second bevel line parallel to the flange and shifting to the desired height, the other flange line may be drawn.


Second Position of Triangle for Flange Line
First Position for Flange Line
a
b
Fine lines Scratched on the Surface of a Transparent Triangle with a Slope of 1:6

The Engineering & Mining Journal

Scribed Triangles for Drawing Steel Flanges

This operation is much simpler than cutting the inner opening of the triangle to the desired slope, as was suggested in the Journal of Dec. 9, 1911, and besides has the advantage of permitting sketching the flanges on a large scale.

To facilitate the lowering of timber, pipes, rails, tools, etc., required on any level in an inclined shaft, a movable landing stage may be employed. It is hinged to the edge of the plat over the shaft and is raised or lowered by pulleys. When in use the upper end engages with the rails of the skip-road, thus closing the shaft. This serves a double purpose, as it guards against material being carelessly dropped into the shaft, which is always dangerous.

---

*Teziutlan, Puebla, Mex.

Details of Metallurgical Practice

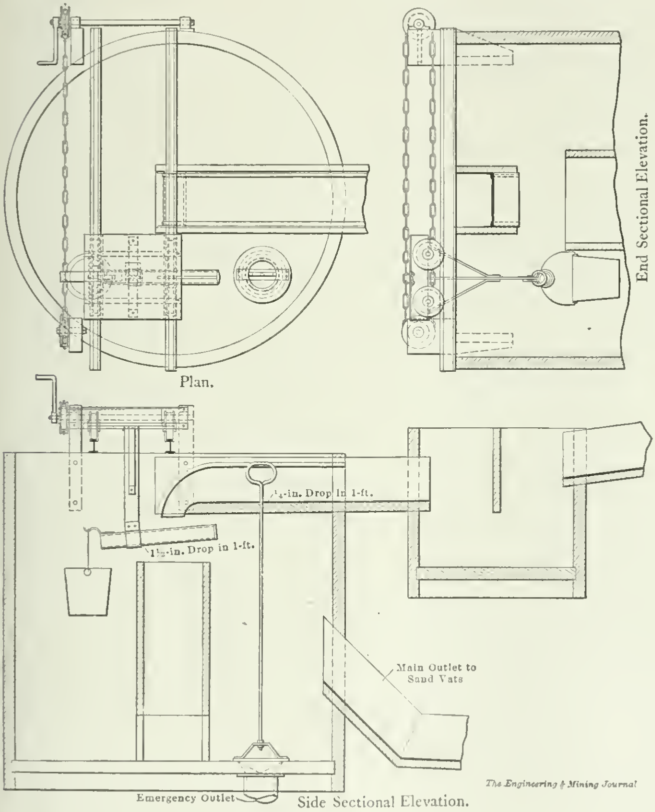
Records of Experience in Ore Dressing, Cyaniding and Smelting

Sampler for Cyanide Plants

The sampler shown in the accompanying illustration was designed by W. H. Todd, and has been in use for a year at the Homestake sand cyanide plants in the Black Hills. In designing the sampler several new features were introduced to correct the more obvious faults of the usual sampling devices, and while the equipment is rather elaborate the results obtained have been most satisfactory.

The features of the design to which particular attention was given are: A small fore-sump, provided to receive pulp from several converging streams, and to cushion the velocity of these streams, thus insuring a smooth and steady discharge of pulp to the sampling sump; an iron deflecting plate at the discharge end of the short launder, connecting the fore-sump and the sampling sump, to direct the stream sharply downward as it delivers the pulp upon the slotted sampling pipe, preventing splash and possible contamination of the sample, for which further protection is provided by a short open conduit, placed vertically and immediately below the sampling blade. The discharged pulp is in this manner conveyed quietly to the bottom of the sump, whence it passes to the leaching vats.

The slotted sampling pipe is brought to a sharp cutting edge on its upper face, and is sufficiently inclined to insure clearance of all particles of the sample. It is supported from a carriage resting on overhead rails and is actuated by a chain driven by a winch, which in the sampler illustrated is actuated by hand, but which might as readily be attached to any convenient source of power. By this arrangement the sampler is caused to move across the stream at a uniform speed, and with the slot always at right angles to the falling stream.



Homestake Sand-sampling Device

Gold Absorption by Amalgamation Plates

The question of the absorption of gold by amalgamation plates has again been taken up by G. H. Stanley and M. P. Murray (*Journ.* Chem. Met. and Min. Soc. of So. Africa, Dec., 1911). The plate examined by the authors had been in use in one of the mills of the Crown mine for 12 years, and was about 0.14 in. thick. It had been sweated and scraped, but not sealed, before being discarded. The under surface was also amalgamated. A portion of the plate, on assaying, showed the presence of 1.69% gold and 1.31% mercury. Successive layers 0.02 in. thick were taken off by a planer, particular care being taken to free the edges by filing from any contamination due to the salting of the edge by amalgam working over. The seven portions ran as follows in gold: 10.48%; 0.0166; 0.00505; 0.0084; 0.0084; 0.0041; 0.0145; 0.0018%. The first layer contained 9.39 % of mercury; the last, the lower amalgamated surface, 1.89%. Mercury was also present in all other cases, but in amounts too small for determination.

This shows that over 99% of the total gold was contained in the first layer of 0.02 in. From microscopic examination it appears that the gold which existed on the interior of the plate, had not truly diffused into it, but that the mercury-gold amalgam had simply entered into minute blow-holes existing in the original plate. However, the amount apparently held by the interior of the plate amounted to only about 0.25 oz., while the total gold for the plate amounted to about 46 oz. On the basis of these experiments true absorption is negligible, and the removal of the surface to a depth of 0.02 in. would give all the gold, which, from a mine point of view, would be worth recovering. This could be effected by the use of a large planing machine or by careful scaling or by several repetitions of sweating and scraping with hard scrapers with a fresh addition of mercury between each scraping. This latter method of cleaning recommends itself for use between short custom runs.

Colorado Mining Decisions

Denver Correspondence

Some important litigation was brought to a close recently when the U. S. Court of Appeals, sitting in St. Louis, Mo., affirmed the decision of Federal Judge R. E. Lewis in the apex case of the Doctor-Jack Pot Mining Co., of Cripple Creek, against the Work Mining & Milling Co., involving ore worth $2,245,000, alleged by the former to have been wrongfully converted by the latter. Judge Lewis entered judgment against the Work company and awarded title to the ores to the Doctor-Jack Pot company. Judge Lewis has also handed down a decision which throws out of court the Portland Gold Mining Co's suit against Stratton's Independence, Ltd., for the alleged wrongful taking of ores variously estimated as worth from $500,000 to $2,000,000.

The Supreme Court has handed down another important decision in the case of the Hart Consolidated Mining Co., which brought suit to restrain the assessor of Teller County from collecting taxes on the basis of the assessment made, alleging that he had violated the law in assessing the nonproducing 30 acres of the company at $540 per acre while the Morning Star, an adjoining producing mine, was assessed at only $125 per acre. Judge Gabbert, who wrote the opinion of the court, declares that the legislature has the right to define a producing mine as one having a certain output of ore annually. Although the limit of $5000 output, as fixed by the legislature, may be unjust to the mine owner who spends more than that amount annually in development, the court holds that it is difficult to frame any kind of assessment law which will not be unjust to some. The value of a mine, declares the court, depends on the output, and the value cannot be determined until the ore is mined. It is, therefore, stated to be just and constitutional to base the value of a non-producing property on the valuation of the lowest producer.

New Zealand 1910 Mineral Production

The report of the Dominion of New Zealand for 1910, recently issued, shows a total mineral production in that year of £3,774,898, a decline of £16,235 from 1909. Of this amount, the quartz gold mines contributed £1,564,189, while the total gold yield was 478,288 oz., valued at £1,896,328. The total coal output amounted to 2,197,362 tons, £1,219,737; kaurigum to 8693 tons, £465,044; silver, 1,711,235 oz., £171,562; and £22,227 is credited to miscellaneous minerals.

The Waihi Gold Mining Co. produced over one-half the yield from the quartz mines, viz., £894,815 worth, although for the first time this company showed a decrease in its bullion production, in spite of 25,207 tons more ore being treated. Alluvial mining suffered severely from prolonged drought in the South Island, the product falling off £157,210. The government decided to exploit the water powers of the country as state enterprises.

Rice and Scheftels Guilty

After their trial had dragged along for five months, George Graham Rice and B. H. Scheftels, of the Scheftels brokerage firm, pleaded guilty in the United States District Court in New York, on Mar. 7, to the indictments charging them with conspiracy and the use of the mails to defraud in seeking to create a market for certain stocks. Judge Ray sentenced Rice to serve a year in the Blackwell's Island penitentiary, the term to be counted as having begun on Dec. 29 last—the date on which Rice was locked up in the Tombs, after there had been a report of an attempt to tamper with a juryman in the case. Scheftels was freed under a suspended sentence. The indictments against the other defendants, Waterman, Belser and Stone, and against John Delaney, who had elected to be tried separately, were quashed.

In rendering his sentence, Judge Ray, addressing the defendants, said:

> This prosecution was instituted under a statute recently amended, and this case is the first of the kind as to the nature and character of the scheme to defraud ever instituted or prosecuted under it. It has been an important case to the Government and to the people of the country as a whole, and to the Post Office Department, which undertakes also to prevent the prostitution of the great institutions of our Government.
>
> The punishment of offenders is not the first consideration of counts in the administration of the criminal law.. It is beyond the power of any man or court to measure the heart of a man with any accuracy; his motives or his weaknesses. The main purpose is to vindicate the law, give the public to understand there is a law and that its provisions cannot be violated with impunity, and also to give a warning to those liable to offend that punishment is certain.
>
> In this case the main purpose of the law has been accomplished. Men will differ as to the wisdom of the course the court is about to pursue in the case of yourself, Mr. Rice, and of you, Mr. Scheftels. Many will think the sentence of the court is not adequate to the offense to which you have entered a plea of guilty, but the court takes the responsibility, remembering that "Vengeance is mine I will repay, saith the Lord," and that the certainty and not the severity of the punishment is the most certain preventive of crime. Long terms of imprisonment are essential when the offender is a confirmed criminal and dangerous to society, a dangerous man to be at large. In your case I do not regard a long term of imprisonment essential to either the vindication of the law or to the protection of society. The law is vindicated and the prosecution by the Government fully justified.

The Court then sentenced Rice and, addressing Scheftels, said:

> In your case, Mr. Scheftels, there is nothing that points to your having been engaged in any criminal matters heretofore, and I am glad of that. In consideration of that fact and of your years and the absence of proof that you have ever been guilty of any offense before, the court suspends sentence. I can only say, in all your business deals hereafter, Mr. Scheftels, be careful not to allow the love of gain to lead you into anything which may take from others their property, their money, their comfort. So long as you adhere to that you will go untouched by the arm of the law.

District Attorney Wise made this statement of the Government's view of the case:

> The defendants, doing business as brokers, sought to create a market for certain stocks of which they held large blocks under option. These stocks they sought to sell to their customers at inflated market prices with a secret profit to themselves. In aid of their stock selling campaign they put out market "literature" cleverly devised to induce the public to accept their advice to order the purchase of the particular stocks in which they expected to make this secret profit.
>
> These and other similar practices with which they were charged have been common in this city. Those engaged in such practices have not heretofore been prosecuted, and it has not hitherto been supposed to be practicable to prosecute them under the Federal statutes. This case has been regarded by the Government as a test case and one of far-reaching importance in that aspect. Its successful termination has established the criminal responsibility of brokers for practices which it had been commonly supposed would expose them at the most to civil liabilities. The prosecution, I am informed, has already had considerable effect in this community. The resulting conviction should have a still further effect.
>
> Taking into consideration the expenditure of time and money that would be involved in the completion of a trial the end of which was not yet in sight, the hardship to the jurors in the case and the likelihood of some casualty that would result in a mistrial, the Government has felt that it would not be justified in opposing the plea of the principal offender. In my opinion, the interests of justice did not require the further prosecution of the other defendants who were minor offenders, and mere tools in the employ of Rice, and upon whom the lengthy trial had already operated as a serious punishment.

The operations of Rice and Scheftels in connection with the Ely Central Copper Co. were exposed by the Journal on Nov. 6, 1909. Their concern was raided by the Department of Justice on Sept. 29, 1910.

A Chilean company has made an offer to the Bolivian government to construct a railway between Iquique and Oruro and other mining centers in Bolivia.

Progress in Mill Design

By Frank E. Shepard *

A review of milling practice with especial reference to the design and performance of the milling equipment. Some interesting data are also given respecting the capacities of various machines.

With the great variety of ores to be treated in the mining districts of this section, there have been developed many systems of ore treatment with the usual accompaniment of mechanical devices for the different stages of the process; consequently, we may be permitted to explore a wide range of subjects with particular reference to improvement in methods and machinery.

Hand Sorting of Ores

In the mill systems of Joplin, Mo., it is customary to crush the entire lot of mill ore, which in the sheet-ground districts is composed of about 95 per cent. of flint gangue and about 5 per cent. lead-zinc mineral. The flint gangue is hard, and in the crushing, great quantities of the galena and blende must be reduced to fines and slimes with consequent losses in the mill system.

Here would seem to be a most favorable opportunity to produce higher recoveries by means of hand sorting. If the original mine ore be sorted and one-half the gangue be thrown away to the dump, the sorted ore delivered to the mill bin would contain about 10 per cent. mineral instead of 5 per cent. in the mine run and the volume to be treated in the mill is reduced nearly one-half.

Much of the Colorado ore is finely disseminated and may not admit of hand sorting, but whenever possible this method of concentration should be carefully considered. Excellent designs of picking belts are furnished by a number of manufacturers and a well designed plant may be automatic as far as the conveying of the material from mine bins to the mill bin or dump is concerned. Coal companies find it profitable to hand pick the slate from the coal, and there should be equal opportunity with the ores of precious metals. The women and children of Mexico are well known as skillful ore sorters, and the patio of nearly every Mexican mine includes this branch of concentration.

Coarse Crushing

In large mills having capacities of thousands of tons in 24 hours the gyratory crusher appears to be in general use on account of the large receiving-hopper capacity, the automatic feed and the absence of vibration. For smaller mills the Blake jaw crusher is the universal practice from the simplicity of its mechanism and the few parts to be renewed. An interesting development of the gyratory principle is found in the Symons gyratory-crusher design and the practical rehalf the vertical height of the usual gyratory crusher design and the practical results are found to be satisfactory. Crusher-jaw plates of manganese, chrome and hardened steel are rapidly taking the place of the hard cast iron or even cast steel.

Under certain conditions the coarse-crushing plant may be situated at the mine. Electric power removes the obstacle of the high fuel cost at a remote station and the reduced size of ore may be an important factor in loading and conveying details. With the possibility of hand sorting of the ore and eliminating the waste rock at the mine, the capacity of the tram or conveying apparatus could be reduced.

Uniformity of Mill Ore

One of the most serious mistakes in the storage of mill ore is found in any plan which will not insure a uniform mixture of coarse and fine ore. In connection with the grizzly above the crusher for screening out the fine ore, there should be installed under the grizzly a chute so placed as to deliver the fines falling through the grizzly to a point under the discharge from the crusher so that coarse ore from the crusher shall be evenly mixed with the fines from the undersize of the grizzly. Then the day shift will have the same ore mixture as the night shift and the mill should run steadily with little change of adjustments.

If the fines falling through the grizzly fall directly to the back part of the ore bin and the coarser pieces from the crusher roll down to the front of the ore bin, then the day shift receives the coarse ore and the night shift receives the fine ore, which may need a general change of adjustments throughout the mill system. Given a steady, uniform feed and constant speed, mill adjustments may then be made with intelligence.

With problems of a large tonnage and with ores fluctuating in grade as well as physical characteristics, we may study with profit the ore-bedding system in large smelting plants. The handling of large quantities of ore by automatic belt conveyors and crane systems from suitably mixed beds of ore might result in improved mill recoveries sufficient to warrant the increased investment.

Automatic Sampling

The basis of all careful work of investigation is correct sampling, and sampling to be correct must be automatic. Messrs. Taylor and Brunton were pioneers in correct sampling methods, and in their plants a system is followed of taking a one-fifth cut, recrushing this one-fifth sample, then taking another one-fifth cut of the recrushed sample and so on—the whole sampling plant including five oscillating time samplers and crushing rolls between each sampler. In large milling systems a separate and automatic sampling plant on the lines indicated is well warranted, but in smaller mill systems the plan must be simpler. Two automatic samplers cutting a fifth sample with a mixing cylinder between the two samplers will give a sample one-twenty-fifth of the entire mill feed.

Two automatic samplers cutting a tenth sample, with a mixing cylinder between the two samplers will give a sample one-hundredth of the entire mill feed. In most mills this one-hundredth sample will bring the amount down to a convenient amount, which may then be further reduced by suitable laboratory methods for final assay.

Under some conditions this sample must be taken after the ore has passed the grizzly and crusher; then it may be necessary to install an extra elevator to give sufficient fall for subsequent mill operations. At the expense of additional installation it is certainly worth while to know the value of the ore with which we start operations.

In a roll-crushing plant a good position for the automatic sampling plant is just below the discharge spout of the elevator delivering the product from the coarse rolls, provided that no other than the original ore stream enters the coarse rolls.

It is even well to consider sampling the various ore feeds to the different mill units so that every phase of the mill system may be studied. Samplers have been designed to be controlled electrically from a master clock, so that the samples may be taken at regular intervals, or at times not anticipated by the mill operators. Such a system need not be too complicated, and with reasonable care will give most valuable records.

About 20 years ago J. H. Ernest Waters, of Telluride, Colo., became interested while in Denver in a steam-pressure recording gage, purchased one and had the gage installed in his office and connected with the steam mains of the boiler

Note—A paper, reprinted practically in full, presented under the auspices of the Colorado Scientific Society and the Colorado School of Mines on Feb. 23, 1912, before the mining men of Telluride.

*President, Denver Engineering Works Co., Denver, Colo.

plant without arousing the suspicions of the firemen. He took records for a few days and obtained some charts with the recorded steam-pressure lines looking similar to the trail leading to Bridal Veil Basin. Then he explained the recording gage to the firemen and showed them the records. Then followed records with a nearer approach to the circle. No doubt that pressure gage paid for itself many times in coal saved and a more uniform steam pressure. This to illustrate the value of accurate records.

FINE CRUSHING

Now we come to the parting of the ways with advocates asking us to take various paths. At this stage of the mill operations we find in Western mills three general systems of fine crushing: Rolls, stamp batteries and roller mills.

For the reduction of ore from crusher product, 1½- or 2-in. size down to a suitable size for coarse-jig or coarse-table concentration, the modern crushing roll employs the correct principles for the liberation of the mineral crystal with the least amount of slime product.

Modern crushing rolls are provided with adjustments so that the space between the shells may be changed while the rolls are in operation. Other details provide an end adjustment of the shafts to prevent beads forming on the edges of the shells. Forged-steel shells are the best for modern conditions. This material may be machine finished with special steel tools and the surface of the shells thus maintained a true surface for fine-crushing conditions.

Modern crushing rolls, with machine-finished forged-steel shells are used to reduce ores to a product as fine as 30 to 40 mesh, and if reasonable care be given the shells such fine crushing is possible. This means an even and regular feed across the entire face of the roll shell, and a new shell for the fine rolls whenever grooving or uneven wear appears, the worn shell of the fine roll being transferred to a coarser crushing roll. In large plants having shops, a lathe may be provided to resurface the worn shells.

The tendency, however, is to use crushing rolls for products not finer than about 12 mesh No. 19 wire (0.042 in.). This 12-mesh product is about the maximum for concentrating-table feed, and with the short tube mill already being established as an economical system for fine crushing, the range of roll crushing does not need to be outside the limits of, say 2-in. maximum down to ¾-in. minimum.

For the recrushing of jig middlings, rigid rolls have advantages over the spring rolls. The average size of the mineral crystal embedded in the middling particle determines the minimum size to which the particle shall be crushed. The rigid rolls may be set to the desired size and the middling particle is crushed down to this size and no further, the aim being to break the gangue portion away from the mineral crystal. The use of the rigid roll insures the maximum size of mineral crystal with the least production of slimes.

SURVIVAL OF THE STAMP

One of the great surprises in the development of mining machinery is the strong position occupied by the stamp mill. Here is a most complicated array of mechanism, producing a chaos of noise, requiring elaborate foundations and having a large number of renewable parts, and yet the ring of the stamp goes merrily on, followed by methods of amalgamation, lixiviation, concentration and cyaniding.

South African practice deals in terms of 2000-lb. stamps and the end is not yet. Such heavy stamp weights call for massive foundations and great increase in the dimensions of mechanical parts and yet the practice appears to be commercially successful.

The use of concrete in mortar blocks is a good advance in point of construction, maintenance and capacity. Cast steel for shoes, dies, cams, tappets and boss heads show increased service over the former cast-iron parts. The narrowing of the mortars at the issue level results in greatly increased capacities. The gradual change from inside to outside amalgamation reduces labor costs and loss through shutdowns. Separate-motor drives for battery units simplifies the plan from the complicated jack-shaft drives. Specifications now call for chrome-nickel steel as a material for the cam shafts.

Structural steel for the battery frame is quite possible. Probably the best form of battery post is a box column filled with concrete to reduce the sound and vibrations. Designs have already been made for concrete battery posts reinforced with steel rods all being molded integral with the concrete mortar blocks. Sub-bases weighing about 7000 lb. give sufficient bearing area for the mortars on concrete mortar blocks, instead of anvil blocks weighing 16,000 to 20,000 lb.

While the crushed product from a stamp mill shows a higher percentage of slimes as compared with roll-crushed products, some ores with a tough gangue material are most successfully crushed in the stamp mill.

CHILEAN MILLS

The large mills treating the copper porphyry ores have brought about a rapid development in roller mills more familiarly known as high-speed chilean mills. In crushing tens of thousands tons of ore a day, certain merits must be found in this type of intermediate crushing device, but when one considers the renewal of large tires and die rings, screens, bearings, pinions and gears, the query appears, will this type of crushing mill endure in mills of great capacity?

BALL MILLS

The cement industry has given us the tube mill, that fine-crushing device of great simplicity, and we shall yet appreciate the great value of the ball mill as a desirable intermediate-crushing device, possibly supplanting rolls, stamp mills and high-speed chilean mills.

The Krupp type of ball mill is successfully used as an intermediate crusher between the coarse-crushing mill and the tube mills, which grind to a final product of 100 to 200 mesh. The Krupp ball mill is cylindrical and is rotated on trunnion bearings, the feed being introduced to the inside of the cylinder at one of the trunnions.

On the inside of the cylindrical shell is arranged a series of steel shelves and perforated plates. On the outside of the cylindrical shell is a screen limiting the size of the crushed product. Inside the mill is a charge of forged-steel balls, the largest of which may weigh about 70 lb., varying down to the steel balls of about 2½ in. diameter.

CONSTRUCTIONAL DEFECTS

With a suitable charge of ore delivered to the ball space, the rotation of the mill turns the mass of balls and ore over and over, and the falling of the balls from shelf to shelf crushes the ore to a size which will issue through the outside screen. While the product from this mill is excellent, objection is found to the shelves and perforated plates as well as outside screens to be renewed. If we may use the high crushing efficiency of the forged-steel balls and in some way eliminate the perforated plates and screens, we may have a very simple intermediate-crushing device.

Such a simple and compact crushing device seems possible. The scoop feed in connection with a spiral lining for the feed trunnion of the tube mill is a success. The device known as the tire discharge on the discharge end of a tube mill is a success. This tire discharge permits an opening about 20 in. in diameter, through which the fine-crushed pulp issues. In this 20-in. opening is fitted a reverse spiral so that any pebbles or large particles of ore falling into the grooves are carried back into the mill. Only the particles which have been crushed fine enough to be carried out by the current of water may issue as product. If, then, we design a ball mill, using the scoop feed for the feed end of the ball mill and use the tire discharge of 20-in. diameter opening for the discharge end of the ball mill we are utilizing two well known and successful elements. A reasonable proportion for the ball mill would be that the diameter be equal to the length of the shell. A mill 4 ft. in diameter would be 4 ft. long; a mill 5 ft. diameter would be 5 ft. long.

The liners of the feed and discharge heads may be hard iron or cast steel. The lining for the cylindrical portion of shell should be of chrome steel or equivalent. The diameter of the balls should be between 3½ and 7 in. The larger the feed particle the larger the diameter of the balls.

Ore as coarse as 2 in. in diameter may be fed to the ball space of the mill by means of the scoop feed. The mill is to be driven by machine-cut pinion engaging with a machine-cut gear bolted to the feed or discharge head. When the mill is rotated the mass of balls and ore is carried up to about the level of the axis of the shell and the heavy balls rolling down the slope crush the ore. Fine-crushed ore issues through the 20-in. diameter tire discharge, any coarse particles or balls worn small being returned to the ball space by means of the reversed spiral inside the tire discharge.

Capacity of Ball Mills

The average results from several types of ball mills show that one ton of steel balls will crush about 50 tons of ore during 24 hr. from a feed of 1½-in. diameter down to a product of from 12 to 20 mesh in one operation. Using the same factor, Table I gives the sizes, capacity and power for such ball mills.

TABLE I. SIZE AND CAPACITY OF BALL MILLS

Diameter, Ft.	Length, Ft.	Wt. of Balls in Mill, Lb.	Wt. of Ore in Mill, Lb.	R.p.m.	Hp.	Capacity per 24 Hr., Tons
3	3	1035	207	35	7	25
4	4	3360	672	28	25	80
5	5	7650	1530	26	56	190

To compare this proposed ball mill with other types of intermediate crushers, Table II is given, assuming ore to be crushed from a 1½-in. feed down to a product passing 12 mesh, No. 19 wire, or about 1 mm.

This type of ball mill in connection with crusher and tube mill, making only three crushing units, will reduce ores from run-of-mine to slime pulps of 150 to 200 mesh, a simple crushing system for cyanide mills.

The ball mill makes suitable product for table feed and then the tube mill may recrush the table tailings or middlings. The consumption of steel balls amounts to about one pound per ton of ore crushed when crushing dry and two pounds per ton of ore crushed when crushing wet.

A review by S. F. Shaw of 19 cyanide mills in the United States and Mexico gives the following conclusion: "Jaw breakers are more favored than gyratory crushers; Dodge breakers are used in only one mill; stamps are almost universal for fine crushing; Bryan, Huntington and chilean mills are used in a few plants as intermediate grinders following the stamps. Tube mills are being used more and more for fine grinding."

By the use of a ball mill following a Blake crusher, run-of-mine ore may be reduced to jig or table pulps in two crushing operations without any screens in the mill system. The small number of mechanical parts; the small mill space occupied; the great range of products which may be produced with simple adjustments; the absence of screens; the crushing of dry ores as well as wet ores and the high capacity per unit weight of wearing parts are strong factors for the use of the ball mill in the intermediate crushing operations of our Western mills.

TABLE II. INTERMEDIATE CRUSHERS

	Capacity per 24 Hr., Tons	Hp.	Wt. of Crushing Moving Parts, Lb.	Total Wt., Lb.	Price
Chilean mill, 6-ft. diam.........	40–50	25	20,000	50,000	$3600
Stamp mill, ten 850-lb.	40–50	20	8,500	35,000	2100
Ball mill, 4x4 ft..	70–80	25	3,500	20,000	1600

In designs for cyanide mills, the diameter of the ball mill and the tube mill might be the same, so that the feed- and discharge-head castings could be interchangeable between ball and tube mill.

The shell lining is bolted to the shell and the large tire-discharge opening permits the changing of lining without removing any manholes.

The Grondal system for the concentration of iron ores uses a ball mill along these general lines but the feed device is more complicated and the discharge is through a trunion bearing. The proposed tire discharge allows a larger and freer discharge as well as a convenient means for renewing the steel liners.

The Hardinge conical mill is a good type for ball-mill crushing and has been successful in several installations for intermediate crushing. The Blake crusher and Hardinge conical ball mill followed by the long cylindrical tube mill makes a good combination for cyanide mills in crushing to 150 or 200 mesh.

Coarse Concenration by Jigs

Concentration of ores by jigs includes sizes of feed as coarse as 2½ in. in diameter and down to sizes as fine as about 12 mesh, No. 19 wire, or about 1-mm. diameter. Formerly finer pulps were concentrated on jigs but since the advent of the reciprocating table ore pulps finer than 1 mm. are treated on the tables.

The Butte copper ores are jigged as coarse as about 2½-in. diameter and the rich pieces of ore including chalcopyrite, chalcocite, enargite and bornite are subjected to a heavy jigging action with the result of excessive attrition and liberation of a considerable proportion of slimes which cause difficulty in subsequent mill operations. Such coarse jigging of friable ores might be replaced by improved systems of picking belts and thus prevent the loss through formation of slimes by attrition. The power and water consumed in such heavy jigging operations are large and the machinery needs to be heavy. When the jig feed is smaller than 1-in. diameter the power and amount of water are greatly reduced. The average sizes of jig feed in American practice probably lie between 1-in. and $^1/_{32}$-in. particles.

Without doubt the jigging of ores is one of the most interesting and the most complicated of milling problems, combining as it does the study of the crystalization of minerals, specific gravity, cleavage planes, relative hardness of mineral and gangue, distribution of mineral contents in the gangue matter, association of minerals of nearly equal specific gravities, and endless combinations which often present baffling problems. Added to these questions are the various jig adjustments referring to stroke, speed, depth of bed, number of jig compartments, relation of screen aperture to feed particle, and combinations varying with each variety of ore, all requiring careful and persistent study.

Jig Capacities

The familiar type of Harz jig found in our western mills consists of one to four compartments, or more, each compartment being 18 to 20 in. wide and 24 to 40 in. long. This Harz jig, under average conditions will treat about 1½ tons of feed per square foot of jig-screen area per day of 24 hours.

The large jigs of the Joplin district are often found with 7 compartments or cells, the area of each compartment being about 20 sq.ft., or a total of 140 sq.ft. of jig-screen area. These 7-compartment Joplin jigs treat at the rate of 700 tons per day of 24 hr., or 5 tons of feed per square foot of screen area.

The Hancock jig, the feature of which is the movable screen, is a successful type for large capacities and will treat about 10 to 15 tons of feed per square foot of jig-screen area daily.

All these jigs employ both a pulsion and suction cycle of water current through the jig screen. The average water consumption for Harz jigs in American practice is about 4700 gal. of water for every ton of ore treated.

The Hancock jig uses from 350 to 800 gal. of water per ton of ore treated, a very low water consumption.

RICHARDS PULSATOR JIG

A few years ago a series of tests on the pulsator jig showed in practical mill operations that one square foot of screen area will treat 100 to 180 tons of ore in 24 hours as compared with 1½ tons for the Harz jig; 5 tons for the Joplin jig; and 10 to 15 tons for the Hancock jig. This high rate of the Richards pulsator jig is made possible by the use of a pulsion stroke only. In the earlier designs the ore bed was 10 to 14 in. deep, requiring about 30-ft. head of hydraulic water at the rate of 1000 to 1200 gal. per ton of ore treated.

The later designs make use of an ore bed but 4 or 5 in. deep and a consequent reduction of the head of hydraulic water to 10 or 15 ft. This reduction of hydraulic-water head has reduced the amount of water to 600 or 700 gal. per ton of ore treated, or about one-seventh the amount of water required in Harz jigs.

The latest types of Richards pulsator jigs also have separate pulsator valves for each compartment, thus giving accurate and wide ranges of adjustment to suit different conditions of ore treatment. Dewatering devices are also placed between the compartments to allow closer and more complete separation between minerals of slight differences in specific gravity. While the theory of this pulsator jig is based on a screen-sized feed, yet in practice a rather wide range of sizes is permitted.

The concentrates are particularly clean with a minimum of attrition from wear of concentrate particles in the jig bed.

The Richards jigs at the Lewis mine, Telluride, deliver concentrates ranging from 65 to 70% lead. In the Bonanza mill, Saguache County, lead concentrates are produced as high as 79% lead. In the Cobalt district, Canada, Richards jigs are making concentrates of the smaltite and niccolite ores running as high as 4000 oz. of silver to the ton. A jig installation in Sonora, Mexico, produced argentite concentrates running 400 to 500 oz. of silver per ton. Low-grade iron ores of 40 to 45 per cent. have been enriched to 65 per cent. iron.

There is no doubt about the favorable application of this pulsator principle to a wide range of ores. The number of necessary mechanical details of the Harz type of jig are replaced by an extremely simple rotating valve requiring a small amount of power and lasting through a long time of service. In several designs of Harz type, great attention has been given to mechanical elements which shall give a pronounced pulsion-water stroke *up* through the screen and to diminish as much as possible the suction stroke *down* through the screen. This differential motion, so called, is found to give a greatly increased capacity and also reduces the blinding of the jig screen.

A study of the elements of mechanism to produce such differential motions will show complication and the necessity for constant attention to adjustments and renewals for wear.

The simple mechanism of the Richards pulsator valve, consisting of but one moving part and entirely automatic action gives this pronounced pulsion stroke with no suction whatever. The recent design having separate pulsator valves for each jig compartment gives additional automatic features allowing any possible jig adjustment.

In the desire to have a simple mill system valuable features are often omitted which would produce higher recoveries. As our ores become more and more complicated we must expect some additional complication in our mill mechanisms as well as greater care and personal interest on the part of mill operators.

Jigging is a mill operation requiring previous preparation of grades of ores as well as in concentrator-table work. We can throw a mixed pulp on a concentrating table and obtain some result but we find that suitable classification into grades produces better quality as well as quantity of products.

The grading of jig feeds, the dewatering of pulps, regularity of feed, uniform water pressure, uniform speed of power —all these are of great importance and all need well developed details here and there in the mill system, and above and behind all there must be a big strong spirit of personal intelligence, interest and coöperation.

PULP CLASSIFICATION FOR TABLES

Progress has been made in the application of important principles in the classification of ore pulps previous to table work, but there is much more to study and to do before we reach the reasonable efficiency. Does it pay to consider all these additional devices designed to produce higher recoveries?

Assume a mill of 100 tons capacity during 24 hr., the crude ore runs $10 per ton; the mill makes a recovery of 70%. Suppose by the addition of some device an increased recovery of 75% is obtained. This means an additional wealth to the amount of $18,250 per year. In an ore carrying $5 per ton an increased recovery of 5% means an additional saving of $9125 per year.

The preparation of fine pulps previous to table concentration involves two general systems, one based on the screen sizing of pulps producing grains of nearly uniform diameter and the other known as the hydraulic classification of pulps, in which the mineral grains are small and the grains of gangue material are comparatively large, or the result of equal falling grains of mineral and gangue in a still body of water or an upward current of water. As mill systems increase in capacity the mechanical difficulties found in maintaining fine-screening systems become too great and so the tendency is toward the application of the hydraulic principles of classification.

To Dr. Robert H Richards is due the great credit for the many practical applications of hydraulic classification for if one will study the results of his 40 years of investigation it will be found that the most successful hydraulic classifiers in the mill systems of today utilize some feature developed by him. The hindered-settling design, as well as the Richards-Janney, are developments of the earlier design known as the vortex classifier.

The Richards pulsator classifier is successful in the classification of a wide range of ores. Recent designs have reduced the number of parts to adjust so that now only one water gate valve is required to be adjusted, whereas in former designs separate water valves for each of the six compartments were required to be adjusted. The gates between the compartments have also been removed and the adjustable concentrates-discharge gates have been removed and in their place are spouts which require but one preliminary adjustment.

LAUNDER TYPE OF PULSATOR CLASSIFIER

The use of the screen in this type of classifier has resulted in the saving of high-grade shipping products direct from the classifier but under some conditions of water supply difficulties are found from the screen blinding and recently there has been developed a type of classifier utilizing the many favorable features of the pulsator-water current and doing away entirely with the use of the screen. This improved form is known as the launder type of pulsator classifier and this design permits the use of any number of pulp classifications to suit the requirements of the mill system.

An ordinary wood launder is used running above and near the feed end of the concentrating tables, separate sorting columns provided for each table, are bolted to the bottom of the wood launder with a separate pulsator valve for each sorting column so that each table may have its own particular adjustment. The only adjustment to make in this launder-type classifier is to determine the diameter of opening in the wood spigot at the bottom of the sorting column.

A novel device for concentration is permitted in the use of a pulsator-jig compartment which is bolted to the bottom of the wood launder the same as the classifier units. This launder jig has a separate pulsator valve but no concentrates discharge gates to adjust. A screen is used in the jig compartment and the concentrates discharge down through the screen into the hutch and out through the opening in a wood plug at the bottom of the hutch. The discharging of the grains of free mineral through such a launder jig relieves the coarse tables from a considerable burden and reduces the amount of middlings product usually delivered from the coarse table.

DEWATERING DEVICES

Great improvements over former methods have been made in the development of systems for the dewatering of pulps and slimes. Too often pulps are delivered to the concentrating tables in too dilute a condition with a consequent loss of fine minerals.

The dewatering of pulps becomes an important point in the feed to tube mills for it has been demonstrated that a feed pulp containing about 40% moisture gives the best efficiency in tube-mill crushing.

In South African practice the Caldecott diaphragm cone is reported to give satisfaction in large installations where large cones may be employed and the mill feed fairly constant. However, in small mills with fluctuating loads difficulties in adjustment may be met.

The dewatering of jig and concentrating-table feed insures a larger capacity and more complete separation of the various products. Slime-table work is particularly sensitive to the consistency of the pulps fed to the tables, for a thickened slime pulp is necessary for successful recovery.

In districts with low or fluctuating water supply the recovery of water from tailings becomes a serious necessity for use again in the mill system. The Tomboy mill in Telluride makes use of a filter plant for the purpose of reclaiming water from the tailings and furnishes clear wash water for the concentrating tables. The Miami mill in Arizona has an extensive plant of cement settling tanks returning about 75% of the tailings water for use in the mill system.

A serious fault in many mill systems is the great volume of wash water used to sluice the material through the mill system. In many cases the use of too flat launders requires the use of extra wash water which is carried over the jigs and tables instead of eliminating the surplus volume by means of suitable dewatering devices.

Philip Argall, at Stratton's Independence mill, Victor, Colo., uses a double spiral classifier of his invention for the purpose of dewatering tailings sluiced from the mill and uses the reclaimed water for further sluicing operations.

TUBE MILLS

Great progress is being made in the design as well as the operation of this excellent device for the fine crushing of pulps. The tube mill appears to be the most efficient means for the final reduction to slimes, previous to agitation in cyanide mills.

The use of the scoop feed has overcome the former troubles from wear of packing joints. This simple and automatic feeder receives general endorsement. The spiral lining in the mills using the trunnion feed insures a positive feed to the pebble space of the mill. The heads are usually lined with hard-iron plates and in the trunnion-type mills the lining is swelled out around the feed and discharge openings to divert the falling pebbles away from the heads, thus allowing freer entrance and discharge of pulps.

Silex or natural flint linings 4½ and 6 in. thick are used as well as the hard cast-iron ribbed linings of the El Oro type and other similar designs. The Brown sectional hard-iron and manganese-steel linings give good results in Australian practice.

The use of machine-cut gears on tube mills was first advocated and used in Colorado and now the practice is general. The design known as the tire-and-trunnion type offers advantages in a large-diameter discharge opening of about 20 in., which allows greater capacity and permits more ready access to the interior of the mill. The tire-discharge opening is bushed with a heavy hard-iron reversed spiral which carries small pebbles or oversize grains of pulp back into the pebble space of the mill, only the slime pulps floating out with the water issue through the discharge opening. Provision is made for changing the level of discharge for the regulation of pulp sizes by varying the diameter of the tire-discharge opening.

Tube mills are in successful operation for the recrushing of jig and table middlings for further treatment on fine and slime concentrators. In the Lewis mill Telluride, a 4x10-ft. trunnion-type tube mill regrinds the coarse-table middlings from a 60-ton mill feed in 24 hr. At the Midvale, Utah, mill of the United States Smelting Co. a 5x14-ft. tube mill of the trunnion type recrushes jig and table middlings at the rate of 136 tons in 16 hr., or 204 tons in 24 hr. delivering a product passing a 40-mesh screen with but 10% of slimes finer than 200 mesh.

The tube mill may be used to produce a granular pulp with but a small percentage of slimes for subsequent table work, as well as a crushing device for sliming pulps for cyanide solution. The tube mill is a remarkable all-round machine for fine crushing and there may be further developments which will serve well in our mill systems.

Official statistics show that the world's consumption of nitrate for the first 11 months of 1911 reached 49,000,000 quintals, an increase of 500,000 as compared with 1910. The production from July to November amounted to 23,000,000 quintals.

Smelting Chromiferous Iron Ore

A correspondent in Greece states that there are deposits of chromiferous iron ore extending for a considerable distance in the northeastern part of Greece and on the islands of Eubea and Skyros; the ores have the following approximate analysis: Fe, 47-50%; Cr_2O_3, 2.5-3; Al_2O_3, 9-10%; SiO_2, 7-11. He inquires with regard to the possible elimination of the chromium and to the practice in smelting chromiferous Cuban ores. In discussing the latter points, Bradley Stoughton writes:

In the smelting of chromiferous ores of Cuba in the blast furnace, followed by refining in the basic open hearth, a steel is made which contains about 10% of the original chromium present in the ores, together with the greater part of the nickel.

In other words, about 90% of the chromium is oxidized and slagged off in the basic openhearth furnace. It is a simple matter to slag off all of the chromium if desired, but the steel companies making this material desire to conserve all of that element possible because of the high qualities which it contributes to the steel.

They are able to turn out a very superior product, by virtue of the nickel and chromium which these ores retain, and find a ready market for it in many lines where steel having a combination of high strength and good ductility is demanded; thus, automobile steels and important parts of locomotives and railroad rolling stock are made of this material, which will have properties somewhat as follows:

Tensile strength	83,400 lb. per sq.in
Elastic limit	62,500 lb. per sq.in.
Elongation in 2 in.	8.67%
Reduction of area	49.53%

After different heat treatment, the steel may have properties somewhat as follows:

Tensile strength	162,500 lb. per sq.in.
Elastic limit	152,000 lb. per sq.in.
Elongation in 2 in.	16.0%
Reduction of area	56.0%

or else:

Tensile strength	226,000 lb. per sq.in.
Elastic limit	190,000 lb. per sq.in.
Elongation in 2 in.	8%
Reduction of area	32%

This steel is used for many different purposes, such as crankshafts, axles, hatchets, axes and other tools, as well as springs. It is now being largely advocated for screw rods and it is said to be an excellent material for wood screws and other screws, and it can be worked with great ease.

It is difficult to see why one would desire to eliminate all the chromium from this steel, but if this be the case, there should be no difficulty in manipulating the openhearth practice so as to oxidize it away.

The Synchron Respiration Apparatus

Artificial respiration is a means used for resuscitating a person who has been drowned, asphyxiated, or shocked by an electric current. Resuscitation of employees is occasionally necessary at mines and it is therefore of interest to note the operation of the Synchron respiration apparatus which has been designed to synchronize the movements of the Sylvester method of resuscitation.

The Sylvester method of inducing respiration consists of three operations:

(1) The patient is laid flat upon his back and his tongue is grasped, drawn forward and held to prevent it from impeding the passage of air through the throat.

(2) The patient's arms are drawn in a vertical plane upward and backward until they touch the ground beyond his head. The arms are thus held for two seconds, then they are swung in a vertical plane until they lie on the ground parallel to the body. They are held in that position for one second. The first part of this operation expands the chest, tending to draw air into the lungs, while the second operation tends to compress the chest and expel air.

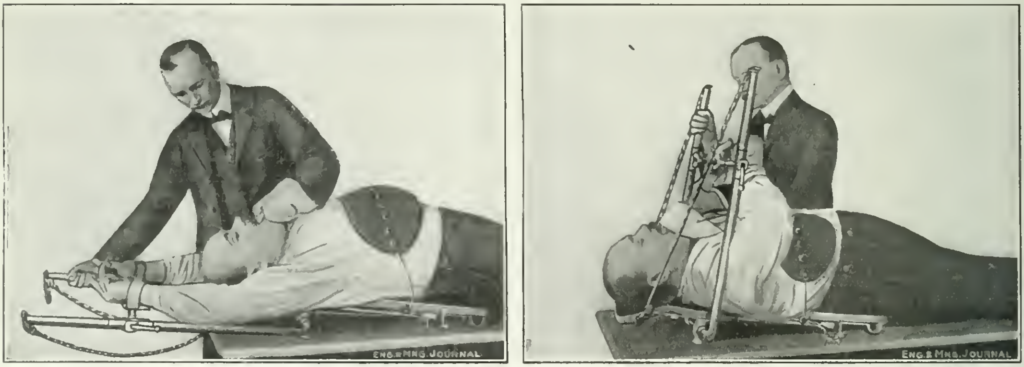
(3) Just before the arms are brought forward parallel to the body, a third attendant who is on his knees astride the patient's hips grasps the body with his hands, the balls of the thumb resting on either side of the pit of the stomach, the fingers falling into the grooves between the short ribs. Now, using his knees as a pivot, at the moment the patient's hands touch the ground he throws, but not too suddenly, all his weight forward on his hands, and at the same time squeezes the waist between them, as if he wished to force something in the chest upward out of the mouth; he will increase the pressure while he slowly counts, 1, 2, 3, 4, or for about two seconds, then he suddenly lets go with a final push, which will throw him back to his position. This completes expiration.

The operations 2 and 3 are slowly repeated, and may have to be persisted in for an hour or more before respiration begins. The Sylvester method requires three attendants, one to hold the tongue, one to operate the arms and one to squeeze the waist. It is hard and tedious work and successful results are rarely obtained in less than an hour, so strong attendants or else a number of men working in relays are necessary.

Dr. Fries, a Swedish physician, has invented the Synchron respiration apparatus to carry out the Sylvester movements but with less exertion on the part of the attendants; in fact, only one is required. The device consists of a board on which the patient is placed and which is raised a little at the head end. The arms are attached by straps of adjustable length to levers made of ordinary pipe. Across the abdomen a girdle or belt is placed which serves to compress the chest and is connected with and operated by the levers. Wires running from the ends of the levers through small pulleys are connected to the girdle by hooks. Several holes at each end of the girdle allow for adjustment. As will be seen, in the accompanying illustration, the three movements of the Sylvester system can be carried out by one man. He holds the levers with his right hand while grasping the tongue with his left. He then alternately swings the levers back over the patient's head, then down so that his arms are approximately parallel to his body, thus carrying out operation 2. The levers operating the wires attached to the girdle compress the belt or girdle when the levers are moved forward, so that the girdle operates as does the third attendant sitting astride the patient's hips in the Sylvester method.

The device has been tested at the Carlinska Institute, Stockholm, Sweden, where Prof. J. E. Johansson has carried out practical experiments in the physiological department; also at the Serafinerlasaret, the Royal Hospital of Stockholm. The appliance has also been adopted by the Life Saving Society and approved by the directors of the Association of Swedish Physicians. At the Royal Hospital, Stockholm, this apparatus proved to be successful in several cases of asphyxiation after manual treatment had been abandoned as hopeless. The Victoria Falls and Transvaal Power Co. has 12 of these machines. It is claimed that respiration can be restored in from one-half to one-third the time usually required by the Sylvester method; the latter is generally regarded as superior to the Schäffer method which is sometimes used; in cases of asphyxiation the Sylvester method is preferred as it causes the respiration of two to three times as much air, provided the prescribed movements are faithfully carried out.

The name Synchron is derived from the synchronous action of the device in tightening the girdle at the same time that the arms are brought to a forward position. It is this synchronous action that is so difficult to secure by manual methods, especially when an unusually protracted period is necessary to restore respiration. The device has been patented and the representative in this country is A. E. Sylven, 29 Broadway, New York.



THE SYNCHRON RESPIRATION APPARATUS IN OPERATION

A recent experiment in copper melting in an electric furnace produced a peculiar physiological action. About 5000 lb. of pure electrolytic copper were melted in a three-phase arc furnace. After a few hours, according to the *Brass World*, all of the 10 men employed experienced difficulty in breathing. For the following 24 hours the men were attacked with a severe nausea, followed by a soreness of the entire system similar to that of acute grippe.

Some Observations in Butte, Mont.

By W. R. Ingalls

It is considered to be a rational forecast that these mines of surpassing magnitude will maintain their present rate of production for 20 years to come and that the cost of production will be reduced to 9c. per lb. of copper by improvements in the mining and smelting practice.

Every time I visit Butte I obtain a deeper impression of the wonderful magnitude of its ore deposits. There is no other copper-mining district of the first order, unless it be Bingham, where the zone of mineralization is so compact. We speak of Lake Superior as being a single district, and indeed it is, but its mines are scattered through a belt several miles in width and 30 miles or more in length, with long reaches of barren country intervening between productive mines. We talk about Arizona displacing Montana as the premier copper-producing state, which is true, but disregards the fact of its production coming from five widely separated districts of the first class, besides many others of less importance. On the other hand, Montana is Butte and Butte is Butte Mountain, wherein the whole group of productive mines is compassed by about three miles in one direction and two in the other.

Within this area of Butte there is a thick and intricate system of lodes; so thick and intricate that they form a network. There is an original system of parallel lodes, which later were faulted by a transverse system, also mineralized, and then the whole arrangement was faulted some more, after which other things happened. All of this is a story for the geologists to tell. I shall undertake to do no more than to express my appreciation of the mystification of the older miners in their exploring ventures and my admiration of the first engineer, I believe it was Mr. Brunton, who perceived that here was a case where the miner needed the assistance of the mining geologist. Undoubtedly the studies that were made in connection with the protracted litigation contributed to the recognition of this principle. Anyway, the Anaconda Copper Mining Co. has for many years enjoyed the services of the best organized geological department, now under the direction of Mr. Sales, that I know of, and it is not immoderate to say that it would not know how to get along without it.

In the popular mind the mines of Butte, which is now substantially equivalent to saying of the Anaconda company, have suffered perhaps by comparison with the claims made for the newer porphyry mines. The position of the orebodies of the latter has permitted their rapid delimitation by the relatively cheap method of churn drilling. During their development the monthly additions to ore reserves have been heralded as if they were dividends. Of course, it is satisfactory to know that the life of a mine is assured for a long period of years and estimates of value are greatly facilitated with such knowledge. Because the same data are not available respecting the lode mines is not, however, good ground for throwing doubt upon them. That lode mines may have a long life is amply illustrated by the history of those at Lake Superior and at Butte. There are many of such mines in which much greater reserves of ore could be shown if there were any good reason why that should be done. On the contrary, the reason is the other way. Such a mine must keep its development of ore sufficiently ahead to insure maintenance of its normal rate of production and be prepared to make quickly an increase if market conditions should indicate that desirability. Further than that development is uneconomical because of the loss of interest upon the money expended in it and the cost of keeping in repair the work that represents the principal, besides which there are other objections.

If all mines were valued upon the basis of delimited ore, there would be relatively little interest in the mining business. Nor is it to be inferred that the chances for ore beyond what has actually been put in sight cannot reasonably be valued. There are some valuable mines, Batopilas for example, which sometimes do not show any ore at all.

Some years ago I had come to have a rather unfavorable opinion of Butte, in common with other engineers. This was based chiefly, I think, upon the gradually diminishing grade of the ore, the idea that such impoverishment might be expected to increase with further depth and the fear that the increase in the difficulty of mining would probably offset the advantages gained from technical improvements. These ideas were inspired and fostered by the statistics in the company's annual reports. They have been wholly dispelled by observation and reflection during the last four years.

The copper production of Butte since 1881 has been about 5,600,000,000 lb. The veins did not become productive of copper until a considerable depth below the outcrops had been reached, the copper having been leached from the superior portions. The depth at which copper mining began varied, but on the average it was perhaps at about 200 ft. It cannot be said definitely to what depth the veins have now been exhausted on the average, or rather what horizontal section of the block, about two by three miles, containing all the veins is represented by the total production of copper, but this is perhaps comprised between the horizons of — 200 ft. and — 1600 ft.; i.e., the total production of copper has come from a block of country about 1400 ft. in depth. Even if this figure be considerably in error, the reasoning which follows will not be seriously invalidated. I do not mean to imply that the veins have been stoped out to the depth of 1600 ft. and merely explored below that depth. On the contrary, much ore has been produced from below that horizon. On the other hand, much ore is still being mined from above it. But it is assumed that what has been taken from below 1600 ft. is offset by what remains above.

On this assumption of ore extraction from a block of country 1400 ft. in depth, the total copper production of Butte has been about 400,000,000 lb. per 100 ft. of depth. In recent years the normal production of Butte has been about 300,000,000 lb. per annum. In the making of that production the ore is exhausted from about 75 ft. vertically. In order to maintain that rate for 20 years the mines will have to be worked out to the depth of 3100 ft. This is, of course, upon the assumption that the ore becomes neither richer nor poorer than it has averaged heretofore. The depth of 3100 ft. does not *ipso facto* present any extraordinary mining difficulties; nor does an expectation that payable ore will extend to that depth either stretch imagination or violate reason.

What, then, is the ground for such an expectation? Simply that the mines have been rather extensively opened to the depth of 2400 ft., and in at least one mine 2800 ft. has been attained and no diminution in the grade, size or character of the orebodies has been observed. For example, ore averaging 6% copper and 12 ft. in thickness has recently been exposed for 2500 ft. in the Gagnon vein on the 2400-ft. level. It is not an unreasonable expectation that the Butte veins in general will maintain their mineralization to the same depth that has already been shown in several of them.

The occurrence of chalcocite in the ore of Butte has been the subject of much study and discussion. At first it was thought to be due to secondary enrichment from above in the usual way. When it continued to be found at depth below where it ought to be, geologists began to talk about the possibility of secondary enrichment from below, although they failed to make it clear how that could come about. There is now a strong belief, perhaps I ought to say proof, that the deep chalcocite of Butte is a primary form of the mineral. The importance of this in forecasting the life of these mines is, of course, obvious.

PRODUCTION OF COPPER IN MONTANA

(As reported by "The Mineral Industry")

Year	Lb.	Year	Lb.
1882	9,058,000	1897	237,158,540
3	24,664,000	8	216,979,334
4	43,093,000	9	237,953,951
5	67,797,864	1900	254,460,713
6	57,611,485	1	229,870,415
7	78,700,000	2	266,500,000
8	98,504,000	3	272,555,854
9	104,589,000	4	298,314,804
1890	110,955,733	5	319,179,880
1	112,359,839	6	299,850,000
2	161,051,477	7	226,290,873
3	154,300,100	8	252,558,330
4	183,094,755	9	313,838,203
5	196,768,925	1910	286,242,403
6	228,958,164	11	273,438,879
Total			5,614,698,521

The extraordinary development of the mines of Butte that has been effected during its history of 30 years has afforded a facility of ore extraction that few of the younger mining districts possess. This was exemplified a few months ago, when it became desirable to increase the production. For about 18 months previously the production had been curtailed to the rate of about 22,000,000 lb. per month. In December last it was decided to make an increase of about 4,000,000 lb. per month. It was only necessary to give the order. In one month the desired increase was made. Such an ability manifests, of course, not merely a wonderful mine development, but also a wonderful organization for operation.

The latter is to me the next most impressive thing about Butte. I am here again using the term Butte as interchangeable with the Anaconda Copper Mining Co., the two being substantially equivalent. There was a time when another name, the Amalgamated Copper Co., was not wholly in good repute, but even amid the quarreling and wire-pulling of the evil days of litigation, the verdict of history will be that the Amalgamated after all was more virtuous than its assailants, and whatever may have been disagreeable in certain phases of its management, there never was any question about its sincerity and efficiency in building up an industrial organization which gradually became a thing to make the mining industry and the country proud. The backbone of this has been the staff, selected for competency alone and kept permanently. Changes in the Anaconda corps are rare. Under Mr. Thayor, the president, Gillie, Mathewson and Goodale, with their own able assistants, have made the Anaconda's the show mines and works of the West, not merely in appearance but essentially for what is done in them. The miners have been leaders in the introduction of improved methods, even if their work is less prominently in evidence than that of the smelters, whose progress has been spectacular in the development of gigantic blast and reverberatory furnaces and numerous other things of economic advantage.

The effort to do things better and cheaper has been going on ever since the Amalgamated got fairly into operation. It is no new thing inspired by porphyry or any other kind of competition. It is the natural outcome of the inspiration of an organization superior to most organizations in the mining business, and, as is always the case with organization, the beginning had to be made many years ago. The results have lately been showing in an impressive and very material way, namely, in the reduction in the cost of production, which has been upward of 1c. per lb. of copper during the last four years.

Nor is there any evidence that the management expects ever to say that its work has been done, that perfection has been achieved, and consequently that it may go to sleep. Among the improvements of the first order that are now being carried out are the introduction of electric tramming underground, the changing from steam to electric-compressed-air hoisting, and the electrification of the Butte, Anaconda & Pacific railway and its branches. These consummations are the results of studies begun some years ago. In the engineering and experimental departments studies are now going on that will materialize some years hence. It will not be surprising if at some time the Anaconda cuts its cost of producing copper down to 9c. per lb. It is a long way from being relegated to the rear by the porphyry mines.

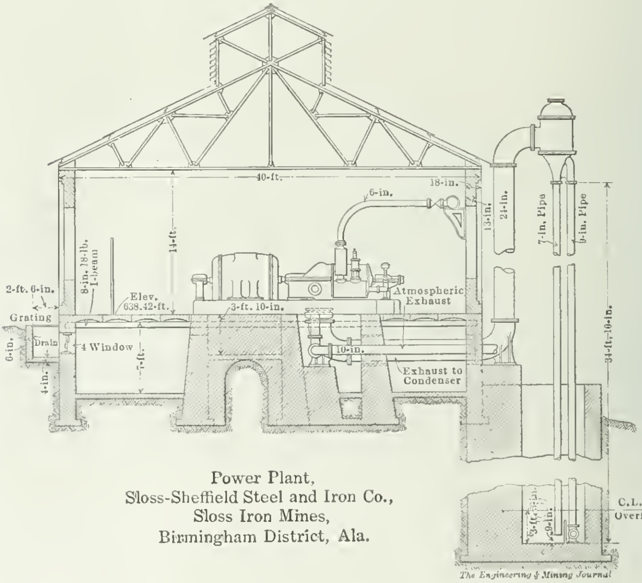
Pumping Plant at Sloss Iron Mines, Alabama

By C. A. Tupper*

To provide a modern electric generating plant solely for the purpose of keeping a mine free from water is unusual; but this was done by the Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., at what are known as the "Sloss" workings on Red Mountain in Jefferson County.

Heavy Intermittent Inflows of Water

Included in these workings are two slopes of about 23° pitch. The lower, designated as No. 1, is 2400 ft. southwest of No. 2. Both lie directly across from Bessemer, Ala., about 1½ miles distant. In common with other slopes on Red Mountain much trouble was caused by heavy inflows of water, that usually broke in from the overlying strata through fractures in the hanging wall. These occasional floodings were originally of relatively short duration, and little difficulty was experienced during most of the year in keeping the workings dry.



Power Plant,
Sloss-Sheffield Steel and Iron Co.,
Sloss Iron Mines,
Birmingham District, Ala.

The Engineering & Mining Journal

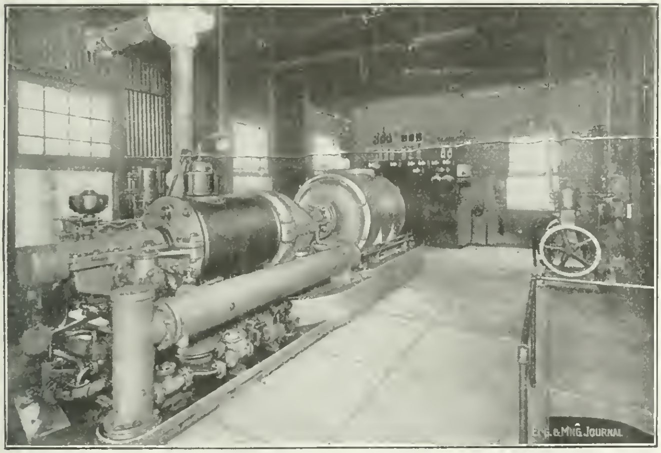
In 1909-10 the condition of No. 1 mine was greatly impaired by heavy falls of top rock, which opened up numerous channels of water and forced a shutdown of the mine. Additional pumps and the necessary pipe lines were installed, but the flow of water was so steady and of such great volume that the direct-acting steam and air pumps proved inadequate. Consequently, F. W. Hausmann, mechanical engineer of the company, in conjunction with M. J. Lide, consulting engineer, prepared the plans for a complete electrically driven pumping plant.

---

*Consulting engineer, 389 Thirty-first Ave., Milwaukee, Wis.

STEAM TURBINE GENERATOR USED

This pumping plant comprises a power house, in which is installed a steam-turbine generator unit of 750 kw. capacity, and an underground pumping station equipped with two 10-in. 4-stage centrifugal pumps, each direct-connected to a 450-hp., three-phase, 60-cycle, 2200-volt, squirrel-cage induction motor. The turbine, which operates at 3600 r.p.m., is supplied through a 6-in. feeder with steam at 125-lb. gage pressure from a battery of water-tube boilers. In its various details standard practice is followed. A three-phase, 60-cycle, electric current is delivered by the generator at 2300 volts. Excitation of the field is from an engine-driven, direct-current generator of 15 kw. in starting and from a motor-driven set of the same size while running. The switchboard consists of an exciter panel with Tirrell regulator, a generator panel and two induction-motor panels.



POWER PLANT FOR ELECTRIC PUMPING AT SLOSS MINES

The turbine is operated condensing, as shown in the accompanying engraving, and the arrangements for this are particularly interesting. All of the water pumped from the mine is discharged into a large circular concrete reservoir, with suitable gates for excess flow, situated on the side of the mountain above the power house. From this reservoir injection water at 60° F. is drawn to a 36-in. Tomlinson barometric condenser, which maintains a vacuum of approximately 28 in. referred to a 30-in. barometer. The piping and other arrangements at the power house with provision for atmospheric exhaust when desirable, may be plainly seen in the illustration.

From the switchboard the alternating current generated is carried to the mine opening by means of three-phase overhead transmission and thence through three-conductor, lead-covered, steel-armored, 2300-volt cable to the pump motors.

ALL MOTORS STARTED FROM POWER HOUSE

For convenience in operation, the engineers' plans provided for starting the motors and stopping them directly from the power house. To this end the induction-motor panels were equipped with hand wheels in the switchboard, working, by means of suitable gearing, in connection with auto-starters situated in the basement. In addition each motor is provided with an emergency oil switch, so that, in the event of an accident, the operator in the mine is not dependent upon the power-plant engineer to enable him to shut down. There is also, however, direct telephone communication. In starting, a pump motor can be brought up to full speed quickly, with the other motor either running or shut down, and the momentary fluctuation in voltage is slight. The turbogenerator can also be heavily overloaded.

The underground pumping station and a permanent sump of 1,500,000 gal. or more, are situated about 1600 ft. from the slope mouth. At this point the pumps have to operate against a total vertical head, including suction, of 655 ft. They were originally installed in gradually advancing positions, the mine being emptied of water in five weeks' continuous pumping. The present station was then constructed and has fulfilled every requirement. The rated capacity of each pump at 1130 r.p.m. is 1800 gal. per minute.

Electrically, there was some difficulty at the start. As is customary in systems containing a combination of overhead and underground circuits, high potentials occurred, due to resonance effects, which on several occasions produced pin-hole punctures in the insulation of the motor-stator windings. This difficulty, however, was remedied by grounding the neutral of the generator and installing aluminum-cell, electrolytic-type lightning arresters.

For the illustrations and data on which this article is based, I am indebted to Jesse Adkins, Birmingham manager of Allis-Chalmers Co., which built the power and pumping machinery, and to F. W. Hausmann, engineer of the Sloss-Sheffield Steel & Iron Co., Bessemer, Ala.

Giroux Consolidated

During the year ended Dec. 31, 1911, the Giroux Consolidated Mines Co. increased its real property holdings by the addition of two placer claims, and its stock holdings in the Butte & Ely Copper Co. were increased to a total of 249,575 shares.

ALPHA WORKINGS

On the 1000 level of the Alpha shaft, 571 ft. of drifting were done to provide a safe connection between the Giroux shaft and the Alpha workings and to test the ore deposits. The ore was found to be black melaconite, cuprite and malachite. On the 1200-ft. level, 909 ft. of drifting and crosscutting were done; the ore on this level occurs as cuprite, carbonate, black oxide and metallic copper. On the 1400-ft. level, which was sunk to during the year, it is stated that, while the ground is heavy, it is all right when drained; it is claimed that if this shaft were sunk to the 1600 and the 1400 level then drained, there would be no trouble. Another method suggested for working this ground is to drive several drifts on the 1400 and to keep changing as each in turn gets too wet and heavy to carry forward. The total drifting done during the year amounted to 3016 feet.

GIROUX SHAFT

The Giroux shaft was completed to the 1400 level; since then the shaft has been sunk and fully timbered to 40 ft. below the 1400 level, making 180 ft. of shaft work done during the year. A station was cut and timbered at the 1400 level. One 600- and one 1200-gal. Presscott, cross-compound condensing pumps, on the 1200 level, were started in January, and one 800-gal. Prescott, duplex-compound condensing pump was started on the 1400 level in May. By Dec. 13, the water had been lowered to a point within 33 ft. of the 1400 level. Each of the two bailers in use holds 1750 gal., or 7.3 tons of water, and 1028 bailers have been brought up in 24 hours, making an average of 1249 gal., or 5.21 tons per min. On Jan. 16, 1912, the 1400-level pump was started with air, the 1200-level pumps with steam and one bailer was also used. It is hoped soon to have the water out.

THE GIROUX SHAFT FIRE

On Aug. 21, at 9 p.m., a fire broke out in the Giroux shaft, which resulted in the loss of seven lives. It is stated that the manner of occurrence of this fire will never be known, as the three survivors were working at the bottom of the shaft and can tell nothing except that the shaft was on fire as they were hoisted through it. Evidence shows that the fire started on the 1000 level, where no work was going on. This station was all burned out, and the shaft was damaged for some distance above and below this point. The pump station on the 1200 level was not damaged, nor were the steam pipes and water-column pipe in the shaft.

PORPHYRY ORE MINES

The Morris-Bunker Hill orebody is being opened for production. The wooden headframe used at the Giroux shaft before the steel one took its place has been erected at the Morris No. 2, which is a three-compartment shaft, 205 ft. deep. The engine house has been finished and the foundation is now being put in for the first-motion hoist, formerly used at the Giroux shaft. The boiler house is nearly completed and contains one 6x16-ft. tubular boiler, two 5x16-ft. tubular boilers and one 4½x14-ft. tubular boiler; these are set up in position, ready to be bricked in. Until machinery is in operation it will be impossible to retimber the old drifts or to drive new ones in the mine, but this will be done soon, and mining is expected to be in progress by May 1. It is stated that the grade of the ore to be shipped from this mine will average more than 2 per cent.

Three churn drills were worked, during the first part of January, near the Nevada Northern Ry., and north of the main shaft of the Butte & Ely Copper Co. It was necessary to shut these down, however, on account of the weather and further work has not been resumed. Twelve holes and 1930 ft. of drilling done there in 1911, disclosed an additional tonnage of porphyry ore. Some additional ore tonnage was shown on an extension of the Morris orebody; in all a total of 2650 ft. of drilling were done during the year.

GEOLOGY

Discussing the geology, the late J. A. Snedaker said:

> The installation and equipment of the Giroux shaft at present is nothing more than one of the preliminaries or initial work to explore the deeper levels of the ore zones of that particular portion of the property. The Giroux property, I believe, presents features different from any other copper-bearing territory existing in the United Sattes, and that is, it has two series of ore measures to develop. The first, and easiest to prove up, has been partially developed and has placed a great many million tons of the concentrating character of ore in sight. The second, in which the deep-level ore measures are found and in which the Alpha mine is situated, occurs in the large contact fissure between the eruptive and sedimentary, following along the southern border of the Giroux property for a distance of something over two miles in length. This Alpha vein presents croppings that are exposed on the surface hundreds of feet in width; and, as the leaching is very deep, it is requiring work of large magnitude and equipment commensurate with the size of the vein to prosecute this development.

At present about 1,000,000 gal. of water per day are being pumped at the Giroux shaft and the work in the Alpha territory has shown that there is a permanent and ample water supply, available at a minimum expense, to enable the operation of a concentrating plant that will treat a tonnage per day several times in excess of the present concentrating capacity of 500 tons per day.

CONTRACT FOR ORE TREATMENT

The report states that it was decided recently to start the production of porphyry ores first and thereby to put the company in position to sustain itself and carry on development from its own resources. Arrangements have been made to commence shipment of porphyry ores on or before May 1, after which it will be possible to carry on both production and development simultaneously.

It is stated that the directors in October and November, 1911, seriously considered enlarging the present concentrating plant, of 500 tons capacity, to one of a daily capacity of from 1000 to 1200 tons. It was found, however, that this would require at least eight months' time. A contract has, therefore, been negotiated with the Steptoe Valley Mining & Smelting Co. for the treatment of ore from the Morris-Bunker Hill mine. This contract covers a term of five years commencing May 1, 1912, and provides for a daily treatment of from 900 tons minimum to 1200 maximum of crude ore. The Steptoe company will transport and treat the ore, and arrange for the refining. It is estimated that refined copper can be marketed and produced for about 9½c. per lb. The report states that there are 4,010,000 tons of porphyry ore fully developed in the Morris-Bunker Hill mine, of an average assay value of 2.14% copper; further that at this mine there is also a large quantity of partially developed ore, the tonnage of which will undoubtedly reach several million tons, of at least an average assay value of 1.73% copper. Attention is called, in the report, to the fact that on a basis of shipping only ores averaging 2.14%, more than 10 years' ore supply, with the maximum daily production contemplated by the above contract, is now blocked out at this mine.

ESTIMATES OF ORES

During the year, additional drilling and other work has made it possible to make more accurate and definite calculations as to tonnages and grade of the porphyry ores. The various orebodies, as far as developed, have been reblocked and sectionalized, and the tonnages and grade recalculated. While not including anything for possible additional tonnages, likely to be shown as development work progresses, it is estimated that there are at present 10,291,000 tons of fully and partially developed ore of an average copper content of 2%, and in addition thereto, 6,599,000 tons of fully and partially developed 1.65% ore. In addition to the tonnage of developed and partially developed ores, and not included in those estimates, a large quantity of lower-grade ore is said to have been disclosed, the average assay value of which will be more than 1% copper. The foregoing estimates are stated to have been calculated in the usual way and not on the basis of net recovery. In calculating the tonnages, the factor of 13 cu.ft. of ore in place is taken as 1 ton.

The financial statement shows: Cash on hand, Jan. 1, 1911, $151,026; sale of first-mortgage bonds, $252,000; miscellaneous receipts, $18,139; total, $421,165. Among the expenditures the following figures are of interest: Nevada mines expenses, $198,706; Nevada mines construction, $70,488; Mexican mines expenses, $7116; Mexican mines construction, $347. On Dec. 31, 1911, the cash on hand amounted to $137,309. Not the least interesting item is that of $34,521, which is given as the cost of putting out the fire and getting the Giroux shaft ready for repair, repairing the shaft, station, pockets and drifts, and bailing and hoisting the water from the date of the fire.

Shaft Sinking by Freezing

Regarding shaft sinking by freezing, it is stated (*Echo des Mines*, Feb. 15, 1912), that if the water to be encountered is known to be less than 1000 to 1500 gal. per min., it will pay to follow the old system of pumping, but if it exceeds 3000 to 3400 gal. per min., it will certainly pay to freeze. Between these extremes the methods are more competitive, and dependent on local conditions. The estimate is given that for a pair of 18-ft. diameter shafts, sinking them simultaneously by freezing, the cost will be about $87,500 for 300 ft.; $140,000 for 600 ft.; and $250,000 for 120 ft.; all costs, including the refrigerating plant, being included.

Ore Dressing in the Joplin District—IV

By James L. Bruce*

In the discussion of milling costs, amortization and operating charges are separately considered. The cost of a complete milling plant is given at from $800 to $1200 per ton of capacity per hour. The principal operating expense is for labor.

Before going into a discussion of the cost of milling the expression should be given some definition and elaboration to show just exactly what operations are included. I will divide it under two heads to show the first cost and the cost of operating. (1) Amortization charges to milling. (2) Operating charges to milling.

The first is one which many superintendents or managers have no control over for various reasons, but a consideration of it is nevertheless of much importance when considering the initial expenditures for mining. Money invested in mill plant beyond any nominal amount is expected to give either greater capacity, better recoveries or cheaper operating costs. Low amortization cost then usually means high operating cost and *vice versa*. Apparently the most advisable investment would be that which gave the lowest total for amortization charges, interest, and operating costs, also considering any increase in profits from better mill recoveries which might be anticipated from an extra investment. This, however, is complicated by the interdependence of the milling with the mining plant and operations. The most profitable rate at which to mill a certain quantity of ore may not be the most profitable rate at which to mine the same quantity. The size of the mill then is dependent on both, and should be chosen to fulfill an average of the two conditions.

COSTS PER TON FOR CULLING AND MILLING IN THE JOPLIN DISTRICT

Year	Tons Hoisted	Labor, Cents	Fuel, Cents	Hard Iron, Cents	Belts, Cents	Repairs to Machinery, Cents	Iron and Steel, Cents	Lumber, Cents	Elevator Cups and Bolts, Cents	Jig Grates, Cents	Oils, Cents	Water for Power Plant, Cents	Supplies and Repairs for Power Plant, Cents	Pipe and Fittings, Cents	Miscellaneous Cents	Total, Cents
1908 ...	83,603	10 95	3 17	3 63	2 06	0 25	1 60	0 41	0 53	0 26	0 40	0.33	0 00	0 35	3.44	27.38
1909 ...	108,728	10 24	3 25	3 24	1 67	1 45	1 08	1 06	0 82	0 25	0.40	0 28	0.28	0 12	1 36	25 50
1910.....	152,164	9 44	2 68	2 95	1 25	1 39	0 70	0 45	0 61	0 57	0 32	0 20	0 37	0 12	0 99	22 04
1911, 11 months.	158,562	9 26	3 42	2 82	1 29	1 36	0 67	0 57	0 43	0 57	0 24	0 26	0 34	0 07	0 53	21 83
Averages.	.. ..	9 80	3 11	3 16	1 48	1 21	0 91	0 61	0 59	0 47	0 32	0 26	0 28	0 14	1 35	23 61

Profit and Amortization Defined

The terms "profits" and "amortization" are often incorrectly used and I think it well here to call attention to the definitions given in the "Standard" dictionary. Profit is defined as "the return from the employment of capital after deducting the amount paid for raw material and for wages, real or estimated rent, interest, insurance, etc." From this it is clear that a nominal interest on the capital should not be regarded as profit, but should be considered as part of the costs of conducting the enterprise.

Amortization is defined as "the extinction or reduction of a debt through a sinking fund." We can consider this debt as being the amount of the capital invested, while the yearly interest on the same is charged to costs, in which case accumulation of the sinking fund should be equal at the end of a certain period to the capital invested. Or we can consider the debt as being equal to the capital invested plus the accumulations of compound interest on the same, in which case the accumulations of the sinking fund should be equal to the debt as described. Or again a fixed yearly sum may be provided, part of which is used to pay interest while the remainder is used to retire part of the capital invested, which together with the yearly interest, thus gradually becomes less. If the rate of interest which can be realized on a sinking fund is the same as the rate which should be charged to capital invested, it makes no difference which of the above methods is applied, the yearly charges will be the same.

If we wish to find the yearly amount of a sinking fund which will retire the capital invested, P, together with compound interest on the same at a rate, r, in a certain number of years, n, we find that the debt at the end of the period will be $P(1+r)^n$. If the sinking fund can be invested at a rate, t, the annual amount, S, necessary to provide for the debt will be

$$\frac{P(1+r)^n t}{(1+t)^n - 1}$$

If r is greater than t the annual sum should be used to pay interest on and retire the capital invested.

The cost of a mill plant including mill hopper, mill buildings, mill machinery, elevators, spouting, tailings dumps, flumes, mill ponds, etc. and its proper proportion of the cost of power plant will run from $800 to $1200 per ton of capacity per hour and the latter figure is not too high for most plants. When running single shift for 220 hours per month the cost of plant per ton handled per year would be from 30 to 45c. When running double shift the cost of plant per ton per year would be from 15 to 22.5c. The rate of amortization of these costs would depend on the probable life of the mine. Let us assume that the capital invested and the sinking fund are each worth 5% interest. Then if there was enough ore to run the mill five years on double shift the amortization would amount to from 3.5c. to 5.2c. per ton of dirt handled.

For the purpose of illustration I will assume; that there is a 10-acre tract of sheet-ground containing approximately 300,000 tons of crude ore available for milling; that a mill of 20 tons capacity per hour can be built for $24,000; that a mill of 30 tons capacity per hour of equal efficiency can be built for $30,000; and that one of 50 tons capacity can be built for $47,500.

Assuming 5000 hr. running time per year, the first would exhaust the ore in 3 years, the second in 2 years and the last one in 1.2 years, provided the mine would supply them. The average operating expense for the first mill would be about 21c. per ton, for the second about 19c. and for the third about 17c. Amortization charges would be 8.93c., 10.9c. and 17c., respectively, with interest at 6%, and the total cost would be 29.93c., 29.9c. and 34c., respectively.

From this it would appear that both of the first mills could be expected to give about the same total costs. Choice between them should then be made by considering the most economical rate at which to mine, and also the time necessary in either case to develop the mine to the point of economical production. The time required to develop a mine to a large tonnage is usually considerable, and the operating expenses, during the development period and until the tonnage can be brought up to its requirements, are much higher with a large plant and equipment than with a small one. On the other hand quick exhaustion cuts down many costs such as pumping, superintendence and general expenses.

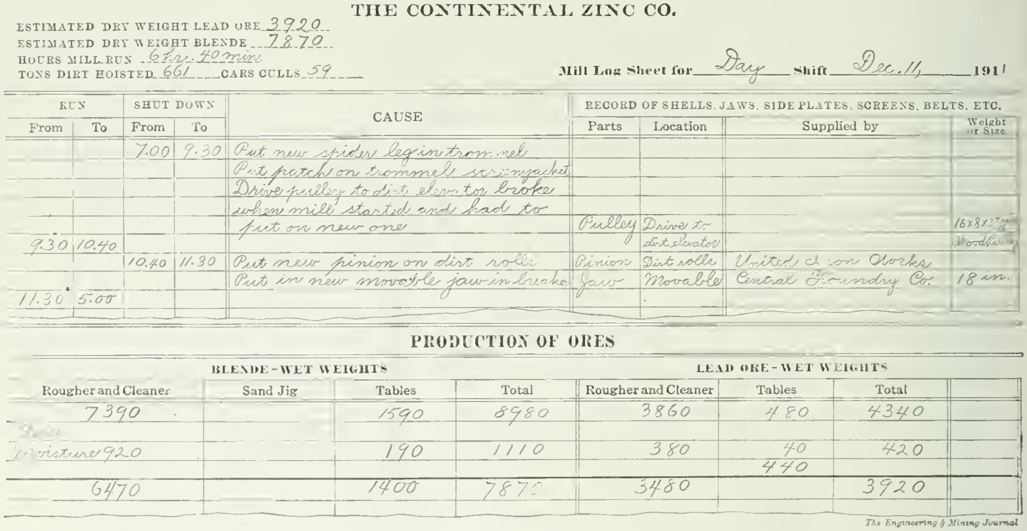
---

*General manager, Continental Zinc Co., Joplin, Mo.

MILL OPERATING COSTS

Under the second heading "operating charges to milling" there is a good deal of leeway possible regarding the operations which should be included. I will include the cost of culling out the waste from all the rock hoisted, the cost of all crushing, concentrating, mill and pond pumping, building repairs, carpenter and blacksmith work, power, and disposal of tailings. The cost of culling is charged at some plants to mining but as it is part of the concentration I have included it in the cost of milling, and have figured the milling costs on the tonnage of dirt hoisted from the mine. It is impossible from the ordinary cost-keeping record to get an average cost per ton of any item of supplies such as dirt-roll shells, return-roll shells, smiddem-elevator belting, tailings-elevator belting, pump impellers, etc., except where such records have been kept in great detail for a number of years, because they do not take account of the length of time such service was rendered for each item charged.

For the purpose of knowing just what the cost per ton is for each of the principal wearing parts in the mill, I have kept for about three years a "service record" which shows briefly the dates on which principal supplies in the mill are replaced by new ones, together with the specifications of the article put in service and its cost. This gives the period of service and by referring to other records, the tonnage handled during this period. These amounts together with the cost of the article, are filed in columns provided for that purpose and the cost per ton of ore handled, readily ascertained. I have made it a practice to keep these records for the following principal wearing parts: stationary breaker jaws; movable breaker jaws; left side plates; right side plates; dirt-roll shells; No. 1 return-roll shells; No. 2 return-roll shells; trommel-screen jackets; dirt-elevator cup belt; return-elevator cup belt; smiddem-elevator cup belt; chat-elevator cup belt; sand-elevator cup belt; tailing-elevator cup belt; shaking-screen jackets; centrifugal-pump impeller; jig-grate records on each cell of each jig; records for each drive belt; top and bottom elevator pulleys.



THE CONTINENTAL ZINC CO.

ESTIMATED DRY WEIGHT LEAD ORE 3920
ESTIMATED DRY WEIGHT BLENDE 7870
HOURS MILL RUN 6 hr. 40 min.
TONS DIRT HOISTED 661 CARS CULLS 59

Mill Log Sheet for Day Shift Dec. 11, 1911

RUN		SHUT DOWN		CAUSE	RECORD OF SHELLS, JAWS, SIDE PLATES, SCREENS, BELTS, ETC.			
From	To	From	To		Parts	Location	Supplied by	Weight or Size
		7.00	9.30	Put new spider leg in trommel				
				Put patch on trommel screen jacket				
				Drive pulley to dirt elevator broke				
				when mill started and had to				
				put on new one	Pulley	Drive to		16x8x2 7/16
9.30	10.40					dirt elevator		Wood
		10.40	11.30	Put new pinion on dirt rolls	Pinion	Dirt rolls	United Iron Works	
				Put in new movable jaw in breaker	Jaw	Movable	Central Foundry Co.	18 in.
11.30	5.00							

PRODUCTION OF ORES

BLENDE-WET WEIGHTS				LEAD ORE-WET WEIGHTS			
Rougher and Cleaner	Sand Jig	Tables	Total	Rougher and Cleaner	Tables	Total	
7390		1590	8980	3860	480	4340	
[illegible]							
Moisture 920		190	1110	380	40	420	
					440		
6470		1400	7870	3480		3920	

The Engineering & Mining Journal

The head mill man turns in to the office daily a record of mill production, actual running periods together with delays and causes of delays, and the size and specifications of any new material or supplies used in the mill showing where they were used. This is shown in the accompanying record sheet.

The following costs given from a four years' record of a sheet-ground mine will illustrate the distribution of such costs. They do not represent normal costs for this character of dirt or for a mill of the capacity given as the mine and mill water during the last 3½ years has been bad with acid which has doubled or trebled the average cost for elevator cups, screens, and screen jackets, jig grates, spouting, elevator pulleys, plunger stands, faucets, pump impellers, etc., and has added much to the hard-iron costs. The great amount of additional time required for making repairs and changes has added at least 15% to the normal costs for labor.

LABOR PRINCIPAL COST ITEM.

Referring to the accompanying table of costs, the principal item, that of labor, has ranged in four years from 9.26c. per ton to 10.95c. per ton, with an average of 9.8c., of this about 20% or 1.96c. per ton was for culling out waste, about 59% or 5.78c. was for mill foreman and millmen. About 9% or 0.88c. was for a proportionate part of the labor costs in the power station, about 8% or 0.78c. per ton was for carpenters and 4% or 0.40c. per ton was for blacksmith and miscellaneous labor. Lower labor costs could be secured at the sacrifice of mill efficiency. The second item in importance, fuel, has cost from 2.68c. to 3.42c. for the four years, with an average of 3.11c. per ton of dirt handled. A corliss steam engine running noncondensing and indicating from about 130 to 150 hp. is furnished with steam from fire-tube boilers fired with natural gas at 12½c. per M for about six months in the year and mine run coal at $2.30 per ton at the boilers for the other six months.

The third item, hard-iron, has cost from 2.82c. to 3.63c. with an average of 3.16c. per ton. The price of the castings during most of this period has been 2¼c. per lb. with a credit of ¾c. per lb. for scrap returned. The rock is a hard sharp flint or chert and exceedingly abrasive. Manganese- and chrome-steel castings have been tried but did not last enough longer to repay the extra cost. Some saving in the consumption of hard-iron was effected by feeding the oversize from the trommel to the return rolls without any water. The fourth item, belts, ranged in cost from 1.25c. to 2.06c. and averaged 1.48c. per ton. About 90% of this amount was for cup belts in wet service, the remainder for drive belts. Cup belts were tried in all grades of belting from the sewed canvas belt to rubber belt purchased at net list price. The rubber belts purchased at prices ranging from 50 to 60% off list have given the most economical service, and dirt-elevator belts of 10-ply material though running on only 30-in. pulleys have proven more economical than the 8-ply belting customarily used. The life of wide belts has been increased by using cups of only half of the width of the belt and mounting them alternately at the opposite edges of the belt. The four items mentioned above constitute about 75% of the cost of milling.

Repairs to machinery have ranged in cost from 0.25c. to 1.45c. and have averaged 1.21c. per ton of dirt. About 0.30c. of this is for repairs to rolls, including replacement of worn out gear wheels, etc., and about 0.16c. is for repairs to crusher. Iron and steel costs varied from 0.66c. to 1.60c. and averaged 0.91c. per ton. About 0.27c. was for screen jackets and 0.22c. for lining for mill launders. Other costs for elevator cups and bolts, jig grates, oils, supplies and repairs for power plant, water for power plant, pipe and fittings and miscellaneous items are shown by the accompanying table.

For some of the drawings used for illustrations I am indebted to the United Iron Works and the Webb City & Carterville Foundry and others, and I wish to express my appreciation of the courtesies extended to me by them.

Mining in Rhodesia

JOHANNESBURG CORRESPONDENCE

The Rhodesian mining boom has passed and the country is suffering the usual relapse in mining and business activity; nevertheless the output shows progressive increase as follows: 1907, 2,178,886 oz.; 1908, 2,526,000 oz.; 1909, 2,623,708 oz.; 1910, 2,568,198 oz., and for the first 11 months of 1911, 2,429,869 ounces.

In general the smaller mines are showing signs of exhaustion, but several important mines are being opened on a large scale and promise to maintain their production. The last report from the Shamva mine shows that the orebody has been pierced at the second level from No. 4 adit. The width is 205 ft.; the unreduced average assay is 21 dwt., or with high assays reduced, 10 dwt. In two other crosscuts the ore is 100 to 140 ft. wide and the reduced assays vary between 4½ and 5 dwt. The deposit has been cut at the third level, or about 400 ft. from the outcrop; the ore assays 5 dwt. The two largest corporations operating in Rhodesia, the Rhodesian Exploration & Development Co. and the Consolidated Goldfields of Rhodesia, have decided to amalgamate. The death rate of natives employed at Rhodesian mines is 15.91 per 1000. The tin discoveries have so far proved disappointing.

Gold Dredge Installations During 1911

By JOHN TYSSOWSKI*

There were 24 gold dredges erected in North America in 1911, distributed as follows: Alaska, 9; California, 8; Canada, 2; Idaho, 2; Montana, 2; South Dakota, 1. These figures are verified by information from manufacturers; the totals, however, include several dredges reconstructed or built previously but first operated in 1911, as will be seen by reference to the accompanying table. The total digging capacity represented by the new dredges is approximately 3,147,000 cu.yd. per month. The digging capacity of the 24 dredges installed in 1910 was approximately 2,745,000 cu.yd. per month.

NORTH AMERICAN DREDGE INSTALLATIONS IN 1911

Locality	Operating Company	Bucket Capacity, Cu.Ft.
Alaska (9):		
Solomon River, S.P.	Casadepaga Mining Co.	2½
Solomon River, S.P.	Solomon Dredging Co.	3½†
Shovel Creek, S.P.	Charles Kimball	2½
Ophir Creek, S.P. . .	Wild Goose Mining & Trading Co.	3½†
Seward Peninsula. .	Star Dredging Co.	2½
Nome distr't	Saunders Dredging Co.	
Nome (Osborn Cr'k)	Gold Beach Dredging Co.	5*
Nome (Osborn Cr'k)	Julien Gold Mining and Dredging Co.	2¾
North Alaska. . .	James Kelleher	2½
California (8):		
Folsom.	Union Dredging Co.	9
Sacramento.	Beaver Gold Dredging Co.	3½
Natoma. . .	Natomas Consolidated of California (No. 9)	15
Natoma. . .	Natomas Consolidated of California (No. 10)	15
Thermalito. .	Feather River Dredge	15
Oroville.	Natomas Consolidated of California (Feather No. 3)	15
Oroville.	Lawrence Gardella	5
Trinity county.	Alta Bert Gold Dredging Co.	7½*
Canada (2):		
Dawson, Y.T. . . .	Yukon Gold Co.	7½
Dawson, Y. T. . . .	Dominion Goldfields, Ltd.	
Idaho (2):		
Idaho City.	Boston & Idaho Dredging Co.	14½
Salmon. . .	Kirtley Creek Gold Dredging Co.	9
Montana (2):		
Cañon Ferry. .	Magpie Development Co.	5
Kennedy placers (Iluson)	California Dredging Co.	5¾
S. Dakota (1):		
Mystic .	Castle Creek Dredging Co	5†

*Reconstructed.
†Built previously, 1911 first operating season.

The accompanying table shows the places where dredges were installed in 1911, the number in each state, the bucket capacity in cubic yards and the names of the operating companies. During 1911 gold dredges were built and installed in North America by: The Bucyrus Co., South Milwaukee, Wis.; Union Iron Works Co., San Francisco, Calif.; Union Construction Co., San Francisco, Calif.; New York Engineering Co., New York; Straub Manufacturing Co., Oakland, Calif., and Yuba Construction Co., Marysville, Calif. It is interesting to note that of these concerns the Union Iron Works Co. is a combination of the Risdon and Union Iron Works; the Union Construction Co. is a new organization; the New York Engineering Co. again entered the list as a builder of dredges for use in North America.

DEVELOPMENT IN DREDGE CONSTRUCTION

As will be noted from the accompanying tabulation, practically all the dredges built for use in the United States, excepting Alaska, are of large bucket capacity. The modern 15-cu.ft. bucket dredges, such as erected in California in 1911, represent the highest type of gold-digging machine, and for ability to successfully handle maximum amounts of gravel under all conditions, are unequaled by any dredges built in this country or elsewhere. These are of the type of the Natoma No. 8 and Yuba No. 13, previously described in the JOURNAL[1].

NOTEWORTHY INSTALLATIONS

The 9-cu.ft. dredge, built for the Union Dredging Co., and installed at Folsom, Calif., deserves particular mention. This boat is designed with especially heavy machinery and will dig to a depth of 55 ft. It also has a heavy hull, larger by far than has heretofore been used for dredges of this capacity. The hull dimensions are: Length, 135 ft.; width, 46 ft. 6 in., and depth, 11 ft. 6 in. (The hull of the 15-cu.ft. Yuba No. 13 is 155 ft. long, 58 ft. 8 in. wide and 12 ft. 6 in. deep.) It is equipped with double gold-saving tables and hydraulic giants fed by a 10-in. centrifugal pump of 2000-gal. per min. capacity, driven by a 125-hp. motor. The revolving screen is 7 ft. in diameter and 37 ft. long. The digging motor is 200 hp., the starboard seven-drum winch is driven by a 30-hp. motor and the pumps by three motors of 100, 50 and 30 hp., respectively; the screen by a 40-hp. and the stacker by a 50-hp.

---

*Mining engineer, 526 Thirteenth St., Washington, D. C.

[1] "Dredge Installation during 1910," by John Tyssowski, "Eng. and Min. Journ.," Jan. 7, 1911; "Notes on the Construction of California Dredges," by John Tyssowski, "Eng. and Min. Journ., Oct. 15, 1910.

motor, making a total power equipment of 625 hp. (Yuba No. 13 has a power equipment of 720 hp.)

The dredge built for Lawrence Gardella and installed on the Downing tract at Oroville, Calif. in 1911 did not commence operation until January, 1912. It has a 5-cu.ft., close-connected bucket line and is electrically driven. This will probably be the last dredge installed in the Oroville field until a scheme for a closer gold saving is perfected.

A point of interest regarding the 5¾-cu.ft. dredge of the California Dredging Co., operating at Kennedy Placers, Huson, Mont., is the use of open-connected bucket chain and steam power. Water-tube boilers and compound-condensing engines are used.

Alaskan Dredges

In the Seward Peninsula region, the dredging industry still exhibits the same steady progress that was noted in 1910, as is witnessed by the installation of new dredges and a steady production of gold. The dredges for this region are generally equipped with open-connected bucket chains and gasoline or steam engines.

The ordinary dredging gravel in the Seward Peninsula region returns from 40 to 50c. per cu.yd. Operating costs, where no thawing has to be done and exclusive of amortization charges, are figured as low as 10 to 13c. per cu.yd. Frozen deposits not exceeding 10 to 12 ft. thick have been thawed at a cost not exceeding 11c. per cu.yd. Steam coal costs about $16.50 per ton and crude oil $2 per bbl. at the coast, but freight charges from the coast to the scene of operations are excessively high.

The 2½-cu.ft. dredge of the York Dredging Co., installed on Buck Creek, in the Port Clarence mining district, was designed for the recovery of placer tin, and is the first successful installation of this kind in the Western hemisphere. The dredge is operated by gasoline engines, and the hull is 30 ft. wide by 60 ft. long and 5 ft. deep.

The dredge built for the Julien Gold Mining & Dredging Co., of Osborn Creek, near Nome, is fitted with gasoline engines, revolving screen and belt-conveyor tailings stacker. This latter feature is quite a departure in the design of boats for this region, the use of sluice boxes instead of screens and stackers being the common practice.

A dispatch announces the completion of the Arica-La Paz railroad, on Mar. 5; this line, connecting Chili and Bolivia, is about 270 miles in length, and gives Bolivia a much shorter route to the Pacific. Beginning at Arica, the road passes over a desert country for 50 or 60 miles, crosses the Andes and then continues for about 200 miles in the high tablelands of Bolivia.

The Messina (Transvaal) Development Co.

Announcement was recently made that Camp Bird, Ltd., had been given an opportunity to acquire an interest in the Messina (Transvaal) Development Co., Ltd., and has agreed to guarantee the interest for five years on an issue of £250,000, 6% debenture stock.

The Messina company has a capital of £250,000 divided into 1,000,000 shares of 5s. each, of which 661,804 are issued. The new debenture stock will be issued at 95% and subscribers will receive an option certificate entitling the holder to subscribe at any time before Mar. 1, 1915, for one share in the capital of the Messina company at 22s. 6d. (the present market price, according to the circular) in respect of each £2 of debenture stock allotted. The shares under said option to rank *pari passu* with the ordinary shares for all dividends declared after date such shares are paid for. The profits of the Messina company up to £35,000 will be set aside beginning July 1, 1916, as a sinking fund for the redemption of the debenture at 105%. The company reserves the right to redeem debenture stock at any time at 105, after giving three months' notice.

The object of this stock issue is to furnish the Messina company with additional working capital with which to further develop and equip the mine, enlarge the mill to a capacity of 120,000 tons per annum, and to establish smelting works, which have not been built on account of lack of transportation facilities. Arrangements have been made with the South African government by which the railroad now being built will, it is expected, reach the mine by the end of 1912.

The Messina copper mine is situated on the government farm, Berkenrode, in the Zoutpansberg district of northern Transvaal. The other properties of the company are in the same district and adjacent to Berkenrode. The Messina company has acquired 200 coal claims, each 150x400 ft., about 15 miles southwest of Messina. The following data are taken from the report for the year ended June 30, 1911, of the company's consulting engineer, J. M. Calderwood:

There are four veins being worked in the mine. The total ore mined and concentrates produced for shipment since the commencement of operations to June 30, 1911, were respectively 65,788 and 9690 tons. The concentrates contained 53.1% copper. The ore in sight and probable ore above the eighth level is estimated at 430,000 tons from which a profit of £600,000 is expected, estimating copper at $55 per ton.

A shaft has been sunk to a depth of 818 ft. and the lowest level has been opened at a depth of 814 ft. The ore in the station at the eighth level is 27 ft. wide and assays 17% copper. From the bottom of the shaft up to the 780-ft. level the ore is bornite and chalcopyrite. The average assay value for the last 54 ft. sunk was 22% copper for an average width of six feet. Chalcocite was found in the shaft where it passed through the north vein at a depth of 660 ft. This ore assayed 36.9% copper at one place and 54.3% at another over a width of 24 in. exposed.

The total amount of development work done during the fiscal year 1911 was 2005 ft., fully half of which was done along the lode. About 650 ft. of the development work has been sampled, giving an average of 9.6% copper over a width of five feet. The total of all development work throughout the mine, including shafts. amounts to 19,533 ft. The blocked-out ore reserve on June 30, 1911, was 102,000 tons averaging 10% copper, and it is expected that it will be possible to greatly increase the production of ore of this average grade.

The total costs for the year ended June 30, 1911, during which time 18,573 tons of ore were mined and milled, were: Mining $3.80; dump ore 30c.; milling $1.56; development redemption $1.20; Johannesburg charges $1.02; total $7.88. The mill power is now furnished by a gas engine supplied with gas made in a suction producer from locally made charcoal, but two seams of coal, one 3 ft., the other 5 ft. wide, have been found on the company's coal land. These are expected eventually to produce fuel for power and smelting.

British Tin Ore Imports

The following table shows the imports of tin ore into Great Britain for the years 1910 and 1911, as reported by the *Mining Journal*, Jan. 13, 1912:

BRITISH TIN-ORE IMPORTS

Imported from	1911 Tons	1910 Tons
Africa—		
Cape of Good Hope	14	73
Natal	75	1
Nigeria	....	457
Portuguese E. Africa	10	79
Southern Nigeria	1,378	433
Transvaal	2,199	2,936
Swazieland	1,119	328
Rhodesia	....	1
America—		
Canada	7	4
United States	228	72
Mexico	14	....
Argentine Republic	19	12
Bolivia	16,114	15,693
Chile	4,450	3,527
Peru	847	580
Asia—		
British India	....	9
Japan	55	110
Straits Settlements	6	10
Australasia—		
Tasmania	....	1
Victoria	....	15
New South Wales	14	....
Europe—		
Austria-Hungary	5	7
Belgium	54	24
Denmark	....	2
France	852	822
Germany	779	325
Italy	66	128
Netherlands	105	108
Portugal	31	16
Russia	177	171
Spain	154	165
Sweden	7	....
Totals	28,779	26,109

The Practice in Blende Roasting

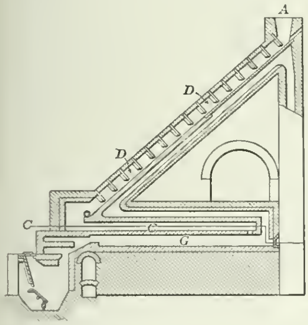
By E. Schütz

An historical review of the development of the methods of blende roasting with descriptions of some of the furnaces employed in Europe and America.

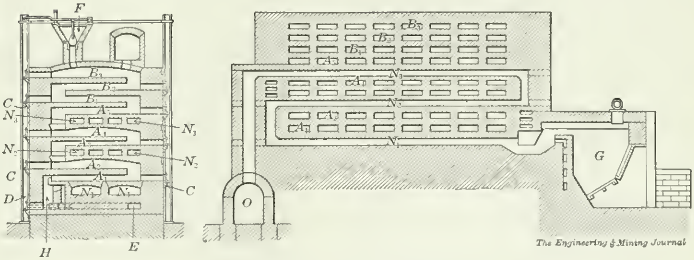
Note—Abstracted by O. H. Hahn from an article in "Metallurgie," Oct. 22, 1911.

The beginning of the rational roasting of blende dates back to the middle of the last century, when the problem of utilizing the SO_2 evolved in the roasting process sprang up. Prior to 1855 the blende was roasted altogether in reverberatories of the Freiberg pattern and the sulphurous acid allowed to escape along with the combustion products into the atmosphere.

Attempts had not been wanting to extract the SO_2 from this mixture, but without notable success, and it became necessary to change the form of the furnace in order to keep the combustion products and roaster gases separate. Before going into a discussion of the various forms of furnaces devised for the roasting of blende, I will briefly touch on the points of difficulty in the process which are due to the chemical behavior of the blende and to the high degree of desulphurization required in the finished product. To illustrate the latter point, a chemical factory which roasted blende as a transitory material for a smeltery had to stand a deduction from its roasting charges if the product delivered contained only 0.1% more sulphur than the limit stipulated by contract.



Hasenclever-Helbig Roaster



Eichhorn-Liebig Furnace

Dead Roast in Reverberatory Easy

As to the chemical behavior of blende in roasting, there was no difficulty in roasting it dead in the reverberatory. After the introduction of muffle furnaces, when the roast gases had to contain at least 5 per cent. by volume of SO_2 in order to make them available for the manufacture of sulphuric acid, the skill of the workmen was taxed to the highest degree in furnishing an unobjectionable product. The process of roasting blende is, according to the equation $ZnS + 3\,O = ZnO + SO_2$, an exothermic one (giving off heat), for a simple thermochemical calculation shows in the above decomposition an excess of 115.5 cal. (458.3 B.t.u.) But, as the blendes contain at the most 30% S, this quantity of heat does not suffice to carry the roasting operation to a successful issue without external firing. For this reason a steady heat has to be maintained in the fire place or places connected with the furnace.

Furthermore, the zinc sulphate formed in roasting has to be split into its components; otherwise the sulphur content of the product would remain too high. The following results have been recorded on the temperatures at which the zinc salt is formed, and at which its decomposition by heat takes place. L. and P. Wöhler and Plüddemann have found that in the oxidizing roasting of blende up to about 800° C., $ZnSO_4$ is formed and that its dissociation temperature is at nearly 900° at the ordinary pressure of the atmosphere. H. O. Hofman, *per contra,* asserts that decomposition of the anhydric sulphate is complete beyond 770° C., and that basic salt is formed in small quantities only.

Zinc Sulphate Decomposition Reversible below 900° C.

Doeltz and Graumann have also found that from 700° C. on, a rapid, although incomplete decomposition of $ZnSO_4$ takes place. They call attention to the fact that the reaction $ZnSO_4 = ZnO + SO_3$ may be assumed as still reversible at 900° C., unless the SO_3 gas can be quickly removed, or if, on the other hand, the temperature is lowered in the furnace; for example, by opening the working doors. It will be seen from these statements that in a blende-roasting furnace a temperature up to 900° C. must prevail if all the sulphate is to be decomposed and roasting is to be carried on successfully. Furthermore, these figures accentuate the importance of correct and judicious firing.

Last, but not least, a good roast depends a great deal upon the quality and willingness of the workmen. The work of constant rabbling is hard, but necessary; neglect on the part of one man may spoil the output of 24 hours' labor. This refers particularly to the Rhenania furnace. It is especially desirable that a green charge, on being dumped into the furnace, should be vigorously rabbled at once, in order to oxidize as much as possible of the sulphur in the blende on the topmost story, since the heat of formation of the sulphurous acid is added[1] to the heat artificially produced and the production of an excessive quantity of zinc sulphate is avoided.

Sulphur First Utilized in 1874

The first furnace constructed with a view of utilizing at least part of the sulphur in roasting blende is the one of Hasenclever and Helbig, which came out in 1874, of which a longitudinal vertical section is given. It consists of a reverberatory furnace *G*, above which there is a muffle *C*. The bottom of this muffle is, at the same time, the roof of the reverberatory, and is heated in that way. The fire gases play around the muffle and finally, in their upward course, heat the most singular part of this furnace construction, consisting of an inclined plane slanting at an angle of 43°. At the top of this incline the ore is charged through a hopper *A* and, to keep it from sliding down too fast, the partition walls or baffles *D* are inserted. In the muffle as much as possible of the sulphur should be removed; the last remnants of it are then left to be expelled in the reverberatory mingled with the fire gases. The SO_2 here evolved, amounting to more than one-third of the original sulphur, is lost entirely; hence only about 60% are available for SO_3 manufacture.

---

[1] This is denied by the constructing engineer of the Stolberger Aktiengesellschaft in "Metallurgie," Nov. 22, 1911, p. 714. He claims that this heat is carried off by the roast gases.

The priority in utilizing the whole of the sulphur of the blende is due to M. Liebig, who, in common with Dr. Eichhorn, obtained German pat. No. 21032 in 1882, on what is known as the Eichhorn-Liebig furnace. It is the regular type of a muffle furnace, designed to keep the roast gases separate from the fire gases. Accompanying illustrations represent longitudinal and transverse sections of this furnace. A_1, A_2, A_3, A_4 and A_5 are hollow floors or hearths, the hollow parts serving as heating chambers N_1, N_2, N_3, through which the hot gases circulate, while the three top floors B_1, B_2, B_3, are solid blocks of special firebrick. Access to the several floors is had by the doors *C*. The heating of the furnace is effected by the gas producer *G*; the hot gases after passing through N_1, N_2, N_3 make their exit by the flue *O*. The air for oxidizing is admitted at *D* and is heated by the hot air in chamber N_1, while passing through *E*. The blende drops through the hopper *F* on B_3, and is, after ignition, shifted further until it finally arrives at *H* in a finished condition. A furnace of that kind puts through four tons in 24 hours, with a consumption of 0.8 ton of coal and, with blendes free from lime, the sulphur content will come down to 0.1% S. In the case of calcareous vein matter, 2½% of the S are retained in the form of gypsum.

Description of the Rhenania Furnace

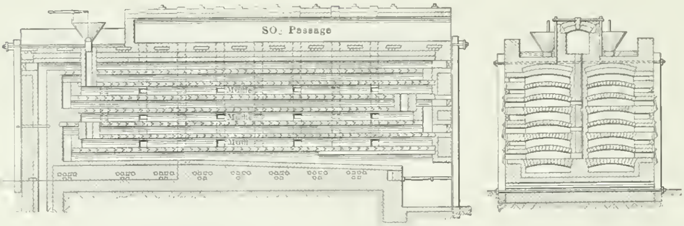
At the Rhenania Chemical Works, Aix-la-Chapelle, Prussia, the above furnace was remodeled, and to distinguish the new style from the old one, has been called the Rhenania furnace. The most troublesome parts in the Eichhorn-Liebig furnace had been the blocks *B*, which were replaced by arch stones, in order to make them more durable. The charges drawn were also too small in bulk; to make them larger it was necessary to enlarge the dimensions of the furnace all around. The cuts represent longitudinal and transverse sections of the Rhenania furnace. It consists of three muffles arranged one above the other, around which the fire gases circulate. If the blendes are rich in sulphur the hot fire gases are allowed to circulate around the lowermost muffle only, and are then conducted directly to the chimney. The engravings show the furnace as provided with a grate firebox, but the use of producer gas would be more appropriate. It is of importance that the finely ground ore should be fed to the furnace thoroughly dried, to insure its immediate ignition upon entering at the top.

Rhenania Roasting Takes 20% of Fuel

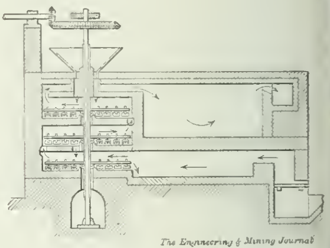
The labor in the furnace consists in stirring or rabbling the ore and shifting it from one hearth to the next lower one until it at last arrives at the draw hole; in this way the sulphur is at first rapidly, then gradually oxidized to SO_2. The air enters through the working doors and the gases leave the furnace proper through flues in the back wall, opposite these doors and are collected in the main flue leading to the lead chamber. A Rhenania furnace has, like its predecessor, a capacity of 4000 kg. of roasted ore in 24 hours, and consumes 20% of fuel.

The weight of each charge drawn varies between 450 and 500 kg. In large works four of these furnaces are generally united in one block, and attended to by a special fireman on a 12-hour shift. After this type of furnace had been brought into successful operation and run for several years, the management, to make itself independent of manual labor, saw fit to construct a mechanical roasting furnace, which was patented in 1891. The rabbling and moving of the ore was here performed by a traveling belt with scraper attachment. But the scheme did not work satisfactorily and was given up.

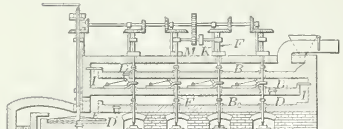
In this connection it may be mentioned that at about the same time two other mechanical furnaces made their appearance, one patented by Haas and another patented by the Société Vieille Montagne. The former resembled the MacDougal furnace in several particulars, notably in having mechanical scrapers which turned over the ore and moved it successively from one hearth to the two lower ones and finally landed it on the floor of the reverberatory, where the roasting operation was brought to a finish. This fur-



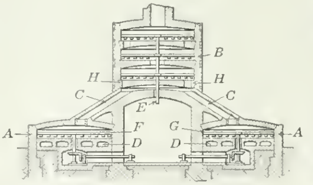
RHENANIA FURNACE



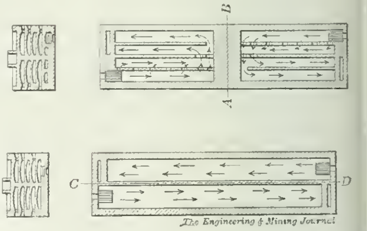
VIEILLE MONTAGNE TYPE



MERTON FURNACE



ZELEWSKI FURNACE



PETERSON AND RHENANIA TYPES COMPARED

nace was operated for some time at Oberhausen, Rhenish Prussia, but was finally abandoned.

The furnace of the Société Vieille Montagne is sketched in the accompanying illustration. The fatal part of this furnace, as of those of Meyer, Wedge, Heberlein-Hommel, Hommel and others, is the large amount of ironwork exposed to a high degree of heat and the corrosive action of the roast gases.

Another drawback of all the mechanical furnaces is that the ore has to be taken as it comes out through the discharge. If it should contain too much sulphur it is unfit for the succeeding reduction process and has to be reroasted in admixture with raw ore. From the Rhenania furnace no charge is drawn until a sample has been tested for sulphur in the laboratory. This is done by boiling the sample with HCl in a test tube and holding a strip of paper impregnated with acetate of lead over it. If a black spot appears on the paper, the charge must be further rabbled. If there is only a brownish tinge on the paper, the charge may be considered as finished.

By reason of their shortcomings, these furnaces had to give way again to the Rhenania furnace and its variations. The Société Vieille Montagne for one has returned to the muffle furnace of the Rhenania.

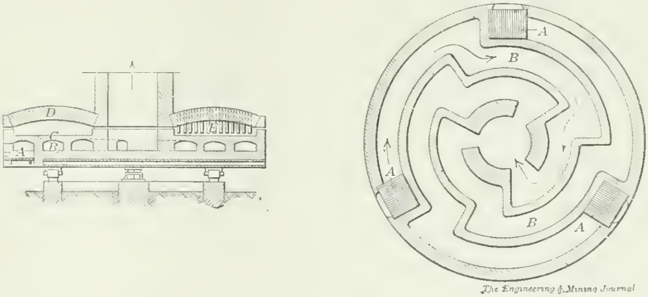
Not Enough Flexibility in Mechanical Furnace

The Merton furnace is strongly recommended by Kroupka in the *Oest. Zeit. für Berg- und Hüttenwesen*, 1904, p. 187, and is said to be in operation at a number of Belgian works. From the drawing it appears that the furnace consists of three stories of rectangular reverberatory hearths B, B_1, B_2 and a finishing hearth E, on all of which the ore is stirred by plows fastened to upright shafts made to revolve by proper gearing. The ore runs continuously through the discharge holes D from the top downward. The reverberatory furnace is not conducive to saving all the roast gases; hence the Merton Furnace Co. advertises that it also sells its furnaces muffled.

Another furnace said to be used by some Belgian companies is the one patented by R. von Zelewski. It consists of the furnace proper B and two finishing roasters A connected with B through flues C. The ore is rabbled and shifted by the gears E, F, G, each of which may be run at a different speed. By the setting of the dampers H the supply of the finishing roasters is regulated.

The Petersen Furnace

Another illustration represents a furnace patented by H. Petersen, who does not think much of the mechanical furnaces so far constructed for blende roasting. This furnace is an altered type of the Rhenania furnace, as a comparison will show. Its advantages are claimed to be: a longer life, a smaller consumption of coal, a better roast without clotting and a larger tonnage. The chief difference of the Petersen from the Rhenania furnace is that its center line $A\ B$ passes through the short axis while in the Rhenania it cuts through the long axis CD. The advantage of this arrangement is that in repairing or tearing down one side of the furnace the other one is not affected. Another advantage of the Petersen construction is based upon the possibility of regulating both compartments of the furnace side connected with a fire place. The fire flues are so arranged that the lowest hearth of the first and then that of the second compartment are heated. Thereafter the fire gases are divided in rising and pass simultaneously through between the lowest and second-lowest muffles of both compartments; at the end they drop into the flue leading to the chimney. The division of the gases for both sides of the furnace is effected by dampers in such a way that either both furnace sides receive an equal volume of hot gases, or the one more, the other less. The dampers are placed at the end of the fire flues where they enter the main flue.



Stolberg Furnace

The Stolberg Furnace

The Stolberg furnace is patented by the Aktiengesellschaft für Bergbau, Blei- und Zinkfabrikation zu Stolberg und in Westphalen. The figures show a rotatable hearth, underneath it the fire places A and the fire flues B. Above C there are the arches D with the rabbles E. By this arrangement the hearth may be heated uniformly in all its parts and conformable to various purposes. But the furnace does not appear to be designed with a view to make use of the heat of reaction[2] emitted in the oxidation of the sulphur. According to the patent specifications the fire places revolve with the hearth; they may be fixed solidly to the hearth or may be made removable so that the number of fire places may be increased and a defective one can be easily and conveniently removed. The advantages of this furnace are, therefore, only in the manner of firing[3].

The Matthiessen-Hegeler Furnace

The Matthiessen-Hegeler furnace, a muffle furnace provided with mechanical stirring apparatus for roasting blende, has been in successful operation in America since the '90s of the last century, at La Salle, Ill. It consists of a heavy rectangular block 24 m. in length by 5 m. wide by 6 m. high and is divided into two single furnaces by a partition running lengthways through the middle. Each furnace side has seven muffles, one above the other, for roasting blende and two muffles for the fire gases, The muffles have a length of 23.5 m. in the clear and a width of 1.85 m. For the blende muffles there is, therefore, a total roasting area of 43.5 × 7 m. = 304 sq.m. and a length of 164.5 m. to be traveled by the blende.

This furnace is much more durable than a Rhenania furnace, its life being stated to be about five years. The greater durability is accounted for by the temperatures being lower in the Matthiessen-Hegeler furnace than in a furnace manipulated by hand. The highest temperature in the blende muffle is 800° C. while in a hand furnace temperatures of 900 to 950° are required. In the Matthiessen-Hegeler furnace are roasted high-grade blendes with 58% Zn and 30% sulphur reduced to 2-mm. size. Its output per 24 hours is 40 tons of roasted blende retaining less than 1% S. There is no clotting in roasting; any slag that may incidentally form sticks to the sides of the furnace and is removed from time to time through holes provided for that purpose. The almost perfect desulphurization of the ore is principally due to two facts: (1) The way which the blende has to travel is seven times as long as in a Rhenania furnace worked by hand.

---

[2] See note 1.

[3] Ibidem, the same authority says that a one-story roasting furnace can only give good results by having several fireboxes, and it is then ready to work any kind of blende, while the multi-story ones are only adapted to one particular ore. The furnace in question is in operation at the Münsterbush zinc works, and gives good results, although the warping of iron parts gives occasional trouble.

(2) The rabbling of the blende takes place much more frequently than in a hand furnace.

While in the Rhenania furnace the blende is only rabbled every six hours, it is done by this furnace every 1¼ hours in a much more vigorous manner, that is to say, five times as often. The whole procedure takes about 72 hours. A further advantage of this furnace, which has been alluded to already, is that the roasting operation takes place at a lower temperature, owing to the vigorous working whereby volatilization of metallic zinc from the blende is prevented, which begins at a temperature of 900°. The manipulation of the furnace is simple and easily learned by any workman. The crew required per 24 hours is 10 men. Coal consumption, varying according to quality, is between 25 and 30% of the roasted blende; consumption of power, 10 hp. at the most. Repairs are slight, amounting to, say, 4000 marks per year. Accordingly, the cost of roasting per 40 tons roasted blende in 24 hours, without counting general expense and amortization of plant, is as follows:

	Marks
Wages of 10 men at 5 marks........	50
Coal, 40 × 0.3 = 12 tons at 8 marks..	96
Power, 10 × 0.24 at 4 marks........	10
Repairs, 4000 ÷ 365.................	12
Total	168

Hence one ton costs 4.20 marks to roast. (1 mark = 23.8c.)

MATTHIESSEN FURNACE EXPENSIVE TO INSTALL

These furnaces are also adapted for ores with lime and magnesia gangue. Although the Matthiessen-Hegeler furnace has won its way in the United States, owing to the economies gained by it, operators in Europe have been chary of adopting it for several reasons. In the first place its great cost is an objectionable feature. Considering that an accident may occur to a single furnace at any time, it would be necessary to have a second one in reserve. This would involve an outlay of twice 120,000 marks, an amount of money which a small reduction works could ill afford to keep locked up. Secondly, an output of 40 tons of ore a day would necessitate the keeping of a large supply in stock to guard against emergencies. The failures of the Haas, the Vieille Montagne and other furnaces may also have contributed their share in making people cautious. Thus far only one instance is known of the introduction of the Matthiessen-Hegeler furnace in Europe, viz., at the works of a wealthy company in Upper Silesia.

USE OF STEAM IN ROASTING

There is a possibility that the application of steam would be of service in accelerating the roasting process, but not through injecting it into the furnace, which has been tried without success. Thomas, in *Metallurgie*, 1910, parts 19 and 20, proposes to produce steam through the combustion of hydrogenous fuel, which is intimately mixed with the zinc ore. For this purpose he briquettes his ore with tar, pitch or other hydrocarbon material. The steam evolved is then in intimate contact with the blende, and contributes materially to its oxidation. The process goes on at a lower temperature (700 to 820° at the most) and in a shorter time than the present mode of roasting. But there is another point to it which the application of mechanical roasting furnaces permits, and that is the manner of automatic removal of the roasted from the unroasted material. The particles of ore in the briquettes are kept together until they are completely roasted. This transformation naturally takes place first on the surface of the briquettes, so that in slowly moving these bodies toward each other in roasting trommels or on movable grates, the well roasted stuff crumbles off from the briquettes and drops through openings in the bottoms or walls of the roasting appliances into a cooling chamber, in which the last remnants of still existing sulphates are finally decomposed by the hot gases from a fire place.

Protection of Pipe from Corrosion

Corrosive conditions are often so severe in pipe lines that unprotected iron and steel will not last long. Since electricity has become widely used, the life of pipe underground is still further jeopardized and the necessity for adequate protection has become more apparent. A special study of the manufacture of slow-corroding steel for pipe has been made by the National Tube Co., of Pittsburgh, Penn. and a soft steel has been developed having an exceptionally high degree of uniformity. This has been further improved by a patented process of hot forging, known as spellerizing, which is applied to the metal in the course of manufacture by which the surface portion is rendered more uniformly dense and less liable to become pitted. Where no protective coating can be applied this steel will give good service.

However, it is the nature of iron to become oxidized and go into solution in the combined presence of water and oxygen, the reaction being accelerated by the presence of free acids and salts in solution, especially where stray electric currents leave the pipe. Against the inroads of such reactions there is no satisfactory remedy except that of keeping moisture away from the metal. To protect pipe from moisture the company has developed the "National" coating and is at present in a position to apply it to pipe ranging from 3 to 18½ in. diameter.

In applying "National" coating, the pipe is first cleaned and dried, and while still at a temperature above the boiling point of water, is dipped into a hot bath of a special bituminous compound and kept there until the pipe has the same temperature as the bath. On removal from the bath the pipe is allowed to drain vertically and cool, leaving the pipe covered inside and outside with an elastic compound, the consistency of which can readily be adapted to the temperature conditions under which the pipe is to be used. By a second operation this enamel-like surface is wrapped with a strip of fabric that has been thoroughly saturated with the hot compound. Immediately after being saturated with the compound the fabric is wound spirally over the surface of the pipe, overlapping about one inch on each turn, covering and firmly adhering to the body coat. Two or three thicknesses may be applied in this way where desired to meet special conditions. The average thickness of ordinary paints or bituminous dips rarely exceeds 1/100 in., but in the case of one-ply "National" coating the thickness of the protection amounts to about 3/64 in. The exclusion of moisture is the main purpose kept in view in applying this coating to pipe. So long as moisture is prevented from reaching the metal, no corrosion or electrolysis is possible.

For providing the joints of this pipe with a similar coating of compound and fabric, extra materials are furnished with each shipment of pipe, sufficient for covering all the joints in the line. When pipe covered with this coating is ordered, the conditions under which the pipe is to be used, character of soil, drainage, etc., and the range of temperature which will probably be found at the time of the year when the pipe is to be laid, should be specified.

A New Tin Discovery

In view of the recent high prices of tin and the discouraging reports of the tin industry of the Federated Malay States, the report of a new tin field in Johore (*Min. & Eng. Review*, Queensland, Nov. 5, 1911) is encouraging. The field is being exploited by Singapore tin men, and is situated at the head of the Lingtu River, a branch of the Johore River, about 45 miles from Singapore. In the future it appears that water transportation will be possible right through to the field, but the waterway is not entirely cleared through the jungle, so that the present plan for working it is to take in overland a suction dredge, which has been designed so that no separate part will weigh more than 400 lb. The machinery at present contracted for is being supplied by Thompson & Co., of Castelmaine, Victoria.

The Mineral Production of Canada

By John McLeish*

The production in 1911 was slightly less than 1910, on account of the protracted strike of the coal miners in Alberta and British Columbia.

The mining industry during the years 1909 and 1910 showed such substantial progress and large increase in output that it is not surprising a slight falling off should be shown in 1911, particularly when it is remembered that the long continued strike of coal miners in Alberta and the Crows Nest district of British Columbia not only seriously reduced the coal output, but also, because of the closing down of the Granby smeltery on account of the coke shortage, caused a lower production of copper, silver and gold than would have otherwise been obtained.

The preliminary statistics herewith published, based upon direct returns from mine and smeltery operators but subject to final revision, show the total value of the production in 1911 to have been $102,291,686, a falling off of $4,531,937 or 4% when compared with the production in 1910. The returns for 1911 are given in the accompanying table.

The subdivision of the mineral production in 1910 and 1911 by provinces was approximately as in table II.

Of the total production in 1911 a value of $46,197,428 or 45 per cent. is credited to metals and $56,094,258 to nonmetallic products. Practically all of the metals with the exception of pig iron show a falling off in production in so far as value is concerned. In the case of copper, however, there was an increased output of the metal although the average price per pound was slightly lower than in 1910. The increase in pig-iron production was quite considerable although this is chiefly attributable to imported ore. Among the nonmetallic products increases are shown in the production of arsenic, asbestos, feldspar, graphite, natural gas, pyrites, salt and in nearly all of the structural materials, including cement, clay products, stone, lime, etc. Outside of the metallic products, the principal decreases are in coal and petroleum; the falling off in value of coal production alone being practically equivalent to the total net decrease for the year.

The reduction of 4.2% in 1911, as compared with 1910, is the first shown since 1905. The total last year was about 10 times that of 1886, the first year that reports were made in the present form.

SMELTERY PRODUCTION

General statistics of smeltery production have been collected by this Branch since 1908. Complete returns have been received for the year 1911 with the exception of one or two plants recently established for the treatment of Ontario silver-cobalt ores. It should also be explained that the accompanying statistics include the treatment of a small quantity of imported ores in the British Columbia smelteries.

MINERAL PRODUCTION OF CANADA
IN 1911

(Subject to Revision)

Product		Quantity	Value
METALLIC			
Copper	Lb.	55,848,665	$6,911,831
Gold		....	9,762,096
Pig iron from Canadian-ore	Tons	42,186	613,404
Iron ore sold for export	"	39,162	86,812
Lead	Lb.	23,525,050	818,672
Nickel	"	34,098,744	10,229,623
Silver	Oz.	32,740,748	17,452,128
Cobalt and nickel oxides		....	221,790
Zinc ore		2,590	101,072
Total metallic		....	$46,197,428
NONMETALLIC			
Actinolite	Tons	67	736
Arsenic, white	"	2,097	76,237
Asbestos	"	100,893	2,922,062
Asbestic	"	26,021	21,045
Chromite	"	27	351
Coal	"	11,291,553	26,378,477
Corundum	"	1,472	161,873
Feldspar	"	17,718	51,924
Fluorspar	"	34	238
Graphite	"	1,269	69,576
Grindstones	"	5,312	49,942
Gypsum	"	505,457	978,863
Manganese	"	5½	300
Magnesite	"	991	5,531
Mica	"	....	119,863
Mineral pigments—			
Barytes	"	50	400
Ochers	"	3,622	28,333
Mineral water		....	223,758
Natural gas		....	1,820,923
Peat	Tons	1,463	3,817
Petroleum	Bbl.	291,092	357,073
Phosphate	Tons	558	4,928
Pyrites	"	82,666	365,820
Quartz	"	60,526	83,865
Salt	"	91,582	443,004
Talc	"	7,300	22,100
Tripolite	"	20	122
Total non-metallic		....	$34,191,161
STRUCTURAL MATERIALS AND CLAY PRODUCTS			
Cement, portland	Bbl.	5,635,950	7,571,299
Clay products:			
Brick		....	6,521,558
Sewerpipe		....	799,756
Fireclay, pottery, &c.		....	996,395
Lime	Bu.	7,227,310	1,493,119
Sand and gravel (exports)	Tons	573,494	408,110
Sand-lime brick		....	424,241
Slate	Sq.	1,833	8,248
Stone:			
Granite		....	880,309
Limestone		....	2,282,146
Marble		....	140,903
Sandstone		....	377,013
Total structural materials and clay products		....	$21,903,097
Total value, 1911		....	$102,291,686

The total quantity of ores treated in 1911 was 2,192,727 tons as compared with 2,683,714 tons treated in 1910. These ores are classed as follows: Nickel-copper, 610,834 tons; silver-cobalt-nickel-arsenic, 8504; lead and other ores treated in lead furnaces, 55,408; copper-gold-silver, 1,517,981 tons.

The closing down of the Granby smeltery, due to coke shortage, was the principal cause of a falling off in the copper-gold ores treated. The products obtained in Canada from the treatment of these ores include: Refined lead produced at Trail, B. C., and fine gold, fine silver, copper sulphate and antimony produced from the residues of the lead refinery; silver bullion, white arsenic, nickel oxide and cobalt oxide produced in Ontario from the Cobalt District ores. In addition to these refined products, blister copper, copper matte and nickel-copper matte are produced and exported for refining outside of Canada.

The aggregate results of these smelting and refining operations for the years 1910 and 1911 are summarized in table III.

Smeltery products shipped outside of Canada for refining were: Blister copper, carrying gold and silver values, 10,710 tons in 1911, as compared with 13,918 tons in 1910; copper matte carrying gold and silver values, 11,320 tons in 1911, as against 11,519 tons in 1910; bessemer nickel-copper matte, carrying small gold and silver values as well as metals of the platinum group, 32,607 tons in 1911, as compared with 35,033 tons in the previous year.

GOLD

The gold production in 1911 is estimated as approximately $9,762,096 which, compared with that of 1910, shows a falling off of $443,739. The Yukon placer production in 1911 is estimated at $4,580,000 as against $4,550,000 in 1910, the total exports on which royalty was paid during the year, according to the records of the Interior Department, being 277,431 oz. in 1911 and 275,473 oz. in 1910. The British Columbia production in 1911 was $4,989,524, of which the placer production, as estimated by the Provincial Mineralogist, was $468,000, smeltery recoveries and bullion obtained from milling ores being valued at $4,521,524. The production in Nova Scotia is estimated at $142,000, all from milling ores. In Quebec there was a small recovery from alluvial workings and a small content in the pyrite ores shipped, the total value of production being $12,443. Returns so far received from Ontario show a production of $37,929.

The exports of gold-bearing dust, nuggets, gold in ore, etc., in 1911 were valued at $7,493,523. Gold was imported in bars, blocks, ingots, etc., to the value of $924,233 during the year.

Note—Abstract of annual report.

*Chief of the Division of Mineral Resources and Statistics, Mines Branch, Canada Department of Mines.

Silver

The silver production of Canada, which has been rapidly increasing during the last few years, will show but little change in 1911.

Returns so far received indicate a falling off of about 128,516 oz. The total production of the year is estimated at 32,740,748 oz. valued at $17,452,128, of which 30,761,690 oz. were from Ontario, 1,910,323 from British Columbia, 50,300 from the Yukon and 18,435 oz. from Quebec.

The production in Ontario was slightly greater than that of the previous year and in British Columbia a falling off of nearly half a million ounces is shown. For British Columbia the figures represent the recovery as silver bullion or silver contained in smelter products, while for Ontario the figures represent the total silver content of ore and concentrates shipped less 5% allowed for smeltery losses, together with bullion shipments.

TABLE II. VALUE OF PRODUCTION BY PROVINCES

Province	1910 Value	1910 Per Cent. of Total	1911 Value	1911 Per Cent.
Nova Scotia	$14,195,730	13.29	$15,354,928	15.01
New Brunswick	581,942	0.54	611,597	0.60
Quebec..	8,270,136	7.74	9,087,698	8 88
Ontario...	43,538,078	40.76	42,672,904	41.72
Manitoba.	1,500,359	1 40	1,684,677	1 65
Saskatchewan	498,122	0.47	618,379	0 60
Alberta...	8,996,210	8.42	6,404,110	6 26
British Columbia	24,478,752	22.92	21,237,801	20 76
North West Territories	4,764,474	4.46	4,619,592	4 52
Dominion.	$106,823,623	100.00	$102,291,686	100.00

The total shipments of ore and concentrates from the Cobalt District and adjacent mines were about 16,234 tons, containing approximately 23,817,198 oz., in addition to which 3,334,052 oz. were shipped as bullion. The average silver content of ore and concentrates shipped was thus about 1744 oz. per ton as compared with an average of 867 oz. in 1910 and 840 oz. in 1909. The 1911 shipments were chiefly high-grade ore and concentrates.

The exports of silver in ore, etc., as reported by the Customs Department were 31,216,725 oz. There was also an importation of silver in bars, blocks, sheets, etc., valued at $847,645 in all.

Copper

There is practically no production of refined copper in Canada, and the production is represented by the copper contents of smelter products, matte and blister copper, produced, together with the amount of copper contained in ores exported estimated as recoverable.

The total production on this basis in 1911 was 55,848,665 lb. as compared with 55,692,239 lb. in 1910. The total copper contents of ores shipped in 1911 were approximately 67,282,590 lb., being 3,123,189 lb. from Quebec, 21,402,221 lb. from Ontario and 42,757,180 lb. from British Columbia. This record is of special interest as illustrating the distinction between ore contents and smelter recoveries.

Of the production or smelter recovery in 1911, Quebec is credited with 2,436,190 lb. This is altogether from pyrite ores, which are mined primarily for their sulphur contents. Ontario's production in 1911 was 17,932,263 lb., all being from the nickel-copper ores of the Sudbury district.

The production in British Columbia notwithstanding the failure of the domestic coke supply due to strikes in the coal mines of the Crows Nest Pass district and the consequent shutting down of the Granby smeltery for nearly five months, shows a slight increase, being estimated at 35,480,212 lb. in 1911 as against 35,270,006 lb. in 1910. The British Columbia Copper Co. operated with larger output, using imported coke, and production from Coast mines, particularly the Britannia and Marble Bay, was specially active. The increased production from these mines more than balanced the falling off at Granby.

TABLE III. SMELTERY AND REFINERY PRODUCTION IN 1910 AND 1911

		1910		1911	
		Refined Products	Metals Contained in Matte, Blister, and Base Bullion	Refined Products	Metals Contained in Matte, Blister, and Base Bullion
Antimony	Lb.	..		30	..
Gold	Oz.	13,298	197,181	15,270	175,189
Silver	Oz.	16,373,799	2,136,414	17,711,077	612,401
Lead.	Lb.	32,987,508		23,525,050	.
Copper..	"		56,149,299	.	47,788,131
Copper sulphate........ . .	"	163,228		197,187	... ...
Nickel......	"		37,587,676	.. .	34,098,744
Cobalt and nickel oxides.. ..	"	13,508		15,174	.... .
Mixed oxides of cobalt and nickel.	"	108,178	. ....	127,224	.
White arsenic	"	3,003,467	..	4,194,209	. ... .

The total exports of copper contained in ore, matte and blister, etc., according to Customs Department returns, were 55,287,710 lb., valued at $5,467,725, which agrees fairly closely with the record of production. The total imports of copper in 1911 were valued at $4,936,459, and included 35,155,550 lb. of crude and manufactured copper; copper sulphate, 2,191,899 lb., and other copper manufactures, valued at $215,588 in all.

Lead

The total production of pig and manufactured lead in 1911 was 23,525,050 lb. There was also a small production of lead concentrate from Calumet Island, Que., the shipments being about 45 tons. The total showed a considerable falling off in 1911. The decrease is probably chiefly due to the diminished tonnage from the St. Eugene mine, in East Kootenay and the idleness of some of the more important mines of the Slocan, following the destruction of the Kaslo & Slocan Ry. by forest fires in 1910. The exports of lead in ore in 1911 are reported as 32 tons, and of pig lead only 36 tons.

The total value of the imports of lead and lead products in 1911 was $1,049,276, including 13,135 tons in the form of pig lead, bars, sheets, etc., valued at $706,020; manufactures of lead, valued at $108,012; litharge and lead pigments having an equivalent lead content of approximately 2395 tons, valued at $235,244. The total value of the imports of lead products in 1910 was $833,743, and with the exception of manufactures, valued at $107,688, represented an equivalent lead content of 10,544 tons. The total bounty paid on lead produced was $219,558 for the year.

Nickel

The mining and smelting of nickel-copper ores in the Sudbury district of Ontario was carried on actively throughout the year, and although the production was slightly less than in 1910, it was still very much larger than in any previous year. Active operations were, as usual, carried on by the Mond Nickel Co., at Victoria Mines, and the Canadian Copper Co., at Copper Cliff, Creighton, Crean Hill, etc., while the Dominion Nickel Co. continued to develop its property at Norman Station.

TABLE IV. NICKEL PRODUCTION

	1901	1911
Ore mined.	652,392	612,511
Ore smelted	628,947	610,831
Bessemer matte produced.	35,033	32,607
Copper contents of matte.	9,630	8,966
Nickel contents of matte.	18,625	17,049
Spot value of matte shipped . ..	$5,380,064	$4,945,592

The aggregate results of the operations on the Sudbury district nickel-copper ores during the last four years were as follows, in tons of 2000 lb.:

Exports included 27,596,578 lb. to the United States, and 5,023,393 lb. to Great Britain.

IRON

The total shipments of iron ore in 1911 are reported as 210,344 tons, valued at $522,319. These may be classified as 72,945 tons of magnetite, and 137,399 tons of hematite. Exports of iron ore from Canada during 1911 are recorded by the Customs Department as 37,686 tons. The exports were chiefly from Bathurst,. New Brunswick. The shipments from the Wabana mines. Newfoundland, in 1911, by the two Canadian companies operating there, were 1,181,463 short tons, of which 765,184 tons were shipped to Sydney and 416,279 tons to the United States and Europe.

The production of open hearth and bessemer steel has been for two years as follows, in tons of 2000 lb.:

TABLE VI. PRODUCTION OF STEEL

	1910	1911
Ingots:		
Open hearth (basic)	580,932	651,676
Bessemer (acid)	222,668	209,817
Castings:		
Open hearth	18,085	13,982
Other steels	599	740
Total	822,284	876,215

The total production of pig iron in Canadian blast furnaces in 1911 was 917,535 tons of 2000 lb., as compared with 800,797 tons in 1910. Of the total output in 1911, 20,758 tons were made with charcoal as fuel, and 896,777 tons with coke. The classification of the production, according to the purpose for which it was intended, was as follows: Bessemer, 208,626 tons; basic, 464,220 tons; foundry and miscellaneous, 244,686 tons. The amount of Canadian ore used during 1911 was 67,434 tons; imported ore, 1,628,368 tons; mill cinder, etc., 30,298 tons. The coke used during the year was 1,121,321 tons, comprising 543,933 tons from Canadian coal and 577,388 tons imported coke or coke made from imported coal. There were also used 1,190,459 bu. of charcoal. Limestone flux was used to the extent of 625,216 tons.

The production of pig iron by provinces was: Nova Scotia, 390,242: Quebec, 658; Ontario, 526,635 short tons.

The exports of pig iron during the year are reported as 5870 tons. Probably the greater part of this is ferro-silicon and ferro-phosphorus, produced at Welland and Buckingham, respectively. There were imported during the year 208,487 tons of pig iron, valued at $2,610,989 and 17,226 tons of ferro-manganese, etc.

The total quantity of asbestos rock sent to mill was 1,484,691 tons; the mill production was 91,237 tons, or 6.14%. The total finished output was 100,893 tons of asbestos of all grades, and 26,021 tons of asbestic. Total exports of asbestos in 1911 were 75,120 tons, of which 62,551 tons went to the United States.

PETROLEUM AND CEMENT

Production of petroleum was 291,092 bbl., 2461 bbl. being from New Brunswick and the rest from Ontario. The value of natural gas was $1,724,258 in Ontario and $96,665 in Alberta. The total quantity of gas used in Ontario was about 9869 million feet and in Alberta probably over 611 million feet.

Complete statistics have been received from the manufacturers of cement covering their production and shipments during the year 1911. These returns show that the total quantity of cement made during the year, including both Portland and slag cement, was 5,677,539 bbl. as compared with 4,396,282 barrels in 1910, an increase of 1,281,257 barrels, or 29%. Imports for the year were 661,916 bbl.; giving approximately 6,338,455 bbl. as total consumption. There were stocks of 903,590 bbl. reported at the close of the year.

COAL AND COKE

Coal production in 1911 increased in Nova Scotia and Saskatchewan, and was about stationary in New Brunswick. In Alberta there was a decrease of 1,396,412 tons, or 48%, and in British Columbia a loss of 794,243 tons, or 24%; the total decrease, as compared with 1910, being 1,617,599 tons, or 12.5%. This was due to the long strike in Alberta and the Crows Nest Pass country.

The production by provinces was approximately as follows, the figures for 1909 and 1910 being also given in short tons:

Province	1909	1910	1911
Nova Scotia	5,652,089	6,431,142	6,994,120
British Columbia	2,606,127	3,330,745	2,536,502
Alberta	1,994,741	2,894,469	1,498,057
Saskatchewan	192,125	181,156	204,253
New Brunswick	49,029	55,455	55,781
Yukon Territory	7,364	16,185	2,840
Totals	10,501,475	12,909,152	11,291.553

The exports of coal in 1911 were 1,500,639 tons, as compared with 2,377,049 tons in 1910, a decrease in exports of 876,410 tons. Imports of coal during the year include: Bituminous, 8,905,815 tons; slack, 1,632,500 tons; and anthracite, 4,020,577, or a total of 14,558,892 tons.

The total production of oven coke in 1911 was 847,402 tons, as compared with 902,715 tons in 1910. The total quantity of coal charged to ovens was 1,228,700 short tons. By provinces the production was: Nova Scotia, 469,305; Ontario, 259,554 (made from imported coal); Alberta, 36,216, and British Columbia, 82,327 tons. All the coke produced was used in Canada, with the exception of 9290 tons, sold for export to the United States.

Petroleum in Peru

The development of the oil fields of Peru is increasing, according to the American consular reports. Peruvian petroleum is especially rich in the lighter distillates, kerosene and gasoline, and it is claimed that it ranks next to Russian oil for producing high-grade lubricants; that the kerosene and gasoline are superior to the best qualities imported from the United States.

FOUR LEADING OIL FIELDS

There are four leading oil fields in Peru. The Negritos or Talara field lies on the coast about 40 miles northwest of Paita, the port for the department of Piura. Talara, where the refinery and wharves are situated, is a fine harbor connected by a 16-mile narrow-gage railway with Negritos. After the volatile constituents have been extracted, the residue is sold as fuel oil, mostly in Chile, whither it is taken in tank steamers for use in the nitrate works. The crude oil produced in these fields in 1909 amounted to over 100,000 tons. Some 25 miles inland from Negritos is La Brea, where a black and viscid substance like asphalt is found. So far this has been evaporated and used for coating the inside of tubs used for holding the spirits called "pisco," or "aguardiente," and in waterproofing the company's pipes, etc. It possesses good lubricating properties.

The Zorritos field lies about 25 miles south of Tumbes in the extreme northern part of Peru, and is on the ocean. At the end of 1910 there were about 45 producing wells, three of which were flowing, and producing about 15,000 tons per annum. The new wells that have been sunk into the deep sand continue to flow freely without pumping, and the same results are being obtained from experiments made in adjoining territory.

In 1910. 27,000 acres of oil land at Cabo Blanco, north of the Lobitos field, were added to the 750 acres of the original Zorritos property, and an addition to the distilling plant increased the producing capacity by 10,000 gal. of kerosene per month. Italian natural-gas engines for well boring have been introduced, and the use of natural gas permits a great saving of fuel oil, for which the demand is already much greater than the supply. The Lobitos field is situated in the department of Piura and is owned by the Lobitos Oilfields, Ltd., a British company. At the end of 1910 the company was pumping 92 wells. The quality of the oil is high, and it is all sold at good prices, chiefly in Peru, Chile, and the United States. The total output of crude petroleum of the Lobitos Oilfields, Ltd., for 1909 and 1910 was 57,226 and 53,344 tons, respectively.

The fourth important field is that in the department of Puno, near Huancane. The oil of Puno has a paraffin base, while that of the departments of Tumbes and

Piura has an asphalt base. Petroleum is also found in the districts of Pirin, Chimbote, Jauja, Huancavelica, and Ica. In fact, it seems to extend through the mineral belt of Peru at intervals from Tumbes in the north to Lake Titicaca, on the Bolivian frontier, in the south. The Peruvian wells along the coast run from out in the sea to many miles inland, varying in depth from 250 to 3048 ft. The total production for 1910 was: Crude oil, 175,000 metric tons; kerosene, 1,050,000 gal.; gasoline and benzine, 155,000 gallons

Commercial Availability of Alunite

The treatment of the double sulphate of alumina and potash, calafatite, has already been noted in the JOURNAL (June 24, 1911, p. 1241). Somewhat similar to this is the treatment proposed by W. T. Schaller for deposits of alunite (Bull. 511, U. S. Geol. Survey). Laboratory experiments have shown that if powdered alunite be ignited, all of the water and three-quarters of the sulphuric acid are volatilized. On leaching the residue with water, about 92% of the total original potash present is obtained in the solution; that is to say, 32.7% of the ignited alunite consists of available potassium sulphate, while the remainder consists of nearly pure aluminum oxide.

EUROPEAN PRACTICE

The best European practice appears to be that in which the alunite is roasted in furnaces like lime kilns, being heated in large pieces by the flame without direct contact with the fuel, until sulphur dioxide begins to escape. The calcination requires about six hours. The mass is then exposed to the air upon a clay floor for several weeks, during which time it is occasionally moistened. The mud-like product is then agitated in boilers with water at 70° C., and the clear decanted liquid (10 to 12° Bé.) is evaporated to 32 Bé. and crystallized in small wooden tubs. The crystals are cubic, opaque and reddish from ferric oxide, which, however, may be separated by recrystallization.

Alunite is also largely converted into alum by treatment with sulphuric acid and addition of potassium sulphate. Guyot recommends the following process for this treatment: Ignite at 800° C. for three hours, thereby producing the maximum quantity of soluble aluminum and potassium sulphates. The composition of the calcined mass is determined, and acids used in proportion to the amount of soft and soluble sulphate contained. For the product of the following composition, K_2SO_4, 14%; $Al_2(SO_4)_3$ as alum, 26.55%; $Al_2(SO_4)_3$, free, 6.56%; Al_2A 18.58; hydroxyl, 11.90; Fe_2O_3, 0.80; insoluble residue 21.61%; the proportions given below would be the most satisfactory. Into a clay oven is poured 12½ tons of sulphuric acid of 52° Bé., diluted to 30° Bé., and heated to 80 or 90° C. Eight tons of the calcined mineral are then added in portions and well stirred. After all has been added, the liquid is left for two hours, then evaporated to 39° Bé. and treated with 2.7 tons potassium sulphate. After a period of 13 hours the clear liquid is decanted. Its density should not exceed 42° Bé. The muddy liquid remaining is reduced to 24° Bé. by the addition of liquid from a previous crystallization, stirred, allowed to settle, drawn off clear, mixed with the first decantation and crystallized. After one day the crystals are removal, redissolved and recrystallized. The muddy residue is crystallized out for a further crop of alum. The total yield of alum is about 2.3 times the original weight of the ore. The insoluble matter contains 3% alumina and 2.01% potassium sulphate in addition to the silica, etc.

AUSTRALIAN PRACTICE

According to C. Schwartz, the best temperature for roasting is 500° C., and the acid used should have a density between 1.297 and 1.530. The Australian treatment at Bullah Delah is as follows: The mineral is ground and calcined in reverberatory furnaces and then treated with a weak solution of sulphuric acid in lead-lined tanks, heated to the boiling point by steam jets. The liquor is allowed to settle in the same tank, and the clear solution is run off in the crystallizing tanks, which are kept in constant agitation while cooling, the alum crystallizing out and the sulphate of aluminum remaining in solution. The residue in the vat is boiled again with water and the solution run off again in the same way.

The liquor[1] containing the sulphate of alumina is then returned to the vat, and sufficient of the calcined mineral added to neutralize completely any free acid. It is then heated to the boiling point, and the ebullition continued until partial reversion takes place, the reversion being accompanied by a precipitation of hydrated ferric oxide. The alum after collection is washed and then again crystallized for market. The sulphate of alumina solution, after all the alum has been crystallized from it, is concentrated in small vats heated with steam coils, and the lower grades of sulphate of alumina formed by running the liquor on to lead tables and making the solidified material into blocks.

While it is feasible by the addition of K_2SO_4 to convert the whole of the alumina contained in the mineral into alum, it is more profitable when the better class of sulphate of alumina can be sold at standard prices to make only as much alum as there is sulphate of potash present in the mineral, and to convert the rest into commercial aluminum sulphate. Following up Schaller's experiment, referred to above, the most desirable method would be to use the potassium sulphate as such, while the use of the alumina as a substitute for the natural bauxite for the preparation of metallic aluminum suggests itself. Bauxite itself is rapidly growing scarcer, and the deposits are of a type that may soon become exhausted.

Phthisis among Rand Miners

JOHANNESBURG CORRESPONDENCE

A preliminary report of the Rand government commission to investigate phthisis among the miners has been made. It is mainly statistical, and was prepared to afford a basis for calculating the cost of compensation to miners suffering maladies directly attributable to the inhalation of dust. The commission is of the opinion that fibrosis, resulting from the breathing of dust, may of itself be the cause of death, even if the miner be removed from underground work, but it is admitted that in recent years it has been increasingly rare to find advanced silicosis unassociated with tuberculosis.

The typical history of most of the cases examined was a beginning with fibrosis, a weakening of health and impairment of lung tissue, ending with the lodgment of tubercular germs. To describe this the term "miner's phthisis" is used. The commission examined 3200 miners, working on the Rand. Of these more than 1000, or over 30% were found to have miner's phthisis, from incipient fibrosis to advanced fibrosis and tuberculosis. Over 1000 were born in South Africa, 1300, came from England, and the rest from all parts of the world. Their previous occupations included farming, skilled labor, clerical, police, trades, and railway work. In regard to workers on machine drills, after six months' work 1½% showed the disease; after 30 months' work, 25%; after 3½ years' work, 40%; after 4½ years, 55%; after 5½ years, 64%; after 6½ years, 70%; after 10½ years, 80%; after 13½ years, 90%; and after 15 years, 100% showed the disease.

These figures are appalling, but must refer mainly to those engaged on development work, though the figures for miners engaged in supervising native laborers doing hand drilling tend to show that one of the chief causes of silicosis must be the fine dust in the atmosphere of the mines. The men engaged in hand drilling make little dust, and the miners engaged in stoping with machines in most Rand stopes, drill all wet holes, making little dust. The figures for men supervising hand stoping are as follows; after 2½ years' work, 20% showed symptoms; after 5½ years' work, 30%; after 9½ years, 40%; and after 15½ years, 50% showed symptoms.

NEW PUBLICATIONS

THIRTEENTH ANNUAL REPORT OF THE MINING INDUSTRY OF IDAHO FOR THE YEAR 1911. Pp. 135, illus. Robert N. Bell, State Inspector of Mines, Boise, Idaho.

ALUNITE. A NEWLY DISCOVERED DEPOSIT NEAR MARYSVALE, UTAH. By B. S. Butler and H. S. Gale. Pp. 64, illus. Bull. 511, U. S. Geological Survey, Washington, D. C.

PROCEEDINGS OF THE LAKE SUPERIOR MINING INSTITUTE, VOL. XVI. Sixteenth Annual Meeting, Aug. 22-24, 1911. 6x9, pp. 265, illus., paper. A. J. Yungbluth, Secretary, Ishpeming, Mich.

AMERICAN RED CROSS ABRIDGED TEXT-BOOK ON FIRST AID. Polish Edition. By Charles Lynch and M. J. Shields. 4¼x6, pp. 186, illus., paper; 30c. P. Blackiston's Son & Co., Philadelphia, Penn.

PORTLAND CEMENT: ITS COMPOSITION, RAW MATERIALS, MANUFACTURE, TESTING AND ANALYSIS. Second Edition. By Richard K. Meade. 6x9¼, p. 512, illus. Chemical Publishing Co., Easton, Penn.

PRELIMINARY REPORT ON THE ROCK ASPHALT, ASPHALTITE, PETROLEUM AND NATURAL GAS IN OKLAHOMA—By L. L. Hutchison. Pp. 256, illus. Bull. 2, Oklahoma Geological Survey, Norman, Okla.

A REPORT ON THE GEOLOGICAL AND MINERAL RESOURCES OF THE ARBUCKLE MOUNTAINS, OKLAHOMA—By Chester Albert Reeds. Pp. 69, illus. Bull 3, Oklahoma Geological Survey, Norman, Okla., December, 1910.

THE MINERAL RESOURCES OF THE PHILIPPINE ISLANDS, WITH A STATEMENT OF THE PRODUCTION OF COMMERCIAL MINERAL PRODUCTS DURING THE YEAR 1910—Pp. 85, illus. Division of Geology and Mines, Bureau of Science, Manila, P. I.

DIE WICHTIGSTEN LAGERSTAETTEN DER NICHTEREZE. By O. Stutzer. (The most important deposits of the nonmetallic minerals). Part I. Graphite, Diamond, Sulphur, Phosphates. Pp. 474 + XVI, illus. Gebrüder Borntrāger, Berlin.

The above work is to be followed by other parts which will presumably take up the remaining nonmetallic minerals, but the author has been temporarily interrupted in his task by a two years' call to South Africa. To a certain extent the completed book will be complementary to "Ore Deposits" by Professor Beck, of whom Doctor Stutzer is junior colleague at the Mining Academy in Freiberg.

Doctor Stutzer's treatment of his subject is systematic and thorough. It is based to a great degree on his personal travels and bears the marks of a close observer and careful student. Under graphite, the world-wide occurrence of this mineral presents subject-matter of peculiar interest. Although in former years regarded as the result of the metamorphism of some deposit of organic origin, fuller knowledge of its relations have for some associations changed these views. When graphite appears in pegmatite dikes and in great masses of eruptive rock, and in gneisses next intrusive batholiths of granite, we seem compelled to consider some other carbon-bearing sources. Geologists in later years have therefore given attention to possible hydrocarbons of inorganic origin, and, under the guidance of Weinschenk, even to consider the possibility of cyanide compounds yielded by the igneous mass. In other cases, graphite is without doubt a metamorphosed form of coal or similar carbonaceous organic bed. Beginning with the European localities, Doctor Stutzer passes all the productive districts of the world in review, and adds statistics of output and remarks on yield and prices.

The other form of pure carbon, the diamond, presents a theme of great scientific interest and of exceptional economic importance. The South African mines naturally claim first attention and are given a detailed review. The older pipes and the newer desert gravels are both described and well illustrated. Members of the American Institute of Mining Engineers have been made familiar with these matters by the writings and addresses of Gardner F. Williams, but will be interested to see a review of all the writings which have thus far appeared. There seems to be no question that the diamond is original with the kimberlite and that it has crystallized out of an igneous magma of a basic character. Following South Africa, the gem-bearing regions of Brazil, British Guiana, the United States, New South Wales, India, and several minor districts are passed in review.

Under sulphur, the Italian localities are first treated. The greater part comes from Sicily, but the mainland also yields appreciable amounts. The Sicilian sulphur is derived from a sedimentary series of Upper Miocene age. The associates are gypsum, limestone, marls and tripoli. The sulphur has been generally believed to be derived from gypsum by the reducing action of carbon, in a reaction which first produces calcium sulphide. By the later formation of calcium carbonate, sulphur is set free. More recently the discovery of sulphur-secreting bacteria has directed attention to these organisms. There are several species whose vital processes seem to require the yellow element in their cells, and there is reason to believe that they may have been influential in producing sulphur deposits. Following Sicily, Dr. Stutzer summarizes the occurrences in Algiers, Russia, France, Spain, Austria, the United States, Mexico, Japan and several minor ones. The small workings of former years in Saba of the West Indies seem alone to have escaped notice. Of all these, the deposits and methods of mining in Louisiana possess perhaps the greatest interest and are in the most advantageous position for cheap production.

The phosphates are the last topic discussed and are certainly the most important of all the four. After a general introduction regarding the scientific aspects of the deposits, the author begins with the crystalline apatite of the ancient rocks in Norway, Sweden and Canada, and of later eruptives in Spain. All investigators must regard them as in some way after-effects of igneous action, although there is some difference of opinion whether they are analogous to pegmatites or are due to gaseous or vaporous exhalations.

The less crystalline varieties are taken next. They appear in sedimentary strata of all ages, and are derived from some organic source. The various occurrences of Germany, Belgium, France and the other European countries are first passed in review. Algiers and Tunis next receive especial attention and are followed by the United States and other American localities. Finally, Asia and Australia conclude the list. Guano is then treated by itself. The general origin of the phosphates is then discussed in connection with a scheme of classification which is as follows.

I. *Inorganic.* (1) Apatite deposits. (a) Impregnations of an eruptive. (b) Apatite veins (dikes). (2) Inorganic deposits other than apatite.

II. *Organic.* (1) Of sedimentary origin. (a) Dry land deposits. (b) Subaqueous deposits. (2) Deposits derived from original sediments by chemical rearrangements. (a) From guano. (b) From marine accumulations. (3) Mechanical concentrates from organic sedimentary deposits.

The book concludes with the following topics: Other sources of phosphates, such as basic bessemer slags; the distribution of phosphoric acid in nature; the uses of phosphates; mining and preparation; evolution and selling price; history and statistics.

J. F. KEMP.

A MANUAL OF FIRE ASSAYING. By Charles Herman Fulton. 6½x9½, pp. 219, illus.; $2. McGraw-Hill Book Co., 239 West 39th St., New York.

This is the second edition, entirely rewritten and somewhat enlarged, of Dr. Fulton's book, which appeared about five years ago. The book appears to be a satisfactory textbook for college use, as well as a desirable handbook for the practical assayer's reference. It is, of course, possible to find flaws; Van Liew's method is hardly standard as the nitric-acid combination method; the mercury-sulphuric-acid combination method is, we believe, more common than the copper sulphate-sulphuric acid combination; the method given for the preparation of proof silver seems inferior to the electrolytic, or to Knorr's method, by which the impurities in fine silver are precipitated by silver carbonate, and then the silver itself precipitated as carbonate and melted down; and parting is dismissed in a rather summary manner. But it is certain the good qualities of this book outweigh the defects, and for fire assaying it is the present standard work.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. B. Farish was at Phoenix, Ariz., last week.

H. W. Turner returned to London this week.

Fred Christey has returned to Phoenix, Ariz., from St. Louis, and will direct some local mining operations.

Thomas Kiddie has returned to Victoria, B. C., from a visit to his son at Morenci, Arizona.

Herbert Carmichael, provincial assayer for British Columbia, was a recent visitor to San Francisco.

J. C. Porter, of New York, left Boston March 8 for the Aguacate mines, San Mateo, Costa Rica.

R. L. Greene has resigned as a director and secretary of La Rose Consolidated Mines Co., of Cobalt.

M. K. Rodgers left Seattle, Wash., late in February, for Hedley, Similkameen, with the intention of going thence to New York.

A. Newman has resigned the management of the Cia. Minera Jesus Maria y Anexas at San Jose de Gracia, Sinaloa, Mexico.

A. G. Hillen, of Las Vegas, N. M., is in charge of properties in Eldorado Cañon, in the Searchlight camp in Nevada.

Ralph T. Hirsch sails from New York March 16 for Antofagasta, Chile. He expects to be at work in that country for more than a year.

Irving R. Gard, mining engineer on the staff of the Canadian Collieries (Dunsmuir) Ltd., has returned to Victoria, B. C., from a trip to the East.

H. H. Lavery, who recently resigned as superintendent of the Monarch mine and concentrating mill, near Field, B. C., was in Houghton, Michigan, last month.

Henry H. Armstead has been elected vice-president and resident manager of the Montana & Mexico Mining Co. operating in La Luz District, Guanajuato, Mexico.

W. J. Elmendorf, general manager of the Portland Canal Mining Co., with mine and concentrating mill in Portland Canal camp, B. C., was in Toronto early in March.

Seeley W. Mudd, of Los Angeles, Pope Yeatman, consulting engineer of the Guggenheim interests, Geo. L. Edwards and H. H. Webb have been visiting the mines at Ray, Arizona.

N. L. Stewart has resigned as engineer of the Murray plant of the American Smelting & Refining Co., to accept a similar position with the East Butte Copper Mining Co. in Montana.

C. R. Murdock has been appointed general manager of the Fairview Aztec Mining Co. He left San Francisco March 7 for Fairview to take charge of the operations at the mine.

Thomas F. V. Curran, president of the General Vanadium Co. of America, sailed from New York on the "Mauretania" this week for a month's business trip to England, Germany and France.

A. W. Constans, formerly manager of the Athabasca gold mine, near Nelson, B. C., is now manager of the Second Relief mine and 10-stamp mill at Erie, Nelson mining division, British Columbia.

D. W. Ohern, professor of geology at the University of Oklahoma, has been appointed director of the Oklahoma Geological Survey to succeed Chas N. Gould, who has resigned to enter private work.

F. William Hausman, for six years chief mechanical engineer for the Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., has resigned and will engage in mechanical engineering for himself in Birmingham.

Robert R. Hedley, of Vancouver, B. C., chairman of the Western Branch of the Canadian Mining Institute, and E. Jacobs, of Victoria, B. C., branch secretary, were in Toronto recently, attending the annual meeting of the Institute.

Albert L. Waters, of Tucson, has been appointed president of the board of regents and chancellor of the University of Arizona. He graduated from Michigan College of Mines in 1893 and is managing large mining interests in Arizona.

D. M. Philbin, general superintendent of the Lake Division of the Great Northern Ry., has been placed in charge of all business relating to the Great Northern, or Hill, iron-ore properties, in Minnesota. He will devote all his time to that department

Prof. A. H. Purdue, who for nearly 16 years has held the chair of geology in the University of Arkansas, and since 1907 has been ex-officio state geologist of Arkansas, has been elected state geologist of Tennessee to succeed Dr. Geo. H. Ashley, resigned.

Dr. C. H. Shamel is engaged in a revision of his "Mining, Mineral and Geological Law," which is to appear soon. He requests that any readers who may have discovered errors, or have any suggestions for additional topics, communicate with him in care of his publishers, the McGraw-Hill Book Co., 239 West Thirty-ninth street, New York.

On the "20th Century" train which was partially wrecked March 7, were several prominent copper men, including Robert H. Gross, president of East Butte Copper Co.; Geo. Rucz, of Ishpeming, Mich., president of Southwestern Miami Development Co.; James Greenaway, general superintendent of Calumet & Arizona; Henry N. Sweet, of Hornblower & Weeks; H. B. Hovland, former president of Live Oak, and James Hoatson, of Calumet, Mich. None of the party was injured, although the car in which they were riding was derailed and overturned.

S. T. Wellman and his son, H. G. Wellman, have formed the firm of S. T. Wellman & Son, and will do a general consulting business in steel works engineering, with offices at 8803 Euclid Ave., Cleveland, Ohio. Mr. S. T. Wellman for over 40 years has been concerned with the construction or operation of openhearth steel works and his well known openhearth charging machine is in use in all the steel-producing countries of the world. He is still chairman of the board of directors of the Wellman-Seaver-Morgan Co., but the business of the new firm is entirely distinct from that of the above company.

OBITUARY

H. L. Whiting of Bradford, Penn., a well known oil producer and operator, died at Harrisburg, Ill., March 10, as the result of an attempt to rob him, in which he was severely handled. He had gone to Illinois for the purpose of buying and leasing oil lands.

Joseph Ford, well known in the charcoal iron industry, died at Grand Rapids, Mich., March 5, aged 60 years. He was president of the Spring Lake Iron Co., with a charcoal furnace at Fruitport, Mich., and also president of the Mitchell-Diggins Iron Co., with a furnace at Cadillac.

Wade Hampton Echard died at Uniontown, Penn., March 10, aged 36 years. He was born in Uniontown, educated in Pittsburgh and at West Virginia University. His father and uncle were large coal operators. He was president of the Unity Coke Co., the Northern Coke Co., the Peerless Coke Co. and the Franklin Coke Co., all of Connellsville.

William Ashley Whitley, one of the California pioneers, died in San Francisco on Feb. 23. He was 72 years of age, having gone to California from Missouri in 1861. During the years that followed he was prominent in mining on the Comstock and elsewhere in Nevada, California, and Montana. He was a close friend of George Hearst, and was an intrepid explorer and adventurer. During recent years he was engaged in the contracting business in San Francisco.

Societies and Technical Schools

British Columbia Mineowners' Association—This association, after having been inactive a number of years, has been reorganized, with the following officers: President, S. S. Fowler; vice-presidents, R. H. Stewart and W. E. Zwicky; secretary-treasurer, Jas. Anderson; other members of executive board, A. H. Gracey, Frederic Keffer, John L. Retallack, G. Stilwell, and William Watson.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Mar. 6—Much of the anxiety of mining operators has been relieved by the rain and snow in the last week. The situation had come to be rather serious in some of the mining districts that are dependent on water for power and for milling, but there has been no time when there was an actual water famine in the last year in any of the districts. The present rain began in the extreme southern end of the state and extended gradually to the northern limit and to the foothills of the Sierra on the east. The fact that there was rain instead of snow at elevations as high as 5000 ft. was rather discouraging to the mining industry; but at higher elevations, and in some sections at much lower than 5000 ft., there was sufficient snow to offset the rain. At the end of February the report of the U. S. Geological Survey showed that the precipitation of snow and rain for January and February was only 35% of the normal; that at the same date in 1911 there were 240 in. of snow at the summit of the Sierra, while in 1912 the amount was not much in excess of 12 in. This fact has been dwelt on with more than necessary emphasis, because 1911 was not a normal year.

The recent snowfall, though not great, is sufficient to prevent such a shortage of water as would be disastrous to mining operations. There is no doubt that the water supply for 1912 will be less than in 1911; but there is one condition not generally recognized, which will enable operators to proceed even though there should be an actual shortage, and that is progressive development. There has been no season in recent years when California mines were so well situated in this respect. The older active mines are generally in such condition that a reduction in the tonnage treated would not affect seriously the financial situation of the owners. Mines that are operating 60 or 100 stamps could reduce the number from 25 to 40%, continue the exploration of new ground and the development of the present workings, and thus add to the future ore reserves without detriment to finances, and with improvement in physical conditions. There are numerous old properties that are being reopened whose progress would not be retarded by delaying production and continuing development. And in some instances delay would be more an advantage than a detriment, as the inclination to install treatment plants at mines that are only partially developed is still alive in various parts of the state. Considered in all its aspects, quartz mining in California in the present season is so thoroughly prepared that nothing short of an actual water famine can affect it disastrously.

Denver

Mar. 8—The snow fall in the mountains having been exceptionally heavy during the winter, and as the ground is now beginning to get warm, the usual results have come. Avalanches are sweeping down the mountain sides, and the high mines are suffering. At Crested Butte, six men at the Buckley mine were carried away, and four of them were buried under 20 ft. of snow, but 200 men employed in the rescue finally got them out alive, one man dying later from his injuries. The Chalk Creek mining district, including St. Elmo, Romley and Hancock, are cut off from food and fuel supplies by the enforced abandonment, owing to snowslides, of the 30 miles of Colorado & Southern Ry. serving the district, and the Mary Murphy mine employing 200 men is out of coal and will have to close down.

Between Durango and Silverton 10 snowslides ran over the railway, covering the track from 3 to 30 ft. deep, and damming the river up until the water rose over the rails. An avalanche 150 ft. wide and 30 ft. deep ran in Ten Mile Cañon, blocking the Colorado & Southern Ry. between Leadville and Breckenridge. At the Cimmaron and Seventy-six mines, in Marshall Basin near Telluride, two avalanches ran, carrying away three houses of the Smuggler-Union mine, and a miner named Edwin Thomas was buried in the snow and it is believed has perished. Between Vance and Ophir, in the same district, the railway to the south has been closed by avalanches half a mile in extent, and as all telephone lines are down, it is feared there are more disasters to be heard from.

The Philadelphia Mines & Tunnel Co., of which Ernest Le Neve Foster is president, filed its annual report with the secretary of state, who refused to accept it on the grounds that the company was in arrears on its flat taxes. The mining company then applied for a writ of mandamus to compel Secretary Pearce to accept the report and the $5 fee, but by a decision of District Judge George W. Allen, the secretary of state was upheld in his refusal.

In addition to the large order for steel rails placed by J. J. Hill with the Colorado Fuel & Iron Co. about a week ago, President Bush, of the Denver & Rio Grande R. R., has ordered 125 miles of new rails to be delivered in June and July. This steel will weigh 15,000 tons and will cost about $500,000. Most of this is for double tracking on the main line.

Butte

Mar. 6—Clifton Applegate & Co., of Spokane, have secured the contract to build the Georgetown extension of the Butte, Anaconda & Pacific R.R., and will begin the work at once with the expectation of having the line graded and ready for the rails by the early autumn. There will be 17 miles of grading from the present terminal, six miles west of Anaconda, to the Southern Cross mine, the end of the line, and the grade will average slightly under 2%. Four grading camps are being established and the contractors have called for station men to whom subcontracts for grading will be let. There are no tunnel sites on the line, but there will be 10 bridges and a great many cuts, some of which will be several hundred feet long.

There has been a somewhat larger flow of mine water lately at the Pennsylvania mine of the Anaconda, due to the tapping of unexplored veins by the diamond-drill hole, which is being driven south from the end of the south crosscut on the 1800-ft. level. About 275 gal. per min. are now being pumped from the 1800- to the 1200-ft. level, where it enters the new flume transporting it to the Leonard pumps; as the electric pump on the 1800-ft. level, which has a capacity of 250 gal. per min., is not quite able to take care of the increased flow, it has been found necessary to run for one hour per day the two new air pumps recently installed for such an emergency. These pumps have a capacity for pumping 150 gal. of water per min., and a third pump of the same capacity has also been installed and will be ready for use as soon as connected.

There is a large quantity of second-class ore blocked out in the Tuolumne mine, which has not been touched yet, owing to the lack of favorable smelting arrangements; however, as this class of ore is constantly increasing in amount as mining proceeds, the company is endeavoring to arrange with the Anaconda company for its treatment at the Washoe smeltery. In the event of reaching no agreement, it is possible that a combination of the Tuolumne and several other mining companies will be effected for the purpose of erecting a concentrator of their own. It is being planned to increase the tonnage somewhat.

Salt Lake City

Mar. 7—Articles of incorporation of the St. John & Ophir R.R. Co. were filed Mar. 5. The company will build and operate a 10-mile branch road from St. John on the Salt Lake route to Ophir in Tooele County. The company may also build and operate telephone and telegraph lines, own water rights, etc. The capitalization is $150,000, divided into 1500 shares, par value $100. The officers of the company are: J. Ross Clark, president; C. O. Whittemore, vice-president; W. M. Comstock, secretary and treasurer. It is said that the road will be completed in three months. Increased activity in the Ophir district will result. The present transportation is by means of a traction engine and ore wagons. The principal shipper at present is the Cliff mine, whose normal production is about 70 tons per day. This property has recently developed new bodies of silver-lead ore on the lower levels, 600 ft. from the surface, and has been shipping about 1000 tons per month. The Ophir Hill is in shape for active production, having overhauled its mill and driven a 3000-ft. drain and transportation tunnel connecting with its lower workings. The Lion Hill Consolidated has been developing its property, and making occasional shipments. Work will undoubtedly be resumed at other properties.

Shipments of ore and concentrates from Park City mines during February, aggregated 9442 tons, which is above the average of approximately 8000 tons per month. The principal shippers were the Daly West, with 3385 tons; Silver King Coalition, 2962 tons; Ontario leasers, 309 tons; Little Bell, 110 tons; Daly-Judge, 2333 tons; New York Bonanza, 131 tons; Grasselli Chemical Co., 183 tons; leasers made up the balance. A number of properties have been unable to ship because of heavy snows.

The local U. S. Land Office has received notice that, by order of President Taft, approximately 60,000 acres of land in Wayne and Emery Counties withdrawn some time ago as coal land, have been restored to entry. In Iron County approximately 200,000 acres have been withdrawn from entry under Section 6 of the Enlarged Homestead Act. Recent investigations have shown that there is sufficient water on the land to make residence possible. Water may be found in most places at a depth of from 30 to 50 ft. The order revokes the one issued Sept. 20, 1909, under which the land was thrown open to entry under nonresidence conditions.

Houghton, Mich.

Mar. 9—Recent operations at the property of the Isle Royale Copper Co. are exciting more than ordinary interest. Periodically this mine occupies the limelight, because of either reported improvement in underground developments, or further economies in operation. When all is said and done, the old truth always floats again—namely that the Isle Royale lode is a low-grade, bunchy deposit. This should not detract, however, from the excellent results that it is generally believed have been obtained during the last year. Through careful underground supervision further economies have been possible, and the company is expected to show a substantial profit for the year, despite the low price for copper. There can be little doubt that such a satisfactory showing is due largely to the close personal supervision which the direction of the work receives from the local officials in direct charge at the mine.

The idea that the capacity of the present mill can be increased by the addition of more stamp heads is hardly tenable in view of the careful government regulation and supervision over the deposition of tailings in the waters of Portage Lake.

Negaunee, Mich.

Mar. 9—The Breitung companies, operating on the Marquette Range, have sold enough ore for delivery during the coming season to insure the employment of good-sized forces of men. During the season of 1911, when general conditions in the iron market were slack, the Breitung mines were working at full capacity. The Breitung-Hematite No. 1 mine reports sales of bessemer ore for 1912; this ore has the remarkably low phosphorus content of 0.015%. The Mary Charlotte mine reports sales of high-grade and medium-grade ore, as does also the Washington Iron Co., operating mines at Humboldt.

The underground fire at the Mansfield mine of the Oliver Iron Mining Co., in the Crystal Falls district, was smothered by covering the shaft. A special train had been run from Iron River with rescue apparatus, but it was not needed, as all of the men got out safely; two mules were drowned on the bottom level, which flooded, due to the breaking of a pipe by a falling cap, from under which the fire had burned the posts. The fire in the shaft was sprinkled with water, obtained by lowering the skip to the flooded level. The air was finally judged to be clear when a lantern lowered and pulled up was found still burning.

The Oliver Iron Mining Co. is doing considerable diamond drilling in the region around Republic. The work is directed from the Duluth office, and is largely on the lands of the Michigan Iron & Land Co. Two drills are working near Trout Lake, four miles west of the Witbeck mine; one on Sec. 31, T. 47-R. 30, south of the Norman Iron Co.'s tract which Jones & Laughlin are exploring; one on Sec. 1. T. 46-R. 31, about one mile to the southwest; one at the old Riverside mine, three miles northwest of Republic and one drill which was working at the old Standard mine, in the same vicinity, has been transferred to Lake Michigamme, where it is drilling a vertical hole through the ice, two miles east of the village of Michigamme. The Cole & McDonald Exploration Co. has the contract for drilling. Both the Oliver Iron Mining Co. and the Jones & Laughlin company have been carrying on dip-needle work southwest of Republic. The iron formation there is narrow and has few outcrops.

Cobalt

Mar. 8—The Cobalt Mine Managers' Association will enter a protest against the proposed amendment to the Mines Act, which has been introduced in the legislature by Sir James Whitney. The amendment provides that no man employed underground shall work more than eight hours in 24, including the time going down and coming out of the mine. The members of the association state that a change in the working hours would necessitate a corresponding cut in wages. The present scale of wages paid is that adopted by the Cobalt Miners' Union for a 9-hr. day, the lowest wages being $2.75 for shovelers, while machine men get $3.50. The local union has representatives in Toronto, in behalf of the amendment.

Porcupine

Mar. 8—Operatons at the Dome mine have now advanced to the stage where ore is being hoisted from the mine and sent to the mill bins. The mill will not start till about Mar. 20, but the crushing equipment is practically complete, and the bins, which have a capacity of 1500 tons, will be filled in readiness. To date, most of the work in the mine has been confined to the 50-ft. level, above which at least two years supply of ore has been blocked out. The second and third levels are now being drifted upon and connected to the main 8x18-ft., three-compartment shaft. The ore is hauled through an inclined tunnel to the crusher stations, and the crushed product is transferred to the mill by a conveyor belt. All the work on the property is progressing smoothly, and when production actually starts, the equipment will be in such shape as will permit of continuous work. At present there are five diamond drills in operation, which are exploring the ground between the present workings and the Dome Extension boundary.

The Mining News

The Current History of Mining

Alaska

During February, shipments of copper ore to the United States were 5082 tons, containing 2,802,361 lb. of copper worth $378,319.

Owing to the lack of snow in the vicinity of Seward, mining operations will begin this year at a much earlier date than ever before in the history of this section. The winter has been the most open experienced for many years, allowing a great deal of surface work to be done at the various mines.

Alaska-Treadwell—During January 58,360 tons of ore were crushed, yielding $132,543 gross and net $28,142. Operating expenses were $97,462; construction, $6938; yield per ton, $2.29; development work, 992 feet.

Brewer-Alaska—This company is making preparations for extensive development work on the property at Mile Seven, on the Alaska Northern Ry. R. G. Dougherty is superintendent.

Rice—This company has purchased a stamp mill and other machinery which is now being transported to the mine in the Porcupine district on Kenai Lake. Dan Rice is in charge.

Arizona

GILA COUNTY

Four different companies are conducting exploratory work, with six "Star" churn drills in continuous operation. The Miami company is working one drill northeast of the orebody, on ground whose surface indications are considered favorable for the development of another body of ore. The New Keystone is operating one drill northeast of the shaft. The Southwestern Miami, whose property lies to the southwest of the Live Oak, is running two drills and intends to add another as soon as possible. The General Development Co. is operating two drills on the Barney group, lying west of the Live Oak. In addition to these, there are possibilities of others being added soon.

Inspiration Consolidated—At the stockholders' meeting of the Inspiration Copper Co. and the Live Oak Development Co., recently held, the sale of all the properties and assets of these companies was authorized and has now been made to the Inspiration Consolidated Copper Co. All of the Live Oak shares, except 25, have been exchanged for the Consolidated company stock and all of the Inspiration Copper shares except about 5000 have been exchanged. The Consolidated company will hold its offer open for a short time. About $5,950,000, face value of Inspiration Consolidated Copper Co.'s 6%, first-mortgage gold bonds were subscribed for by stockholders, so that only about $50,000 of these bonds will go to the underwriters.

Barney—Hole No. 1 is 1175 ft. deep and is in iron-stained silicified schist. At 1030 ft., it was thought that the hole was in granite, but this was found to be only granite boulders included in the dacite flow near its bottom. The chances are now considered favorable for finding ore at a little greater depth. Hole No. 2 is 130 ft. deep and is in the Gila conglomerate. It was near this hole that a hole drilled by the Barney Copper Co. is reported to have discovered ore at a depth of 500 ft., penetrating it for a distance of 20 ft. before it became necessary to abandon the hole on account of caving.

Superior & Boston—Development work continues on the 12th level. The crosscut north from the McGaw shaft is in about 300 ft. and has not yet cut the old Dominion vein. The drift that is being driven west on the Great Eastern vein is in 125 ft. and breasted in 4 ft. of soft, altered and mineralized diabase, containing considerable hematite.

Miami—The mine is producing 3000 tons per day, and the concentrator is in full operation. Three of the shrinkage stopes above the 420-ft. level are producing, and a large amount of ore is derived from the operation of interposing a mat of square sets between the ore and the capping. In the sixth unit of the concentrator the mill superintendent is experimenting with the view of introducing graded crushing to a greater extent and also the roughing system, which is not at present used here.

Live Oak—The work of enlarging shaft No. 2 is expected to be finished this month. It is being done by raising from three points in the shaft. The surface equipment is being erected. The two 150-hp. boilers have been bricked in and the 15x20-in., double-drum hoist is being assembled.

MARICOPA COUNTY

Col. William F. Cody (Buffalo Bill) has installed a drilling outfit of 3000 ft. capacity at Agua Caliente, west of Phœnix, and will drill for oil. Gas has been struck in a water well in the Verde Valley, near Camp Verde, northeast of Phœnix.

Copper Top—Work will be resumed on this copper mine about 20 miles north of Phœnix, in the Rogers Spring District. A 25-ton smeltery is at the property. H. H. Uddel, of Phœnix, is in charge.

Union—Leasers are working on this old mine north of Phœnix.

Fortuna—This and the Gila Monster properties in the Rogers Springs District are idle but resumption on the Fortuna is planned.

Contention—This mine, near the Fortuna and Gila Monster mines, has been entirely abandoned after expensive explorations.

Mammoth—This mine at Mesa, east of Phœnix, is being extensively developed by George V. Young, formerly secretary of the territory. The ore yields gold, chiefly, and lies in a brecciated zone along a granite contact. The deposit is low grade but extensive, except as to a rich gouge streak along the hanging wall, from which in early days high-grade ore was taken. Negotiations for the sale of the property are under way. In the meantime the development is being vigorously carried on. The mine is on the government road to the Roosevelt dam.

PINAL COUNTY

Ray Consolidated—During January production amounted to 2,476,944 lb. of copper as compared with 2,271,654 lb. in December. The blowing-out of a motor prevented greater production. Since Feb. 12 the concentrates have been shipped to the Hayden smeltery of the American Smelting & Refining Co., where they will be held until the plant starts. Four units of the concentrator are running and costs are said to be under 9c. per pound.

YAVAPAI COUNTY

Monte Cristo—This silver property near Wickenburg is being extensively developed by Ezra W. Thayer of Phœnix. It is now down to the 500-ft. level. Mr. Thayer proposes to continue development to the 600-ft. level and to drift the full length of the oreshoots now opened, nearly a claim's length, before taking out any ore; an extensive mill is being considered and an aërial tram project is planned to carry the ore to Wickenburg about 12 miles distant. This is considered one of the most successful recent operations of development in the southwest. It was begun about two years ago when Mr. Thayer bought the property from a Mexican.

California

AMADOR COUNTY

Original Amador—The action of J. E. Bullard to quiet title to the Eclipse, Eclipse Extension and Last Chance quartz claims has been decided in the Superior Court, quieting the title in this company.

Bunker Hill—The repair of the working shaft damaged by a falling skip on Feb. 7, has been completed, and solid bracing has been added to prevent a like result should another accident of the same character occur. The unwatering of the 1950-ft. level, which was flooded during the period of repair work, proceeded preparatory to the resumption of ore extraction and milling. E. Hampton, Amador City, is superintendent.

BUTTE COUNTY

Mammoth Channel—The crosscut tunnel has opened up some good gravel, which washes free and carries colors. There are indications that the breast is in the outer rim of the Perschbecker ancient channel. Capt. J. R. Foster, of Marysville, is manager.

CALAVERAS COUNTY

Delmonte—Preparations are being made to develop this former producer, at Railroad Flat. A winze will be sunk with air drills from the crosscut tunnel. The mine is equipped with a good 10-stamp mill. Fred W. Wright is manager.

Petticoat—A concrete foundation has been built for the engine; the boilers will be set in soapstone, a material that has been satisfactory in other installations. A new shaft will be sunk 300 ft., to connect with the south level.

ELDORADO COUNTY

Carpendar-Kumfa—Work has been resumed after a shutdown of two weeks, resulting from electric power-plant troubles.

INYO COUNTY

Panamint—It is reported that J. K. Turner, engineer for A. D. Myers, of Nevada, has arranged for the purchase of these old silver mines by Mr. Myers. The mines are situated on the west slope of the Panamint Range, near the base of Telescope Peak, about 11 miles distant from Ballarat. The nearest railroad station is Randsburg, about 70 miles southwest. Mr. Myers has been exploring the property under bond for the last nine months. The old workings have been cleaned out and stopes opened to the surface.

PLACER COUNTY

Pioneer—The mill at this mine, in the Humbug district, seven miles from Towle, resumed crushing on Feb. 23, after a shutdown of several weeks from lack of water. Thirty men are employed, and H. W Morris is superintendent.

Cache Rock Dredging & Mining Co.—This incorporation, with head office at Oakland, has leased the dredge and the land of the Eldorado Placer Dredging Co. The gold-saving tables are being remodeled by George L. Holmes, consulting engineer, and the dredge was expected to resume operations about the first of March. A. W. Copps is general manager.

SIERRA COUNTY

Rainbow—Through a reorganization the operating company has taken in sufficient capital for thorough development. Electrical machinery and machine drills are being added, the stamp mill is being overhauled, all tunnels have been retimbered and new steel rails have been laid. L. P. Woodbury is superintendent.

Sovereign—Shortage of water for power has curtailed operations. A cleanup of over $800 has just been made from an 8-day run, with the single Beers mill running two 8-hour shifts. F. O. Richardson is in charge.

SISKIYOU COUNTY

Blue Ledge Copper—This company has secured patents to 17 copper claims on Joe Creek, and it is reported that a smelting plant will be installed. A large amount of development work has been done and a water system has been installed, besides the erection of a number of surface buildings.

TRINITY COUNTY

Trinity Gold Mining & Reduction Co.—The report for the year ended Nov. 30, 1911, shows net profits of $66,264. These came from six months' operation. Fixed assets were increased by $42,668 and indebtedness reduced by $10,930.

TUOLUMNE COUNTY

Harvard—The 1200-ft. shaft will be deepened 300 ft. Surface improvements are also in preparation, including the installation of concrete foundations for 30 stamps, to conform to the 30 stamps already so placed. About 150 men are employed; H. W. Gould, Jamestown, is superintendent.

United Gold Mining & Milling Co.—Development of the Tarantula mine near Chinese Camp continues. The shaft is over 950 ft. deep and still sinking, while drifting to the north is in progress. William Blackmar is in charge. The same company is doing drilling and prospecting on the gravel deposits at Yankee Hill, near Columbia, and active mining operations will be inaugurated soon. F. J. Dondero is in charge of the latter work, and Chester B. Allen is general manager and consulting engineer.

YUBA COUNTY

Red Ravine Mining Co.—This company, which has been developing the Red Ravine property, in the Indiana Ranch district, has been reincorporated with capital stock $500,000, chiefly subscribed by Marysville men, including R. R. Raish, H. A. Bruce, M. T. Brittan and others.

Yuba Construction Co.—A number of men have been returned from the San Francisco office to the shops at Marysville, including draftsmen and heads of departments. New orders are in for dredges. J. H. Hinton is superintendent.

Colorado

CRIPPLE CREEK

Modoc—A rich strike is reported in the fifth level; the width of the ore is 4 ft., and the grade is estimated at about 2 oz. of gold per ton.

Trilby — Superintendent Williams is sinking the shaft 3 ft. per day, beginning at 940 ft. and it will be continued to 1100 ft. A winze was sunk 45 ft. on the ninth level and a test car of ore showed $20 per ton for the rock, after being separated from the rich screenings.

Lucky Gus—E. S. Chillson has taken a lease on the Joint shaft on this Bull Hill mine and has installed a 15-hp. electric hoist and commenced work at the 350-ft. level.

Old Gold—This mine on Beacon Hill has been leased for three years to Oscar Fogleman, of Cripple Creek, who will commence work soon. John M. Roach, a street railway man of Chicago, is said to be associated with Fogleman.

Elkton—The large oreshoot developed in the upper levels has been developed for 1000 ft. on the 10th, or 950-ft. level, and is stated to be 5 ft. wide, containing 2 oz. of gold per ton.

Stratton's Independence—Conditions at this mine, under the management of P. H. Argall, are better than for years, and a new discovery has just been made on the 200-ft. level of a shoot of pay ore, which, it is said, will furnish heavy output for at least six months.

El Paso—The February output was 103 cars of 1-oz. gold ore. The drift on the 1000-ft. level has a pay shoot 3 ft. wide, which has been opened for 50 ft.

Jerry Johnson—L. S. Cox, lessee on a block of ground taken over from the Damon mine by this company, has opened a flat vein of gold ore 4 ft. thick.

Blue Flag—The company's cyanide mill, on Raven Hill, is said to be treating 40 tons per day of $4 ore from a new orebody recently opened.

CLEAR CREEK & GILPIN COUNTIES

Saxon—This mine is said to have been purchased by Poindexter & McDonald, of Seattle, who will expend $30,000 in development.

Lincoln—Owing to the heavy cost of pumping and hoisting, the shaft at this mine was abandoned 10 years ago. A crosscut tunnel will be driven to intersect the 500 level of the shaft, and the ores left in the mine will probably be extracted profitably.

LAKE COUNTY—LEADVILLE

About 18 miles south of Leadville, near Winfield, D. Johnson and associates are working a property which produces ore, assaying 7% molybdenum and from ½ to 3 oz. of gold per ton. The property has been idle for many years, but a company is being incorporated to work it again.

Hellena—The mill buildings are ready for the machinery, and men and teams are at work digging the snow out of the road so that the material can be hauled in.

Across-the-Ocean—This mine is making regular shipments to the Arkansas Valley smeltery each month, the output for February being about 100 tons of $25 ore. Ten men are at work under Manager Gilroy.

Fairplay—Three cars have been shipped from the new strike in this mine, in Stray Horse Gulch. The orebody is 4 ft. wide, and carries silver, gold and lead ore.

Dome—Development work on this mine, on Rock Hill, is going on steadily, the quality and quantity of the product being the same as for some time past.

Louisville—The mine is shipping regularly and the lessees are keeping development ahead of extraction.

SAGUACHE COUNTY

Raleigh—Reports state that a large orebody has been opened in this tunnel, at Bonanza. The vein is said to be 30 ft. wide, 15 ft. of which carry lead, zinc, gold and silver. This ore was struck 3000 ft. from the portal. It is 15 miles from the railway at Villa Grove. The property is owned by the Raleigh Mining & Tunnel Co., and New York men are interested.

SAN JUAN REGION

Tomboy—During February the mill crushed 8200 tons of ore, yielding bullion worth $18,000. Concentrates worth $60,500 were shipped. Expenses were $46,000; profit, $32,500; permanent improvement, $263.

Bagley—This tunnel at Animas Forks has been completed by Manager Charles Gagner, and he is now about to erect a mill to treat the ores of the many veins intersected.

Idaho

Columbus—The tunnel being driven on this property has encountered the orebody; the latter is 5 ft. wide and will concentrate four tons into one. The length of the orebody has not yet been determined. The property is in the Murray district and is on the proposed line of the new railroad which is to tap the north side mines.

Michigan

COPPER

Arcadian—Two copper-bearing formations have been cut by drilling. One was reached at a depth of about 1000 ft. on the southeastern part of Section 9, which is at the northern end of the property and a part of the section that had not been explored. This lode at the point of intersection is about 12 ft. wide, 7 ft. of which carry copper. The second strike was made recently at the southern end of the property, in proximity to Portage Lake.

Houghton Copper—Drifting in both directions at the 600-ft. level continues to open good ground, and a small stockpile is being accumulated. The shaft is concreted for a distance of about 300 ft. and is to be concreted for the entire distance, owing to the badly broken character of the ground in which the shaft was sunk.

Ojibway—No. 1 shaft is down to the 1600-ft. level, and the crosscut from this level should reach the lode within a few days. An exploratory drift is being driven from the 1700-ft. level of No. 2 shaft.

Oneco—Shaft sinking continues and copper has appeared from time to time; at the 900-ft. level good ground has been exposed, but no attention will be given to lateral openings until the lode, which yielded a rich core about two years ago, is reached; this is about 1200 ft. below surface.

Mass—The annual report for the year ended Dec. 31, 1911, is expected to show: Copper sold, 1,326,898 lb.; total receipts, $364,764; expenses, $464,123; deficit, $99,359; previous surplus, $130,069; total surplus, $30,710. An average price of 12.76c. per lb. was received for copper during the year.

Tamarack—The report for the year 1911 shows: Total receipts, $957,916, compared with $1,435,035 in 1910; total costs of $1,159,090 against $1,607,282 in 1910; deficit, after all charges, of $201,173 against $191,348 in 1910; assets, $1,462,163 against $1,579,715 in 1910.

Hancock—The report for the year ended Dec. 31, 1911, shows total receipts of $324,497. Disbursements were: Superintendence, office, legal, mining, transportation and smelting expense, $117,406; interest, $1760; taxes, $24,356; construction and development, $215,754; total, $359,278; excess disbursement over receipts, $34,780. The test mill-run yielded 754,749 lb. refined copper from 41,449 tons of rock, an average of 18.21 lb. per ton.

Osceola—Judge Weist, of Lansing, Mich., has issued an order restraining the holding of the annual meeting, scheduled for Mar. 14. Application was made by Charles M. Turner and other Michigan stockholders, who were opposed to the consolidation plan a year ago.

Superior—The report for 1911 shows: Total receipts, $430,884; total expenses, $482,873; deficit from operations, $51,989; balance of liabilities Dec. 31, 1911, $73,089; tons stamped, 162,599; refined copper, 3,236,233 lb.; total cost per lb., 15.31 cents.

Isle Royale—The report for 1911 shows: Total income, $969,365; mine expenses, smelting and transportation, $762,397; gross operating profit, $206,968; net profits, $156,708; balance of assets, Dec. 31, 1911, $137,976; tons of rock stamped, 457,440; fine copper, 7,490,120 lb.; cost per lb. at mine, 8.97c.; total cost per lb., 10.85 cents.

Adventure—The report for 1911 shows: Total expenses, $64,402; total receipts, $2849; deficit, $61,553. The assessment of $100,000 due July 20 resulted in the balance of assets amounting to $72,375 as against $33,929 at the end of 1910. A Kimberly skip has been installed.

IRON

It is reported from Ishpeming that the Oliver Iron Mining Co., a Steel Corporation subsidiary, has announced its intention to reduce working hours for underground men to three 8-hour shifts per day with no wage reduction. It is said that this will affect 10,000 men.

Davidson Ore Mining Co.—This subsidiary of the New York State Steel Co., operating the Gleason and Goodman properties, north of Iron River, has contracted to take electrical power from the Peninsula Power Co., of Iron Mountain. An electrically driven compressor has been ordered.

Bristol Mining Co.—This Oglebay-Norton subsidiary, at Crystal Falls, recently requested from the city council the refund of $12,186, because of alleged irregularity in the assessment of the taxes in 1911. It was stated that the Bristol mine was assessed at 75% of its true cash value, while general property was assessed at about 40%. The council replied that the matter was beyond the jurisdiction of the city, as the valuation of mines had been made by the State Tax Comission, and the refund was denied. Attorney I. W. Byers, of Iron River, appeared for the mining company.

Sheridan—At this property, south of Iron River, Alexander MacKinnon, who owns the mine, has let a contract to the McPherson Exploring Co. to put down several diamond-drill holes. The first hole has been started and is reported to be in ore formation. The mine was worked several years ago, and there is a shaft and headframe on the property.

Jones & Laughlin—At the Iron River property of this company, the shaft which is being sunk is down 110 ft. Work has been started on the combination engine and boiler house by J. S. Wahlman, contractor, of Ishpeming. The building will be of frame with iron sheeting; Will Walters is superintendent.

Rogers—At this mine, of the Munro Iron Mining Co., near Iron River, the 11x16½-ft., 5-compartment shaft, being sunk in rock, has cut out the first level and is sinking for the second.

Austin—This and the Stephenson mines are at present the only operating mines in the Swanzy district and both are owned by the Cleveland-Cliffs Iron Co. At the two shafts, near Cyr, recently sunk to bedrock by the Foundation Co., sinking in rock is in progress, using the temporary compressor plant that was used for the caisson work. One shaft is reported to be encountering considerable water, while the other, only a few hundred feet distant, is giving no trouble.

Missouri

Rider Mining Co.—This company, operating a mine at Pioneer, Berry County, has completed the erection of a $20,000 mill.

Short Creek Mining Co.—This company, operating on the Connor land, at Central City, has incorporated for $15,000. W. J. Von Borries, of Joplin, is manager.

Montana

BUTTE DISTRICT

Anaconda—At the Pennsylvania mine, 876 ft. of sill work was done during February, of which drifting constituted 644 ft.; crosscutting, 121 ft., and raising, 111 ft. There are about 490 men on the payroll at present, and 1100 tons of ore are being hoisted daily. On the 1000-ft. level an electric motor has been installed for ore hauling, taking the place of horses. This addition makes a total of three such motors in use at the mine, the other two being on the 1600-ft. level. The air shaft, which was raised from the 1600-ft. level, three compartments wide to the 1400-ft. level, is being enlarged to the same dimensions from the 1400-ft. level to the surface by cutting out a third compartment on the east end. This work has reached a point about 60 ft. above the 1200-ft. level, and will be continued without interruption until completed, after which it is the intention to install an air hoist and to use two compartments of the shaft for hoisting purposes, leaving the third for air lines and electric cables.

United Copper—Omission in paying the New Jersey State franchise tax has resulted in the Governor's declaring the charter forfeited. When interviewed, Mr. Heinze stated that it was undoubtedly due to a clerical error and that the company had no intention of permitting the charter to lapse.

Tuolumne—The east drift on the 1800-ft. level recently encountered a fault, which, upon investigation, was found to have caused a north displacement of the vein; by crosscutting through the fault, the vein was again picked up and found to be much wider and richer. With the amount of development work already done, it has been shown to be the finest body of ore yet encountered in the property. For a width of 4 ft. it averages 12.7% copper; 6 ft. averages 5.75%, and there is also a good silver content. This orebody is the same as the one on the 1600-ft. level, from which a heavy tonnage has been mined and shipped, but it is both wider and richer on the 1800-ft. level.

DEER LODGE COUNTY

Trilby—Development work has been going on for several months at this mine, in the Georgetown district; a crosscut from the bottom of the shaft, which is 44 ft. deep, recently encountered the vein, and a small amount of drifting has been done with encouraging results. There has been such an increase in the flow of water, however, incident to tapping the vein, that the buckets cannot handle it, and it is probable that operations will have to be suspended until the pump, which has been ordered, can be installed. It is the company's intention to leave the ore mined in the immediate future on the dump until the coming of the Butte, Anaconda & Pacific R.R. cheapens transportation.

JEFFERSON COUNTY

Grand View Mining & Development Co.—This company has been incorporated recently with main office at Whitehall. The incorporators are Henry Schmidt, Jack Bradley, Jesse Johnson and Dan Minier, of Whitehall, and Cladius Bros., of Ritzville, Wash. The company is operating its group of nine claims in Goodrich Gulch, 20 miles south of Whitehall. Three tunnels have an aggregate length of 1000 ft. The ore is lead-gold and a quantity is on the dump.

Nevada

COMSTOCK LODE

Ophir—Run 37, consisting of 2000 tons of ore at the Kinkead mill, has been completed, and the returns from concentrate and bullion shipments to the smeltery give a net yield to the company, less freight and treatment charges, of $53,903. One bar of bullion shipped netted $6169. Sill-floor sets are being installed on the 2100-ft. level of the mine, in the ore recently opened in the west crosscut from the south drift, and a raise will be carried up in the pay ore.

C. & C.—Shipment from the factory of the new centrifugal pumps with motors has been promised for March, and they will be installed at once. The new electric cable to connect with the new pumping plant has arrived, and is the largest yet used in the district. It is 4000 ft. long and weighs 14 lb. per lineal foot. The cable is being installed and will connect with the pump stations of this shaft and the old joint Ophir and Mexican winze, at the head of which one pump will be placed, recovering the levels below the 2500. It is expected that the new system will be working in about three months.

Con. Virginia—The raise in the ore on the 2400-ft. level has been carried up to the second floor, and second-class ore is being extracted. On the 2300-ft. level, an old west crosscut is being reopened, and it is proposed to explore the main Comstock vein at this point, near the footwall formation.

Sierra Nevada—The directors of this company, upon recommendation of Superintendent Julihn, have decided to start a northeast drift at once, from the west crosscut on the 2500 station of the joint winze. The drift will follow along the course of fracture into Sierra Nevada ground, assays secured from the formation being high enough to warrant this new exploration work.

Mexican—Five bars of bullion, shipped from the mill, netted the company $12,065, and the returns from the cleanup at the end of February are expected to increase the income from the mill for that month to at least $25,000. The mine and mill expense for the same period is approximately $15,000, showing a net profit of $10,000 for the month.

Crown Point—A run of 3500 tons of low-grade ore has been completed at the Yellow Jacket mill, and gave about 45 tons of concentrate, which were shipped to the smeltery. A preliminary estimate of the returns is between $20,000 and $30,000. The Yellow Jacket mill is now treating ore from the Jacket surface dumps.

NYE COUNTY

Tonopah Extension—The monthly report states that during February the mill treated 3822 tons of ore of a gross value of $51,583. The western workings of the mine on the 500-ft. level are showing up large bodies of ore averaging $20 per ton.

Montana-Tonopah—During February the mill produced bullion worth $29,821, and 62 tons of concentrates. A shoot of high-grade ore has been opened at a depth of 350 ft. and indicated for a length of 140 ft.; it is from 5 to 15 ft. wide. A new vein 3 ft. wide has also been cut on the 665-ft. level.

MacNamara—The new mill is now treating 60 tons of $15 ore per day. It is thought that the capacity of the mill can be worked up to 70 tons per day.

Tonopah-Halifax—The shaft, which is being sunk to intercept the extension of the Belmont vein, is now 930 ft. deep and is cutting stringers of low-grade quartz.

West End—The mill is treating about 800 tons of ore per week, and in addition, the company is shipping 40 tons of ore, averaging from $50 to $60 per ton, to the smeltery every week. The main stope on the 500-ft. level shows the vein to be 19 ft. wide, all of which is mined.

New Mexico

Romero—This company is developing some tungsten deposits in the El Porvenir district, 18 miles northeast of Las Vegas. The ore carries gold and silver. A shaft is down 65 ft. and an adit on the vein is in 310 ft. A concentrator is being erected. The officers are M. Romero, president; Dr. J. M. Cunningham, treasurer; H. C. De Baca, secretary.

Socorro—The new power plant is furnishing power for both mine and mill and the full force is at work in the mines.

Ernestine—During a recent week 640 tons were treated in the mill. The second 10-day cleanup in February amounted to 7675 oz. of gold and silver bullion and 1100 lb. of concentrates. The second battery of 10 Allis-Chalmers stamps was placed in commission on Feb. 26.

Deep Down—The leasers have installed a temporary pump in the tunnel to keep water out of the winze now being sunk. Specimen ore is found occasionally.

Oaks—The winze in the tunnel on the Pacific lode has encountered small quantities of high-grade ore. The south shaft continues sinking and a drift is being run from the north shaft.

Oregon

J. W. Morgan, of Portland, contemplates the erection of a concentrating plant for his property near Gold Hill, Jackson County.

Braden—This property near Gold Hill, in Jackson County, has been leased by J. W. Opp, who will improve it.

Sterling Quartz—This mine in Jackson County has been leased by R. L. Bar. The mine is already equipped with some machinery, and it is the intention to start operations.

Utah

BEAVER COUNTY

Majestic—Silver-lead ore of shipping grade is being mined from the west drift in the Harrington-Hickory. Three cars were shipped recently.

Indian Queen—Leasers are making occasional shipments from the upper levels.

Summit Mining—The property of this company, recently organized, consists of five claims adjoining the Black Bird on the east, and 2½ miles north of the Horn Silver. The claims were formerly worked by the Francisco Mining Co. Leasers are reported recently to have mined 70 sacks of good ore in two months. Development on company account will probably be undertaken in the summer.

King of the Hills—Considerable work has been done on this property in the past and several shipments of from 6 to 7% copper ore made. During the present winter development at deeper levels was undertaken with encouraging results. A strike of 5 ft. of copper ore of good quality is reported on the 240-ft. level.

JUAB COUNTY

Tintic shipments for the week ended Mar. 1 were 187 cars.

Beck Tunnel—Shipping ore has been opened in a raise from the 175-ft. level of the No. 2 shaft. When the company's indebtedness, half of which has been cleared off, is entirely liquidated, it is the intention to drive below the 1100-ft. level.

Eagle & Blue Bell—The shaft, which is being driven to connect the 1000- and 1400-ft. levels, is below the 1200. During February, about 1000 tons of ore were shipped from the 1200- and 1300-ft. levels. A car of shipping ore from the 700-ft. level is ready for the market and the orebody here is reported to be opening satisfactorily. The report for the year ended Dec. 31, 1911, shows a total production of 5831 tons of ore, gross value being $109,962; smeltery returns, $61,017. The ore yielded: Gold, 1995 oz.; silver, 98,738 oz.; lead, 726,796 lb.; copper, 9747 lb. In development, the report states, that the policy of "staying with the ore" was strictly adhered to and rigid economy was exercised. The year closed with $21,241, net operating profit.

Opohongo—About four cars per week are being shipped from the levels above the 700. On the latter level a raise will be driven at a point where gold ore has been opened. Crosscutting to the east is being done on the 1000 level, in order to connect with ore found some time ago through the Black Jack workings.

Gold Chain—Ten cars were shipped the week ended Mar. 1, most of the ore coming from above the 700-ft. level. Work at greater depth, however, is planned, and a winze from the 700 is being sunk in ore.

Tintic Standard—Two drifts, 100 ft. apart, are being driven northeast on the 1000-ft. level.

Grand Central—The shaft is down 2325 ft., and a station will be cut on the 2300. When this work, which will take about three months, is completed, a drift will be driven under the orebody on the 2200. The average weekly shipments since Jan. 1 have been nine cars.

Swansea—Shipments from the recent discovery on the 940-ft. level ran 20 oz. silver and 28 to 30% iron, and this appears to be the average grade. It is stated by one of the officials that the company will make about $8 per ton from this ore. Three cars were shipped during the week ended Mar. 1.

Iron King—A report to stockholders has been issued. During 1911 and up to the time of closing the mine in February, 1912, the main work has been that of developing and opening the orebodies. The report gives 100,000 tons as a conservative estimate of the iron ore blocked out. In closing down, the idea of the probable existence of precious metals under the large iron bodies has not been abandoned, and the management hopes at some future time, when the sale of iron will meet the expense, to go deeper in search of these metals. Receipts for the period from Jan. 1, 1911, to February, 1912, were $25,685, and disbursements, $29,950. In closing down it is thought necessary to meet all obligations of the company, and the money raised by assessment No. 6 will meet these and leave a small working capital.

SALT LAKE COUNTY

Utah Apex—Net profits for January were $31,993. The total gross value of the ore shipped during the month was $69,416; $5407 came from gold, $15,704 from silver and $48,303 from lead. Smelting and freight charges were $16,538, and mining, milling and development costs were $20,884.

Montana-Bingham—The 4000-ft. drain and development tunnel is in 510 ft., and progressing at the rate of 4 ft. per day. It will cut the Quinn fissure and several other fissures in Montana-Bingham ground, and will reach the Bingham Amalgamated lines with 3200 ft. of work. The face is in quartzite and porphyry, showing mineralization.

Dalton & Lark—The report for the year ended Dec. 31, 1911, shows a total production from the Lead Mine vein of 13,759 tons, bringing smeltery returns, after deducting freight and treatment, of $136,828. The Lark vein produced 3368 tons of lead and copper ore, bringing net smeltery returns of $56,234. The Commercial mine, also owned by the Bingham Mines Co., shipped no ore until April, and was shut down in September. About 110 tons per day are now being shipped. Development work totaled 1928 ft. and cost $6.68 per foot.

Washington

Germania Tungsten—Efforts are being made by William Scheck, Springdale, to reopen these tungsten mines in the Deer Trail district, Stevens County. It is the intention to enlarge operations.

Vance—This company has been organized for the purpose of developing a group of claims near Leavenworth, Chelan County. Albert Van Epps is general manager. Active operations will be started soon.

Canada

BRITISH COLUMBIA

Shipments and receipts in tons in the Boundary district for the week ended Feb. 29 were as follows:

Mine	Week	Year to Date
Granby	23,515	194,412
Mother Lode	6,532	68,305
Rawhide	4,810	12,344
Jack Pot	329	3,177
Athelstan	89	340
Emma	436	4,465
Others	493	1,937
Totals	36,204	284,980
Smelteries		
Granby	23,875	238,470
B. C. Copper Co	12,872	91,999
Totals	36.747	330,469

ONTARIO

Brandon Oil Syndicate—The first pumping at the well, recently put down at Milton, was done Mar. 6, and nine barrels were filled at the rate of four per hour. Ten 1400-gal. tanks have arrived and are being filled. The well will be emptied as fast as possible, and drilled 35 ft. deeper and shot.

ONTARIO—COBALT

Cobalt shipments for the week ended Mar. 8, were: La Rose, 145,400 lb.; Kerr Lake, 131,440; Temiskaming, 84,880; Wettlaufer, 65,140; Hudson Bay, 62,340; McKinley-Darragh, 60,640; Buffalo, 58,680; Coniagas, 58,300; Cobalt Townsite, 58,000; Trethewey, 40,960; Crown Reserve, 39,780; total, 871,420 lb. Bullion shipments were: Nipissing, 22,687 oz.; O'Brien, 10,262; Trethewey, 2024; Crown Reserve, 18,390; total, 53,633 ounces.

Beaver—This company has just completed a concentrating mill of 50-tons daily capacity, the especially interesting feature of which is the system of jigging the product from a gyratory crusher and regrinding the tailings by Hardinge ball and pebble mills, one of each, and finally washing on James tables.

Casey-Cobalt—At a meeting in London, Eng., a resolution was adopted authorizing the increase of the capital from £200,000 to £250,000. It is proposed to install a new compressor, to secure power from one of the Cobalt electric companies and to put up a concentrator of 125 tons daily capacity.

Nipissing—The output for last month was $226,419, net produced, and $545,559 shipped, which is probably the largest amount sent out by any Cobalt mine in one month.

Hargrave—The report shows a total production during 1911 of 113,000 oz. of silver, worth over $58,000, and expenses amounting to $59,418; in addition to $10,178 expended in the purchase of a Porcupine claim. The cash balance on hand, Dec. 31, was $22,954, and $37,260 ore on hand and at smelteries.

McKinley-Darragh—This company, by declaring a 10% dividend, payable Apr. 1, has amortized its capitalization, bringing the returns to shareholders up to a total of 106 per cent.

ONTARIO—PORCUPINE

The extension of the railway from South Porcupine to Timmins, five miles, has been opened for passenger traffic.

There are three mills in the district under construction, viz., the Hollinger, 40 stamps, the Dome, 40 stamps, and the Vipond, four Hardinge conical mills. The McIntyre mill, 10 stamps, has been put in operation. Remarkable feats have been done in the construction of these mills during a severe winter.

New York men are considering the erection of a customs mill at Swastika, to treat the ore from the Lucky Cross and Swastika mines, provided satisfactory arrangements can be made with the directors of these companies.

United Porcupine—The shareholders have authorized the directors to borrow $25,000 to carry on development work.

Rea—The 400-ft. level has been reached and crosscutting to pick up the vein will be undertaken immediately. This is expected to be reached at a distance of 45 ft. The vein widened from 4 ft. of $20 ore at the upper levels to 32 ft. at the 300-ft. level, but carried less gold at the latter depth.

Swastika—The report for the year 1911 shows that the company is about out of funds. The mine has 10,000 tons of $12 ore blocked out. It is understood that New York men are interested in the property and that they may furnish the money to finance the mine until it reaches the stage of production; $80,000 is to be advanced.

Vipond—Recent development on the No. 2 vein has opened another shoot of high-grade ore.

West Dome—This company is short of money, but it is understood that inside interests have taken up a sufficient block of the treasury stock to provide capital.

Porcupine United—The shareholders have authorized the directors to raise $25,000 to carry on the development work.

McEnaney—This property is showing up well under development.

Hollinger—The mill building has been completed and the foundations for the stamps are laid, but relatively little of the machinery has yet been set. The mill will probably be ready to begin operating before summer.

Dome—The mill is practically completed and probably will be put in operation before May.

ONTARIO—SUDBURY

Development work on one or two claims in the Wahnapitae gold district, has shown up some promising ore, and it is quite possible that more of the old claims would show up pay ore if a reasonable amount of work were done on them. All past efforts to make a paying mine in this district have failed.

Alexo—This nickel claim, owned by Alexander Kelso, and situated near Kelso, on the Temiskaming & Northern Ontario Ry., is being developed by the owner and associates.

Mexico

AGUASCALIENTES

Dispatches state that operations of the American Smelting & Refining Co. have not been interfered with. Train service has been interrupted at certain points, and the smeltery at Aguascalientes has been unable to receive ore from the north. Should the San Luis division of the National Railways of Mexico be put out of commission, the smeltery would only be able to run for a week or 10 days. That the San Luis division will be put out of commission is expected at any time.

CHIHUAHUA

Rio Plata—The fourth annual report shows: Total earnings, $410,996; expenses, $194,049; net profit, $216,946. After deducting dividends paid, $192,139 remained as earned surplus on Nov. 30, 1911, the end of the fiscal year.

MEXICO

El Oro—During February the mill crushed 22,900 tons of ore yielding bullion worth $161,180. Working expenses were $92,220; development, $18,280; total profit from mine and railway, $63,820; permanent improvement, $6960.

OAXACA

Natividad—A serious fire is reported to have occurred on Feb. 26. The fire originated in the deserted upper levels and 10 men are stated to have been killed.

Africa

TRANSVAAL

Gold production in the Transvaal in February was 703,866 oz., or $14,548,910. This is 33,194 oz. less than in January, but the decrease was due entirely to the shorter month, the daily average being 23,776 oz. in January and 24,271 oz. in February. For the two months ended Feb. 29, the total was 1,261,855 oz. in 1911, and 1,440,926 oz. or $29,783,940 in 1912; an increase of 179,071 oz., or 14.2%, this year.

Asia

CHOSEN

Oriental—The cleanup for February was $125,200. During January, 25,840 tons were crushed. Total bullion receipts were $127,472; lack of cordwood continued to necessitate only partial operations.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Mar. 13—The coal trade seems to be generally uncertain and wholly at the mercy of "wars and rumors of wars"—strikes in England and Germany and possible strikes here. The other important factor is in the railroads. There is a great demand for coal, but the railroads do not respond. Short car supply and slow transportation are the rule everywhere, though the railroads are showing some improvements. There is a widespread desire to stock coal, in addition to the current demand; but there is much difficulty in meeting these calls. The coal can be mined, but it does not seem possible to get it moved with any degree of promptness.

There are reports of large orders for export, though it is difficult to trace them with any certainty. If any have been placed—and some probably have—dealers do not know just when they can be filled. The demand for bunker coal on the Atlantic seaboard is exceedingly heavy.

The anthracite mine operators' committee meets the miners' representatives in New York today, with a refusal of all the demands presented at the last conference. There is no opening for discussion; but there is an opportunity for the presentation of new conditions later. The whole situation seems to hinge on the anthracite position, and probably nothing will be done in the West until there is some settlement in the East—or a strike.

Anthracite shipments in February were 5,875,968 long tons, being 112,272 tons more than in January, and 805,020 tons more than in February, 1911. They were the largest ever reported in February. For the two months ended Feb. 29, the shipments were 10,970,065 tons in 1911, and 11,639,664 in 1912; an increase of 664,599 tons, or 6.1% this year.

Coal and coke carried on Pennsylvania R.R. lines east of Pittsburg and Erie, month of January, short tons:

	1911	1912	Changes	
Anthracite	1,101,192	1,040,535	D.	60,657
Bituminous	3,621,472	3,581,365	D.	40,107
Coke	847,140	940,931	I	93,791
Total	6,569,804	5,562,831	D.	6,972

The total decrease was 0.1% this year, coke alone showing a gain.

Bunker coal supplied to steamships in New York harbor in 1911 was: Steamers in foreign trade, 3,796,022; coastwise, 937,809; total, 4,733,831 tons. This is an increase of 48,985 tons, or 1 per cent., over the previous year.

Coastwise shipments of coal from leading Atlantic ports year ended Dec. 31, long tons:

	Anthracite	Bituminous	Total
New York	14,651,401	10,749,988	25,401,386
Philadelphia	2,197,750	4,856,626	7,054,376
Baltimore	257,025	4,002,809	4,259,834
Newport News	....	2,678,156	2,678,156
Norfolk	....	4,698,769	4,698,769
Total	17,106,176	26,986,348	44,092,524
Total, 1910	16,243,378	25,835,029	42,078,407

Total increase in 1911 over 1910 was 2,014,117 tons, or 4.8%. New York covers all the harbor shipping points, and includes coal for city and other neighboring wharves.

IRON TRADE REVIEW

New York, Mar. 13—Business in iron and steel continues generally active. New orders and specifications on contracts keep the mills in good shape as far as work is concerned. Perhaps the strongest point just now is in structural steel, as many new orders for spring work are coming in, both for large and small quantities. The demand for steel has brought about the placing of some considerable orders for bessemer and basic pig with the merchant furnaces.

Besides these pig iron orders, a number of contracts for foundry iron are reported, especially in Eastern territory. Prices of pig iron have not actually advanced, but there is a general firming up and sellers are not inclined to make concessions.

There are indications of increased interest in Lake ore, and some sales direct to furnaces are reported, but no prices have yet been fixed. The sales have been mainly by companies which have stocks on hand from last season.

In order to further the interests of steel mills making bars for reinforcing concrete, the Rail Steel Bar Manufacturers' Association has been organized. These officers have been elected: President E. E. Hughes, Franklin, Penn.; vice-president, J. G. Joseph, Buffalo, N. Y.; secretary-treasurer, A. S. Hook, Chicago.

The unfinished orders on the books of the United States Steel Corporation, on Feb. 29, were 5,454,200 tons. This is an increase of 74,479 tons over Jan. 31, and is the largest total reported since Dec. 31, 1909. The gain in February indicates that new orders exceeded shipments.

Pig-Iron Production—The reports of the blast furnaces, as collected and published by the *Iron Age*, show that on Mar. 1 there were 234 coke and anthracite furnaces in blast, having a total daily capacity of 73,650 tons, an increase of 2550 tons over Feb. 1. Making allowance for the charcoal furnaces, the total production of pig iron in the United States in February was 2,120,400 tons; for the two months ended Feb. 29, it was 4,197,900 tons.

Baltimore

March 11—Exports for the week included 2,764,720 lb. steel billets to Liverpool; 657,200 lb. galvanized steel pipe to Rotterdam. Imports included 101 tons spiegeleisen, 1427 tons ferromanganese and 75 cases silicospiegel from Liverpool; 5340 tons manganese ore from Batum, Russia.

Birmingham

March 11 There continue to be small sales, mostly at the basis of $10.50 for No. 2 foundry. There are some large inquiries, it is stated, but these buyers generally want concessions which the makers are not willing to grant. Very little second-half business has been closed yet, at any price.

Cast-iron pipe plants are very busy, and there is an actual scarcity of the lower grades of foundry iron.

Scrap business is quiet and dealers are not pushing sales, as they look for better prices.

Chicago

Mar. 11—There is no marked change in the market for pig iron. Sales continue to be of the small-tonnage, short-time delivery kind, with every founder looking closely to future developments and figuring on prospective changes in market conditions. There are some fair inquiries, which may develop good-sized contracts in the coming week, but they are probably intended to test the market rather than to develop actual orders.

Northern iron holds to $14 furnace, and is very firm. Southern is between $10 and $10.50 Birmingham, with the selling agents trying hard to hold the price to the higher quotation, but rumor saying that the price is cut by at least 25c. on any order of importance. The $10.50, Birmingham, price means $14.85, Chicago.

Sales of pig iron run from a carload up to 500 or 600 tons. The aggregate is not large, but compares favorably with the aggregate tonnage of any week in the last two or three months. It is still a waiting, quiet market.

In iron and steel products the tendency is upward. Structural material has had a good sale in the last week, bridge and building requirements increasing. Prices are unchanged, beams and channels under 15 in. selling for 1.28@1.33c. Bars are stronger, with local mills busy and no price cutting, though the total of sales is not heavy. Soft steel bars bring 1.25@1.33c., base, and bar iron holds to 1.50@1.60c., base. Billets are quiet at $26.50 for openhearth forging. Plates are in good demand at unchanged prices, and sheets also hold up fairly well, the price of No. 28 black being 2.03c. minimum. Railroad supplies are still in light demand generally. Wire products are selling rather lightly yet, but prospects are for a heavy business soon. Coke sales, as an indication of the iron market, are encouraging.

Cleveland

Mar. 11—Some scattering ore sales are reported, but no further movement to fix prices.

Pig Iron—The market remains quiet, but there are a good many inquiries. The Algoma company at the Sault is reported to be in the market for 50,000 tons of bessemer and basic, deliveries to run over some time. Prices are unchanged.

Finished Material—Business is generally active and hopeful, large orders being in sight. Prices are inclined to be firmer than for some time past.

Philadelphia

Mar. 13—The possibilities of an anthracite and bituminous strike, especially the former, are causing some uneasiness. The stock of coke at Eastern furnaces is large and is being increased against possible emergencies. Basic has advanced and large purchases are said to be in sight for forward delivery. Low-grade iron has further advanced and extensive purchases have been concluded within a week and other purchases are now pending. Today's rumors indicate favorable possibilities of sales abroad which will probably be secured by Southern furnaces. Both favorable and unfavorable influences are at work in the pig-iron market but the run of ordinary buyers are taking no special interest outside of supplying their needs for a few weeks in advance. Quotations are close to $15 for No. 2 X foundry with very little difference in Southern makes. Gray forge is $14.25, basic $14.25 and low phosphorus is $19 per ton.

Steel Billets—Openhearth rolling billets are quoted $22.40@23.40 without large sales, though the inquiries denote business at an early day if offers are accepted. Forging billets sell in small lots for immediate needs.

Bars—Some mill owners report an increase in car orders for common bars while others are picking up only the usual run of small orders. Steel bars are strong without much additional business.

Sheets—Sheets have advanced slightly for early deliveries, with inquiries enough to give confidence as to continued activity.

Pipes and Tubes—Pipe makers report quite an improvement in inquiry in all lines and tube mills have secured some important business from this territory; and discounts are firmly maintained.

Plates—A large amount of business is in sight from the shipyards. The outlook for plates has considerably improved. Contracts have virtually been placed by a European government for two large vessels with a local shipyard.

Structural Material—The interest in the market at present is due to prospective business of large proportions. Local construction requirements are also looming up.

Scrap—The market has begun to show signs of activity. Satisfactory purchases have been made by a number of buyers for considerable quantities and shipments will be made immediately.

Pittsburg

Mar. 12—The feature of the week has been the heavy movement in steel-making irons, fully 175,000 tons of bessemer and basic having been sold within the past 10 days. The bessemer iron purchases have not advanced the market, but they have served to emphasize the fact that the steel mills are busy and have greatly improved the statistical position of pig iron. The basic iron purchases have actually advanced the market, making it quotable at fully 50c. above the level prevailing at the close of January, the major part of February being dull, with no closely quotable market.

The finished-steel trade gives better reports as to demand and firmness in price, but the improvement is barely noticeable and is not as great as should reasonably be expected at this season, when an unprecedentedly hard winter is giving way to spring, and when there should be a rush to get material if buyers have not already been taking heavier deliveries than they needed. The prospect is that the present level of finished-steel prices will be maintained, with perhaps slight advances, but there does not appear to be much prospect of a restoration of prices. A point of importance is that there is little new buying this month, when it was reported in November and December that many of the contracts then entered were for first-quarter delivery only. If those reports were all true, a fresh buying movement should certainly be in progress by this time. It seems quite clear that the output of the mills has been sold up fairly well to July 1 at the low prices and that consumers will not need to enter the market afresh in a large way unless their consumptive requirements prove larger than they anticipated.

The increase of 74,479 tons during February in the United States Steel Corporation's unfilled tonnage is in line with the later predictions, though not with those made up to the middle of the month, when it was expected that the corporation would break even or else show an actual loss. Evidently the gain was made entirely in the second half of the month.

Pig Iron—Sales in the past 10 days include 10,000 tons of Valley basic to the Jones & Laughlin Steel Co. at $12.40, Valley, already reported, the closing up of the warrant iron at Midland, held speculatively under warrant, about 50,000 tons, 5000 tons of Valley basic to the Gould Coupler Co. at $12.60, Valley, and 1000 tons to another interest at $12.75, Valley, at which last price the market is quotable, furnaces asking $13. Bessemer sales include 20,000 tons taken by the Steel Corporation at $14, Valley, half from a Sharpsville and half from a Youngstown producer, 25,000 tons taken from a Sharpsville furnace by the Youngstown Sheet & Tube Co., with freight equalized with $14 at Youngstown district furnace, 55,000 tons taken from a Lowellville furnace by the same interest at $14, furnace, 100,000 tons of ore being given in partial payment, and 10,000 tons purchased by the Republic Iron & Steel Co. at $14, Brier Hill furnace. Foundry iron continues quiet, but furnaces are still more frequently obtaining $13.25, Valley, on the small lots they sell. We quote: Bessemer, $14; basic, $12.75@13; malleable, $12.75@13; No. 2 foundry, $13@13.25; gray forge, $12.75@12.85, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market continues quiet, with prompt and forward quoted at $41, Baltimore.

Steel—The Youngstown Sheet & Tube Co. has sold the Brier Hill Steel Co. 25,000 tons of sheet bars, and several other sales have been made in that district, making the market firmer. at $19.25@19.50 for bessemer billets and $20 for bessemer sheet bars, f.o.b. maker's mill, Youngstown. At Pittsburg the market has been well sold up and prices continue firm, at $19.50@20 for bessemer billets and $19.25@19.50 for openhearth billets, with openhearth sheet bars about $20.50, f.o.b. maker's mill, Pittsburg. There is really no close quotation on bessemer sheet bars at Pittsburg. Rods are $25, Pittsburg, and very quiet. Mills are behind in deliveries on contract in both billets and sheet bars.

Sheets—The market continues irregular, but is perhaps a trifle firmer, owing to the withdrawal of a few particularly low quotations. Specifications are excellent, and several large mills are not only comfortably filled for the present but can see a continuance of present operations for weeks to come without the advent of much new business. We quote black sheets at 1.80c., galvanized at 2.80c. and blue annealed at 1.35c. The price on black is occasionally shaded.

St. Louis

Mar. 11—The market is about the same, though the threatened coal strike is a weight upon trade. Agents have tried hard to get an additional 25c. on Southern iron, but the current price on Southern No. 2 foundry iron remains $10@10.25, Birmingham, or $13.75@14, St. Louis. No. 2 Northern foundry is quoted at $14.25@14.75 per ton.

Coke is in poor supply now, and foundry coke is selling at $5.10@5.20 per ton, St. Louis.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for the month of January, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1911	1912	Changes	
Exports...	$18,738,391	$18,451,914	D.	$286,477
Imports.......	2,874,740	2,404,702	D.	470,038
Excess, exp.	$15,863,651	$16,047,212	I.	$183,561

Decrease in exports, 1.5%; in imports, 16.4%. The leading articles of iron and steel were, in long tons:

	Exports		Imports	
	1911	1912	1911	1912
Pig iron............	10,798	8,663	19,177	13,085
Scrap..............	5,116	7,501	303	624
Billets, blooms, etc.	11,731	12,779	2,865	1,392
Bars..............	8,842	12,180	2,601	2,055
Rails..............	43,127	24,445	.	335
Sheets and plates..	21,234	30,054	292	265
Structural steel....	12,152	13,647		35
Wire-rods..........	475	3,272	2,156	1,760
Wire..............	15,322	15,586	.....	......
Nails and spikes.	6,184	3,237	.....	.....
Tinplates......	2,857	4,076	5,677	267
Pipe and fittings..	1,431	1,597	.....	......

Imports of wire are not reported in quantities; values were $124,172 in 1911, and $93,833 in 1912. Exports of mining machinery were valued at $420,773; a decrease of $264,679, or 38.6%, from last year.

Iron Ore Trade

Rail shipments of Lake Superior ore in 1912, as finally adjusted, were 662,719 tons, making the total shipments for the year, 32,793,130 tons; a decrease of 10,649,267 tons, or 24.5%, as compared with 1910. Particulars of the shipments are given elsewhere.

German Iron Ore—Imports of iron ore in Germany for the year ended Dec. 31 were 10,812,595 metric tons, an increase of 995,773 tons over 1910; exports, 2,581,698 tons, a decrease of 370,934 tons. Imports of manganese ore in 1911 were 420,709 tons, a decrease of 67,163 tons; exports, 9615 tons, an increase of 5056 tons.

Metal Markets

New York, March 13—The metal markets show no special change during the week. Business has generally been quiet.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January....	110	111	July........	112	......
February ..	115	109	August.....	117	......
March......	112	....	September.	111	......
April.......	114	......	October	112	.....
May	118	....	November .	111	....
June........	115	......	December..	110	......

Year 1909, 115; 1910, 115; 1911, 112.

Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Jan. 1912..	$ 1,915,202	$ 5,165,543	Imp.	$3,250,341
" 1911..	923,676	9,540,830	Imp.	8,617,154
Year 1912..	1,915,202	5,165,543	Imp.	3,250,341
" 1911..	923,676	9,540,830	Imp.	8,617,154
Silver				
Jan. 1912..	6,027,905	4,358,009	Exp.	1,669,896
" 1911..	5,651,076	3,551,426	Exp.	2,099,650
Year 1912..	6,027,905	4,358,009	Exp.	1,669,896
" 1911..	5,651,076	3,551,426	Exp.	2,099,650

Exports from the port of New York, week ended March 9: Gold, $5,294,800, chiefly to Argentina; silver, $1,087,291, principally to London. Imports: Gold, $816,754; silver, $209,476, from Mexico and South America.

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for American coin. An increased amount was taken for India. In New York more gold was taken for Argentina.

Platinum—The market remains quiet, with no change in prices. We continue to quote $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Through an error in transcribing, the imports of platinum in January were given erroneously in the table published last week. The actual imports for the month were 5926 oz. in 1911, and 8215 oz. this year.

Silver—The tendency of silver is toward steadiness at current rates. The best advices indicate that no great fluctuations in price are expected at present.

Exports of silver from London to the East, Jan. 1 to Feb. 22, reported by Messrs. Pixley & Abell:

	1911	1912	Changes	
India	£1,793,200	£1,291,300	D.	£501,900
China	602,800	400,000	D.	202,800
Total	£2,396,000	£1,691,300	D.	£704,700

SILVER AND STERLING EXCHANGE

Mar.	7	8	9	11	12	13
New York....	58⅜	58¼	58¼	58½	58⅜	58½
London.....	26⅞	26 13/16	26 13/16	26 15/16	27	26 13/16
Sterling Ex.	4.8715	4.8715	4.8720	4.8720	4.8725	4.8720

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

NEW YORK

Mar.	Copper		Tin	Lead		Zinc	
	Lake, Cts per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
7	14½ @14¾	14.40 @14.45	42¾	4.00	3.92½ @3.97½	6.60 @6.90	6.45 @6.75
8	14½ @14¾	14.40 @14.45	42½	4.00	3.92½ @3.97½	6.60 @6.90	6.45 @6.75
9	14½ @14¾	14.40 @14.45	42½	4.00	3.92½ @3.97½	6.65 @6.95	6.50 @6.80
11	14½ @14¾	14.40 @14.45	42⅞	4.00	3.92½ @3.97½	6.65 @6.95	6.50 @6.80
12	14½ @14¾	14.40 @14.45	42½	4.00	3.92½ @3.97½	6.65 @6.95	6.50 @6.80
13	14½ @14¾	14.40 @14.45	41⅞	4.00	3.92½ @3.97½	6.65 @6.95	6.50 @6.80

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Mar.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
7	64¾	65½	69	192¼	188¼	15 13/16	26½
8	64 11/16	65 7/16	69	190	186¼	15 11/16	26½
9	......	......	......	......	......	......	......
11	64 7/16	65 3/16	68¾	192¾	187½	15 11/16	26½
12	64 9/16	65¼	68¾	192	187½	15⅞	26½
13	65 1/16	65 11/16	69	189¼	186¼	15⅞	26½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—During the last week the market has been dull and uninteresting, sales having been small in volume. Most of the large sellers of electrolytic have been holding firmly at 14.60@14.62½, delivered, usual terms, but there has been some shading by second hands, especially during the last two or three days, and what little business was placed must have been secured by them; but its amount has been too small to affect the general position. Some moderate sales of Lake copper at 14½@14⅝c. have been reported, with 14¾c. continuing to be the price asked by the leading seller for its premier brand. The undertone of the market remains strong, sellers regarding the outlook encouraging for a more active business, due to the favorable reports regarding an early settlement of the English coal strike. The close is steady at 14½@14¾c. for Lake; 14.40@14.45c. for electrolytic in cakes, wirebars or ingots, while casting copper is quoted nominally at 14.20@14.25 cents.

The London standard market was reactionary up to Mar. 11, when prices touched £64 8s. 9d. for spot and £65 3s. 9d. for three months. Since then, there has been a decided improvement, and the close is firm at £65 1s. 3d. for spot and £65 16s. 3d. for three months prompt.

Copper sheets are 19@20c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 15½c. base, carload lots at mill.

Copper exports from New York for the week were 6113 long tons. Our special correspondent gives the exports from Baltimore at 3398 tons.

Brass Prices—The following list prices took effect Mar. 1: Sheets, high brass, 15¾c. net per lb.; low brass, 17¼c. Rods, high brass, 15½c.; low brass, 18c. Tubing, brazed, 20½c.; open seam, 19⅛c. Brass angles and channels, 19½c. Scrap allowances are 10¼c. net per lb. for high brass and 11¼c. for low brass.

Tin—The London market was somewhat affected by the English coal strike, a fear having been expressed of unfavorable statistics, due to smaller deliveries. It grew steadier as an early settlement of the strike became apparent, but closes rather weak at £189 5s. for spot and £186 5s. for three months.

Considerable business was done in this market, due to a good demand from the tinplate manufacturers. However, the declining tendency of the London market during the first half of this week tended to make buyers more reluctant, and they are now holding back pending further developments. At the close, March tin can be purchased at about 41⅞ cents.

Tin shipments from the Straits in February are reported at 5260 long tons, an increase of 970 tons over February of last year.

Visible stocks of tin, on Feb. 29, are reported as follows: London, 9351; Holland, 543; United States, excluding Pacific ports, 5102; total, 11,996 long tons, a decrease of 1711 tons from the Jan. 31 report.

Lead—The market is unchanged at 4c., New York, and 3.92½@3.97½c., St. Louis.

The London market is very firm, and some nervousness is being shown on account of the decrease in lead shipments from Mexico, as there is no way of determining when the movement of lead from that country will be resumed from the districts which are now affected. The close is firm at £15 17s. 6d. for Spanish lead and 2s. 6d. more for English.

Spelter—There has been an active demand for future deliveries and some rather large sales have been reported at about 6.50c., St. Louis. For near-by deliveries the situation is uncertain. Some sellers report a fair demand; others the reverse. The market is very irregular, widely different prices being accepted for similar deliveries. Metal for prompt shipment continues to fetch a premium, but this is realized on but relatively small quantities. Some fair tonnages offered at 6.80c., St. Louis, failed to find buyers, but that price has been paid for carload lots. It would appear, that the demand for near-by spelter is on the decrease and that all urgent wants have been fairly covered. The close is firm at 6.65@6.95c. New York and 6.50@6.80c. St. Louis.

The London market is unchanged at £26 10s. for good ordinaries and £26 15s. for specials.

Zinc dust is quoted at 7⅛@7¼c. per lb., New York.

Base price of zinc sheets was advanced ¼c. per lb. on Mar. 7, and is now $8.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Other Metals

Aluminum—The market is fairly active and prices are firmer, but without quotable change. Current price is 19¼@19½c. for No. 1 ingots, New York.

Antimony—Business has shown little change and prices remain about the same. Cookson's is 7¼@7⅜c. per lb., Hallett's is 7⅜@7½c., while 6¾@6⅞c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is a little firmer, and prices are unchanged. The New York quotation is $46 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $45 for domestic orders and $42.50 for export. The London price is £8 7s. 6d. per flask, while £8 2s. 6d. is quoted from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80 per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 9—The base price paid this week for 60% zinc ore was $49@53. The highest price paid for zinc ore was $55. The base price for 80% lead ore was $49 per ton.

SHIPMENTS, WEEK ENDED MAR. 9

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Shullsburg	1,048,580	....	....
Benton	713,200	....	225,900
Galena	702,600	....	....
Mineral Point	671,800	....	....
Hazel Green	566,600	......	......
Platteville	330,000	......	88,000
Cuba City	143,700	88,390	63,750
Rewey	83,000	......	....
Montfort	82,000	....	.....
Linden	80,000	......	295,330
Harker	64,590	....	......
Total	4,486,070	88,390	672,980
Year to date	36,113,510	978,170	3,085,980

Shipped during week to separating plants, 1,583,500 lb. zinc ore.

Joplin, Mo., Mar. 9—The high price of zinc sulphide ore is $57.50, and the assay price per ton of 60% zinc is $50@55.50. Zinc silicate sold at $27@30 per ton of 40% zinc. The average price, all grades of zinc, is $49.96 per ton. Lead ore sold all week at $53@54.50 per ton, unchanged from last week. The average price, all grades of lead, is $53.70 per ton.

SHIPMENTS, WEEK ENDED MAR. 9

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,400,670	.....	1,047,400	$140,485
Joplin	1,825,810	......	306,340	55,740
Alba-Neck	893,880	......	55,070	25,620
Galena	808,970	.....	119,920	23,460
Carl Junction	524,330	......	.....	14,680
Duenweg	451,380	......	74,510	13,520
Oronogo	434,660	......	71,720	11,978
Granby	278,780	356,330	19,210	11,630
Cave Springs	382,960	......	......	8,425
Miami	42,440	......	233,850	7,200
Carthage	221,620	......	......	5 540
Spurgeon	73,950	115,200	71 120	5,350
Jackson	121,290	......	15,710	3,330
Springfield	112,200	......	......	3,030
Lawton	118,150	......	......	2,950
Quapaw	109,330	......	......	2,620
Aurora	49,180	66,000	......	2,100
Stott City	62,660	......	......	1,500
Totals	10,912,260	537,530	2,014,480	$339,158
10 weeks	96,210,270	5,401,900	15,461,110	$2,670,508

Blende val., the week, $277,168; 10 weeks, $2,167,324
Calamine, the week, 7,890; 10 weeks, 74,514
Lead value, the week, 54,100; 10 weeks, 428,570

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.[illegible]
February	40.21	45.75	39.16	43.31	54.46	52.3[illegible]
March	39.85	.....	38.45	.....	54.57	....
April	38.88		37.47	.....	56.37	.....
May	38.25		36.79	..	55.21	..
June	40.50	.....	38.18	.	66.49	....
July	40.75	...	38.36	......	68.81	....
August	42.50	..	41.28	.	60.74	.
September	42.63	....	41.29	..	59.33	....
October	42.38	...	40.89	.....	54.72	..
November	45.40	....	43.25	.....	57.19	..
December	44.13	....	40.76	..	62.03	....
Year	$41.45		$39.90	...	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

New Caledonia Ores

Exports of ores from New Caledonia for the year ended Dec. 31, 1911, as reported by the *Bulletin du Commerce*, of Noumea, were 120,060 metric tons nickel ore, 32,807 tons chrome ore and 4 tons iron ore. Exports of metals were 301 tons nickel matte and 798 tons copper matte.

Chemicals

New York, Mar. 13—The general market remains quiet, with some signs of improvement.

Copper Sulphate—A fair trade is being done at last prices, $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is improving, as the influence of the spring trade begins to be felt. Quotations are 2.22½c. per lb. for both spot and future positions.

Arsenic—Supplies are still rather scarce. Quotations remain at $2.75@3 per 100 lb. for white arsenic.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, month of January:

	Imports	Exports		Excess
Copper sulph. lb.	....	1,306,079	E.	1,306,079
Copper sul., '11	....	1,137,105	E.	1,137,105
Bleach, lb.......	9,414,490	. . . .	I.	9,414,490
Bleach, 1911....	8,880,365	....	I.	8,880,365
Potash salts, lb..	79,084,635	4,000	I.	79,080,835
Potash salts, '11	88,558,067	100,000	I.	88,458,067
Soda salts, lb....	1,040,146	58,205	I.	981,941
Soda salts, 1911	4,177,218	90,180	I.	4,087,038
Acetate lime, lb.	....	4,161,248	E.	4,161,248
Acetate, 1911...	....	2,371,804	E.	2,371,804
Nit. of soda, tons	44,564	382	I.	44,182
Nitrate, 1911...	61,351	857	I.	60,494
Phosphates, tons	....	103,532	E.	103,532
Phosphates, '11	....	61,375	E.	61,375
Sulphur, tons....	2,082	1,902	I.	180
Sulphur, 1911..	1,799	101	I.	1,698
Pyrites, tons.....	81,034	....	I.	81,034
Pyrites, 1911...	104,287	....	I.	104,287
Magnesite, lb....	12,114,841	149,440	I.	11,965,401
Magnesite, 1911	26,245,673	... ..	I.	26,245,673
Sul. ammonia, lb.	19,289,216	... .	I.	19,289,215
Sul. am'nia, '11	46,441,563	. . ...	I.	46,441,563
Arsenic, lb.......	445,099	....	I.	445,099
Arsenic, 1911...	495,372	... ...	I.	495,372

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 43,797 tons.

MINING STOCKS

New York, Mar. 13—On March 7 the Exchange was strong and rather active. Amalgamated Copper gained near 2 points and Steel common 1½. The Curb was irregular. Mining stocks were slow, while the Standard Oil issues were very strong.

March 8 there were some reactionary movements on the Exchange, but prices closed very near the opening level. On the Curb trading was wider, though the total sales were not heavy. Cobalts were firm and coppers irregular.

March 9 the Exchange was still firm, with some advance in Steel common. The Curb was fairly active and coppers were in good demand. Other mining stocks quiet, but firm.

March 11 there was a rather dull market on the Exchange and some weakness developed. Trading on the Curb was slow, with narrow fluctuations, the only large sales being of South Utah in the coppers, and of Tonopah Extension and Porcupine Northern in other mines. There was a sale of Homestake at $86.50 per share.

March 12 the Exchange was uncertain, with very small changes in price and light business. The Curb was irregular, with some demand for copper stocks at fractional declines; while Cobalt and Porcupine shares had fractional advances. On March 13 much the same conditions prevailed.

At auction in New York, March 7, sales were made of 20,000 shares Peregrina Mining & Milling Co. common, $10 par, at 10c. per share, and 45 shares preferred $100 par at $25 per share; 5000 shares Guanajuato Development Co. common, $100 par, 50c. per share, and $500 bonds at $200 for the lot; 1450 shares common, 400 shares preferred and $89,000 leasehold bonds of Herbert Collieries Co., $260 for the lot.

A special sale of the right, title and interest of the Development Co. of America in certain securities, for account of the Empire Trust Co., trustee, showed the following prices: 232,031 shares London-Arizona Copper Co., $10 par, $500 for the lot; 46,379 shares Lookout Copper Co., $10 par, $100 for the lot; $3000 Saddle Mountain Mining Co. bonds, $200 for the lot; Tombstone Consolidated Mines Co. $575,852 demand notes, $500, and $108,020 special contract bonds, $200; Imperial Copper Co. $25,200 special contract bonds, $200 for the lot, $238,000 demand notes, $200, and 664 shares, $10 par, $6 for the lot. Poland Mining Co. special contract bonds, $300, and 10,638 shares, $10 par, $7 for the lot; Development Co. of America, $144,000 gold bonds, $300 for the lot.

Boston, March 12—Dullness is the principal feature in the local mining-share list, although a fair amount of strength accompanies this condition.

Following the Wolverine's increased dividend rate the Old Dominion Co. has increased its rate of payment. In fact the latter company is declared to be earning at the rate of $5 per share, per annum. Of considerable interest is the publication of the annual reports of the Calumet & Hecla subsidiary companies. Accompanying them are recommendations by the management relative to new stamp mill arrangements which involve several of these companies. Tamarack will benefit to the amount of $230,000 by the sale of a portion of its mill and the others will receive additional mill facilities and reduced costs.

The market for Amalgamated is closely watched as it is considered the key to the situation. An increase in this com-

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	Dec.	Jan.	Feb.
Alaska shipments.	4,995,008	3,701,010	....
Anaconda	23,500,000	26,350,000	27,450,000
Arizona, Ltd... .	3,100,000	3,200,000	3,020,000
Balaklala	....	....	....
Copper Queen......	8,365,265	6,748,264	6,046,864
Calumet & Ariz....	4,486,000	4,544,000	4,452,000
Detroit...	1,969,313	1,941,970	2,008,374
East Butte.. ...	1,498,000	....	. ....
Mammoth.... ..	1,721,404	1,665,319	. . ..
Mason Valley......	....	600,000	....
Miami......... .	2,500,000	2,600,000	.. ..
Nevada Con .	4,679,674	6,309,228	... .
Old Dominion ..	2,610,000	2,044,000	2,039,000
Ray...............	2,660,000	2,476,945	....
Shannon.	1,255,858	1,550,000	1,300,000
South Utah...	267,514	189,678	... .
United Verde*	2,000,000	....	... . .
Utah Copper Co .	9,039,557	8,156,612	... .
Lake Superior*....	17,500,000	....	. ....
Non-rep. mines*.	8,500,000	8,400,000	....
Total production.	100,647,593	....	....
Imports, bars, etc.	21,101,256	31,790,590	....
Total blister....	121,748,849	....	....
Imp. in ore & matte	5,159,997	8,340,740	....
Total....	126,908,846	... .	. .....
Brit. Col. Cos.:			
British Col. Copper	. ....	....	
Granby	....	1,607,558	....
Mexican Cos.:			
Boleo.......	2,645,640	2,315,040	. . .
Cananea	3,706,000	3,552,000	....
Moctezuma	2,864,464	2,732,857	2,687,712
Other Foreign:			
Cape Cop., S. Africa	701,120	784,000	.
Kyshtim, Russia...	1,570,000	....	. .
Spassky, Russia..	721,280	795,200	. .
Famatina, Argen..	217,280	172,480	. .
Tilt Cove, Newf'd..	....	153,257	....
Exports from:			
Chile.......	5,824,000	8,064,000	6,720,000
Australia...	11,200,000	7,056,000	7,164,000
Arrivals in Europe from other count.†	16,331 840	13,144,320	10,868,680

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
II, 1911... ...	109,828,297	50,518,998	45,111,019
III............	130,532,080	66,080,789	59,081,127
IV...........	118,085,223	52,407,650	62,129,599
V.	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI.......	111,876,601	68,039,776	67,049,279
XII......... .	122,896,697	65,988,474	79,238,716
Year, 1911. .	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II.............	116,035,809	55,228,368	63,148,096

VISIBLE STOCKS

	United States	Europe	Total
III, 1911.. ...	156,637,770	233,385,600	390,023,009
IV....... .. .	162,007,934	223,014,400	385,022,434
V......... ..	165,555,908	212,284,800	377,840,708
VI........ .	165,995,932	202,540,800	368,536,732
VII..	157,434,164	195,932,800	353,366,964
VIII . ..	137,738,858	191,891,840	329,630,698
IX. .	133,441,501	191,228,800	324,670,301
X.	140,894,856	191,945,600	332,840,455
XI	134,997,642	176,825,600	311,823,242
XII ..	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III......	62,939,988	141,142,400	201,082,388

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

pany's dividend rate will go further toward promoting a good feeling and active times in copper shares than any other one thing.

Curb trading has been of fair volume and at firm prices.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich.	Jan. 22	....	$1.00
Alpha Con., Nev.	Feb. 21	Mar. 13	0.05
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah,	Feb. 6	....	0.01
Boston Ely, Nev.	Jan. 18	....	0.50
Challenge, Nev.	Mar. 5	Mar. 26	0 05
Crown Point, Nev.	Mar. 28	Apr. 19	0.05
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev.	Feb. 14	Mar. 6	0 05
Hancock, Mich.	Mar. 28	....	1 00
Kentuck, Nev.	Feb. 29	Mar. 19	0 05
King David, Utah	Feb. 13	Mar. 6	0 005
Lehi Tintic, Utah	Feb. 29	....	0 01½
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
Ojibway, Mich.	Jan. 10	....	1 005
Raven, Mont.	Feb. 1	....	0.10
Savage, Nev.	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev.	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz.	Jan. 15	....	1 00
Spider, Utah	Jan. 15	Feb. 15	0 002
Swansea Con., Utah	Jan. 17	Feb. 8	0.01
Tintic Central, Utah	Mar. 9	Mar. 27	0.005
Tintic Standard, Utah	Jan. 8	Feb. 5	0 00
Union Con., Nev.	Feb. 20	Mar. 12	0.15
Utah, Nev.	Jan. 19	Feb. 9	0.05
Wabash, Utah	Mar. 19	Apr. 10	0.10
Yellow Jacket, Nev.	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24 865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	......	23.690	24.324	......
April	53.221	53.325	......	24.483	24.595	......
May	53.870	53.308	......	24.797	24.583	......
June	53.462	53.043	......	24.651	24 486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24 428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53.486	53.304	......	24 670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	14 094	12 680	14 337	55.600	62 760
February	12.256	14 084	12 611	14 329	54 974	62 893
March	12 139	......	12.447	......	54 704	......
April	12 019	......	12 275	......	54 034	......
May	11 989	......	12 214	......	54.313	......
June	12 385	......	12 611	......	56 365	......
July	12 463	......	12 720	......	56 673	......
August	12 405	......	12 634	......	56 266	......
September	12.201	......	12 508	......	55.253	......
October	12 189	......	12.370	......	55 170	......
November	12.616	......	12 769	......	57.253	......
December	13.552	......	13 768	......	62.068	......
Year	12.376	......	12.634	......	55.973	......

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	
February	41 614	42 962	August	43 319	
March	40 157		September	39 755	
April	42 185		October	41 185	
May	43 115		November	43.125	
June	44 606		December	44.655	
			Av. Year	42 281	..

Prices are in cents per pound

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4 435	4 334	4 327	13 009	15.619
February	4 440	4 026	4 266	3 946	13 043	15 738
March	4 394	......	4 238	......	13 122	......
April	4 412	......	4 262	......	12.889	......
May	4.373	......	4 223	......	12 984	......
June	4 435	......	4.292	......	13.260	......
July	4.499	......	4.397	......	13 530	......
August	4 500	......	4 406	......	14 260	......
September	4 485	......	4 356	......	14 744	......
October	4.265	......	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	......
December	4 450	......	4.332	......	15.648	......
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	6 499	5 368	6.349	23 276	26 661
March	5 563	......	5 413	......	23 016	......
April	5 399	......	5.249	......	23 743	......
May	5.348	......	5.198	......	24.375	......
June	5 520	......	5 370	......	24 612	......
July	5 695	......	5 545	......	25.006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	......	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14 40	$13.32	$14 75	$14.00
February	15 90	15.03	14 50	13.28	14 81	14.01
March	15.90	......	14 65	......	14.96	......
April	15 90	......	14 65	......	15 00	......
May	15.90	......	14 30	......	14 72	......
June	15 90	......	14 05	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Mar. 12

Name of Comp.	Bid.
Acacia	.06
Cripple Cr'k Con.	.02
C. K. & N.	16⅜
Doctor Jack Pot.	.05½
Elkton Con.	.58
El Paso	.67¼
Findlay	.04¼
Gold Dollar	.14¼
Gold Sovereign	.02
Isabella	.11¼
Jack Pot	05
Jennie Sample	.04¼
Lexington	01
Moon Anchor	01
Old Gold	03¼
Mary McKinney	.52
Pharmacist	.01⅞
Portland	.90
Vindicator	70
Work	.007

SALT LAKE Mar. 12

Name of Comp.	Bid.
Beck Tunnel	.16¼
Black Jack	.15
Carisa	‡.15
Cedar Talisman	.02¼
Colorado Mining	.36
Columbus Con.	.22
Daly-Judge	10.00
Grand Central	.75
Iron Blossom	1 25
Little Bell	.35
Lower Mammoth	.03¼
Mason Valley	12.25
May Day	.15½
Nevada Hills	2 70
New York	‡ 03
Prince Con.	1 17½
Silver King Coal'n	1 57½
Sioux Con.	.09
Uncle Sam	26½
Yankee	‡ 15

TORONTO Mar. 12

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7 05	Pearl Lake	17
Hudson Bay	‡70 00	Porcu. Gold.	45
Temiskaming	.37	Porcu. Tisdale	02
Wettlaufer-Lor	73	Preston E. D.	07½
Apex	.06	West Dome	50
Central	‡3 75	Standard	.18½
Doble	60	Foley O'Brien	32
Dome Exten	50	Rea	80
Hollinger	10 90	Crown Chartered	17
Imperial	05	Swastika	22

SAN FRANCISCO Mar. 12

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.05	Belmont	10.40
Belcher	.65	Jim Butler	50
Best & Belcher	.11	MacNamara	.25
Caledonia	4.00	Midway	31
Challenge Con.	.25	Mont.-Tonopah	2 30
Chollar	.11	North Star	.30
Confidence	.95	West End Con.	1 42½
Con. Virginia	.77	Atlanta	.21
Crown Point	.60	Booth	.11
Gould & Curry	.05	C.O.D. Con.	.12
Hale & Norcross	.23	Comb. Frac.	.17
Mexican	3.45	Jumbo Extension	.28
Occidental	.60	Pitts.-Silver Peak	1.37½
Ophir	1.42½	Silver Pick	.09
Overman	2.00	St. Ives	.30
Potosi	07	Tramp Con.	‡.01
Savage	.23	Argonaut	‡2.00
Sierra Nevada	.29	Bunker Hill	‡5 50
Union Con.	1.15	Cent. Eureka	.30
Yellow Jacket	.73	So. Eureka	‡5 00

N. Y. EXCH. Mar. 12

Name of Comp.	Clg.
Amalgamated	70⅜
Am. Agri. Chem.	59¼
Am.Sm.&Ref.,com	75⅛
Am. Sm.& Ref., pf.	104⅛
Am. Sm. Sec., pf. B	85¼
Anaconda	39
Batopilas Min.	1¼
Bethlehem Steel pf	59
Chino	26
Federal M.& S., pf.	38
Goldfield Con.	4¾
Great Nor., ore ctf.	38¾
Homestake	86
Miami Copper	24⅜
Nat'nal Lead, com.	53¼
National Lead, pf.	107
Nev. Consol.	19¼
Pittsburg Coal, pf.	82
Ray Con.	17⅛
Republic I&S, com.	19⅛
Republic I & S, pf.	71⅜
Sloss Sheffi'd, com.	41¾
Sloss Sheffield, pf.	100
Tennessee Copper	37⅛
Utah Copper	56¾
U. S. Steel, com.	64⅝
U. S. Steel, pf.	110⅛
Va. Car. Chem.	53½

N. Y. CURB Mar. 12

Name of Comp.	Clg.
Barnes King	‡.12
Beaver Con.	.48
Braden Copper	5⅛
B. C. Copper	4⅝
Buffalo Mines	‡1¼
Butte & Vipond	‡ 53
Butte Coalition	‡23
Caledonia	.74
Con. Ariz Sm.	9/16
Davis-Daly	1 1/16
Diam'field-Daisy	12
Ely Con.	5/16
Florence	‡ 60
Giroux	4⅜
Gold Hill Con.	‡¼
Greene Cananea	7⅝
Greenwater	08
Guggen. Exp.	200
Inspiration Con.	18¾
Internat. S. & R	‡128
Kerr Lake	2 13/16
La Rose	3⅞
McKinley-Dar-Sa.	1 11/16
Min. Co. of A. new	3½
Nev. Utah M. & S.	1/16
Nipissing Mines	7¾
Ohio Copper	1 3/16
Pacific Sm. & M.	¼
Porcupine T'nsite	‡ 03½
Precious Metals	‡1⅜
Ray Central	2⅛
Red Warrior	‡1½
South Utah M.& S.	‡1/16
Standard Oil (Old)	853
Stand'd Oil of N.J.	364
Stand'd Oil Subs.	500
Stewart	1 3/16
Tonopah	7⅛
Tonopah Ex.	2⅛
Tri-Bullion	1/16
Tularosa	⅝
United Cop., pfd.	15
Yukon Gold	3 7/16

LONDON Mar. 13

Name of Com	Clg.
Camp Bird	£1 9s 6d
Dolores	1 10 0
El Oro	0 17 3
Esperanza	1 12 0
Mexico Mines	6 15 0
Oroville	0 6 3
Stratton'aInd.	0 2 1½
Tomboy	1 0 6

BOSTON EXCH. Mar. 12

Name of Comp.	Clg.
Adventure	7½
Algomah	5⅞
Allouez	39¾
Am. Zinc	26
Ariz. Com., ctfs.	4⅝
Bonanza	40
Boston & Corbin	7⅝
Butte & Balak	4
Calumet & Ariz	61⅜
Calumet & Hecla	450
Centennial	20
Con. Mercur	.06
Copper Range	55¾
Daly West	5¾
East Butte	13
Franklin	13½
Granby	36½
Hancock	32½
Hedley Gold	17
Helvetia	1 3/16
Indiana	14½
Island Cr'k, com.	43½
Island Cr'k, pfd.	87
Isle Royale	28
Keweenaw	1 3/16
Lake	37
La Salle	5½
Mass	7¾
Michigan	3
Mohawk	55
New Arcadian	4¾
New Idria Quick.	7¼
North Butte	27¾
North Lake	6¼
Ojibway	6⅝
Old Dominion	48½
Osceola	114
Quincy	78
Shannon	12
Shattuck-Ariz	19
Superior	27½
Superior & Bost.	3¼
Tamarack	29
Trinity	5¾
Tuolumne	3¾
U. S. Smelting	38
U. S. Smelt'g. pf.	47⅞
Utah Apex	2⅞
Utah Con.	16
Victoria	4½
Winona	6½
Wolverine	105
Wyandot	2¾

BOSTON CURB Mar. 12

Name of Comp.	Last
Ahmeek	262
Bingham Minea.	3 11/16
Boston Ely	1⅛
Boswyocolo	.08½
Butte Central	6½
Cactus	17
Calaveras	1⅝
Chief Cons.	1¼
Corbin	2⅜
Cortez	1 3/16
Crown Reserve	3⅛
First Nat. Cop.	2⅜
Majestic	58
Mazatan	‡½
Moneta Porc.	15
Nevada-Douglas.	3⅜
New Baltic	4½
Oneco	2⅜
Raven Copper	.39
Rhode Island Coal	13
San Antonio	‡3½
S. W. Miami	5⅜
South Lake	6
Trethewey	.65
Union Mines	‡¼
United Verde Ext.	.35
Vulture	‡5¾

‡Last quotation.

The Engineering and Mining Journal

Vol. 93. MARCH 23, 1912. No. 12.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue, 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Editorials:
  The Smelting Company's Report.. 581
  Will There Be a Coal Strike?..... 582
  Physical Chemistry 582
  A Training School for Miners..... 582
By the Way....................... 583
Correspondence and Discussion:
  Where the Primer Should Go.... Research Work in Technical Schools....Bat Guano........... 584
American Smelting & Refining Co... 585
Mining Accidents in Ontario........ 585
Details of Practical Mining:
  *Drinking Water in the Mine.... *Estimating Irregular Areas.... Testing Cage Safety Catches.... *Safety Crossheads for Hoisting Buckets....A Four-Sided Leveling Rod....*Landing Chair for Skips in Inclines....*Control of Induction Motor Hoists....*Piping for Continuous Agitation.... Volumes of Prismoidal Tanks ....*Bucket Elevator Chart.... 587
Eight Hour Shift in Lake Superior Iron Mines 586
Trinity Gold Mining & Reduction Co. 586
The Homestake Mining Co.......... 593
Phelps, Dodge & Co................ 593
Notes on Porcupine....H. Y. Russell 594
*Blast Desiccation by Calcium Chloride ....J. B. Van Brussel 595
West Australian 1910 Mineral Production 596
Stanley Steel Investigation......... 596
Iron Blast Furnace Changes........ 596
The Beginnings of Physical Chemistry...............Harry C. Jones 597
Peculiar Tin Mine............... ... 600
*Argentine Government Aërial Tram. C. A. Tupper 601
Notes on Pioche, Nev. Edward R. Zalinski 601
Cyaniding Weathered Pyritic Tailing ....Herbert R. Edmands 605
*Northern California Gold Dredging...............Lewis H. Eddy 607
Burning Temperatures for Limestone 610
Neutralization of Roaster Gases... 610
Uses of Zirconium.................. 610
Nevada-Utah Mines & Smelters Corporation 611
Premier Diamond Mine 612
South African Notes............... 612
Mineral Production of Quebec 1911 612
Investigation of Alleged Smelting Trust 613
Mason Valley Mines 613
Personal, Obituary and Society.... 614
Editorial Correspondence 615
Mining News 617
Markets 623
*Illustrated.

The Smelting Company's Report

The 13th annual report of the American Smelting & Refining Co. is noteworthy for two things, anyway, and perhaps for others. In the first place, it is for the first time a report for a calendar year, the old fiscal year having been abolished. This is a commendable innovation that ought to be adopted by every company. There is no reason under the sun why any company should report in any other way. In the next place this report is noteworthy for a lumping of the business of the American Smelting & Refining Co. and the American Smelters' Securities Co. With the interlocking arrangement between these two companies, clinched by the purchase last year of the outstanding common stock of the securities company by the smelting company, the latter became the unqualified controller of the former, subject only to the demands of the debenture holders of the securities company (who were guaranteed by the smelting company) and the rights of certain preferred stockholders. Incidentally we may remark that the position of the preferred stockholder in the two companies is somewhat anomalous. Some have claims upon certain equities and some upon others. However, while the dividends on the preferred stocks be paid regularly, which seems to be reasonably assured, so long as the company continues to be a going concern, we do not suppose that any objection will be raised on this ground.

The new form of the 13th report shuts off any comparison with former reports, and in general the presentation is obscure. The president of the company, in four printed pages, does not tell his stockholders anything of extraordinary interest beyond the repetition of what is stated in the balance sheet, the brief mention of plans respecting the new smeltery at Hayden, Ariz., the purchase price of the Tiro General mine, and the assurance that the stocks of silver and copper are still inventoried at 50c. per oz. and 12c. per lb., respectively, which are comfortably conservative figures.

The statement of assets and liabilities is still confused by the ledger entry for property account, and the manner of writing off for depreciation and new construction. The officials of the company no doubt are able to interpret this bookkeeping (we can't), but they keep their knowledge to themselves. We understand that the company has got the following things:

Investments	$1,585,670.35
Deferred charges	704,166.66
Reserve fund assets.......	232,554.84
Metal stocks	26,492,980.70
Working assets	2,967,021.29
Current assets	13,652,980.88
Total	$45,635,374.72

In addition to the above assets it possesses a lot of physical property, including mines and smelting works, of great but unindicated value; and goodwill, represented by its contracts, organization and generally its ability to conduct a successful business, all of which is undoubtedly also of great value. The company had obligations as follows:

Debenture bonds	$15,000,000.00
Current liabilities	8,810,109.90
Reserve funds	1,089,271.66
Total	$24,899,381.56

Consequently, the company had a surplus of about $21,000,000 in cash assets, besides the physical property, good-will, etc., that we mentioned above. The value of the latter is indicated by the ability of the company to earn money. Its showing of earning capacity in 1912 was very satisfactory. We think, however, that the stockholders would like to have (and ought to have) data to enable them to form their own opinion of continuance of earning capacity.

In the income account for 1911 there is a step in the right direction toward proper itemization, the earnings of the smelting and refining plant, the mining properties, and other sources of revenue being reported separately. We have, in previous years, criticized the Smelting Company for insufficient allowance for amortization. In 1911 the deductions on this account seem to be liberal, although we have but an imperfect idea of the meaning of the several items. Out of gross earnings of about $14,000,000 by the smelting and refining plants, $1,944,000 is deducted for "ordinary repairs and replacements." Then out of the total gross income ($15,112,125), the sum of $1,887,399 is deducted for "depreciation and amortization of properties." Finally, $900,210 is deducted "for depreciation in value of investments." Here we have a total writing off of about $4,700,000. We are always confused by the item of "ordinary repairs and replacements." Commonly, repairs and renewals are figured in operating expense and do not appear in the income account any more than does fuel, flux and other items of direct operating expense. The mere keeping of plants in good repair, of course, is not a figuring of amortization in any sense of the word.

We have no reason to criticize the report of the smelting company very extensively. We could not find many points to seize hold of if we tried, most of them having been rounded off, or buried. We hope that next year the directors of the company will give us a better opportunity. We may say that in their recent reports we see signs that they are moving in that direction, and we have no doubt that before the passage of many years they will issue an annual report as full, explicit and commendable as that of the Steel Corporation. We shall conclude our comments upon the 13th annual report by remarking that last year the company seems to have made a lot of money, and is, no doubt, comfortably well off, nay, even prosperous.

Will There be a Coal Strike?

Rather an unreasoning panic seems to have set in over the probability of a strike of the miners in the anthracite region. The public seems to have made up its mind that supplies of coal are to be cut off for an unknown period, and this belief is industriously fostered by coal dealers in the seaboard cities, to their own great and immediate profit. It is true that the miners and operators have apparently developed radical differences, and the miners' demands have been refused. Nevertheless the negotiations have been conducted amicably so far, and there is not only a possibility but a probability that a new set of conditions may be presented which will permit a compromise. It is probable that there may be a suspension of mining for a short time, but that no strike will be declared, and in that case the consequences to business will not be serious, especially as spring is coming on with its decreased demand.

Physical Chemistry

There has been developed during the last 25 years a new science that for convenience is referred to as "physical chemistry," although in truth it is but general chemistry interpreted in the light of physics. The beginnings of this interpretation were made much earlier than 25 years ago and in the early '80s, with the publication of Thomsen's classic "Thermochemische Untersuchungen" (1882-6), a fair practical acquaintance with one important phase of the new knowledge became general, but we think we are correct in saying that the crystallization of the new ideas occurred within the last quarter of a century and that the chemists and metallurgists who were in school before that time have still but a vague idea of modern teachings. The metallurgist who dates back to that time finds it difficult to follow the modern papers of Boudouard, Bodländer and others, for the reason that he failed to get the rudiments of the new science during his student days, a natural failure inasmuch as the science had not then been formulated and was scarcely referred to in the classrooms and textbooks. It is difficult in later years for such men to become thoroughly conversant with a new science, just as it would be difficult for a man of 45 to take up mathematics from the beginning. The mind of that age is less receptive than the youthful, and moreover the engagement with the material things of everyday life precludes the kind of application that can be given in school.

Yet the teachings of physical chemistry are something whereof the practical metallurgist needs to know, because they afford keys to further progress in the practice of the art. The cyanider wrestling with the problem of colloids is concerned with one phase of this subject that but 10 years ago did not occur to him, and the smelter has many conditions of things that may or may not be done. To most engineers who have not studied chemistry in recent years the term "physical chemistry" is one of unknown meaning, suspected of being a cloak to disguise chemical ignorance by a show of mathematical learning. It is, however, capable of presentation in relatively simple language, and in order to give some ideas about this science, introducing the basis of the newer concepts of chemistry, we invited Dr. H. C. Jones, of Johns Hopkins University, to contribute to the JOURNAL a series of articles on this subject, the first of which is presented in this issue.

A Training School for Miners

The mining department of the Cleveland-Cliffs Iron Co., at Ishpeming, Mich., is planning to conduct a training school for its employees. The company desires to select foremen and shift bosses from among its own men and those in charge of the school will endeavor to educate the miners so that they may become competent to fill these positions. Instruction in general mining and underground work will be included in the curriculum. Any able-bodied employee of the company who can read and write English may enroll in the school.

A little more than a year ago Dr. George Kirchensteiner gave a lecture at a meeting of the American Society of Mechanical Engineers in New York on the industrial training schools of Munich. Employers permit young apprentices to attend these schools at certain hours in alternate weeks or fortnights. The apprentices learn their trades in these training schools while actually engaged in the work they are studying. All who heard that lecture were convinced that such trade schools must develop efficiency.

We hope that the school of the Cleveland-Cliffs company may prove so beneficial as to stimulate other large industrial corporations to follow its lead.

Silver prices, which still continue high, seem for the moment to depend chiefly upon China. Affairs in that country are still in disturbed and uncertain condition, but there is a general impression that the new government will soon be in a sufficiently secure condition to negotiate a loan, which will require a large proportion of silver in its payment. The adjustment of currency is necessarily postponed for a time.

By the Way

One of our financial exchanges says: "Porcupine stocks are in the main stationary." Probably a printer's error, changing an "e" to an "a" in the last word.

Attention is called by the U. S. Geological Survey to the fact that it does not make analyses or assays of ores or metals for the public, and suggests that if an assay is desired the proper course is to employ a private assayer or to send the specimens to one of the government assay offices where a regular charge is made for such work. Government assay offices are situated at Carson, Nev., Seattle, Wash., Boise, Idaho, Helena, Mont., Deadwood, S. D., Salt Lake City, Utah, and Charlotte, North Carolina.

A practical application in mining technique, probably not included in any of the elaborate courses of the various mining schools, was observed recently in an Arizona district. The prospector was driving a tunnel, and in view of the active interest displayed in his operation by the rattlesnakes and Gila monsters which abounded in his locality, he fixed up a screen door which closed the tunnel and prevented its being used in a social way by these "varmints," and also by the dreaded and perhaps fabled "hydrophobia" skunk of the Southwest. It also excluded the omnipresent bats, though these are not considered objectionable by the operator.

The St. Mary's Mineral Land Co., presents an interesting outgrowth of the old-time policy of giving large land grants in payment for construction work of a public nature. The present company controls the stock of the St. Mary's Canal Mineral Land Co., which was organized in 1863, under New York laws. The latter company constructed the first ship canal at Sault Ste. Marie, Mich., and received from the State of Michigan, therefor, 180,000 acres of land in Houghton, Ontonagon and Keweenaw counties in the upper peninsula of Michigan. Among the mines that have been developed from this tract are the Calumet & Hecla, Baltic, Trimountain, Champion and others. In 1911, the St. Mary's Mineral Land Co. owned shares in Michigan copper companies as follows: Champion, 50,000; Hancock, 20,000; King Philip, 6; La Salle, 20,165; Pacific, 20,000; Copper Range, 208; Winona, 56,774; Old Colony, 80; Mayflower, 25,000; St. Mary's, 640; Ojibway, 2000; North Lake, 9000; Franklin, 1571; Houghton Copper, 37,222. During the last four years the company has paid out $993,108 in assessments. Of the above companies but four are producing, Champion, Copper Range, Winona, and Franklin, and of these only Champion and Copper Range, the former being an integral part of the latter, are paying dividends. The company owns 93,426 acres of land and mineral rights on 14,038 additional acres and at present maintains an annual dividend rate of $3 per share on its 160,000 shares. Since 1900 the policy of the company has been to sell no mineral lands outright.

Two shotfirers were recently saved at Radley, Kan., by means of a mine-telephone system. When the shotfirers were at work one evening, in the mines of the Girard Coal Co., an explosion occurred. The engineer at the surface, to whom the shotfirers reported from station to station as the blasts were set off, was able to direct the rescue party to the approximate location of the shotfirers, who were quickly taken out and resuscitated. This mine-telephone system thus not only saved the lives of these men, but from a purely business point of view, more than paid for itself in the elimination of damages that would probably have accrued in the event of these men not being rescued.

"No," said the Michigan miner, "mining ain't what it used to be in the days when good miners were scarce and got high pay. I recall in the old ——— mine before Cap'n Bill ——— died, when the miners were all Cornishmen, we'd go down in the morning and sit around till nine o'clock to smoke our pipes. The talking would finally come 'round to our work, and having laid out what we would do for the day, we'd set to and put in a few holes, shake down a bunch of ore and at half past three knock off, smoke an hour and go up. There was considerable hand drilling in those days, and the qualifications for a miner were stiffer than being able to turn the crank of a machine. I remember old Cap'n ——— who laid great stress on the miners being able to swing a hammer either handed; if he came 'round and saw you swinging left, he'd call, 'Swing her right,' and if you were swinging right, he'd say left. If you couldn't do it, up you'd go—and he himself couldn't hit a drill with a shovel. When he was 'round you was to quit work and listen to him; if a gang wanted to put up a show of undue industry before him, he'd stop it quick, 'If you can't do the work when I'm not watching, you'd better quit,' he'd say. Him it was that came up to lazy Bill Scroggin in the stope just after Bill had blasted; says he, 'Bill, I catched all the dirt in my hat; is that the best you can do?' At the ——— mine it was common practice among the men not to go in the stope after dinner on night shift; at first we left one man at the crosscut to watch out for the shift boss, but as he was doing the same as we, there was no use of keeping one good man from sleep. There was old Cap'n Dick ——— who was really general manager for his company, as the eastern officials knew nothing of practical work. After a time they began to think they had picked up a good general knowledge of mining, and tried dictating to Cap'n Dick. On such occasions the Cap'n would pack his grip and go down to Boston; said he, 'If that's the way you're going to do it, I have to inform you that there's a vacancy in your Lake Superior mining department,' and he always got his way. Iron was high then, and we got good wages, a dollar a car; yet, the men took it easy you might say, but all our work counted, and they were all good miners then. We got our share; the company made considerable, and all were satisfied."

Alchemy is again to the fore. Workers on the green-gold myth and catchers of volatile gold may cease their efforts in the Adirondack country and elsewhere. According to dispatches, one M. Verley, an inventor in Paris, has discovered the secret of the manufacture of gold out of baser metals. He warns the public that he must not be compared with Lemoine, the diamond fakir, nor with alchemists of the past, and has invited all the governments of the world to a conference for the purpose of making the production of gold a state monopoly. Reporters, however, have been unable to find the alleged "gold factory," which was to turn out tons of yellow metal from mere scrap iron, and we therefore conclude that monetary commissions will not be compelled to halt their deliberations on this account.

We have all been "up in the air" at various times in our hunt for gold but this heading of a Canadian dispatch, "Balloon Hunt for Gold," does not refer to exactly this sort of aeronautics. However, it may develop that it is only another way of reaching the same point. At any rate the dispatch chronicles that A. E. Clarke, of Toronto, is preparing to make a 500-mile dash by balloon from Cockrane to Ungava, the vast unexplored no-man's land, lying north of Quebec, west of Labrador and east of Hudson Strait, in search of gold. He hopes to beat a party of eleven men whom New York and Toronto capitalists are providing with money to go into Ungava to confirm the stories about the gold fields. This party will sail from St. Johns, Newfoundland, May 16, with a year's supply of provisions. It will be recalled that some mention was made in these columns a few weeks ago of a party that had started overland from Cobalt for Ungava. That the Ungava gold fields are to receive earnest attention is evident by a charter which has been issued by the government for the expedition that is outfitting to sail from St. Johns, the Ungava Exploration Co., being the title under which the New York and Toronto syndicate will operate.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Where the Primer Should Go

Replying to my notes on the position of the primer, Harvey S. Brown, in the JOURNAL of Mar. 16, 1912, is rather emphatic in his disapproval of my contention that in blasting with dynamite and fuse the primer should be placed at the top of the charge. My reason, as stated in the JOURNAL of Mar. 2, 1912, was that if placed in any other position there was danger of the explosive being deflagrated from "side-spitting" of the fuse, in which event it would not develop as much rending power as it would if detonated. I believe the majority of experts on the use of explosives will agree with me in this contention.

If a piece of ordinary mine fuse be threaded through a series of dynamite cartridges and one end of the fuse be ignited, it will usually happen that the powder will be ignited from "side-spitting" of the fuse. I have tried this experiment many times and have rarely seen the fuse burn to the end without deflagration of the powder. There is manufactured a special brand of fuse in which the faults of intense smoking and side-spitting are reduced as much as possible, but at the sacrifice of regularity in burning and water-resisting qualities. Probably this is the fuse to which Mr. Brown refers, but, in my experience, I have not found that it is extensively used. I do not believe that it would be considered good practice to load a hole so that the fuse had to burn past eight sticks of powder before reaching the cap, when ordinary safety fuse is used.

The argument against my recommendation, that there is danger of the collars of the later holes being knocked off by the shock of those going before, is well taken. I can readily understand how such a result would cause a misfire by tearing the fuse or cutting off the primer and perhaps other cartridges below it, but I have never had that experience in practice. If such trouble were experienced it seems to me that by a different arrangement of the holes or different sequence in firing the difficulty might be overcome. Furthermore, would this not indicate that the later holes were too heavily loaded? Nine sticks of powder in one 5-ft. hole is a heavier charge than I have ever had to use. It would be interesting to learn the diameter of the drill hole. If it is common practice at any mine to use so much powder in a hole 5 ft. deep it would seem to me to be advisable to drill larger holes so that the charge of powder would not fill it so full that there would be danger of tearing out the primer by the firing of an adjacent hole.

CLARENCE C. SEMPLE.

New York, Mar. 18, 1912.

Research Work in the Technical Schools

After reading the article of "An Assayer," discussing research work in the technical schools, p. 203 of the JOURNAL of Jan. 27, I would like to say that I agree with him in certain statements made, but take a different view of the situation with regard to certain others.

It is very true that assaying is considered a rule of thumb matter in some schools, and also in some custom work. In the schools it is possible to place temporarily the blame on inefficient equipment, but too often we find the instruction being handled by a student assistant who gathered his fund of knowledge of the subject while a member of the class just ahead of the one he is trying to teach. Also in many schools there are an incongruous lot of samples that are not representative ores at all, but are "cleanups" of the laboratory. The student is rarely shown a sample of the ore in an uncrushed state, and it is not uncommon to find among these samples unusual combinations, such as hematite, which has been mixed with galena; copper carbonates mixed with pyrite, and many others.

It seems to me that the instruction in assaying should be so systematic that no matter what amount is done, the student is personally conducted from the first, inasmuch as manipulation plays such an important part. Manipulation cannot be taught by reading textbooks in the classroom, but must be learned by personal contact with one who knows the work thoroughly.

For this instruction there should be one teacher or instructor to eight or ten students, and he should be in the laboratory during the entire laboratory period, to criticize and point out the reasons for carrying out the operations as they should be and to answer the numerous questions that necessarily arise. It is almost needless to add that different instructors should have their work so well coördinated that the answers given to the questions will not be conflicting. Lectures in assaying are of the greatest importance and have their own ground which they cover admirably, but it is not possible to teach manipulation from a lecture platform.

There is much to be said in defense of the present practice in teaching assaying in the mining schools. The curriculum is crowded even to cover the elementary subjects necessary to a mining-engineer's training. It is practically impossible under such conditions to devote more time to the subject of assaying than is necessary to train a student in the fundamental principles of the work. However, this training can be systematic and accurate, so that the student should be able to develop his knowledge to meet any circumstances which may arise in an assay office later.

To train a student so that he will be capable of "running 30 to 50 samples in triplicate, the first day he goes to work" is not what the schools are attempting to do, and is not what is expected of a student just out of college. My experience has been that even when an experienced assayer is engaged by a mining company he is given about a week in which to get his bearings and to adapt himself to his new conditions. If he makes his beginning in the assay office of a smelting company, he will be given a week in which to learn the routine in connection with a part of the work, either cupelling, weighing and mixing charges, weighing and parting, etc. He is only one unit in an office force that is capable of doing a large amount of work each day.

I hope to be able to present to the readers of the JOURNAL, in the near future, what I think a course in assaying should be.

L. W. BAHNEY.

New Haven, Conn., Mar. 7, 1912.

Bat Guano

Referring to the note in the JOURNAL of March 9, on the exportation of bat guano from Mexico, it is understood that the conservation craze has struck Mexico, and that the Department of Fomento has recommended the prohibition of future guano exports. This seems to be quite in line with German potash regulation, and the reservation of certain Chilean nitrate fields for domestic use. When will Spanish pyrites and American phosphate be looked after?

A. A. NASON.

St. Louis, Mo., Mar. 14, 1912.

American Smelting & Refining Co.

The thirteenth annual report of the American Smelting & Refining Co., covers the year ended Dec. 31, 1911, the fiscal year having been altered to correspond with the calendar year, and for purposes of better comparison the full year was taken, although a portion of it had already been covered by the previous annual report.

Owing to the fact that the American Smelting & Refining Co. now owns the entire issue of common stock of the American Smelters' Securities Co., and is entitled to all the earnings of that company over interest charges and preferred-stock dividends, the income account and balance sheets of the two companies are presented in consolidated form, and all inter-company accounts and entries eliminated.

CONSOLIDATED INCOME ACCOUNT, CALENDAR YEAR 1911
A. S. & R. CO. AND A. S. S. CO.

Earnings of smelting and refining operations, repairs and replacements not deducted	$14,045,334
Less repairs and replacements	1,944,593
	$12,100,761
Earnings from mining property	2,000,187
Other earnings and income	1,011,177
Gross income	$15,112,125
Deduct:	
Corporate and excise taxes	114,198
Administrative expense	767,982
Depreciation and amortization	1,887,399
Total deductions	2,769,579
Net income before deducting fixed charges	12,342,546
Fixed charges and preferred stock dividends:	
Interest and discount on A. S. S. debenture bonds	$70,833
Dividends on A. S. & R. preferred stock	3,500,000
Dividends on A. S. S. preferred stock	2,520,000
	$6,890,833
Net income in excess of fixed charges and preferred stock dividends	$5,451,713
Less dividends on A. S. & R. common stock	$2,000,000
	$3,451,713
Adjusted surplus as at Jan. 1, 1911	11,148,223
	$14,599,936
Deduct	
Depreciation in investments	900,210
Surplus as at Dec. 31, 1911, as per consolidated balance sheet	$13,699,726

The previously issued reports of the companies covered to April 30 for the Smelting company, and May 31 for the Securities company. Since those dates the two companies have expended $2,131,692 on new properties and construction. This includes about $600,000 for the still uncompleted smeltery at Hayden, Ariz., which is being built by the American Smelting & Refining Co. pursuant to a contract with the Ray Consolidated Copper Co., for smelting the products of that company's mines. The plant, it is expected, will also have excess capacity to take care of other ores of the vicinity. The above expenditure also covers $550,000 paid for the Tiro General mine, lying adjacent to the Matehuala, Mex., plant of the Smelting company.

CONSOLIDATED BALANCE SHEET AS OF DEC. 15, 1911
A. S. & R. CO. AND A. S. S. CO.

ASSETS

Cost of property owned by the two companies		$178,152,197
Less depreciation and new construction	$26,188,764	
Less difference between A. S. S. Co.'s common stock par and A. S. & R. valuation of same	12,000,000	38,188,764
Net value of property account		$139,963,733
Investments, book value		1,585,670
Deferred charge, discount on A. S. S. Co.'s debenture bonds		704,167
Insurance fund securities, at cost		232,555
Metal stocks, book value of refined metal[1]	32,473,186	
Less unearned treatment charges	5,980,205	26,492,981
Materials and supplies	2,566,872	
Prepaid expenses	400,149	2,967,021
Accounts collectible	4,236,519	
Loans to affiliated companies	333,705	
Demand loans secured by copper in process	3,192,049	
Cash	5,890,708	13,652,981
		$185,599,108

LIABILITIES

A. S. & R. common stock[2]		$50,000,000
A. S. & R. preferred stock		50,000,000
A. S. S. Co. preferred A		17,000,000
A. S. S. Co. preferred B		30,000,000
A. S. S. Co. debenture bonds		15,000,000
Drafts in transit	1,555,044	
Employes' savings deposits	116,404	
Accrued taxes	198,493	
Accrued bond interest (due Feb. 1)	379,125	
Unclaimed dividends	15,760	
A. S. & R., pfd. div., payable Jan. 2	875,000	
A. S. & R. pfd., payable Mar. 1	583,333	
A. S. & R., com. div., payable Jan. 15	500,000	
A. S. & R., com. div., payable Mar. 15	333,333	
A. S. S., pf. A and B. divs., Feb. 1	210,000	
Current accounts and wages	1,043,617	8,810,110
Employes' benefit funds	391,436	
Operating suspense accounts	335,948	
Insurance fund	358,888	1,089,272
Profit and loss		13,699,726
		$185,599,108

[1] Does not include metals on hand refined for tolls and deliverable to consignors (approximately $7,981,840).

[2] $15,000,000 additional common stock in possession of trustee for conversion of A. S. S. Co.'s debenture bonds.

During the same periods there was credited to the property account $791,667, the regular appropriation for depreciation, and a further credit of $637,399, representing special appropriations for adjustment of property values. The property account was also reduced by $12,000,000, the difference between the par value of the Securities common stock, and its appraised value of $18,000,000 on the Smelting company books, and the common stock issue of the Securities company is omitted from the balance sheet, as being only an inter-company account. The book value of investments not controlled by the Smelting or Securities companies was written down by $900,210 from their value as at the last annual reports.

While the operation of the mines and smelteries in Mexico was interfered with by strikes and traffic disturbances, the company suffered only minor losses of property. Attention is called to the fact that in spite of the shutdown of the Chihuahua plant, and the diminished earnings of the other smelting and mining properties in Mexico, the diversity of interests and the broadened sphere of business activity of the companies has kept earnings nearly level.

In the balance sheet as presented the inventory value of silver is taken at 50c. per oz. and copper at 12c. per lb. and no enhancement in the value of the metals is shown in the income account.

Mining Accidents in Ontario

TORONTO CORRESPONDENCE

A report by E. T. Corkill, provincial inspector of mines, issued by the Ontario Bureau of Mines, shows that in 1911, 49 men were killed in accidents at mines, metallurgical works and quarries regulated by the mining act. The number of men killed and injured is distributed as follows: Mines, 36 killed and 86 injured; metallurgical works, 9 killed and 25 injured; quarries, 4 killed.

The number of men employed at mines is approximately 9423, so that the ratio of men killed was 3.82 per 1000. The causes of fatalities underground were: Falls of ground, 2; shaft accidents, 8; explosive accidents, 16; miscellaneous, 7. Of the three men killed on the surface, 2 were the victims of an explosion. These figures show a marked decrease in the accidents from falls of ground and in surface casualties, but a large increase in those caused by explosives.

The following classification distributes the responsibility for the causes of the fatal mine accidents: Due to dangers inherent in the work, 10; arising out of defects in the mine workings, 10; due to fault of fellow workman, 2; due to fault of injured person, 14. Of the 86 nonfatal accidents, 12 were due to explosives. The inspector notes that the provisions of the mining regulations most frequently broken by the workmen are those referring to the use of explosives.

Eight Hour Shift in Lake Superior Iron Mines

NEGAUNEE CORRESPONDENCE

Most of the large iron-mining companies in Michigan and Minnesota have recently changed from a 10-hour shift to an 8-hour shift for all underground work. It is not yet definitely known how many of the smaller organizations will accept the change, but the Oliver Iron Mining Co., which is the mining department of the U. S. Steel Corporation, in the Lake Superior district, the Cleveland-Cliffs Iron Co., which is the largest operator on the Marquette Range, the Republic Iron & Steel Co., the Pickands-Mather companies, the Jones & Laughlin companies, the Breitung companies and the Volunteer Ore Co. have adopted the 8-hour system. Other companies will also make the change, and it is probable that shortly all the iron mines will be working under the new rules. Several thousand men are affected by the change, which was the result of a conference of mine managers of the different companies.

W. J. Olcott, president of the Oliver Iron Mining Co., made the following announcement in regard to hours of labor at the company's mines:

> Beginning Monday morning, Mar. 11, there will be inaugurated a change in the underground labor of the iron mines on the various ranges in the Lake Superior district. The matter has been considered for some time with a view of shortening the hours of underground labor and of making same conform more closely to the hours worked by men employed in the various departments of surface labor.
>
> Under the new arrangement miners and underground laborers are to be in their places ready for work at 8 a.m., and work until 12 noon. There will be a period of rest until 1 p.m., and they are supposed to continue at work in their places until 5 p.m., thus making two periods of four hours each, with an hour of rest between. Where two shifts are employed, the men of the night shift will be in their places underground at 8 p.m., work until midnight, rest and lunch from 12 o'clock till 1 a.m., resume work at one o'clock and stop at 5 a.m. The Saturday night shift will start work at 6 p.m., and end at eleven o'clock.

The last provision, concerning Saturday night work, is the same that applied when 10-hour shifts were in force. At mines of those companies, where speed of development or operation is desired, there will be three 8-hour shifts, from 7 a.m. to 3 p.m., from 3 p.m. to 11 p.m., and from 11 p.m. to 7 a.m. There will in no case be any reduction of wages due to the change. It is understood that the shifts in the openpit workings on the Mesabi will be kept at 10 hours.

The 8-hour shift for underground work has been successfully practiced by a few mines for several years, notably the Marquette Range properties of Jones & Laughlin and the Breitung companies.

The reasons for the widespread adoption of the 8-hour shift are many. It is believed that practically as much work is accomplished by a miner working on 8-hour shift as on 10-hour shift; he is more apt to work a greater percentage of the shift and to work harder. Less time is wasted in going to and from the change house and the place of work underground, and a somewhat shorter "spell" is taken for lunch.

Trinity Gold Mining & Reduction Co.

The second annual report of the Trinity Gold Mining & Reduction Co., recently published, gives the results of operations at the company's property in Trinity County, California, for the fiscal year ended Nov. 30, 1911. The net profit for the year was $66,265, which is about half of what was expected; but all this profit was practically made during the last half of the year.

The reduction plant was completed just at the beginning of the rainy season, making it necessary to open the glory holes, by which method the ore is mined, during the months of rain and snow. This made mining costs abnormally high, and as the mill was not operated at full capacity during the first five months of the year, the costs for mining and milling are given for two periods of five and seven months, respectively.

During the first period, 15,995 tons of ore was mined and delivered at the crusher at a cost of 65c. per ton; during the second period, 41,331 tons of ore was mined and delivered at a cost of 57c. per ton, of which 20c. represents the cost of handling waste which occurs as porphyry "horses" in the orebody.

In the spring a full head of water for removing the overburden by the hydraulic method was available for only two months. An average of 30 ft. was removed from about a half acre of ground, leaving 25 ft. to be removed to expose the ore. The ore is stated to be 40 ft. thick below this area. The ditch has since been enlarged to carry 50% more water for use in removing overburden. No addition to ore reserve was made.

During the first period of the year, 15,037 tons of ore, assaying $4.36 per ton, was treated at the mill and cyanide plant at a cost of $3.12 per ton, including development, mining and milling. The average extraction was 79%. The tonnage treated during this period was about half the capacity of the plant. During the second period, 41,331 tons of ore, assaying $4.77 per ton, was treated. The extraction was 80%. This period represents normal conditions. The costs per ton were: Development, 10c.; mining and tramming, 57c.; milling, $1; other expenses, including refining, assaying, bullion expense, power, maintenance and general charges, 52c.; total, $2.19 per ton.

It is claimed that if it were possible to obtain clean ore from the mine, it would assay $5.25 per ton, but when porphyry is being taken down, some of it becomes mixed with the ore, causing a falling off in grade. To overcome this and bring the gross value of the ore treated to the original estimate, the capacity of the mill is being gradually increased, so that the excess over the estimated 6000 tons per month will balance the increased quantity of material that must be treated on account of admixture of waste. For November, the estimate of $5.25 per ton on a basis of 6000 tons would have been $31,500; the actual ore milled contained $31,457 in gold.

The average extraction was 10% less than preliminary tests indicated. This was due to: (1) In the tests the ore was crushed to 30-mesh, producing a larger proportion of slime and fine sand than is obtained in practice when crushing through a 16-mesh screen; with finer crushing a slightly better extraction is obtained. At present it is necessary to sacrifice this extraction because extensive bodies of hard ore occur in the deposit, which reduce the stamp duty, and to crush the desired tonnage a coarser screen must be used. (2) The capacity of the agitating vats is hardly equal to the work required. (3) The slime is difficult to wash, so a considerable loss of soluble gold occurs at this stage of the treatment. (4) Early tests showed that the unreduced sulphides carried less gold per ton than the original ore. More recent tests prove that this is not true; that a large part of the 10% difference between estimated and actual recovery is due to loss of these sulphides, which, when concentrated, assay from $8 to $20 per ton.

It would not be economy to remedy the first trouble. The second is being remedied by the installation of another vat. The third will be remedied by additional filters, furnished at the expense of the patentee of the process being used. The fourth calls for concentrating tables, which will be installed; meanwhile the tailings are being stored.

The capacity of the crusher plant, as originally installed, was not satisfactory. The smaller breaker was replaced with the larger that had been used above it, and in place of the latter a 12x24-in. Blake crusher is now used. This change made the crushing plant satisfactory.

The cone classifiers below the stamps allowed too much slime to pass into the sand vats. Dorr classifiers were substituted and that difficulty was eliminated. In order to bring the plant up to estimated capacity, another sand vat, 8x30 ft., was installed, and the sides of the four original vats were raised 1½ ft. Many minor changes were also made to improve the working of the plant.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

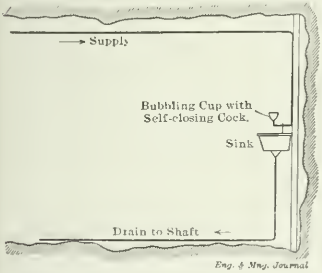
Drinking Water in the Mine

By R. B. Wallace*

Drinking water for miners is usually carried underground in kegs and pails for distribution to the different working levels. The method is unsanitary and causes loss of time.

Recently the Republic mine, one of the properties of the Cambria Steel Co., was piped for drinking water. Galvanized iron pipe ½ in. diameter was used throughout and porcelain bubbling-cups were placed at the shaft stations of each working level. Where the pressure became excessive from depth pressure regulators were introduced in the line, also stop cocks were placed at intervals of 400 or 500 ft. along the line to shut off water in case of breakage of the pipe.

As shown in the accompanying sketch, small sinks one foot square with the drain leading to the shaft were placed under each drinking cup to carry off the water. The cup and sink are fastened to a plank wedged between the floor and roof of the station.



DRINKING FOUNTAIN IN A SHAFT STATION

---

*Mining engineer, Republic, Mich.

Estimating Irregular Areas

By R. H. Rowland*

In engineering and mining work it is often necessary to estimate areas, the outlines of which are irregular. The methods adopted consist in segregating the area into triangles, which means considerable figuring, or obtaining the result by the use of the planimeter. This instrument is not always at hand, and even with its use one seldom reads the same result after traversing the given area twice. It is my intention to describe here a rapid and accurate method of estimating areas. The method has been generally adopted wherever introduced; it has been indorsed by all who have become acquainted with it, and is so simple that it can be employed with accuracy and rapidity after little practice.

The implements employed in the operation are pencil, pricker and either a roller parallel ruler, or two triangles. Fig. 1 shows an irregular area, such as may be found in track widening in railroad excavation work. By adopting the ordinary method of dividing this area into a number of triangles in order to derive the result it will be seen that it necessitates considerable computation, whereas by eqalizing the line marked "original face of rock" and in the same manner equalizing the line marked "line of excavation," the entire area may be computed at one operation. This can be accomplished in the following manner: In any such figure it is first always essential to adopt the most convenient base line, which in this case is taken at *O G*. Prolong this line for a short distance to either side as shown, then proceed to equalize the line "original face" by placing the pricker at point *O* and the parallel rule (or triangles) in line *O* to *B*, parallel in line back to point *A* and insert the pricker in the base line. From this point in the base line move the parallel rule to point *C*, parallel back to point *B*, insert the pricker in the base line, and from this new point in the base line move the parallel rule to point *D*, parallel back to point *C*, again placing the pricker in the base line. From this point in the base line move the parallel rule to point *E*, and again parallel back to point *D*, again inserting the pricker in the base line. Then from this point in the base line move the rule to the last point *F*, again paralleling back to point *E* and inserting the pricker in base line. This gives the final point of the operation, and a line drawn from this point *X* to the point *F* is the line of equalization, viz., the portion shaded in full lines indicating the area left out, is equal to the portion shaded in dotted lines, indicating the area taken in.

In the same manner the line marked "line of excavation" with points *G, H, I, J, K, L, F*, can be equalized, as shown in dotted lines, thus forming one complete triangle *XGF* the area of which is easily computed.

It is essential that the pricker be held perpendicular during the operation, otherwise slight discrepancies may be found in the result; this, however, is easily accomplished with a little practice. While this operation sounds somewhat lengthy in description, it can be rapidly accomplished in practice, and the advantages of one triangle and one computation can be readily recognized.

In each case it is always advisable to check the equalization; this can be carried out in the same manner, and if the

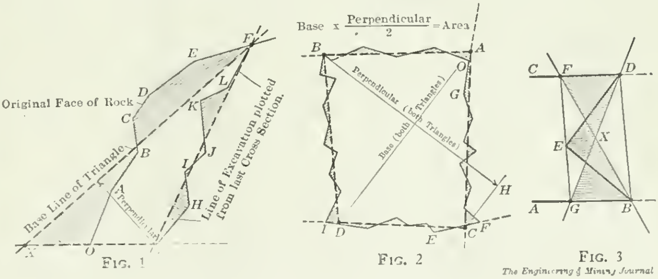

Original Face of Rock
E
F
D
L
K
C
B
J
I
H
A
Base Line of Triangle
Perpendicular
Line of Excavation plotted from last Cross Section.
X
O
Base x Perpendicular/2 = Area
B
A
O
G
Perpendicular (both Triangles)
Base (both Triangles)
H
I
D
E
C
F
C
F
D
X
E
A
G
B
The Engineering & Mining Journal

FIG. 1 FIG. 2 FIG. 3

METHOD OF EQUALIZING IRREGULAR AREAS

---

*Civil engineer, 363 Henry St., Brooklyn, N. Y.

final point in the base line does not agree, it is owing to the fact that either the pricker has not been held in an upright position or that the points designated have not been correctly followed.

This system can be carried out for any number of points, and it is adaptable to any kind of irregular figure. As to the most convenient base to adopt, this must be determined by the computer; usually, it can be seen at a glance which is the most suitable. It will sometimes be found more convenient to adopt a square or parallelogram, owing to the shape of the figure, and in this case it would be more convenient to compute two triangles, as shown in Fig. 2.

In this figure the line *OG* is prolonged and equalized to the point *B*, obtaining line *AB*; then prolong line *EE* in same manner and equalize to point *A*, obtaining line *CA*. Using line *CA* as a base equalize to point *I*, obtaining line *CI*. Then by using *CI* as a base equalize line *IB*, obtaining line *DB*. Taking *AD* as a base line (both triangles) and *BH* as perpendicular (both triangles) the desired area is computed in one figure.

This system is also especially adaptable where it is necessary to estimate the quantities of coal or ore taken from mines, which can be directly taken from the mine plans, or from estimate tracings of them, after the surveys are plotted thereon, and with a little practice will be found invaluable, better results being obtained than with the planimeter, and, all things taken into consideration, more expeditious.

Regarding the accuracy of this method, the proof is shown in Fig. 3. Prolong the line *CD*, placing the pricker at point *D* and parallel rule in line *DB*, then parallel back to point *E*, obtaining the point *F*, line *FB* being the line of equalization. Then, in the same manner use *AB* as a base line, and obtain the point *G*, this latter being line of equalization from that base. The line *DB* will then be found to be parallel to the line *FG* which cuts through the point *E* and the area *FXG* equal to the area *DXB*; also the area *FDX* is equivalent to the area *GXB*, thus proving the accuracy of the equalization.

Testing Cage Safety Catches

It is the practice at West Australian mines to test the safety catches used on the cages at regular intervals. Attention, according to Cleland[1], is especially given to the quick response of the spring.

The spring is tested by loading the cage and suspending it over the mouth of the shaft, which has been covered with timber on which bags of sawdust are laid. The hoisting rope is then slackened out several feet and is fastened to the cage by a rope and slip-hook. The cage is then raised, the hook slipped, and the cage allowed to drop. If the dogs do not stop the cage before it drops 1½ or 2 in., new springs are attached and the test repeated.

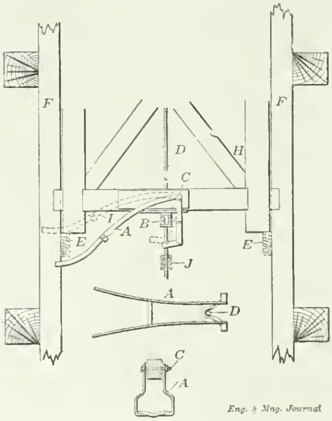
---

[1] "West Australian Mining Practice."

Safety Crossheads for Hoisting Buckets

Because accidents have been caused by the falling of crossheads in shafts, the Canadian Bureau of Mines calls attention in its report for the year 1911, to the safety crossheads that have been designed and patented by Mr. Morin, master mechanic at the Nipissing and Mr. Sargeson master mechanic at the Waldman mine.

The object of the design of these crossheads is to prevent them from falling when they stick in the shaft. In the Sargeson crosshead, which is shown in the accompanying illustration, the attachment *A* is fastened to the crosshead at *C*. If the crosshead sticks, this arm automatically engages the clip *B*, attached to the cable, and so stops the bucket. In sinking operations the arm *A* is automatically tripped by the stop block *E*, allowing the bucket to descend to the bottom of the shaft.



SAFETY CROSSHEAD USED AT A COBALT MINE

In the accompanying illustration, *A* shows the attachment in normal position; *I*, the attachment tripped by the crosshead stop; *B*, the clip in normal position; *J*, the clip lowered through the tripped attachment; *C*, the draw pin; *D*, the cable; *E*, the crosshead stops; *F*, the guides; and *H*, the crosshead.

The same principle is followed in the design of the Morin crosshead in the bucket follower, shown in the illustration. It is further equipped with an automatic safety device, which by the aid of springs, enables dogs to grip the guides, thus preventing the crosshead from falling.

A Four-Sided Leveling Rod

Some time ago I saw a party of engineers running a set of precise-levels using a self-reading rod, states S. P. Baird in *Engineering News*. The party consisted of instrument man, recorder, two chainmen and a rodman. Great pains were taken in setting the instrument to secure firmness, and practically all the time was consumed in setting up and in moving from one set-up to the next. Since seeing the party at work I have designed, and tried a new rod for use as a self-reading rod.

The peculiarity of the rod is not in the graduation, as any marking can be used, but in the fact that it is graduated on each of its four faces, with the zeros of the faces not coincident.

For identification purposes I have called the different faces *A*, *B*, *C* and *D*. The zero of the *A* or principal face is the bottom of the rod; the zero of the *B* face I placed 0.432 ft. above the bottom of the rod, and the zeros of the *C* and *D* faces I placed two and three times 0.432 above the bottom. For the information of the instrument man I marked the different faces at frequent intervals with the designating letter.

The use of the rod is somewhat as follows: The instrument is set up and the rod is held on the benchmark, with the *A* face presented to instrument. This side is read and recorded, then on signal to the rodman the *B* face is presented, read, and recorded, and then the same is done with the other two faces.

The readings of the *B*, *C* and *D* faces should be, respectively, 0.432, 0.864 and 1.096 ft. less than the reading of the *A* or principal face. Unless the readings all agree after making the proper corrections for height of zero there has been some mistake in rod reading.

The object of the arrangement is to insure accuracy in rod reading. If an error is made in reading one face it will not likely be made in reading the succeeding faces, as the cross-wire will cut the rod at points that will give entirely different sets of figures.

I have tried this rod, keeping an accurate check on the time required for the different parts of the work, and find that the time required to read the extra three faces and make the necessary subtractions for check is less than 20% of the time required to set up, read one face, and move to the next set-up. In other words, for 20% more working time I have three checks on the rod reading.

In reading of the precise-leveling done recently in Ohio I notice that it is usual to use two rodmen, each man turning on different turning points. The object of this is to secure different rod readings with the same instrument height. The method does not compare to the plan suggested above in economy or accuracy.

Landing Chair for Skips in Inclines

The usual form of chair or gate that is used in inclines for the skips to rest on consists, as shown in Fig. 1, of a strong piece of timber bolted to the ends of two arms that are equipped with a counterweight to lift the gate out of the way as soon as the skip is lifted from the chair. These gates are carried by two posts in the incline, and from the end of the arm that carries the counterweight a chain goes to the station floor by means of which the chair is raised so as to catch the skip.

The objection to this kind of chair is, that when the skip is lowered heavily on the chair or gate, the arms to which the cross piece that catches the skip is fastened are bent, as the cross piece, in order to get it out of the way of the skip when not in use, has to be carried on the end of arms at least two feet long. It therefore takes considerable time to repair this form of gate. On this account a gate the cross piece of which rests loosely in hooked carriers, which was devised by Mine Captain Samuel Richards, is used at the South Hecla shafts of the Calumet & Hecla company.

This form of gate has a three-armed spider at one end and a two-arm spider at the other. To the end of one of the three arms is connected by a hinged joint the counterweight that lifts the cross piece out of the way of the skip as soon as the skip is lifted off the gate. To the arm extending out in the opposite direction is connected by a hinged joint the hook in which is carried the cross piece that stops the skip, while to the third arm, which is at right angles to the other two, is connected the chain or rod that extends to the floor of the station, by means of which the gate is thrown in when desired. The details are shown in Fig. 2 of the accompanying illustration. Owing to the fact that the hooks that carry the cross piece are loosely connected to the arms, the cross piece as it moves up or down slides along the top side of the two posts that carry the spider. Consequently, in case a skip comes down heavily on the chair or gate, only the cross piece can be broken as it rests directly against the two posts; as the cross piece is carried loosely in the hooks, a new gate timber can be put in quickly to replace a broken one.

Chairs of this type have been in use in the South Hecla shafts for quite a little time, and now this type of gate is to become standard for all the inclines of the Calumet & Hecla company, as it has been found to be a considerable improvement over the old type having a cross timber or I-beam bolted fast to the arms, for the arms of such a gate are apt to be injured if the skip strikes it hard enough to break the cross piece or bend the I-beam.

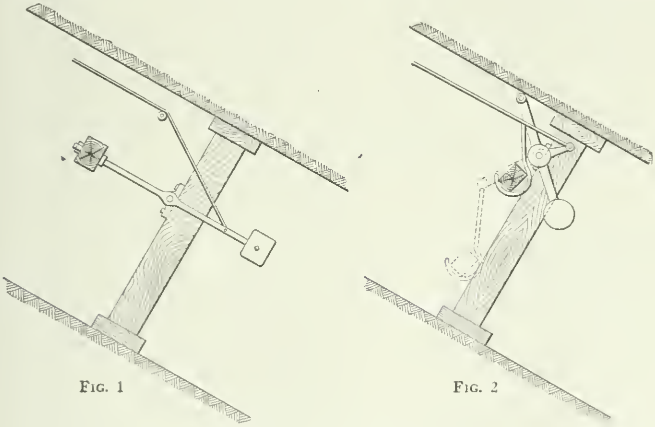


Fig. 1

Fig. 2

The Engineering & Mining Journal

Two Types of Buffer Bars for Incline Skipways

Copying Old Mine Plans

It occasionally happens in connection with the re-survey of an old mine, or in development work involving the examination of old plans, that copies of plans are required the originals of which are so faint and the paper on which they are drawn is so deteriorated by age that the task of copying is a most tedious or almost impossible one.

In such a case the following method was adopted some few years ago to reproduce a large and intricate mine plan which was 50 years old and a copy of which was required. This plan had been badly kept and as a result mildew and mold had played havoc with it. The ink lines were so faint and obscure that they could not be seen through the best tracing cloth or paper that could be obtained, and it therefore, at first appeared that to obtain a copy of the plan was impossible.

The method finally adopted, however, and one which was successful was to spread over the plan a sheet of transparent celluloid so that the whole plan was covered with a layer of this material. On this sheet all the details were readily traced as the sheets were absolutely transparent, by using Higgin's waterproof blue ink. The celluloid sheet was then removed from the plan and placed on white paper, and the drawing so obtained enabled a finished tracing on cloth to be made with ease.

Control of Induction Motor Hoists*

By H. J. S. Heather

An interesting instance of what appears to be a misapprehension in regard to the action of the induction motor has recently come to my notice. The makers of the electrical equipment for operating a winding engine by means of an induction motor were found to have included in the gear supplied a runaway governor. This was designed to do its work by actuating through a centrifugal ball arrangement, a no-voltage release on the main circuit breaker, at the same time liberating the brake weight and causing the automatic application of the mechanical brakes. The latter part of the process was, of course, not unreasonable, but it was certainly an error of judgment to include the former one.

If it is assumed that the winding-engine gear, including the electrical part of it, is in good order, and that current, at a voltage not below normal, is available for the driver's use, the circumstances most likely to produce excessive speed of the drum are wrong manipulation of the engine or a runaway at the power station. Of these two, the first is far more probable than the second, particularly if the power plant is a large one, and it will accordingly be first dealt with.

Ordinarily a rise in speed occurring through wrong manipulation of the engine would at once be evident to the driver, and if the main circuit breaker remained "on", it would be possible for him satisfactorily to brake the motor electrically, for if a sufficiently high resistance is provided it is possible at any speed to apply electrically as a brake the maximum torque of which a motor is capable.

But even supposing the driver under the circumstance were to "lose his head," and to switch on current in the direction giving a forward instead of a reversed field, the speed being above synchronism he could not avoid applying electrically some braking torque, and if he paid attention to the amount of current flowing, or if this were automatically controlled, he would be able to give this braking torque its maximum value, thereby slowing down the motor to the point where he had reduced the speed to about the synchronous speed. He could not slow down below this without putting his switch lever into the proper position to give him a reversed field, but even if he failed at this point to realize this, the fact of having so far regained control would give him a better chance of avoiding an accident.

---

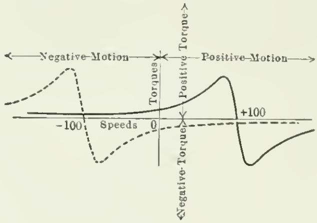
*Abstract from a paper entitled "The Driving of Winding Engines by Induction Motors," read before the Institution of Electrical Engineers, May 4, 1911.

Torque-speed curves can easily be drawn to show clearly the truth of the above statement; i.e., that with an induction motor maximum braking torque is available between any runaway speed and approximately synchronous speed with the stator switch in either position, forward or reverse; the maximum braking torque is available between synchronous and zero speeds with the stator switch in reverse position only. The necessary torque-speed curves are best drawn so as to show not only both directions of motion and both directions of torque, but also the torques available under both forward and reverse fields. Whenever the torque is in the same direction as the motion, driving is taking place, but when opposed to the motion, braking is taking place.

Such torque speed curves are shown in Fig. 1 in the acompanying illustration which may be supposed to apply to the induction machine with short-circuited rotor, while the curves in Fig. 2 would hold good for the same machine with a considerable amount of resistance in the rotor circuit. In both figures speeds in percentages of synchronous speeds are plotted horizontally and torques vertically. Positive speeds are plotted to the right and negative speeds to the left of the zero speed line, and positive torques above and negative torques below the zero torque line. If the positive direction of torque is chosen to be the same as the positive direction of rotation, the torque speed curves of an induction machine acting as a motor in the positive direction will be like the curves shown in both figures in full line. Consideration of the signs makes it clear that the torque is acting as a braking torque on this machine over all speeds between infinity in the negative direction and zero, and again over all speeds between 100% and infinity in the positive direction. The machine is a motor only between zero speed and 100% positive speed.

The behavior of the same machine with its field so excited that it runs as a motor in the negative direction is shown by the dotted curves in the two figures. With the machine so excited a braking torque is exercised at all speeds between infinity and 100% in the negative direction, and again at all speeds between zero and infinity in the positive direction. The machine thus excited is a motor only between zero speed and 100% negative speed. In whichever direction therefore the field is excited a braking torque must be produced at all speeds higher than 100% in either the positive or the negative direction, that is at all runaway speeds.

To guard against a runaway due to wrong manipulation on the driver's part, it is consequently bad practice to make a runaway governor open the main circuit-breaker, as such an arrangement eliminates a most valuable control.



(Fig. 1

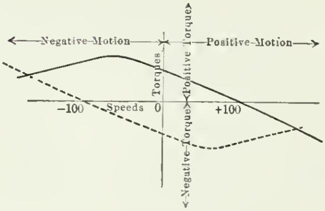


Fig. 2

The Engineering & Mining Journal

Induction Motor Hoist Torque-speed Curves

The less probable case, that in which the running away of a winding engine driven by an induction motor is due to a runaway at the power station, remains to be considered. It will be seen that under these circumstances the use of such a governor is equally wrong.

If this sort of runaway happened when a load was being lifted, no danger would be likely to arise before the driver had time to notice the increase in speed, and to check it by inserting resistance, unless the runaway were to take place near the end of a wind, at which moment the driver would normally be on the alert to apply brakes and reverse current, and the automatic elimination of the possibility of using reverse current would certainly not then make for safety.

If, on the other hand, the runaway at the power station happened when a load was being lowered, two cases have to be considered. The operation of lowering might be taking place in either of two ways: the motor might be in use regeneratively or with reverse current. A driver of a hoist working regeneratively would be in the habit of using reverse current for braking at the end of the trip, and if he found that his motor was running faster than usual it is unlikely that he would do anything but apply reverse current somewhat earlier or somewhat harder than under ordinary circumstances. The action of the governor in taking electrical control out of his hands would be extremely likely to cause a catastrophe.

In the second case, in which the driver is supposed to be lowering according to custom with reverse current, it is unlikely that excessive speed at the power station would cause the skip to run away, as the driver in keeping the current at its normal value, would probably use a somewhat higher resistance than usual without noticing that he was doing so, or without being aware of the fact that anything abnormal was going on. If, however, a runaway did occur, the governor by taking away the means of control he was using at the time, even though it automatically substituted the mechanical brakes, could only increase the risk of accident.

In connection with the whole question of momentarily excessive or reduced speed at the power station, an interesting point may be mentioned. On the supposition that for a few seconds the voltage would vary proportionally to the frequency (and this would be the case in practice) my proposal to use an ammeter in either the rotor or the stator circuit to prevent the winding-engine driver from losing electrical control by using a current greater than that corresponding to maximum torque, affords a reliable guide even under these emergency conditions. The current at which maximum torque would be reached would remain the same though the torque itself would vary. This statement is exactly correct in the case of the rotor circuit and approximately so for that of the stator, but the proof, being extremely simple, need not be given here.

In no case, therefore, would the automatic cutting off of current be likely to do any good; under most circumstances it would increase the risk of serious accident.

My own view is that no-voltage releases should be set low; that overload releases should be regarded only as a means of preventing further damage to a broken-down machine; and that a runaway governor should only apply the mechanical brakes, and should certainly not cut off the electrical supply.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

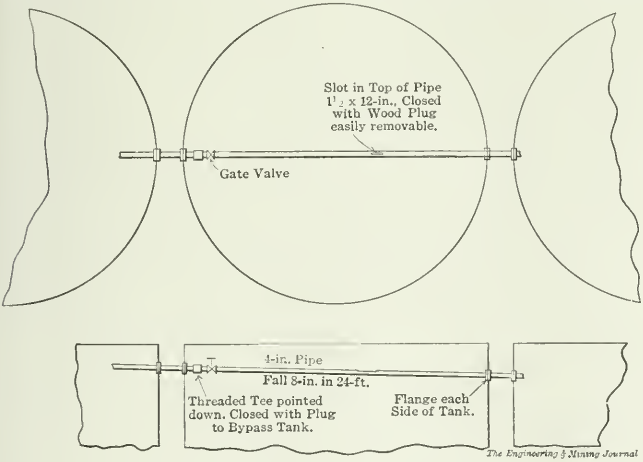
Piping for Continuous Agitation

By H. R. Conklin*

I devised the layout of piping for continuous agitation, herein described, having in view the simplest satisfactory design. Five tanks, each 24 ft. in diameter and 32 ft. deep, with conical bottoms, were to be piped for continuous agitation, without interrupting their use for intermittent agitation, with settling and decantation.

A straight line of 4-in. pipe, with grade of 8 in. in 24 ft., was put through all five tanks, the first tank having the pipe at entrance resting on its top and at exit, 8 in. below the top. The fifth tank has the pipe at exit 40 in. below the top. The work on the tanks consisted in cutting two 4-in. holes in each tank at proper elevations and boring holes for flange bolts. Connections through the sides of the tanks were made by flanges on each side of the tank sheet using gaskets of old rubber belting. On the pipe in each tank, a threaded tee, pointing down, was placed about 5 in. from the entrance side of the tank for discharging the pulp into the tank. A gate valve was placed next to prevent any pulp from passing along the transfer pipe.

The pulp is discharged from the tank through a slot in top of the transfer pipe, about 1½ in. wide and 12 in. long. This slot is closed by a hard-wood plug, fitted with a handle of suitable length so that it can be pushed into place from the platform on top of the tanks. This wood plug should not project far inside of the pipe, as it would hinder the flow of pulp in the pipe. The downward-pointing tees are closed, when so desired, by pipe plugs screwed in. These 4-inch pipe plugs, and the wooden plugs are both attached to the tank platform by loose chains, to prevent workmen dropping them into the tanks. To bypass any tank, it is simply necessary to screw in the pipe plug, open the gate valve and plug the discharge slot. Air agitation produces sufficient elevation of the pulp in the middle of the tank to cause a continuous sampling out through the discharge slot, while a continuous supply enters through the threaded tee. The level of the pulp in the tank takes care of itself. Any tank can be bypassed and pumped out for repairs or other reason, and no difficulty is experienced in bypassing three or four tanks at the same time. The transfer pipe can be easily cleaned of any settled pulp by air or water hose passed through any of the slotted discharges. By placing both plugs in any tank, thus bypassing it, it can be used for agitation and decanting, if desired, and the change from one system to the other causes no delay.



Piping for Continuous Agitation at Lluvia de Oro

---

*Superintendent, Lluvia de Oro Gold Mining Co., Lluvia de Oro, Chihuahua, Mex.

Volumes of Prismoidal Tanks

For computing partial volumes of rectangular tanks or reservoirs having sloping sides, Douglas McLean, Coolgardie, West Australia, recommends, according to *Engineering News*, the method of constant second differences. Dividing the tank into zones or layers of equal height, the difference between the contents of one zone and the contents of the zone next below is the first difference; the difference between two successive first differences is the second difference. The second difference is constant for a tank of the shape mentioned. To apply this fact, calculate the volume of three successive zones, find the first differences and the second difference, and add the latter successively to the first differences, thus obtaining all the first differences. The latter, added to the volumes that have already been calculated, will give all the zone volumes.

A little calculation will be saved by using the formula for the second difference:

$$D'' = 8\,mnh^3$$

in which h is the depth of the zone, m is the ratio $\frac{\text{horizontal}}{\text{vertical}}$ for the side slopes, and n is the corresponding ratio for the end slopes.

Example—Rectangular reservoir with side and end slopes 1 on 2; bottom dimensions 286 by 135 ft.; depth 14 ft.; find the contents of zones 6 in. deep.

Here $m = n = 2$, and $h = \frac{1}{2}$, so that $D'' = 8 \times 4 \times \frac{1}{8} = 4$ cu.ft. Computing the volumes of the two lowest zones, we get 19,516.17 and 19.941.17, with a first difference of 425. Then the successive first differences are 425, 429, 433, 437, etc. The volumes are then found.

Zone	Second diff.	First diff.	Volumes
0 — ½	4 00	.	19,516 17
½—1	constant	425	19,941 17
1 —1½	constant	429	20,370 17
1½—2	constant	433	20,803 17
2 —2½	constant	437	21,240.17
2½—3	constant	441	21,681 17

Precisely the same method of calculation applies to conical tanks, *i.e.*, circular tanks with sloping sides, except that the second-difference formula is slightly different. Calling m the side slope $\frac{\text{horizontal}}{\text{vertical}}$ and h the depth of zone, the formula is

$$D'' = 2\pi m^2h^3 = 6.283\,m^2h^3$$

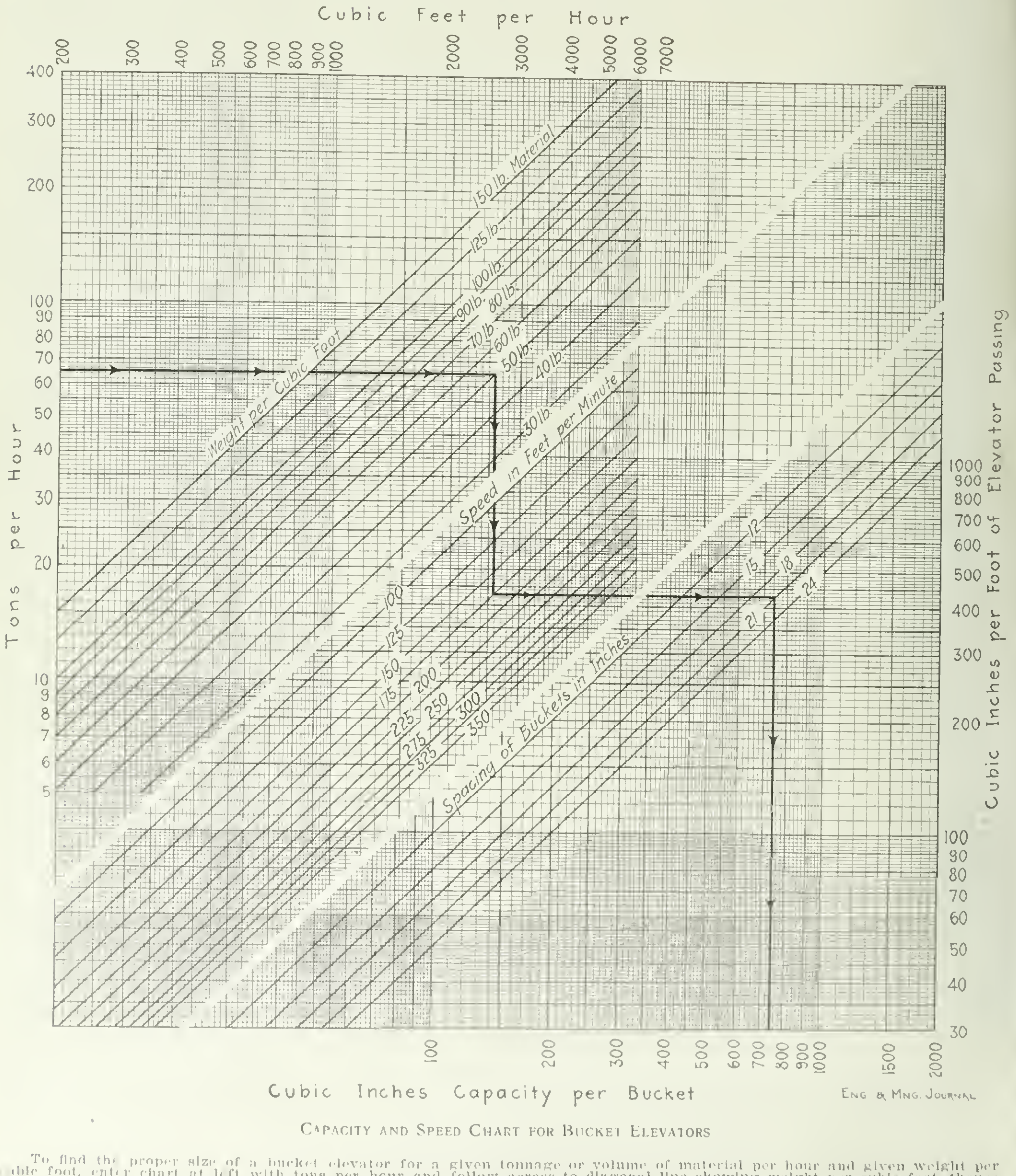
which is constant.

Bucket Elevator Chart

The accompanying chart shows at a glance, practically all the data necessary to determine the speed, capacity and size of bucket elevators, according to the practice of the Robins Conveying Belt Co., of New York. In using the table it should be borne in mind that the required bucket capacity found in the diagram is the working capacity, and somewhat larger buckets should be used, depending on conditions. It is common practice to assume the working capacities of Salem buckets as two-thirds to three-quarters of total capacity when they are operated on a vertical belt.

The heavy line gives the solution for 65 tons of coal per hour, at a speed of 175 ft. per min., and a spacing of 21 in., showing required working capacity of 740 cubic inches.

To find the horsepower required for driving a vertical bucket elevator, multiply tons per hour by lift in feet and divide by 500. This allows for 100% friction.



ENG. & MNG. JOURNAL

CAPACITY AND SPEED CHART FOR BUCKET ELEVATORS

To find the proper size of a bucket elevator for a given tonnage or volume of material per hour and given weight per cubic foot, enter chart at left with tons per hour and follow across to diagonal line showing weight per cubic foot, thence down to diagonal line representing the desired speed of elevator, thence across to the right until the diagonal showing desired spacing of buckets is reached. At the bottom, directly below this intersection, is found the required capacity of bucket in cubic inches. If the hourly capacity is given in cubic feet, enter at the top of the chart and follow down until the desired speed line is found, thence across to spacing, etc., as before.

The Homestake Mining Co.

The latest report of the Homestake Mining Co., operating in the Black Hills of South Dakota, covers two periods, the year ended June 1, 1911, and an iterim period from June 1 to Dec. 31, 1911. Hereafter the fiscal year will be the calendar year.

The costs for the two periods, bullion yield, etc., are shown in the accompanying table, which we have prepared from the statements of receipts and expenditures published in the company's report; in that report no cost-per-ton figures are given. The item net sundry expense includes shop and foundry, general, and all other expenses that the report does not clearly distribute. During each period the company received about $123,000 in return for castings, wood, timber, other sales and interest. This amount was deducted from the item "net sundry expense" before the figures of that item were placed in the table. From the nature of those receipts it seems proper to regard them in this way. During the first period 1,468,263 tons of ore were milled and 888,057 in the second.

On the assumptions that 5% of the ore milled is reground, that 60% is leached as sand and 40% treated as slime, regrinding costs 28c., cyaniding sand 22c., and slime treatment 27c. per ton of material actually treated.

The broken ore in the stopes on Jan. 1, 1912, was 1,883,277 tons, and it is estimated that enough ore is blocked out to supply the 1000 stamps for 20 years. Water was turned into the hydro-electric plant at Spearfish early this month and on Mar. 15, 1912, the full available head was turned into the ditch and through the tunnel. The generating station, pipe lines, etc., were given a thorough test.

COSTS AT THE HOMESTAKE MINE

	June 1, 1910 to June 1, 1911		June 1, 1911 to Dec. 31, 1911	
	Amount	Per Ton	Amount	Per Ton
Assaying	$32,164	$0.0219	$12,237	$0.0137
Surveying	24,364	0.0165	16,441	0.0185
Mining	2,726,622	1.8570	1,529,939	1.7219
Milling	410,651	0.2797	244,857	0.2756
Regrinding	20,884	0.0142	12,273	0.0138
Cyaniding sand	204,099	0.1390	108,463	0.1219
Cyaniding slime	155,098	0.1056	95,359	0.1073
Net sundry expense	371,621	0.2534	231,788	0.2608
Total costs	$3,945,503	$2.6873	$2,251,357	$2.5335
Spearfish hydroelectric power plant	393,088		231,134	
Dividends	1,310,400		764,400	
Surplus for period	397,537		414,261	
Bullion return	$5,251,454	$3.5766	$3,661,152	$4.1205

The oil-tank steamer "Rosecrans," owned by the Associated Oil Co., was wrecked on the rocks off Alcatraz, San Barbara County, Calif., on the morning of Mar. 12. The "Rosecrans" was 320 ft. long and of 25,000 bbl. capacity.

Phelps, Dodge & Co.

The report of Phelps, Dodge & Co. for the year 1911 shows a total production of 134,149,627 lb. of copper by its smelteries, of which 123,653,978 lb. was from its own ores. The Copper Queen works produced 111,445,229 lb. of copper, and the Detroit Copper Mining Co.'s smeltery, 22,704,398. During the year 158,900,257 lb. of electrolytic copper and 21,401,708 of casting ingots were sold, the latter being made from the Detroit pig. The average price received for the copper was 12.36c. per lb., net cash, f.o.b. New York. The Copper Queen plant produced 1,794,895 oz. of silver, and 27,154 oz. of gold.

The total ore extracted from the company mines was 1,841,210 tons. The concentrators treated 1,017,352 tons, producing 179,234 tons of concentrates (5.7:1). The smelteries treated 930,331 tons of new copper-bearing material, of which 822,647 was company ore, while some lead-bearing ores were shipped to the El Paso smeltery, and some sulphides to the Old Dominion works.

Copper Queen Mines

At the Copper Queen mines, 62,150 ft. of development work was done during the year, and 884 ft. of diamond-drill holes put down. The discovery has been made in the Spray mine of a series of layers of sulphide ore in the Abrigo limestones of the Cambrian age, encouraging the hope that older rocks than the Upper Devonian and Lower Carboniferous may carry commercial deposits. The only great change in mining methods has been the substitution of smaller stulls and closer filling for the old heavy square timbers. This has resulted in lowering timber consumption per ton of ore extracted as follows: Stoping, 20.1 ft. in 1910 to 16.6 ft. in 1911; exploration and development, 4.2 to 3.9 ft.; surface repairs and construction, 0.3 to 0.1; while underground repairs rose from 2.3 to 2.7 ft. The total fell from 26.9 to 23.3 ft. Eight and one-half miles of electric haulage is now in operation, and it is found that the average tramming distances are as follows: By hand, 229 ft. per car of ore; mule, 646; electric locomotive, 2669 feet.

The operation of the Copper Queen central power plant has been efficient. The actual evaporation has been 12.78 lb. water per lb. oil, and evaporation from and at 212°, 15.64 lb. The plant consumes 6,450.5 gal. of oil per day, generates 629,751 lb. steam, 323.4 kw. per hr. of 2300-volt, three-phase alternating current, and compresses 6127 cu.ft. of air per minute.

The Copper Queen smeltery treated 1,135,646 tons of charge, exclusive of coke, of which 854,463 tons were ore. The coke consumed was 128,923 tons. The flue-dust recovery was 6.55% of the charge treated. The copper, silver and gold in the flue dust as compared with the recovery of these metals were 14.3, 12.8 and 7.7%, respectively. The matte fall was 24.94%, with a 36.7% tenor.

In the converting department a new flue was built, removing the converter gases from the main dust chambers. The converters are still lined with siliceous ore and slimes, about 25 tons of bullion being produced per day from a 36.7% matte. A license has been obtained from the Peirce-Smith Converter Co. to use the basic lining, and George B. Lee recommends adopting the Great Falls type of converter, but in the meantime putting basic lining into some of the present shells.

Molten converter slag is mixed with flue dust in a truncated revolving cone. The slag absorbs about 25% of dust, and is effectively balled by this process.

Detroit Copper Co.

At the Detroit works 517,087 tons of ore treated gave 22,704,398 lb. bullion, as against 494,286 tons of ore, which yielded 23,056,292 lb. bullion, in 1910. Up to 1907, square setting only was practiced in the Detroit mines; the accompanying table shows the work done since that time. While general exploratory work has not been encouraging during the year, ore has been found on lower horizons than it was previously known to exist

COMPARISON OF MINING SYSTEMS AT MORENCI, ARIZ.

	Tons Ore Extracted	Per Cent. Total	Comparative Cost	Timber per Ton Ore
Stoping	460,340	90.55	81.6%	9.03
Block caving	13,909	2.71	54.8%	1.85
Square set and fill	21,283	4.19	100.0%	10.19
Underhand square set and back fill	11,061	2.17	127.1%	11.99
Gopher and fill	1,762	0.35	51.7%	1.8
	508,355	100.00		8.985

The concentrator gave a saving of 73.05%, putting 7.57 tons into 1, the ore carrying 2.869% Cu, the concentrates 15.876%. The tailings assayed 0.848% Cu, and the water used amounted to 522.6

gal. per ton of ore milled. The blast furnaces and converters made a saving of 92.608%, although less than 49% of the charge was new copper-bearing material.

In the Moctezuma mines, in Sonora, 13,668½ ft. of development work was done, of which 4466 ft. was purely prospecting work. The mines delivered 524,336 tons of ore and increased the reserves of broken ore by 181,000 tons, making a total reserve of broken ore ready for drawing of 302,000 tons. A scheme has been adopted which will allow the mine pillars to be taken hereafter at the same time that adjacent ground is being stoped. During the year recovery of ore from the cave-in of several years ago was commenced, 14,000 tons being thus recovered.

The Moctezuma concentrator treated 517,352 tons of 3.1708% ore, and produced 113,222 tons of 11.932% concentrates (4.569: 1), the saving amounting to 85.19%, and the tailings assay being 0.5579%. As far as possible, Mexican foremen have been substituted for the Europeans.

Stag Cañon Company

The production of the Stag Cañon Fuel Co. for the year was 1,148,471 tons, a decrease of 232,986 tons, as compared with 1910, used as follows: For steam raising at mines, 1443 tons; sold to employees, 4203; sold to railroads, 448,625; commercial sales, 120,801; used for coking, 573,399 tons. There were three fatalities, making 382,823 tons of coal mined per life lost. The product of the mines is marketed through the Vermejo Coal & Coke Co., a newly organized subsidiary of the Stag Cañon company.

The general stores business, hitherto conducted by these subsidiaries, has been taken over by the Phelps-Dodge Mercantile Co., which pays a rental to the mining companies for the store buildings. The total sales of merchandise were $5,317,994, on which a profit of 7.51% was made.

Owing to the rulings of the Treasury Department in regard to the Corporation Excise Tax Law, permitting depreciation to be written off on mining properties, the book values of the various company mines have been written up during the year as follows: Copper Queen, from $500,286 to $13,967,242; Detroit, $585,984 to $2,821,569; Moctezuma, $992,771 to $3,846,202; Stag Cañon, $500,000 to $3,479,032. The Copper Queen had net earnings of $4,155,011 for the year, before allowing for depreciation, and paid $5,200,000 dividends; the Detroit earned $930,496, before allowing $267,709 depreciation, and paid $800,000 dividends; Moctezuma earned $1,206,183 before allowing $655,506 depreciation, and paid $754,000 dividends; Stag Cañon earned $345,071 before allowing depreciation of $56,498, and paid dividends of $240,000. It appears, therefore, that with the exception of Stag Cañon, the surplus accounts of all the subsidiaries would have decreased had it not been for the additional mines values written in.

Notes on Porcupine

By H. Y. Russell*

While there has been a lull in the boom in Porcupine stocks work on several properties in the district has gone steadily ahead since the fire in July, and earnest and well directed efforts are being made to prove the orebodies. Shafts have been sunk deeper, deeper drilling has been done and much additional information has been gained. While the information gained has not been sufficient to establish many hard and fast facts, it enables one to guess a little better than before, and a few notes made in Porcupine last year might be of interest.

The following observations may be said to include the townships of Tisdale, Deloro and parts of Shaw and Whitney.

Two Vein Systems

Speaking generally I think it may be said that the strike of the country rocks, which are mostly schists and diabases, is from east and west to about N. 70 E. Mag.; also that there are two what might be called vein systems, one running with the strike of the schists, and the other striking from N. 45° E. to almost North.

In these vein systems the quartz appears to be in lenses of varying lengths and widths. So far depths have not been determined. Surface examination shows that in a general way the lenses in the easterly and westerly system are longer and more continuous than those in the second system. They are frequently from 500 to 700 ft. long and from 2 to 8 ft. wide. In one particular case one of these lenses had been stripped for a distance of about 700 ft. gradually pinching at each end. Following on the strike of this lens another was exposed 700 or 800 ft. further on; 1000 ft. farther was another lens, and 300 ft. farther a lens longer and wider than the first was seen.

The quartz in these lenses is similar and acts in the same way gradually pinching to a small seam and then disappearing. In a number of places between these lenses the ground was low and wet and it was impossible to trench, so there may have been other lenses between those observed.

The lenses of the second or more northerly system appear to have a length of from 100 to 250 ft. and widths of from 2 to 20 ft., but do not seem to be by any means so continuous horizontally as the lenses of the easterly and westerly system. Several lenses, however, may be found in the one zone, when they lie east or west of each other, separated often by considerable distances of country rock, but having the same northerly strike.

Gold Occurs in the Quartz Lenses

The only valuable metal in the veins is gold which occurs in the quartz lenses. In places good assays are obtained from the schists adjoining the quartz, but a close examination of the schist will usually show minute stringers or nodules of quartz and it is with these that the gold seems associated. Iron pyrites is found in stringers and crystals through the quartz and adjoining country rock of both systems but the iron in the easterly system seems coarser than that in the northerly system. Visible gold is frequently found along these iron stringers.

The trend of development so far seems to show that the easterly veins are low grade; specks of visible gold are seen but few if any bodies of pay ore have been reported.

The northerly lenses are often exceedingly rich, some of the gold showings being most spectacular. The gold is not confined to specimens but distributed over the whole width of the lens in many places. Gold is also found in the schist walls where small quartz stringers are seen.

On account of the tremendous glaciation the district has undergone it seems reasonable to suppose, that if gold is not found on, or very close to, surface, it is unlikely to be discovered at depth. Surface showings can however be expected to continue to considerable depths so long as the quartz goes down, and the published reports of drilling to depths of 800 and 900 ft. would confirm the belief that the quartz is continuous vertically.

I have not seen a case of the veins of the two series crossing although in places they are fairly close together, either one or the other pinching before a junction is reached.

Several shafts are down over 200 ft. and the orebodies hold their size and value to that depth. Should the orebodies go to considerable depth they would of course be more properly called shoots, and it is to decide the question of shoots or lenses that the real work of Porcupine is being directed.

Senator Nixon has offered a bill at Washington, providing that all public lands containing borax shall hereafter be subject to location as placer deposits.

---

*Mining engineer, 423 Guy St., Montreal, Canada

Blast Desiccation by Calcium Chloride

By J. B. Van Brussel*

Iron-furnace blast dried by calcium chloride, which is kept cool by water pipes embedded in it. The hydrated calcium chloride is then in turn desiccated by a mixture of furnace gas and air.

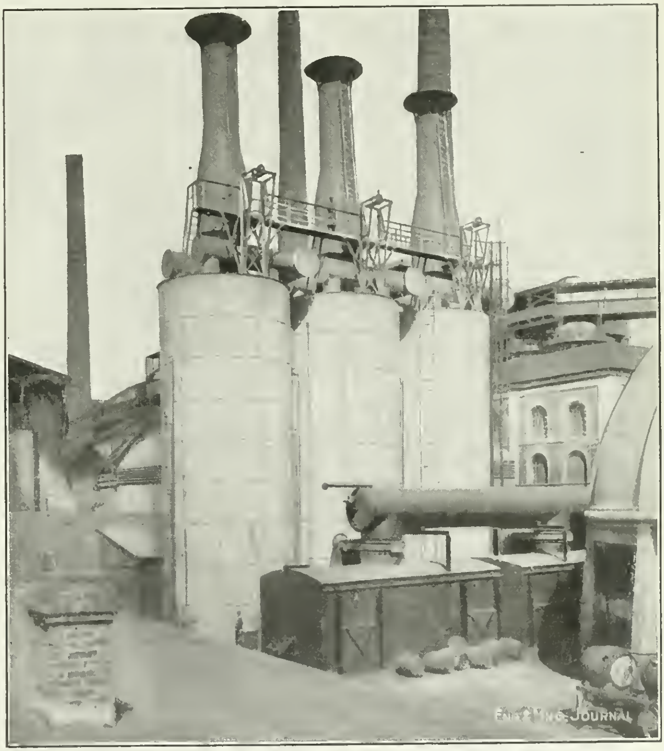
The desiccation of the air required for blast furnaces unquestionably affects a great economy in fuel, and up to the present, numerous attempts have been made to devise practical and cheap methods of air desiccation. Quite recently, the Differdange Iron & Steel Works, in Luxemburg, has made trials of a process invented by two French engineers, Felix A. Daubine and Eugene V. Roy, based on the employment of calcium chloride. The results obtained at Differdange were communicated by the inventors to the Iron and Steel Institute at the last meeting of that great association of English metallurgists.

Highly concentrated solutions of low vapor tensions are hygroscopic, being capable of extracting, up to a certain state of equilibrium, the moisture contained in gases possessing higher vapor tensions than those of the solutions in question. The more rapidly equilibrium is attained, the more suitable is the substance for playing its part as a desiccating agent. Calcium chloride is a good desiccating agent that can be conveniently and economically regenerated.

Briefly, the details of the process are as follows:

Calcium Chloride Must be Cooled

A layer of broken calcium chloride, the smaller pieces at the bottom and the larger pieces at the top, rests on a sieve. Within the mass of the calcium chloride, in its lower part, is submerged a spiral grating, consisting of pipes for the circulation of water. The volume of air to be dried is made to traverse the mass of calcium chloride from top to bottom, the draft being created by a fan. The absorption of the water by the calcium chloride leads to an evolution of heat, and this heat is carried away simultaneously with its production by the water circulation within the spiral. Without this indispensable precaution, the temperature of the mass of calcium chloride would rise, the tension of its hydrates would rise likewise, and the chloride mass would cease to act efficiently.



Calcium Chloride Desiccating Towers, Differdange Works

The hydration of the calcium chloride should be arrested when the outside pellicle of the broken pieces commences to liquate. If it were continued, the mass of calcium chloride would be completely liquefied, and it would be impossible to regenerate it on the spot. Further, the fact of its being liquefied indicates that the calcium chloride has formed a hydrate whose dilution is already considerable and that, as a result, its vapor tensions render it unfit for effective desiccation. At this point, it becomes time to regenerate and to do this it is only necessary to attain the temperatures between which that hydrate best known for this purpose is formed, namely $CaCl_2+1H_2O$, which is produced between 175 and 235° C. During the progress of this regeneration, it is necessary gradually to raise the temperature in such a manner as constantly to maintain the hydrates in their solid phase.

Suppose, for instance, that after the passage of the air to be dried, the formula of the exterior hydrates is, at a given moment $CaCl_2 + 4\ H_2O$, a hydrate which melts at about 40° C. Owing to the circulation of the water, which has maintained the temperature of 15° C, this hydrate has remained solid; if, at the moment of regeneration, the temperature be suddenly raised, to above 40° C. the pellicle corresponding to the above formula melts, breaks down, and is wasted. It is necessary, therefore, to proceed progressively, according to the law which has been recognized in practice, and may be deduced from theory, from the curve of the liquid and solid phases of the different hydrates of calcium chloride. It is necessary also, in the course of this regeneration, to be careful not to exceed the temperature of 235° C. The regeneration of the calcium chloride is thus to be effected with sources of heat of comparatively low grade, and it is possible to employ, with this object, the waste gases which occur plentifully in all iron and steel works. The regeneration of the calcium chloride having been effected by this systematic warming, it is necessary, in order to render it again fit for the complete absorption of water vapor, to cool it completely. This cooling is quickly attained by a rapid circulation of water in the pipe system, and when the average temperature of the water is regained, the chloride of calcium again has all its hygroscopic properties, and is capable of desiccating afresh the new volumes of air.

---

*P. O. Box 151, Brussels, Belgium.

The experiments at the Differdange Iron & Steel Works were made with a blast furnace producing 150 tons of pig per day, and requiring a blast of about 1,000,000 cu.ft. per hr. The installation put down is shown in the accompanying half tone. It consists essentially of three high towers, the interior construction of which is also shown.

Each tower is divided into 10 stories or compartments, each of which contains a ring-shaped gate, which supports a layer of calcium chloride about 10 in. deep. The air to be dried enters at the bottom and passes upward through a central conduit, downward through the layers of calcium chloride and the grate, and upward through the annular space surrounding the grates and partitions, until it reaches a collecting chamber at the top of the tower, whence it flows down through a lateral conduit to its outlet, at the level of the fifth story. During this operation, each compartment is cooled by water flowing in a coil of pipes, buried in the mass of chloride above the grates. This pipe is arranged in the form of a cone to insure complete emptying, and all its joints are inclosed in a water-tight box from which all leakage escapes by an outlet without coming into contact with the chloride and forming a solution which would corrode the pipe and the grate.

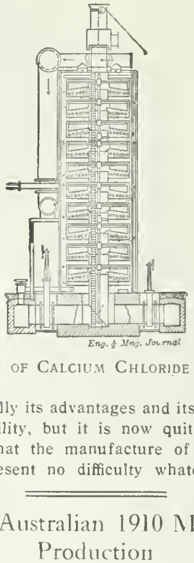
EXTRA TOWERS NECESSARY DURING REGENERATION

After six or eight hours' use, the stream of air to be dried is turned into the second tower, and the chloride in the first tower is regenerated by a current of hot furnace gas tempered by admixture with air. This current in general follows a course contrary to that taken by the air in the operation of desiccation. The regeneration is completed and the chloride restored to its initial condition in about four hours. The hot gas is then shut off and the hot regenerated chloride is cooled by a current of water flowing through the coils which serve to keep the mass cool in the drying operation.

Blast-furnace gas often contains so much dust that the chloride would become unfit for use after a few regenerations. The original idea of the investors was to confine the hot gas to a system of pipes buried in the layers of chloride, and thus to accomplish the regeneration by conduction, and not by direct contact. It was deemed unnecessary to introduce this complication at Differdange, where a sufficient quantity of gas containing little dust could be obtained.

The fact of having three towers explains itself. While one is being used for desiccation, the second is employed in regenerating the used chloride, and the third is cooling in order to fit it for resuming the work for desiccation. In winter, when the humidity of the air decreases, the simultaneous use of two towers would probably suffice.

The charge of chloride in each tower at Differdange was 24 tons, the cross section of the air or gas current about 1100 sq.ft., the refrigerating surface for the water pipes about 1800 sq.ft. The installation was calculated for the most unfavorable condition presented in summer. The cost of the whole installation amounted to about $10,000. Only one man is required to watch the operations and move the valves. The calcium-chloride method, it must be said, has not yet been employed long enough to demonstrate fully its advantages and its general applicability, but it is now quite established that the manufacture of dry air need present no difficulty whatever.



SECTION OF CALCIUM CHLORIDE TOWER

West Australian 1910 Mineral Production

According to the official report, just received, the value of the West Australian mineral production for 1910 was £6,522,263, a decrease of £536,816 from 1909, the value of the gold mined shrinking £529,426. The production was made up as follows: Gold, 1,470,632 oz.; silver, 176,139 oz.; coal, 262,166 tons, £113,699; copper, 6309 tons ore, 1281 tons matte and metal, £95,928; tin, ore and ingot, 500 tons, £45,129; all else £1882. To obtain the gold production of 1,470,632 oz., 2,884,298 tons of ore were treated, the average working costs per ton being $4.88, and the average tenor, $10.15. East Coolgardie was responsible for 57.05% of the total production, and employed 5729 men. Yilgarn, containing the Bullfinch mine produced 2.11% of the total. The state erected a new stamp battery at Marble Bar, Pilbara, which is expected to help that field.

Stanley Steel Investigation

WASHINGTON CORRESPONDENCE

Probably the last witness before the Stanley Steel Investigating Committee will be an engineer of national reputation who will be called to testify with reference to the probable reasons for the breaking of steel rails on railroads which has been such a prolific cause of accident within the last few months. The intention now is to put this man in the witness stand within a week and to question him closely as to the methods of manufacture in the steel mills. It will be attempted to have him state how rapid is the process of manufacture and how far the use of quick methods may be considered responsible for the defects which have been found in the present type of rails.

The committee intends to let a substantial part of its report deal with the whole question of efficiency in the steel industry as affected by the present type of organization under the United States Steel Corporation. There is a strong feeling that the grade of products, as exemplified in the case of defective rails, has been allowed to deteriorate within recent years.

Iron Blast Furnace Changes

The American Iron & Steel Association reports that in 1911 there were eight entirely new blast furnaces built in the United States, all coke, with an annual capacity of 1,152,500 gross tons. Three of the furnaces, with an annual capacity of 437,500 tons, had not been blown in by Jan. 1, 1912. Of the total new furnaces, five, with an annual capacity of 675,000 tons, were in Pennsylvania, and three, with an annual capacity of 477,500 tons, were in Ohio.

On Dec. 31, 1911, there were one charcoal and 12 coke blast furnaces in course of erection in the United States, with a total annual capacity of 1,744,500 tons, of which 20,000 tons were charcoal and 1,724,500 tons were coke. One or two of the coke furnaces have been completed and blown in since the opening of the present year; others are to be completed later in the year; while still others may not be ready for blast before the end of the year.

During 1911 there were 20 blast furnaces abandoned or dismantled in the United States, with a total annual capacity of 404,700 gross tons. Of the total seven furnaces, with an annual capacity of 60,700 tons, used charcoal for fuel when last in blast, and 13 furnaces, with an annual capacity of 334,000 tons, used mineral fuel.

The Beginnings of Physical Chemistry

By Harry C. Jones *

Many metallurgical processes depend on physical chemistry, and many future developments appear to hang on its advancement. This, the first of a series of articles on the subject, takes up some of the great generalizations and their discoverers.

These are interesting days in which to live, both from the standpoint of pure and of applied science. The developments of the last 25 years mark a new epoch, not only in the discovery of facts, but what is vastly more important, in the bringing to light of generalizations which correlate and coördinate these facts.

The result is that a fundamental and in some cases almost a revolutionary change has taken place during this period in a number of branches of natural science. Of the various branches to be affected perhaps none has undergone such serious changes as chemistry; yet the generalizations in question have been so wide reaching as to make their influence felt in almost every quarter where nature is studied.

THE NEWER CONCEPTS

The chemistry of atoms and molecules is now hardly more than of historical interest. The importance of solution is just beginning to be recognized. The effect of mass or quantity in chemistry has only recently come into its own, and the stable chemical atom of the last century is gone forever. We are just beginning to learn what is meant by chemical valence, and quantitative analysis has taken on a new aspect since we have learned the meaning of precipitation, and since electrolytic methods have been so generally worked out for effecting the separation of the metals from one another.

The industries have been scarcely less affected than pure science. Compare the methods today for obtaining the pure metals with those of a quarter of a century ago, and the meaning of this statement will become clear. Or study the advances during this period in the conversion of intrinsic energy into electricity. Or again, the progress that has been made in the so called "fixation" of nitrogen, i.e., the conversion of the free nitrogen of the air into compounds that are available for plant life and growth.

These facts are probably as well known to the live engineer as to the man of pure science. It is scarcely an exaggeration to say that a new science and a new industry have come into existence during this period. It is, however, not quite certain how general the knowledge is, as to how this all has come about, and through whose energy it has been accomplished.

RISE OF MODERN PHYSICAL CHEMISTRY

The progress in question has centered around what is generally termed the modern or new physical chemistry. The term physical chemistry is unfortunate, since it may leave the impression that we are dealing here with something that is fundamentally different from chemistry, while such is not the fact. We are dealing, as we shall see, only with the broadest and best that chemistry has thus far afforded—with really scientific chemistry. Again, the term physical chemistry is unfortunate, because we have had physical chemistry for nearly a century, but the new physical chemistry differs from the old not in degree, but absolutely in kind. The term physical chemistry is, however, now so widely disseminated that there is scarcely a hope for an immediate reform in this nomenclature, although "general chemistry" or "generalized chemistry" would have been a far more faithful term with which to designate these recent advances.

The use of physical chemistry to designate this new branch of science has, it must in fairness be stated, some justification in the fact that the generalizations which underlie it were reached, as we shall see, through the application of physical methods to chemical processes, and this is the historical significance of the term.

DISCOVERY OF THE LAW OF MASS ACTION

The first great generalization, to take them up historically, which led to the recent advances, was reached in 1867, by the Norwegian physicist, Guldberg, and the Norwegian chemist—his son-in-law—Waage. It had been known long before their time that the relative quantities of the substances that were brought together had an influence, in some cases very marked, on the chemical reaction that would take place between them. This influence was in some cases so great that not only the velocity of the reaction in question, but the very nature of the reaction, i.e., the direction in which it would go, and, consequently, the products formed, would be determined by it.

The importance of quantity or mass in chemistry was first clearly recognized by that very great French chemist of the first decade of the nineteenth century—Berthollet. But this man, like so many other really great men, was ahead of his time; or, as we say, the time was not ripe for him, and the importance of his work was neither seen nor appreciated for half a century. During this period, there were a number who caught glimpses of the importance of mass or quantity, which had been pointed out much earlier by Berthollet, but no one for 50 years saw it half as clearly as he had done.

It remained for another French chemist who died recently—Berthelot—almost exactly 60 years later (1862-1863), to furnish the experimental basis for the formulation of the effect of mass in chemistry—for the discovery of the law of mass action.

Berthelot and a co-worker who afterward acquired distinction—Saint Gilles—studied the following chemical reaction:

When a strong acid like sulphuric is treated with a strong base like sodium hydroxide, molecule for molecule, the reaction is, as we say, complete—all of the acid is neutralized by all of the base.

THE ACETIC-ACID ALCOHOL REACTION STUDIED

When, on the other hand, a weak acid like acetic is treated with a weak base like alcohol, the reaction does not proceed to the end; but when equivalent quantities, i.e., an equal number of molecules of the acid and base are used, the reaction proceeds only about two-thirds of the way toward the end. Only about two-thirds of the acid reacts with two-thirds of the alcohol, giving two-thirds of the ethyl acetate that would be formed if the reaction were complete. This was the reaction which Berthelot and Saint Gilles studied, to see whether the relative quantities of the substances present would have any effect on the relative amounts of ester formed. They took a given quantity of acetic acid and added just enough alcohol to combine with just one equivalent of acid; and determined the amount of the ester formed.

They then took a fresh quantity of acetic acid and added two equivalents of alcohol and determined the amount of the ester produced; then to another sample of acetic acid they added four equivalents of alcohol, to another 12, and finally 50 equivalents of alcohol to one of the acid, determining in every case the amount of ester that was formed.

This is obviously one of the best chemical reactions that could have been chosen to study the effect of quantity or mass in chemistry. If the amount of ester that was formed should increase as the amount of the alcohol relative to the acid was increased, it would be due to the mass action of the alcohol, since this was the only thing that had changed in the reaction. What was the fact?

---

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

When one equivalent of the alcohol was added to the acid, just two-thirds of the theoretical amount of ester was formed, as has been stated. When two equivalents of alcohol were used 83% of ester was produced. With four equivalents of alcohol the ester increased to 88%; with 12 equivalents to 93, and with 50 equivalents to 100% ester.

The above results were so clean-cut, unambiguous and therefore convincing, that after their publication no one seriously doubted the effect of mass in chemistry; but this effect was not yet formulated.

It remained for the Norwegians already referred to, to take this epoch-making step.

WORK OF GULDBERG AND WAAGE

In the program of the University of Christiania for 1867, the physicist Guldberg and the chemist Waage published a paper which was destined to exercise a most potent influence in the development of chemistry—as a whole. They supplemented the work of Berthelot and Saint Gilles with a number of experiments of their own, bearing upon the effect of mass as conditioning chemical reaction.

They studied especially the reaction between barium sulphate and potassium carbonate. If solid barium sulphate is boiled with a sufficient quantity of an aqueous solution of potassium carbonate, practically all of the barium sulphate is transformed into barium carbonate, a corresponding amount of potassium sulphate being formed.

If, on the other hand, solid barium carbonate is boiled with a sufficient amount of a solution of potassium sulphate, practically all of the barium carbonate is transformed into barium sulphate, a corresponding amount of potassium carbonate being formed.

This reaction is one of the best in all chemistry as illustrating the effect of mass in changing not only the velocity and magnitude of a chemical reaction, but even in changing the direction in which the reaction will go. But this is all purely qualitative.

A quantitative study of this reaction enabled the Norwegians to formulate the law of mass action.. They determined the amounts of all of the substances entering into this reaction, and the amounts of the products formed, both when the barium sulphate was being transformed into the carbonate, and when the barium carbonate was being transformed into the sulphate.

If we represent the amount of the barium sulphate which takes part in the reaction by p, the amount of the potassium carbonate taking part in the reaction by q, and the velocity of the reaction by v, the equation expressing the velocity of the reaction is:

$$v = pqk$$

in which k is a constant whose value depends upon the nature of the substances taking part in the reaction. The velocity of this reaction was thus shown to be equal to the *product of the active masses of the substances taking part in the reaction, times a constant.*

This equation was then shown to apply to the velocities of chemical reactions in general, and is the expression of the law of mass action for the velocities of chemical reactions—*chemical reactions are proportional to the products of the active masses of the substances taking part in the reaction.*

Guldberg and Waage, however, did not stop here. Chemical reactions often proceed to a certain distance and then appear to stop. As it is usually expressed, a condition of equilibrium is reached. What is this condition? Do chemical reactions actually proceed to a certain point and then stop, or do they only appear to do so?

CHEMICAL EQUILIBRIUM

Guldberg and Waage showed that chemical equilibrium is a condition that is very different from what it was supposed to be in the early half of the nineteenth century. It was the English chemist Williamson, recently deceased, who called attention in 1851 to the nature of chemical equilibrium. Before his time chemical equilibrium had been looked upon as a condition of rest—a reaction proceeded so far and then stopped, and this was the condition at equilibrium. In a word, chemical equilibrium was regarded as a static condition, as a condition of *rest.*

Williamson, in his work on the preparation of ordinary ether by the action of sulphuric acid on ethyl alcohol, was forced to the conclusion that the conception of chemical equilibrium then in vogue was fundamentally wrong. Suffice it to say, without going into unnecessary detail, that Williamson could not account for the facts that he had discovered in connection with his study of this reaction in terms of the statical or rest conception of chemical equilibrium. In the first stage of the reaction the sulphuric acid combined with the alcohol, forming ethyl sulphuric acid; while in the second stage of the reaction more alcohol reacted with the ethyl sulphuric acid, reforming sulphuric acid and forming ether.

There were thus two stages to the reaction, or in reality two reactions going on simultaneously, the one, in a sense, the reverse of the other, and this is the key to Williamson's interpretation of chemical equilibrium.

CHEMICAL EQUILIBRIUM DYNAMICAL

We have in general two reactions taking place at the same time, the one between the initial substances giving rise to certain products, and at the same time the products of the first reaction react with one another, reforming the original substances. When equilibrium is reached, these two opposite reactions have *the same velocity;* as much of the products of the first reaction being formed in a given time as decompose in that same time. Chemical equilibrium is then not static, not a condition of rest, but dynamic. It is simply that condition where the two opposite reactions have acquired the same velocity. This, as we shall see, is of fundamental importance in connection with the whole subject of reversible reactions. This work of Williamson was published about 16 years before the discovery of the law of mass action by Guldberg and Waage, as has already been stated. The latter, therefore, applied their law not only to the velocity of chemical reactions but also to chemical equilibrium, and as follows:

Equilibrium is the condition where the two opposite reactions have the same velocity. If we represent the velocity of the first reaction by v, and that of the counter reaction by v_1, we have

$$v = kpq$$

If in the counter reaction the active mass of one of the substances is p_1, and that the other substance is q_1, the velocity v_1 is

$$v_1 = k_1p_1q_1$$

where k_1 is a new constant. Thus was discovered the law of mass action, not only for the velocity of chemical reactions but also for chemical equilibrium. Some idea of the importance of this generalization will be gathered from the later chapters of these papers. Let us now turn to the discovery of the second great generalization which made the new physical chemistry possible.

APPLICABILITY OF THE LAWS OF GAS PRESSURE TO OSMOTIC PRESSURE

There was born in Rotterdam in 1852 a son who was destined to become one of the greatest men of science of all time; a man who found chemistry one thing, and who left it something entirely different. I refer, of course, to Jacobus Henricus Van't Hoff. After studying at the Polytechnic Institute in Delft, he went, at the age of 20, to the University of Leiden, Holland. A little later he went to the University of Bonn in Germany to work with August Kekulé, who was then the most prominent figure in chemistry, especially the chemistry of carbon, or organic chemistry as it is usually called. From Bonn, Van't Hoff wandered to Paris to work with Würtz, who was at that time one of the leading French chemists. Van't Hoff then returned to Utrecht, Holland, where he received the doctor's degree at the age of 22. At the age of 26 he was appointed professor of chemistry in the University of Amsterdam, a position which he held until 1896, when he accepted a call to the University of Berlin, where he remained until his death on March 1, 1911.

What did this man do which placed him in the very front rank of men of science?

While working with his various teachers he showed an unusual originality, which at times expressed itself in open opposition to the prevailing conceptions of that period. He was especially dissatisfied with the condition of organic chemistry. To bring certain substances together, to allow them to react as under the conditions they would, and after the reaction was all over simply to determine the nature of the products formed, appealed to him as most unsatisfactory.

This, he recognized, was studying simply the beginning and end of the transformation, and leaving the intermediate steps to take care of themselves, and it was these intermediate steps which were by far the most interesting.

Van't Hoff wanted to know something about the velocities with which chemical reactions take place, and the effect of varying such conditions as temperature, pressure or concentration on these velocities. He wished to know the real conditions present when equilibrium was reached in chemical reactions, i.e., when the two opposite reactions acquired equal velocities. These were the kinds of questions to which his mind turned, and he realized that we could never have a real science of chemistry until such questions were raised and answered.

Osmotic Pressure of Solutions

When he was revolving such questions as these in his mind, he communicated his line of thought to his colleague Devries, the botanist of the University of Amsterdam, and Devries referred him to the work of another botanist, Pfeffer, on the osmotic pressure of dilute solutions of a few substances, which Pfeffer had measured with considerable care. This was the introduction of Van't Hoff to Pfeffer, and to the work of Pfeffer on the osmotic pressure of dilute solutions.

From the comparatively few data furnished by Pfeffer on the osmotic pressure of solutions, Van't Hoff, with that insight which is characteristic of a great genius, saw relations which almost anyone else would have failed to discover. The osmotic pressure of a 1% solution of cane sugar was found by Pfeffer to be 53.5 cm. of mercury. A 2% solution exerted an osmotic pressure of 101.6 cm.; a 4% solution 208.2 cm. and a 6% solution 307.5 cm. of mercury. If we divide the osmotic pressure by the concentration we obtain nearly a constant value[2].

The importance of this fact would not have been seen by an average mind; indeed, not by anyone of smaller caliber than Van't Hoff himself. Here we have two variables, concentration of the solution and the osmotic pressure which it exerts, and one is proportional to the other, one is a linear function of the other, and in this alone there is nothing remarkable. We know of many such cases in science—one variable being a linear function of another. Expressed in simple words it says only this that two molecules of cane sugar exert just twice the osmotic pressure of one molecule, and this is certainly not surprising. To Van't Hoff it said far more than this. Boyle's law for gases states that gas pressure increases proportionally to the concentration of the gas, i.e., the pressure is a linear function of the concentration of the gas; by the concentration of a gas is understood the amount of the gas in a given volume. Two gas molecules in a given volume exert twice the pressure of one. There was thus an analogy between the osmotic pressure of solutions of cane sugar and the gas pressure exerted by gases; but thus far it was only an analogy.

Having found that one law of gas pressure applied to the osmotic pressure of solutions of a substance like cane sugar, Van't Hoff then looked about to see whether osmotic pressure conformed to any other laws of gas pressure.

Another well known law of gas pressure is that of Gay-Lussac, which has to do with the temperature coefficient of gas pressure. A gas increases in volume $^1/_{273}$ for every rise in temperature of 1° C., pressure remaining constant, or the pressure increases $^1/_{273}$ if the volume is kept constant. The question then is, does osmotic pressure increase with rise in temperature, and if so, does it increase at the same rate as gas pressure?

Pfeffer measured the osmotic pressure of a given solution of cane sugar at different temperatures, and thus enabled us to calculate the temperature coefficient of osmotic pressure. The result from Pfeffer's measurements was not satisfactory, ranging from about $^1/_{200}$ to $^1/_{300}$. There is, however, an indirect method of answering this question that gave satisfactory results.

Principle of Soret

Given a glass tube filled with a homogeneous solution, this solution will remain homogeneous just so long as all parts of it are kept at the same temperature. If one part is kept warmer than another, the solution will soon cease to be homogeneous—the warmer part will become more dilute and the colder part more concentrated. This heterogeneity is brought about by diffusion of the dissolved substance from the warmer to the colder part of the solution. Diffusion, as we shall see, is due to osmotic pressure. It is, therefore, osmotic pressure that drives the dissolved substance from the warmer to the colder part of the solution. A warm molecule exerts more osmotic pressure than a cold one. The dissolved substance will distribute itself throughout the solvent so that the osmotic pressure will be equal in all parts of the solution; consequently, the difference in the concentration of different parts of a solution which are at different temperatures. This is known from its discoverer as the principle of Soret.

If osmotic pressure obeys the law of Gay-Lussac, then it is a perfectly simple matter to calculate the difference in the concentration between the warmer and the colder parts of the solution. If the difference in temperature between the two parts of the tube is 50°, the difference in concentration when equilibrium is established would be $^{50}/_{273}$ of the original homogeneous concentration.

The experimental results confirm the theoretical conclusion. When the tubes containing the solution were allowed to stand for a sufficient length of time, the difference in concentration found between the two parts of the solution agreed with that calculated on the assumption that Gay-Lussac's law applies to the temperature coefficients of osmotic pressure of solutions. Gay-Lussac's law, then, applies to the osmotic pressure of solutions as well as the law of Boyle.

Before leaving this "principle of Soret" a few lines should be added both from the scientific and the technical side. A solution remains homogeneous only so long as all parts of it are kept at the same temperature. The osmotic pressure in the different parts must be kept exactly the same in order to preserve by diffusion the same concentration throughout. "Standard solutions" are used in a large number of quantitative determinations. These solutions, after having been carefully standardized, are often set aside until desired for use. If the analyst is not familiar with the principle we are now discussing—does not know that all parts of the standard solution must be kept at the same temperature or the standard solution is rendered worthless, he is apt not to take the necessary precautions to place his standard solutions for volumetric work where all parts are kept at the same temperature. If the homogeneity of a standard solution is destroyed by unequal temperatures, the usual shaking of such solutions is not sufficient to make the different parts of the same concentration.

---

[2] Osmotic pressure is detected and measured by placing the solution on one side, and the solvent on the other side of what is known as a semi-permeable membrane. A membrane such as is used for such purposes is formed by precipitating a gelatinous substance in the walls of an unglazed porcelain cup. The substance most frequently used for such purposes is copper ferrocyanide. The solvent passes through such an artificial membrance into the solution, but the dissolved substance cannot pass outward through the membrane, which is consequently termed semi-permeable. The pressure produced by the water passing in, is measured usually by a mercury manometer.

Avogadro's Law Applied to Solutions

The laws of Boyle and Gay-Lussac apply to the osmotic pressures of solutions. This relation, however, tells us nothing about the actual value of osmotic pressure as compared with gas pressure under similar conditions; i.e., where the gas has the same concentration as the solution, containing the same number of gas parts in a given volume of the gas as there are dissolved parts in the same volume of the solution. This is, after all, the most important question.

What relation is there between the actual gas pressure exerted by, say, hydrogen gas, and the osmotic pressure of a solution of cane sugar containing as many molecules of cane sugar in a given volume of the solution as there are hydrogen molecules in the same volume of the gas? Van't Hoff made this comparison and with the following result, also extending the comparison to different temperatures.

Taking hydrogen gas of such a concentration that at 6.8° it would exert a gas pressure of 0.665 atmospheres, and preparing a solution of cane sugar of the same concentration as the hydrogen gas, we can calculate its osmotic pressure. The accompanying table shows the relations between the two pressures—gas pressure and osmotic pressure from 6.8 to 36°.

Temperature	Gas pressure	Osmotic pressure
6.8°	0.665	0.664
15.5°	0.686	0.684
36.0°	0.735	0.735

The surprising result comes out that the gas pressure of a gas is exactly equal to the osmotic pressure of a solution of the same concentration as the gas.

This is among the most remarkable relations ever discovered. In a word it is the application of Avogadro's law for gases to the osmotic pressure of solutions. We have, on the one hand, matter in the form of a gas with all of the properties of a gas—practically unlimited expansibility, molecules moving through space with enormous velocities. On the other hand we have a solution of one substance in another—a solid, cane sugar, in a liquid, water; the molecules of the sugar moving with almost infinitesimal velocity through the solvent, and yet the gas pressure of the one is exactly equal to the osmotic pressure of the other.

Our astonishment at this relation is still further increased by the fact that while we know the cause of gas pressure, we know practically nothing as to the cause of osmotic pressure. Gas pressure is explained by the kinetic theory of gases—the pressure is due to the impact of the rapidly moving gaseous particles against the walls of the containing vessels. About all that we really know as to the cause of osmotic pressure is that it is in some unknown way connected with surface tension. Yet the two pressures are identical in magnitude.

The result of this epoch-making work of Van't Hoff was then to show that the laws of gas pressure apply to the osmotic pressure of solutions of substances like cane sugar.

Importance of Gas Laws Applying to Solution

The question that arises here is, why is this of sufficient importance to call it epoch making, or why is it important at all? We know very little about matter in the solid state. We know the shapes of the crystals which it forms, and to some extent how solids conduct the various forms of energy such as heat, light and electricity; but these are after all comparatively superficial matters.

When we come to liquids, our knowledge is far more satisfactory than with solids, but even here the fundamental problems for the most part remain to be solved.

With gases it is different. We know incomparably more about matter in the gaseous than in any other state of aggregation. Indeed, it is no exaggeration to say that many of the fundamental problems in connection with gases have been solved. We can deal with gases by the only exact method, viz., the mathematical. We can apply the methods of thermodynamics to matter in the gaseous state.

We shall see that solution is the most important condition of matter from the standpoint of the natural sciences. Matter in the pure, homogeneous condition has very little activity, chemical or otherwise. It becomes active only when mixed with foreign matter—when it is dissolved, as we say.

The generalizations reached by Van't Hoff enable us to apply the same methods to them that we use with gases; the latter being the state of matter about which we know most; while solutions are incomparably the most important state of matter from the standpoint of natural science in general. The importance of this advance, if not obvious from what has been stated, should become so as we progress.

It has been stated that the laws of gas pressure apply to the osmotic pressure of solutions of substances like cane sugar. Why this limitation? Do the laws of gas pressure not apply to osmotic pressures of all substances? If not, what classes of compounds present exceptions to these relations?

The laws of gas pressure apply to the osmotic pressures of nonelectrolytes, of which cane sugar is an example, i.e., to those substances whose aqueous solutions do not conduct the electric current. These include, in general, the neutral organic compounds. But these are by far the least interesting and least important chemical compounds.

All of the acids, bases and salts, i.e., all of the electrolytes, or those substances whose aqueous solutions conduct the current, present exceptions to the above relations. The laws of gas pressure do not apply to the osmotic pressure of a single one of them. They all exert osmotic pressures that are too great in terms of the pressures exerted by nonelectrolytes.

Van't Hoff recognized this fact and stated it clearly in his first paper in which the above relations were announced—in the *Zeitschrift für physikalische Chemie*, Vol. I, p. 481 (1887). He was, however, unable to explain the apparent discrepancy. This remained for a young Swedish physicist.

A Peculiar Tin Mine

In his report on the local tin mining, Meadows Frost, adviser to the Perlis, Federated Malay States, Government, writes (*Engineer*, Feb. 2, 1912):

"The mining is most peculiar, the ore being found in underground streams and hollows in the limestone range which separates Perlis from Setul. People who have been all over Perak and the other States of the Federation unite in saying that the Perlis mines are unique. The miners have followed up an underground stream for over three miles, the entrance to which is through a steep funnel, down which the coolies crawl for a quarter of a mile before reaching the stream in which the ore is found, and which opens out at different places into large caverns."

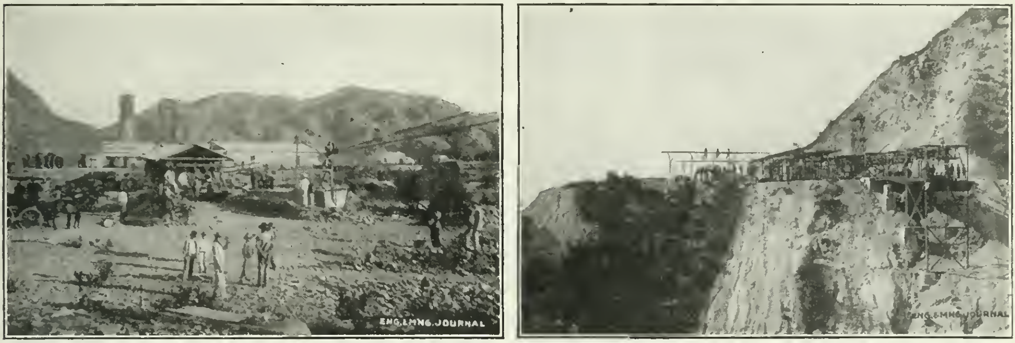
The only hydraulic phosphate mining plant in Tennessee is on Swan Creek, about four miles from Centerville, on a spur track of the Nashville, Chattanooga & St. Louis Ry. The hydraulic method of mining is used in the Florida phosphate fields to considerable extent, states *American Fertilizer*, but this plant is the first to be successfully operated in the Tennessee district.

Argentine Government Aërial Tram

By C. A. Tupper*

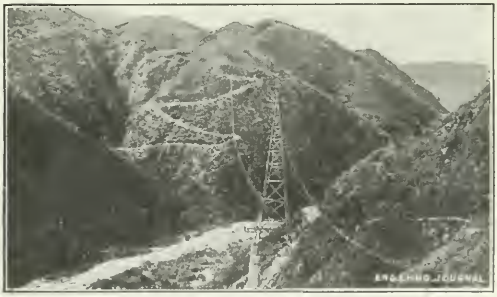
Description of the government-owned line extending from Upulungos in the mountains of the Famatina district to Chilecito. The air-line distance is about 22 miles and the difference in elevation, 11,574 ft. The down capacity is 40 tons per hour; the up capacity, four tons.

Among recent enterprises undertaken by governmental authorities for the encouragement of mining, the most notable has probably been the construction, in behalf of the Argentine Republic, of the aërial tramway from Chilecito, at the foot of the Andes in the province of Rioja, to the mines of the Mejicana Mountains in the Sierra de la Huerta range, sometimes known collectively as the "Famatina" workings. This tramway has a rise of 11,574 ft. in a horizontal distance of about 21½ miles. Chilecito is about midway between 65° and 70° west of Greenwich and 29° south of the equator. It is the terminus of a line of railway from Cordoba, which connects with the trunk road to Rosario, Buenos Aires and La Plata. The place has a population of about 5500, and copper-smelting works have been erected there by the Famatina Development Corporation, a British company.



TERMINAL STATION AT CHILECITO AND PARRON STATION DURING CONSTRUCTION, ARGENTINE TRAMWAY

LOWER MOUTH OF THE TUNNEL DURING CONSTRUCTION



ARGENTINE TRAM CROSSING SAN ANDREAS VALLEY

The various mines of the Famatina district, scattered over numerous mountain slopes, of which a small settlement known as Upulungos is the established center, were originally worked for the Incas, and after the Spanish conquest their exploitation was continued by the natives under the direction of the Jesuits. At the time of the War of Independence, however, the latter withdrew from the district and all mining operations ceased. In subsequent years these were again inaugurated by various individuals in a desultory fashion but gradually increased. All of this ore had to be carried down a difficult and extremely circuitous path over 90 miles in length. At Chilecito the copper was smelted to a first matte and sent by railroad to Buenos Aires to be forwarded to Europe for refining.

The federal government of Argentine made an investigation of the possibilities of a systematic development of the district, and, having interested foreign capital, proceeded to outline plans for opening regular and continuous communication between the mountain slopes and the plain. At first a cog railway was projected; but the enormous difficulties and expense of construction led to the abandonment of this plan. Finally an aërial tramway was decided upon, Adolf Bleichert & Co. of London and Leipsic being the successful bidders. It is from this firm, which I called upon in Leipsic, that the following details of construction and operation were obtained.

LOWER TERMINUS AT CHILECITO

The aërial tramway, which is designed for a down capacity of 40 tons and up loads aggregating four tons or more hourly, with buckets holding about 1125 lb. of ore and traveling at a speed of approximately 8.5 ft. per second, has its beginning near the steam railway terminal at Chilecito. The station here for unloading the ore includes large bins overhung by a loop track, and the incoming loads are dumped by tripping.

---

*Consulting engineer, 389 Thirty-first Ave., Milwaukee, Wis.

after being automatically weighed and recorded. From the bins the ore is discharged through hopper bottoms into railroad cars on a lower level. This station has no driving machinery and is simple in construction. The carrying cables are firmly anchored and the traction-cable tension suitably provided for by a system of connecting cables, idlers and weights.

From this point, which lies at an elevation of 1075 m. above sea level, the line is carried to Upulungos, 3528 m. higher and distant by air line 34.3 km., with division into 9 operating sections, each of which has its own traction cable. The first, to station No. 2, is 8958 m. in length, with a rise of 5.2%. For this stretch the line is subdivided, although with a continuous traction cable, into three parts, by means of two double tension towers; and near the center point there is a single tower for anchoring the carrying or track cables, illustrated by the accompanying engravings. Similar provisions, with additions to be noted farther on, obtain all along the route, according to conditions. The tension cages and removable weights, which are characteristic of the arrangements at all stations and tension towers, may be plainly seen in the illustration, also the type of supporting tower ordinarily used and the telephone line which was independently constructed by the side of the tramway.

At station No. 2 there are a steam boiler and an engine of 40 hp. to furnish power for keeping the traction rope in motion on the stretch below and exercise any necessary braking force. Quarters for attendants, a repair shop and a side track on to which buckets carrying supplies can be switched, are also provided. The through loads pass from one carrying cable to the other on a rail track and are automatically uncoupled and coupled again to the traction cables.

From this station, the tramway, which has heretofore traversed level ground, ascends the slopes of Mt. Durazno along the cuttings shown in an accompanying engraving, crosses the Amarillo River at 14.5 km. from Chilecito and enters station No. 3, designated as Parron, 17.5 km. out. Here driving machinery is installed for the stretch below. Attendants' quarters are also provided but no repair shop, as the station is perched on the shoulder of a steep declivity. The down grade from Parron to the station below is 5.2%; the distance 8486 meters.

The sheer rise of the line from this point is indicated by the tower in the upper right-hand corner of an accompanying illustration, far up the slope of the mountain. The difference in elevation between stations Nos. 3 and 4 is 565 m., or 18.5% over a distance of 3054 m. The upper station, named Rodeo de las Vecas, is 20.5 km. from Chilecito. Here the driving mechanism serves both the upper and lower stretches but is no greater in capacity than the others mentioned and is merely intended to keep the traction cable in motion; for, when the line is fully loaded, there is excess energy which has to be neutralized by braking, so far as not applied to minor purposes about the station. The usual attendants' dwelling was erected.

LINE GOES THROUGH ONE TUNNEL

The line up to station No. 5, or Cueva de Romero, covers the most difficult part of the route, although the net grade does not quite reach 5%. This is owing to the fact that several peaks have to be crossed and the tramway then carried through a 150-m. tunnel, 4½ m. wide, 4 m. high and inclined upward. The accompanying engravings show the entrance to the tunnel during construction and a view from the interior. At each end there are tension weights. On the farther side of the tunnel the remaining distance to the station above includes two long spans 258 and 540 m., one of which crosses the valley of the San Andreas River, to the side of Cerro Negro. The rise for the entire distance of 3095 m. is 150 m. or a little more than 4.8%. Station No. 5 has no driving machinery. There are tension appliances for both the upper and lower traction cables and also heavy weights on the upper carrying cables in addition to the usual anchoring. An attendants' dwelling is the only other feature.

From this point on, the line begins to go up precipitately over the peaks and crags of Mt. Cielito Rodado y Cabrera Moreno. In the distance of 1946 m. to station 6, there is a rise of 554.6 m., or nearly 28.5%. This point, designated Cielito, has driving machinery for the lower traction cable and tension arrangements for the upper, with switch track and attendants' quarters. Leaving here the tramway continues on over the stream Rio del Rodado, which it crosses in a 670-m. span, and a little farther there is another long span of 575 m. The total rise is 667 m., or 29.4% in a distance of 2267 meters.

Station 7, known as Cueva de Iltanes, lies 27.8 km. from Chilecito at an elevation of 3911 m. It is provided with driving machinery for the lower traction cable and tension appliances for the upper, with switch track and attendants' quarters, which at all of the upper stations include space for repair outfits.

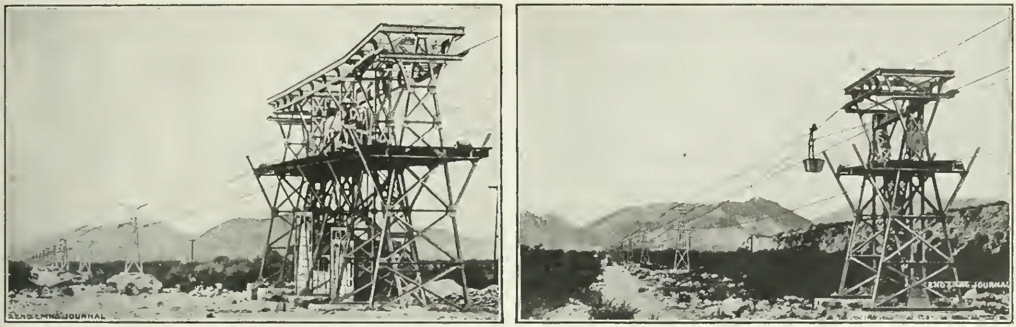
Between Cueva de Iltanes and Bayos, as station No. 8 is known, there is a cable length of 3072 m. and a rise of 460.5 m., or nearly 15%. This part of the route includes one span of almost 800 m. Station 8 has driving arrangements for both the upper and lower stretches but is otherwise constructed similarly to station No. 7. In both stations the lines entering and leaving are at more of an angle to each other than has been the case on the intermediate sections. From station No. 7 on, the temperature at night is below freezing point, and in winter the mean temperature at the higher altitudes is 20° below zero Centigrade.

UPPER END OF TRAM AT UPULUNGOS

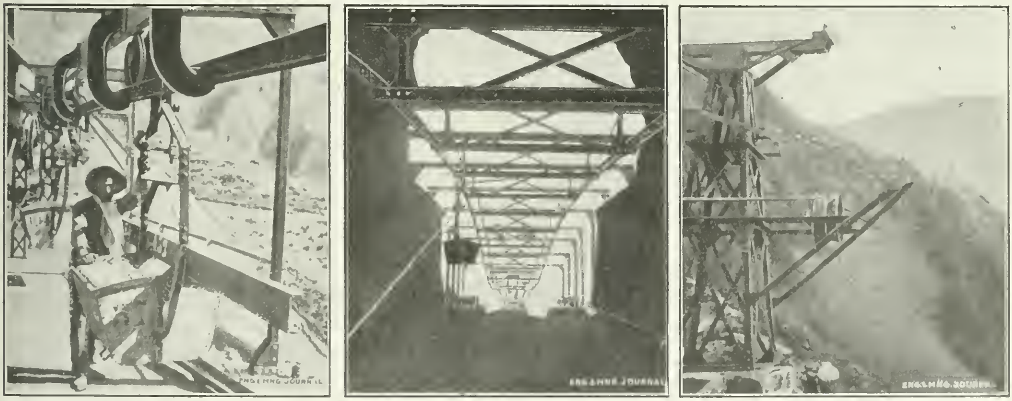
Between station No. 8 and the upper end of the tramway at Upulungos, the distance is 3450 m., with a rise of 232 m., or a little over 6.7%. Included in this are spans of 600 and 900 m. Not far from Bayos, owing to a heavy dip in the line, the carrying cable is anchored and provision also made for taking up slack in its tension, the same as at station No. 5. The only other places where this was found necessary is midway of stations Nos. 2 and 3, where the total distance is 8486 m. and a succession of long spans had to be provided for, and also at the Bello Plan station. The latter is situated on the last mountain slope before reaching Upulungos and forms the real terminus of the tramway, the remainder of the distance being covered by a relatively short section in a single span. The Bello Plan station has driving machinery for both the upper and lower traction cables and consequently none had to be provided at the end of the line in Upulungos. Attendants' quarters, main upper repair outfits, switch track, etc., are also situated at the former.

With the tramway loaded to 40 tons hourly capacity there is an excess of power, theoretically, on the down grade of 37, 33, 71, 11, 82, 88, 59 and 24 hp., enumerating from Chilecito, for the eight sections respectively, with actual reduction in consequence of friction. This excess is neutralized by the braking appliances.

Between stations there are 275 supporting towers, spaced from 100 to 900 m. apart. Their construction may be plainly seen from the illustrations. Everything, including these towers, the tension structures and the stations, is built of iron, over 2000 tons of which were used. The carrying line is entirely wire cable, except through the tunnel and in one place beyond station No. 7 where the line would not clear the profile of an intervening peak without higher, more expensive suspension, increase in grade, etc., and a rail track supported by short columns offered the most economical solution of the problem. Besides being anchored at both terminals, the line is similarly secured at the eight intermediate stations and nine other points *en route*, with provision for the proper tension of the carrying cables as above enumerated.



Double Tension Tower for Traction Cables and Anchoring Tower for Carrying Cables



Loading Supplies on Switchtrack; View from Tunnel Interior and Upper End of Argentine Tramway

Two Types of Cable Used

In order to keep the cost of construction and maintenance as low as consistent with safety and economy of operation, the choice of the carrying or track cable was carefully made, with due regard to the particular service conditions of each section of the line. For the heaviest gradients the wire cables used are of the so called locked-coil type, and the best grade of smooth-coil cable was selected for the remainder. The diameter of the locked-coil cable is 35 mm. for the loaded line and 26 mm. for the lightly burdened return; while the smooth-coil cable measures 32 mm. and 30 mm. for the down line of the upper and lower stretches, respectively, and 23 and 25 mm. for the corresponding reaches of the up line. The traction cable is of equally good quality and strength for the operating requirements. In tightening the cables, chains have not been used, owing to rapid deterioration from unfavorable climatic conditions, but the tension weights are hung by a special kind of steel-strand cable. All cable lengths are fastened together and all connections made by patent coupling originated by the tramway builders.

In order to provide carriage grips which would adapt themselves to varying cable diameters on different sections owing to differences in wear, the bucket carriages were provided with the Bleichert patent "automat" coupling, with underhung grips which operate automatically. These hold the buckets with absolute security in a vertical position at any grade and are self-adjusting to variations in the traction cables. For the carrying cables there are special shoes which prevent springing.

Care was taken in the construction to have all connecting rails at stations and towers exactly in line with the carrying cables, so that there is no shock or reaction as the loads enter and leave. The ore buckets are of strong steel plate. Receptacles for water, coal and other supplies, double-carriage platforms for boxes or other material, and passenger cars like sedan chairs are also in service.

For lubrication of the carrying cables a special traveling oiler was furnished by the builders. This consists of a carriage underhung by a receptacle in which there is an oil tank and a small pump. The latter is so connected to the moving wheels of the carriage that it is kept constantly in operation and sends a light spray between them on to the carrying cable. One filling of the tank would suffice for about a third of the entire line; but an oiler is kept in service for each stretch between stations. For the traction cable there is a ring oiler installed with the sheaves at the station, so that the cable is oiled as it turns. Communication between stations is maintained over the independent telephone line which follows the tramway, and the attendants are equipped with portable sets so that they can cut in at any point along the route in case of need.

The work of construction was completed in a little more than a year, in spite of enormous difficulties to be overcome. There is, in the entire enterprise, much that can be emulated in other parts of the world, including the United States and neighboring countries.

Notes on Pioche, Nev.

By Edward R. Zalinski*

Construction was started Feb. 9, 1912 on the new railroad branch which will connect the Prince mine with the spur of the San Pedro railroad at Pioche. This branch will be standard gage, 8¾ miles long, with a maximum grade of 2%, and will run from Pioche westerly around the north side of the Pioche Range, circling the northwest end of the range, and running southeast down the southern side to the Prince Consolidated mine.

The grading contract has been let to the Thompson Construction Co. of Salt Lake, and supplies and men have been arriving for several weeks. There are two construction camps where about 50 teams and 80 men are employed. Work has been started on the Pioche end and also near the point at the northwest end of the range near the Pioche Metals property. There will be one large cut and fill here; the cut is 22 ft. deep in places, and 250 ft. long. There are other cuts and fills, but except the one mentioned there is little heavy work to be done.

The new branch will probably be ready to traffic by summer or early in the autumn. A separate company is to be organized, controlled by the Prince Consolidated, to complete and operate the road.

Bullionville Tailings Shipped to International Smeltery

The Prince Consolidated company is shipping five to eight cars (200 to 300 tons) daily, from the tailings at Bullionville to the International smeltery at Tooele, Utah. The proceeds from these shipments will be used in the construction of the railroad to the mine. It is understood that there are in the neighborhood of 40,000 to 60,000 tons of tailings at Bullionville from the mills which were operated in the early days of the camp. Stamps were used principally, though other crushers were tried. Some of the tailings have since been cyanided, but even these can be profitably shipped. The current talk is that a little over half of the tailings can be sold at from $6 to $7 per ton, while the remainder will bring about $4. There are also some sands which may be shipped later, though these may be worked over or concentrated first. The tailings are loaded on the cars by men and teams at a cost of 35c. per ton. About 267 cars, or 12,015 tons have been shipped. A new tailings pit will soon be opened, which is estimated to contain about 32,000 tons; approximately, two-thirds of this will be shipped.

Low-Grade Ores May be Shipped

Pioche has been quiet for some time, especially since the Nevada-Utah difficulties. Since the work has been started on the branch line, the town and district have taken on new life and now that better shipping facilities will be available, preparations are being made to resume work at many properties.

Cheap transportation is a necessity, as the ores at present are mostly of medium- or low-grade. In the early days of the camp, higher grade silver ores, carrying some lead, were mined from fissure veins in the quartzite and shale, by such well known producers as the Raymond and Ely, Meadow Valley and other mines which first made the camp known. These veins were worked extensively above the water level.

The greater part of the ores at present being mined carry an excess of 25 to 35% iron and manganese over silica, with some lead and silver. These are desirable fluxing-ores and a large part of the payment made by the smelters is for the excess of iron, manganese and lime. A typical ore of this character assays 4 oz. silver, 5% lead, and 30% excess iron. In some cases there is a small amount of gold present, 20 to 40 cents.

The geological section at Pioche from older to younger consists of: Cambrian quartzite, 1500 ft.; shale, 400 ft.; limestone, 600 ft. or over; shale, 75 ft.; limestone, 800 ft., more or less eroded.[1] There has been strong fissuring and faulting, the displacements in some cases being large, with upthrows of several hundred feet.

Iron-Manganese Ores in Limestone and Shale

The iron-manganese ores occur in good-sized bodies, up to 250 ft. in length and more than 100 ft. in width and thickness, along the contact of the lower or 600-ft. limestone and shale, replacing the limestone in the neighborhood of mineralizing fissures. Shale forms the foot wall of some of the most important bodies so far developed. Iron-manganese ores also occur in the limestone beds above the shale, and in the shale beds of the 400-ft. series. Some of the orebodies here are 20 ft. or more in thickness.

A higher grade silicious silver-lead ore also occurs in the lower shale, and replaces certain beds with considerable regularity. The beds replaced are from four to eight feet in thickness. A typical ore of this character will average about 12% lead, 16 oz. silver, and $2 gold, with an excess of 20% silica. This ore occurs in workable quantities in the mineralized fissures. In the Highland district a few miles west of the Pioche Range, the ores, silver with lead, occur largely in fissure veins though there are some bedded deposits.

At present none of the mines on the north side of the camp are operating. Some work is being done at the Pioche Metals at the northwest point of the range, and by properties on the south side, along the line of the new railroad. The Demijohn is employing a few men, the Pioche Coalition Mines Co. is working, and the Virginia-Louise, near the Prince, is sinking a new two-compartment shaft, in search of the Prince ore zone on the south.

The Prince mine is overhauling the buildings and equipment. Ore bins of 650 tons capacity will be built. The bodies of iron and manganese ore at this property will be further opened and prepared for mining by a caving system. When mining is started about 200 tons of this class of ore will be shipped daily to the International smeltery, in addition to the tailings now being shipped from Bullionville. The Prince also has higher grade silver-lead ores developed on the lower levels, in the 400-ft. shale beds and in fissures.

The Pioche King northwest of the Prince will probably resume development.

The Day-Bristol mine at Jack Rabbit, owned by the Nevada-Utah, is shipping two cars of iron-manganese ore daily. Ore carrying copper is mined at intervals. Jack Rabbit is 14 miles southwest of Pioche.

Mines in the Highland District

A new prospect has recently been opened in the Highland Range about six miles south of the Day-Bristol. This is called the Home Run and is controlled by Salt Lake men. The ore is composed chiefly of copper silicate (chrysocolla) carrying some silver. A small gasoline hoist has been installed.

The mines of the Highland district should be benefitted by the new railroad to the Prince mine, as it will reduce the wagon haul by several miles and it is down grade from most of the properties to the railroad. It is proposed to put in a 500-ft. spur south of the Pioche Metals and build a loading platform so that loading can be done direct into the cars. The mines in the Highland district are the Mendha and Last Chance; they are being worked at present. Work is being done at the Highland Mary, and at the X-Ray on the eastern slope. The railroad will cause work to be resumed at other mines or prospects in this district.

---

*Mining engineer, 607 Newhouse Building, Salt Lake City, Utah.

[1] "Geology of Pioche, Nevada and Vicinity," by F. J. Pack, School of Mines Quarterly, April and July, 1906, pp. 294.

Cyaniding Weathered Pyritic Tailing

By Herbert R. Edmands*

In a temporary leaching plant 2300 tons of highly acid tailing was profitably cyanided, an extraction of 88% being obtained. The tailing, in 400-ton lots, was well mixed with lime; screened to break up clayey lumps and a 40-day treatment given.

The tailing on the dump of the Lady Gladys Co., Mulline, Western Australia, contained marcasite, blende, arsenical pyrite, and the decomposition products of these minerals. It had been exposed to the weather for three or four years and was exceedingly acid, giving off a sulphurous smell which was apparent for some distance from the dump. Although it had been sampled several times and pronounced quite untreatable except at a loss, it yielded a fair profit to my firm although we had to pay 10s. per ton for the dump. The dump contained 2300 tons of this material assaying 43s. 6d.; after treatment the residue assayed 5s. 4d. The bullion recovered realized, after paying bank and mint charges, £4377, or a little over 38s. per ton, practically all in gold, the silver being negligible.

Tailing Highly Acid

The average soluble acidity was 12.2 lb. CaO, and the total acidity 35.2 lb. per ton. The soluble acidity contained ferrous iron equal to 3.3 lb. Fe_2SO_4 per ton. A screen test gave the following: On 30 mesh, 2.8%; on 60 mesh, 29.4%; on 80 mesh, 13.1%; on 100 mesh, 8.6%; on 120 mesh, 7.1%; on 150 mesh, 4.7%; through 150 mesh, 33.4%. The portion passing 150 mesh was mostly a true clayey slime and contained a larger portion of acid and soluble iron than the sand portion. Had the tonnage been greater, classification and separate sand and slime treatment would have been better.

Owing to the limited tonnage, the plant had to be as simple and cheap as possible, but as long treatment was necessary the capacity could not be too small. Two leaching vats 40 ft. diameter, by 6 ft. deep, were erected each capable of containing 200 tons. The ground was first prepared for the bottoms by gradually sloping it from the circumference to the center, the fall being 10 in. From the center a large pipe conveyed the solution to the extractors. Light duck, sewed so as to form a circular surface, 41 ft. 6 in. in diameter, was thoroughly tarred and laid on the prepared ground thus forming the bottom. The sides were of 22-gage galvanized corrugated iron.

The bottom duck was turned up round a board, fastened to the bottom of the iron sides, to prevent escape of solution. The sides were stiffened by posts placed at intervals of 8 ft., the whole being encircled by three bands of old wire rope. The filter-bed support was formed of slats ⅝ in. square, placed 1⅛ in. apart, center to center, and resting directly on the tarred duck. These were kept in position by 1¼ x ¼-in. laths, tacked on top of the slats. The support was made in sections 5 ft. square, which were put in the vat with the slats pointing toward the center. The bottom was then covered with Hessian (burlap) and finally with 6 in. of rather coarse sand.

With such vats, which were mere filter beds with retaining walls, it was not possible to check the flow of solution, which was great at times, yet the precipitation averaged 65%. No solution was lost by leakage. These vats were afterwards used for treating another parcel of ore and at the end of two years' use showed absolutely no deterioration as far as the duck bottom and filter bed were concerned, although the iron sides were eaten through in many places. Such a plant, however, could only be justified by the special circumstances.

Preliminary Wash Not Profitable

Tests showed that although so much soluble acidity was present little was to be gained by a preliminary wash. The extraction was more rapid at first, but soon fell off and the total time of treatment was not greatly shortened. Moreover, a preliminary wash involved the use of soda for subsequent neutralization of the "latent" acidity, as lime could not be mixed sufficiently intimately with the wet sand. In any case it necessitated another handling. The use of soda was too costly, and was objectionable for other reasons, as will be seen later.

The main feature in the successful treatment consisted in first adding about 50 lb. of slaked lime per ton, which had to be thoroughly mixed, and then passing the mixture through a ½-in. screen, all slime lumps being broken up. After charging the vat with this mixture the next step was to wash with water or barren solution. The first wash always came off slightly alkaline. The original sand contained about 3.3 lb. Fe_2SO_4 per ton, which was now converted into ferrous hydrate. It was necessary to thoroughly oxidize this to the ferric state, otherwise the destruction of 8.1 lb. of KCN would result. Oxidation was accomplished by giving a succession of washes and draining between each wash. All wash water was well aerated, air being admitted into the suction of the centrifugal pump used, but the greater part of the oxygen supplied was contained in the drained sand, which was for the most part forced downward through the charge by each succeeding wash. It was estimated that a wash of 31 tons would contain about 0.4 lb. oxygen in solution, but the drained sand would contain about 14 lb. oxygen most of which would be forced downwards through the charge. The washing occupied four to five days, about ½ ton of solution per ton of sand being used. In some cases 1 lb. of lead acetate per ton of sand was added to the wash water, but without marked benefit.

A 40-Day Treatment Given

The sand now being well oxidized, about 50 to 80 tons of 0.05% cyanide solution were pumped on the 400 tons of sand daily. A 40-day treatment was generally required, the total solution used amounting to 6 tons per ton of sand, exclusive of wash water for oxidizing.

The solution carried gold in amounts varying from 18 to 20s. per ton at the commencement to 1s. or less at the end of the treatment. The cyanide consumption was a little under 4 lb. NaCN per ton. Notwithstanding the long time occupied in treatment the cost was not unduly high, as after the vats had been filled only one man was required to attend to the pumping, testing and assaying of solutions.

Before the treatment described was adopted the first charges treated threatened total failure. To these vats only 16 lb. of lime were added, the mixture was imperfect, and it was not screened. The idea was to wash out some of the soluble acidity and then complete the neutralization with caustic soda. The first wash came off showing soluble acidity equal to about 7.6 lb. Na_2O per ton of solution; this with succeeding washes was thrown away until the acidity had fallen to 1.5 lb. Na_2O. The wash was then neutralized with lime, soda added and the solution returned to the vats. A large amount of pumping was required; much time was expended, an additional 34 lb. of lime and 34 lb. of caustic soda were consumed per ton, bringing the total amount of lime up to 50 lb. and of soda 34 lb., which was more than twice the amount called for by the usual "total acidity" test.

Upon investigation it was found that on this class of ore the "total acidity" test, (shaking a weighed quantity of ore with a measured volume of alkaline solution of known strength and noting the amount of alkali consumed) gave varying results, depending on the quantity or strength of alkali used and also on the time of contact. The accompanying examples show the effect of long contact in increasing the alkali consumption. The tests were made on ore from both vats at different depths which had already been partially neutralized. Samples of 112 grams each were shaken with 200 c.c. of 1% Na_2O, and the consumption of alkali noted after one hour's contact and after standing 15 days.

---

*Edmands & Gidney, Metallurgists, Menzies, Western Australia.

TESTS FOR CONSUMPTION OF ALKALI

"A" Vat Depth	Pounds of Na_2O Consumed per Ton After 1 hr.	Pounds of Na_2O Consumed per Ton After 15 days
0 to 1 ft.	3.76	17.92
1 to 2 ft.	3.04	37.76
2 to 3 ft.	15.84	33.20
3 to 4 ft.	24.40	37.72
4 to 5 ft.	26.64	36.64
Average	14.7	32.6
"B" Vat Depth		
0 to 1 ft.	1.24	15.04
1 to 2 ft.	0.96	13.84
2 to 3 ft.	2.00	16.88
3 to 4 ft.	10.80	24.48
4 to 5 ft.	20.80	34.40
Average	7.2	20.9

These tests show clearly that much alkali is consumed beyond that required to neutralize the sand if sufficient time be given, one of the chief reasons being the solution of considerable amounts of sulphur.

The presence of alkaline sulphides was never detected in the solutions coming from the vats but thiosulphates were present in quantity. Probably alkaline sulphides were first formed and were immediately oxidized to thiosulphates, etc. Alkaline sulphides could be detected in the above bottle tests that had stood for 15 days, as there was little chance for oxidation.

Several 112-gram samples of "Gladys" sand were each agitated with 200 c.c. of a solution of either caustic or carbonate of soda of a strength equivalent to 1% Na_2O. The consumption with the caustic solution after 1 hr. was 18.8 lb. per ton; after 20 hr., 20.96 lb.; after 72 hr., 25.6 lb. With the carbonate solution the consumption at the end of 1 hr. was 9.44 lb.; after 20 hr., 9.44 lb.; after 72 hr., 11.6 lb. per ton.

The caustic gave a colored solution and settled well; the solution contained alkaline sulphide. The carbonate gave a colorless solution and did not settle so rapidly; the solution contained no alkaline sulphide. These tests seem to show that when soda must be used the carbonate is better than the caustic alkali.

It was noted that with neutralization with caustic soda there was apparently a much greater oxidation of the ore than was the case when lime was used. When the treated ore was discharged from the vats its color was distinctly changed from yellowish to red or warm brown. This did not happen, at least to anything like the same extent, with lime-neutralized sand. The color imparted to the solution was also characteristic of caustic-soda neutralization, which became a dingy brown and which persisted throughout the whole cyanide treatment of that particular parcel.

According to Julian[1], "pyrite is much more soluble in cyanide solutions when a large excess of oxygen is present; with an excess of oxygen the pyrite caused the solution to become colored varying in shade from amber to muddy brown; the brown solution was found to have lost much of its dissolving power on gold and silver but the power was easily restored by the use of desulphurizing and oxidizing agents." From this it would be inferred that the solution of the pyrite with consequent coloring of the solution and loss of dissolving power was caused by the action of KCN solution in presence of excess of oxygen, whereas I found it to be caused by the action of an excess of NaOH in the presence of an excess of oxygen and that the same ore if neutralized with lime gave no such solution.

Constituents of Brown Solution

The brown solution contained 0.36% $Na_2S_2O_3+5H_2O$, some thiocyanate and the merest trace of ferrocyanide. After aeration it was as effective as colorless solution in dissolving gold, but the addition of permanganate or ferricyanide decidedly impaired its solvent activity for gold. Why this should be so was not clearly established. It was found that the addition of sodium thiosulphate to a pure cyanide solution increased its solvent activity, and of course the addition of permanganate or ferricyanide would destroy the thiosulphate, but this explanation is not altogether satisfactory.

While the addition of "hypo" to a cyanide solution gave increased solvent activity on immersed strips of gold, yet its advantage in practical work is at least doubtful. Leaching and percolation tests were made on other ores with and without the addition of "hypo" but the results were discordant. In the leaching tests there was no great difference, but the plain cyanide gave rather better results; in bottle tests the results varied. The tests were made on ores containing copper as carbonate and sulphide.

Julian shows[2] the great loss of dissolving power if the same solution is successively passed over several vats of ore containing pyrite and marcasite, and I noticed the same effect when the brown solution was passed several times over the ore without running it through the zinc boxes. Zinc apparently has some power of restoring the solvent activity which mere aeration has not. I have no explanation to offer but the effect was very marked.

After the initial trouble with soda, there was no difficulty in getting neutralization with an intimate mixture of lime and as already stated the amount of hypo formed increased with the amount of lime added, but the best work was done if the lime was not in large excess.

Methods of Testing

The ordinary test for reducing power, which consists of adding K_2MnO_4 to an acidified solution, is of no practical use for this type of solution. Solutions showing a high reducing power, owing to the presence of thiosulphates, may actually have a higher solvent activity than pure cyanide solutions of similar strength. The method adopted was to pass a current of air for two or three hours through the solution, testing it with permanganate in the usual way, and also testing solution which had not been so aerated, the difference giving the "active reducing power" which as a rule was exceedingly small or nil.

At the time this work was going on I knew of no published method for the estimation of thiosulphate in the presence of cyanide, so the following was adopted: Excess of lime was added to remove certain organic matter if present; 10 c.c. of the filtered solution was then taken and diluted with 50 c.c. of water and a slight excess of H_2SO_4 added (generally 2 c.c. of a mixture of 1 volume of strong acid with 2 volumes of water); this was then titrated with N/10 iodine, 1 cc. of iodine equalling 0.0248 grams of crystalline sodium thiosulphate.

Tests were made on "model" solutions containing "hypo," cyanide, thiocyanate, and ferrocyanide, and the test was found to be accurate to within 3% of the total "hypo," (more "hypo" being shown than was actually present) which was near enough for the purpose. If the solution were not sufficiently diluted the error was greater. Since that time Clennell in his "Cyanide Handbook" has given an almost identical method.

Topographic maps of two important mining camps have recently been issued by the U. S. Geological Survey. These are maps of Ray and vicinity, in Pinal County, Ariz., and of the Creede district, in Mineral County, Colo. The Ray map is on a large scale, 1:12,000, the contour interval being 25 ft.; the scale of the Creede map is 1:24,000. The topographic surveying of the area shown on the Ray map was done by W. M. Beaman and that on the Creede map by R. H. Reinecke, under the general direction of R. B. Marshall, chief geographer.

---

[1] "Cyaniding Gold and Silver Ores." First Edition, pp. 72 and 101

[2] "Cyaniding Gold and Silver Ores." Chap. 10.

Northern California Gold Dredging

By Lewis H. Eddy

Three dredges, each of a different type, are operating in Siskiyou County in ground formerly worked by crude methods. One of these dredges uses a clam-shell bucket, another an orange-peel bucket, and the third the customary bucket elevator digging ladder. A fourth dredge of the latter type is about to go into commission on the Trinity River. The cleanup methods of the first two dredges are interesting.

Gold dredging in Siskiyou County, California, is active on Klamath River in the northwest and McAdams Creek in the central part of the county. Three types of dredges are employed, each especially designed for the particular character of the gravel and the topographical situation of the ground dredged. On Klamath River there are two dredges (a clam-shell and an orange-peel dredge): one operating in an old channel of the river at McConnell Bar; the other in the gravel and bedrock of the live stream at Hamburg Bar. On McAdams Creek a bucket-elevator California-type dredge operates in the old channel of the creek. There have been other attempts, and preparations are said to be making for still further dredging on the Klamath, where placer claims extend for several miles between the two points of present active operation.

Three Active Dredging Districts

The accompanying sketch map embraces a portion of the west half of Siskiyou County and includes the Klamath River and McAdams Creek dredging areas. It delineates Klamath River in its westerly and southwesterly flow from Humbug Creek to Scott River, the two points near which the shell dredges are operating; Humbug Creek as it flows northeasterly to the Klamath, and Scott River as it flows westerly and northerly to the Klamath; McAdams Creek channel and Cherry Creek flowing south to the Scott; and the present active dredging operations at McConnell Bar, Hamburg Bar and McAdams Creek. The prominent elevations are Humbug Mountain in the east and Scott Bar Mountain in the southeast. Yreka, the county capital and commercial *entrepot* is situated in the east; Fort Jones is south of McAdams Creek dredging ground; Scott Bar, an active placer mining camp is shown on Scott River in the west; and Hamburg Bar and McConnell Bar the extreme points of active dredging on the Klamath, one to the northwest, the other to the northeast part of the region mapped.

Active placer mining is practiced on the Klamath, Humbug and Scott, and quartz mining in the Humbug and Scott Bar Mountains and on the Klamath at Happy Camp. This mining territory, extending 40 miles east and west and 18 miles north and south geographically, is wholly without rail transportation facilities. The distances by wagon roads are in most districts approximately doubled by the various elevations, thus appreciably increasing the initial cost of installing mining machinery.

Yreka, the political capital of the county, situated in the eastern side of the territory mapped, has rail connection with Montague a distance of eight miles east, and stands approximately half way between San Francisco and Portland. This proximity to Oregon and Washington attracts capital from those states to the quartz mines; but the active dredging work is all done by California investors. Despite the isolation of this part of the county resultant from lack of interior rail transportation there is an air of prosperity and a strong faith expressed that the gold which escaped the crude methods of the early miners will be recovered by the modern methods now being introduced.

Dry-Land Clam-Shell Dredge on The Klamath

The dredging of the old river channel at McConnell Bar is operated by the Northern California Mining Co., H. G. Wellman, superintendent, with electrically driven machinery designed and constructed by the Wellman-Seaver-Morgan Co., of Cleveland. The equipment is composed of a clam-shell bucket, operated from a portable derrick standing on dry land at the edge of the dredged channel; a hydraulic giant; and three pumps. The purpose of this design and installation was to operate in ground that might not be economically handled with the bucket-elevator or other type of California dredge.

There are two gravel channels, covered by five placer claims, a total of 100 acres, of which 10 acres has been dredged in two years. These channels have an average depth of 45 ft. and maximum of 70 ft. The length of the cut described by the excavation is about 1800 ft., average width about 150 ft. The ground is broken down with a 3-in. giant under 125-lb. pressure. The gravel is lifted to the hopper with a 2½-cu. yd. cast-steel clam-shell bucket, weighing 13,000 lb. The boom is 126 ft. long, 18 in. square, in one piece of Oregon fir. The derrick frame is built of the same wood in parts of proportional dimensions, the base timbers being about 22 in. square; the whole, with its machinery equipment, resting on 8-in. rollers similar to those employed in the ordinary house-moving. As the excavation is advanced the derrick is moved by its operating machinery toward the "dead-man" to which it is anchored; the dead-man being reset as required.

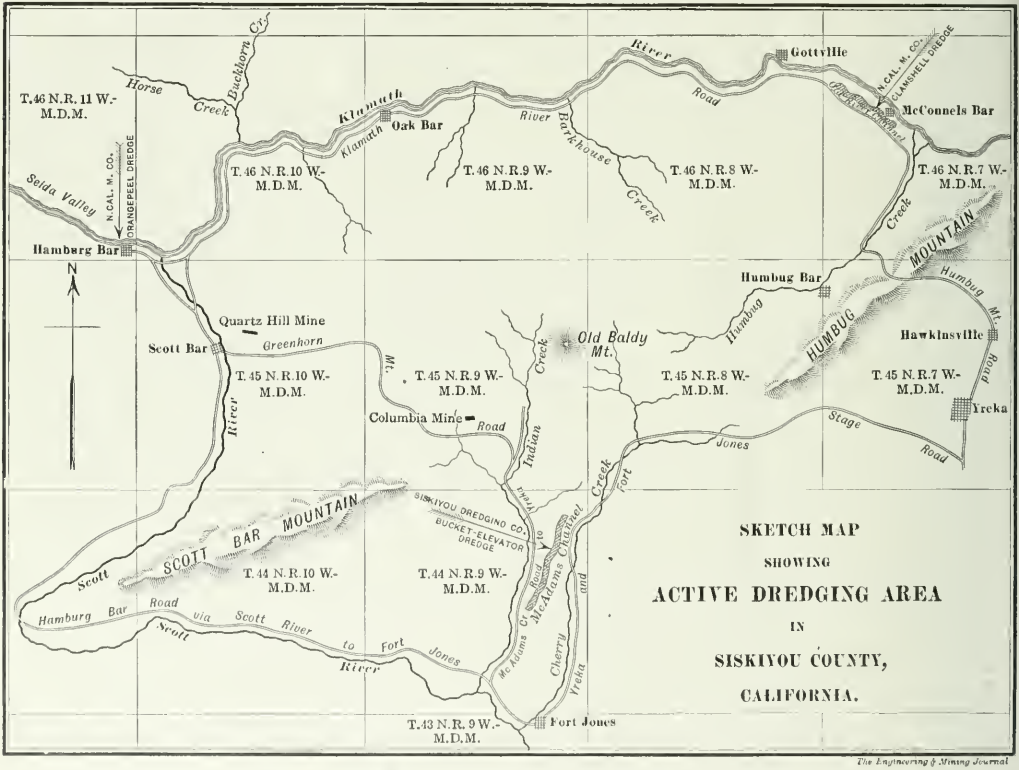
Serpentine Bedrock

The bedrock, a compact serpentine having occasional soft spots, after being stripped by the machine shovel, is cleaned by hand with pick and shovel and hand scraper and brush; the soft places being dug to a maximum depth of about 12 in. The bedrock material is shoveled into tubs and dumped into the flume by an ordinary derrick. The water in the pit accumulated from the giant, and a proportion of the sand, is pumped out. The hopper into which the machine bucket dumps is equipped with an iron-rail grizzly, which separates the heavy rocks from the finer material, and the rocks are removed with an ordinary 4-ft. tub about 10 in. deep; the finer material being run to an ordinary 4-ft. wooden flume with Hungarian riffles for a length of 150 ft., and bottomed for a further length of 400 ft. with pine blocks 9 in. deep and about 12 in. square. The flume is situated between the dredged channel and the river, standing approximately parallel with the river into which it empties the water. As the advancement of the excavation requires the forwarding of the machine derrick the receiving end of the flume is extended by additional construction, and a new hopper is built. The bucket handles about 1200 cu.yd. in 24 hours; the small derrick on the bedrock delivers about 50 cu.yd. per day.

Most of Gold Near Bedrock

Seventy-five per cent. of the gold is recovered from within two feet of the bedrock. The bedrock material is said to yield about $1 per cu.yd., and the gravel delivered by the bucket 10 to 15c. per cu.yd. An average of the cost of handling the entire output was not obtainable, but the cost of recovery from bedrock by the hand method is about 90c. per cu.yd. The excavation so far has disclosed two channels, one deep, the other higher up. The best grade of material is found in the higher channel and on the rims. These channels are irregular in course, but generally run nearly north and south, approximately paralleling the river.

The ground was prospected with a Keystone drill, the best ground being found to lie next to the live-stream shore. About 60 acres of the 100 have so far been proven of dredgeable grade. By advancing the excavation 2000 ft. further, making a total length of nearly 4000 ft., the cut may be extended to the stream. It is the purpose to turn the stream into the excavated channel; and to prospect the bed of the present live stream in the vicinity of the mouth of Humbug Creek which flows into the Klamath at a point about 1000 ft. southerly from the point at which the river stream is to be diverted.



SKETCH MAP
SHOWING
ACTIVE DREDGING AREA
IN
SISKIYOU COUNTY,
CALIFORNIA.

The Engineering & Mining Journal

In the early days of placer mining Humbug Bar gave high yields, and like other placer regions was by no means cleaned by the crude methods then employed. Humbug Creek flows in a northeasterly course for a distance of about 10 sectional miles, having its source at a point westerly from Humbug Mountain and about half way between that mountain and Mt. Baldy. It is the most important creek east of Scott River.

McConnell Bar is situate geographically about seven miles north and two miles west from Yreka, and distant 10 miles by good wagon road over Humbug Mountain along the westerly side of Humbug Creek. The machinery for the plant of the northern California Mining Company was wagon-hauled over this road; the timbers for derrick construction, with the exception of the boom, were formed in a raft and floated down the Klamath from Hornbrook; the boom was floated from the same point separately.

The derrick machinery is operated by a 100-hp. Westinghouse 2200-volt A. C. motor. The hydraulic giant is supplied with water by a 12-in. Worthington centrifugal pump driven by a 100-hp. motor; the water for the big flume is supplied by a 20-in. Samson pump requiring about 150 hp. The water in the pit is pumped out with a Krogh 8-in. sand and gravel pump. Electric power is furnished by the Siskiyou Electric Power Co., over a pole line from a branch power station 18 miles south on Fall Creek.

Operations at Hamburg Bar

Hamburg Bar is situated 10 miles west and 6 miles south, measured by sectional miles, from McConnell Bar, while the wagon road which skirts the southerly bank of Klamath River measures about 32 miles, and covers some heavy grades. The road is in places approximately level with the river bank, but for the greater length it is several hundred feet above the river. Between these two points of active dredging the river placers have been and some are being worked in the vicinity of Oak Bar. A steam shovel was operated on the north side of the river with some success, and the China-pump device has also been employed. Hydraulic elevators have been contemplated by A. C. Aiken at Daggett ranch, and others. The Pine Grove placer is being worked at Oak Bar by G. Barton, and on Barkhouse Creek the Siskiyou Mines Co. contemplates extensive hydraulic operations.

The possibility of economical dredging in these districts evidently has not been seriously or practically considered, possibly due somewhat to the small publicity given to the dredging operations in this section, and to lack of study of the various dredging devices that have been introduced. There appears to be a constant effort to improve upon the obsolete methods of the early days; but the modern methods of handling gravel and devices for saving the gold have not been generally considered. The demonstrations at Hamburg and McConnell have amply proved the mechanical practicability of handling both dry and stream gravel; whether or not these methods are largely profitable is a matter of concern to the companies themselves, which they are not disposed to make public. The impression, therefore, obtains in this section of the county that they are not profitable; but the operations continue.

The Northern California Dredging Co., J. C. Hampton superintendent, has been operating in the stream of Klamath River at Hamburg Bar for the last three years, averaging seven months in the year, beginning in April or May, dependent on the height of the water. The plant is composed of a floating boat, equipped with an orange-peel bucket, suction pump, and diving apparatus. The entire plant is driven by steam generated with wood fuel. The geographical situation of Hamburg Bar is 13 miles west and 4 miles north, by sectional measurement, from Yreka; the wagon-road distance via Klamath River is 42 miles; by the McAdams Creek and Scott River roads, 53 miles.

The situation of the stream placers at Hamburg in relation to the point of confluence of Scott River with the Klamath is similar to that of the McConnell Bar old channel in its relation to the point of confluence of Humbug Creek with the Klamath. At the latter point the Klamath makes a sharp turn from southwest to northwest; and at Scott River a more abrupt change in course is from almost due south and southwest to west.

Scott River, like Hamburg Creek, has been a large producer of placer gold, and there are still important operations in the placer-mining season. For a distance of 15 miles the course of Scott River in its flow to the Klamath is first northeasterly and then northwesterly. The dredging at Hamburg is toward the mouth of the Scott, as the operation at McConnell is toward the mouth of Humbug. Both are directed toward the point where a considerable deposit of placer gold may be expected; and in each case the river bed at the objective point will be thoroughly prospected; but at Scott River the prospecting will be done in the stream, as it is now done at Hamburg.

An Orange Peel and Suction Dredge

The operations of the Northern California Dredging Co. have extended three-quarters of a mile; the river in this length has a maximum width of 200 ft. and minimum 115 ft., which approximately describes the area of river bed dredged. This company and other locators have the stream located with placer claims from Scott River for a length of about 15 miles in a northwesterly course, thence southerly for 10 miles. The method of prospecting practiced by the company precludes the securing of practical data until the boat is installed on the located claim; except where there are bars or banks that may be prospected with the pan or drill. When the boat is installed at the desired point of operation it is anchored, with cables run to the shore, at the down-stream end of the area surveyed and platted for prospecting.

The bucket is a 21-cu.ft. Hayward orange-peel type, 7 ft. 9 in. high when closed and 6 ft. 4 in. diameter when open; operated with a 27-ft. boom equipped to dig 60 ft. below the water line; the maximum depth here required has not exceeded 27 ft.; the average mean depth of stream is about 5 ft. Following the line of the survey across the river the heavy rocks are cleared out with the bucket. This is followed by digging a ditch to bedrock across the river, the gravel being thoroughly prospected. The areas of the river bed thus shown to contain gold-bearing gravel are then stripped and extended up stream. This is followed up by the diver and suction pump to clean the bedrock. These areas are extended such distances as may be determined by the survey and the reach of the boom. Should one side or any part of the river disclose material foo low grade to be economically handled, the stripping and cleaning are confined to the producing areas, to the point predetermined by the survey. The same methodical process of prospecting and dredging is repeated until the claim or claims determined fail to produce gold-bearing gravel in commercial quantity. Then the boat may be floated to another district or section of claims.

Work Requires two Divers

The yardage capacity of the plant is an average of 500 cu.yd in a 9-hour day; the divers working 5-hour and 4-hour shifts. The labor requires, in addition to the two divers, an engineer, a fireman, a deckhand and the superintendent, a total of six. The boat is 100 ft. long, 35 ft. wide, and 25 ft. high over all; hull 5 ft. deep; displacement 125 tons. The suction pump is a 10-in. DuBois type, especially designed for pumping gravel. The engine is a 10x15x10-in. compound condensing Westinghouse; the boiler, 105 hp.; wood fuel is used at a cost of $5.50 per cord delivered. Considering the geographical situation of the placers being dredged, wood is the most economical fuel, and probably the only generator of power that could be used profitably. Electricity already installed is unquestionably cheaper than steam generated with wood fuel; but the expense of constructing an overhead pole line from Hornbrook, the most economical point, a distance of 51 miles over rough country, or from McConnel Bar, a pole-line distance of 25 miles, would be prohibitive.

The flume is built within the boathouse; it is 30 in. wide, 18 in. deep, equipped with Hungarian riffles of 2¼-in. angle iron. The gravel being separated from the heavy rocks by the initial work of the bucket, goes direct from the hopper to the sluice flume; a small canvas plant handles the black sand. The yield from the gravel washed is not made public, nor the cost per yard for operating.

Operations on McAdams Creek

The situation of McAdams Creek channel is about five miles north of Fort Jones and 18 miles by wagon road over Cherry Hill, southwest from Yreka. It lies between Cherry Hill and Scott Bar Mountain and is approximately parallel with Cherry Creek, a live stream. There are active and profitable quartz mines on either side, at elevations of 2000 to 5000 feet. The channel is a live stream only in the stormy seasons; in dry seasons it carries about 100 in. of water on the bedrock. The bedrock of the channel is decomposed slate; the gravel is a clean wash, medium coarse and carries no clay.

The early miners sunk shafts and drifted on the bedrock, throwing the heavy rocks out back of their workings. They did a large amount of work, and are reputed to have taken out a good deal of gold. These shafts varied in depth from 3 ft. to 22 ft. The pay must have been much more per cubic yard at that time than at present, as the methods of hand digging and hoisting with windlass could not have been profitably employed in gravel that can now be dredged at great profit. The Siskiyou Dredging Co. prospected the channel for a length of about two miles in its northeasterly and southwesterly course through T. 44 N., R. 9 W., M. D. M., and across an average width of 400 ft., with Keystone drills, sinking varying depths from 10 to 26 feet.

In February, 1910, the company installed a 5½-cu.ft. bucket-elevator dredge, designed by the Boston Machine Shop at Thermalito in Butte County, which is a branch of the Hammon dredge construction interests. The boat is 110 ft. long, 38 ft. 8 in. wide, hull 8 ft. deep; equipped with 81 Bucyrus type 5½-cu.ft., close-connected buckets, and belt conveyor, revolving screen and nozzle washing device. The machinery is driven by electric power furnished by the Siskiyou Electric Power & Light Co., whose main line extends across the northerly end of these claims. The electric current is brought over at 2080 volts for the digging-ladder motor, and transformed to

440 volts for the other motors. The digging motor is 100 hp. variable speed, winch motor, 20 hp. variable speed. All the other motors are constant speed; pump motor, 75 hp.; screen motor, 25 hp.; stacking motor, 20 hp.

In the 22 months ended November, 1911, the dredge turned over about 15 acres to an average depth of 40 ft. through the center of the channel and across a width of about 200 ft. in the southerly half of the claims, averaging 65,000 cu.yd. of gravel per month. The average value of the gravel is not made public, but in the richer portions of the channel runs as high as 15c. per cu.yd. There are 221 acres of ground in these channel claims, and 165 acres have been proven dredgeable. The estimated life of the hull of this dredge is about 12 years. Allowing for a decrease in the average depth of the ground and other physical contingencies the life of the boat approximately equals the probable life of the dredging field.

PERSONNEL OF SISKIYOU DREDGING CO.

The company was organized under the laws of the State of Maine and capitalized at $200,000. George J. Carr, field superintendent of the Yuba Consolidated Goldfields at Hammonton, is president; John J. Hamlyn, field superintendent of the Natomas Consolidated at Oroville, is vice-president; J. C. Osgood, San Francisco is secretary; J. W. Bole of Fort Jones is dredge superintendent. This company is not a part of the W. P. Hammon interests, but an independent concern owned by men, some of whom are in the employ of the Hammon interests. It is of interest to note that this is an independent company, organized by men of small means for the installation of a small-capacity dredge at a time when the advancement of dredging seemed to be demanding dredges of large capacity. The installation and profitable operation of this boat demonstrates the fact that gold dredging in California is not necessarily confined to large capital investment.

While a 15-cu.ft. dredge would dig an equal field in less than three years, or a saving of more than 75% in time occupied in earning an equal gross amount, with an equal expenditure for labor and an increase in cost of operation only in the power consumed, the investment in a larger dredge, would not be profitable for the reason that the excess life of the boat over the life of the field would have no value, without large expenditure for dismantling, moving and reinstallation. So the small boat is an economic investment in a limited field; and the limited field and small type of dredge offer opportunity to men of modest capital in other sections of Siskiyou and the northern counties. These small boats of 4 to 6 cu.ft. capacity are operating in several counties in limited territory, and are profitable investments.

SCOTT RIVER DREDGE REMOVED TO TRINITY

In the summer of 1908 the Scott River Dredging Co. installed a 7½-cu.ft., bucket-elevator dredge in T. 40 N., R. 8 W., M. D. M., on Scott River west of the town of Callahan. The company held about 200 acres of ground that had been drilled and shown to contain coarse wash gravel with no clay and but little sand. The dredge turned over 7½ acres in the first 12 months, averaging about 30 ft. deep, and outputting about 355,000 cu.yd. of gravel, or less than one-half the output of the 5½-cu.ft. dredge of the Siskiyou Dredging Co. The dredge was put out of commission in 1910, and the machinery was purchased by the Alta Bert Gold Dredging Co. in July, 1910, dismantled and hauled by team to Trinity Center in Trinity County 28 miles south, where it was reconstructed by the Union Construction Co. with a new hull, and some changes in design and equipment.

Originally the dredge was designed and constructed with a plate-girder digging ladder, 85 ft. 5 in. long, equipped with 72 close-connected buckets, weighing 2300 lb. each. The revolving screen was Risdon patent, and the gold-saving tables, the Holmes type; most of the remaining machinery was of the Link-Belt Co. make, while the hull was constructed and the machinery installed by the Western Engineering & Construction Co. The hull of this boat differed from the usual design of California type dredge, being 9 ft. deep at the bow and 5 ft. at the stern. In the reconstruction the boat is being adapted to the field on Trinity River, and was to have been ready for commission in December. It will be electrically driven with 250 to 350 hp., G. E. motors.

Burning Temperatures for Limestone

The maximum and minimum permissible temperatures for, and the physical changes involved in limestone burning have been the subjects of recent work by Bleininger and Emley.[1] The minimum temperature must of course be above the dissociation temperatures, which are found to be 880° C. for calcium carbonate, and 750° C. for magnesium carbonate. The proper burning temperature for a lime may be fixed by a study of its hydration and porosity curves at different temperatures. For pure limestones the maximum permissible temperature is over 1300° C., for impure limestones between 1050 C. and 1150° C.; for pure magnesium carbonate, between 1000 and 1050° C.; and for impure magnesium carbonate, 900 to 1020° Centigrade.

---

[1] Journ. Soc. Chem. Ind., Dec. 15, 1911.

Neutralization of Roaster Gases

The apparatus for the application of Sprague's method of neutralizing the SO_3 in smeltery smoke[1] is described in U. S. pat No. 992,391. The smeltery gases treated are those from converter roasters containing comparatively little SO_3, and those from reverberatory roasters containing large amounts. For the treatment of the former class a furnace is used consisting of a number of units each of which has a perforated grate for a bottom, upon which is placed a charge of finely ground zinc ore mixed with slack coal, through which a light blast is forced. The zinc oxide formed floats up and into the flues from the reverberatory roasters, where the SO_3 is completely neutralized. On account of the highly acid character of the reverberatory-roaster gas, it is uneconomical to attempt to neutralize with zinc oxide, so an apparatus is employed to feed finely ground lime into the fan handling these gases. This fan is provided with a small shaking feeder, by which pulverized lime is admitted on the suction side. The quantity of lime admitted can be varied according to the acidity of the gases treated.

While this is a much cheaper method of neutralizing than that by zinc oxide, the results are not complete, and the fumes from this fan should be driven into the flues from the converter roasters, where they will be completely neutralized by the remaining zinc oxide in the treated converter-roaster gases.

Uses of Zirconium

The extreme hardness of zirconium carbide renders it suitable for a polishing material and for cutting glass[2]. Zirconia makes a good insulator, and mixed with good conducting material, is used for electrical heating purposes. Pure zirconium oxide is a fine white powder which is suitable for the manufacture of white paint. It can also be used as a nonirritant dressing for the surface of wounds. It is also suggested because of its heat-resisting power that it be substituted for thorium nitrate in the mixture of thorium and yttrium salts used to glaze the iridium bars in the Heraeus iridium furnace.

---

[1] Eng. and Min. Journ., Mar. 5, 1910.

[2] Chem. Zeit., 1911, p. 1261.

Cf. Journ. Sc. Chem. Ind., 1901, p. 884; 1910, pp. 150, 218; 1911, pp. 210, 551

Nevada-Utah Mines and Smelters Corporation

Attention was recently called to the affairs of the Nevada-Utah Mines & Smelters Corporation by the filing of the schedules in bankruptcy by the company, on Feb. 6, in the United States District Court, in New York. According to the schedule, the company's debts are as follows: Taxes due in Maine, $775; secured claims, $140,000, the largest of these being one for $92,500 of L. Vogelstein & Co. and one for $40,000 of the Bristol Consolidated Mining Co. The largest of the unsecured claims are: Paterson National Bank, Paterson, N. J., $7500, John W. Griggs, Paterson, N. J., $5000, C. J. Caughey, New York, $13,977, and others, bringing up the total to $44,258. In addition to these there are disputed claims amounting to about $180,000, of which the largest is a note for $125,000, held by the Merchants National Bank, of Salt Lake City. It is also shown that the subsidiary companies are indebted to others in an amount greater than $50,000, aside from certain disputed claims against these companies. The schedule of assets filed shows principally a large amount of debts due to the Nevada-Utah company from subsidiary companies on open accounts, and shown at their face value to be worth $307,743. There was cash on hand 86c., and deposits of money amounting to $274 in the banks and elsewhere.

PLAN OF READJUSTMENT

Under date, Dec. 15, 1911, the stockholders were advised by circular of a plan of readjustment of the company's affairs. This plan has been superseded by one dated Feb. 26, 1912, in which it is stated that the existing indebtedness of the corporation and its subsidiary companies, after adjustment of certain claims, is about $230,000; the present stock outstanding amounts to $15,000,000 and consists of 1,500,000 shares, par $10. It is further stated that the plan outlined below will be carried into effect under the direction of Trippe & Co., as successors to T. Gross, who was named as the syndicate manager in the original plan.

It is proposed to form under the laws of the state of Delaware, or some other state, as may be selected, a corporation to be known as the Consolidated Nevada-Utah Co., which shall have certain authorized issues of capital stock and convertible bonds. The securities and properties now owned by the Nevada-Utah Mines & Smelters Corporation, will be conveyed to this company, and the new company in payment for these properties will issue its stocks and bonds in the amounts provided and distributed in the manner prescribed. It is stated that at the request of the syndicate managers, and of the directors of the Nevada-Utah company, Willard V. King, president of the Columbia Trust Co., L. Vogelstein, of L. Vogelstein & Co., of New York, and William D. Elwell, of Wiggin & Elwell, of Boston, have consented to select the personnel of the new company and its first board of directors.

Under this plan there are to be 2,000,000 shares of common capital stock, par $3, total $6,000,000; 900,000 of 6% first-mortgage, serial convertible bonds, payable $90,000 per year, commencing July 1, 1918, secured by stocks and first mortgages, covering the Nevada and Utah properties and convertible at any time into stock at par.

PURPOSES OF NEW ISSUE

The new company will issue upon the order of the syndicate managers in payment for securities and properties purchased, 1,700,000 shares of its capital stock, and $900,000 of its bonds, the new company reserving 300,000 shares of stock to provide for the conversion of bonds.

The stock issue will be distributed as follows: 1,500,000 shares will go to the stockholders of the Nevada-Utah Mines & Smelters Corporation, who deposit their stock under this plan and take bonds to an amount equivalent at par to 50c. per share so deposited, one share of stock in the new company for each share deposited; 150,000 shares will go to the syndicate managers and to subscribers who have underwritten not less than $200,000 par value of the bonds of the new company, and 50,000 shares to the treasury of the new company, making the total of 1,700,000 shares. Of the bonds it has been arranged that $750,000 par value will be offered to the present stockholders of the Nevada-Utah company at par, before being sold or disposed of to others. The stockholders joining the plan must deposit with the Columbia Trust Co., on or before Mar. 31, 1912, the signed subscription agreement accompanied by their stock certificates and a check for 60% of the par value of the bonds being subscribed for; 20% of the par value of the bonds is due May 31, 1912, and the remainder, 20%, Sept. 30, 1912. In return a receipt will be given for each of the first two payments and the stock and bonds will be delivered on final payment and surrender of receipts. This will give each stockholder one share of new stock for each share of old stock so deposited, in addition to a 6% bond, or scrip, for the full amount paid, secured by a first lien on the property of the new company, and at his option convertible into stock at par.

Under this plan it is proposed to raise $750,000 cash, which will be distributed as follows: To holders of notes and other valid indebtedness of the Nevada-Utah company and its subsidiary companies, not exceeding approximately $230,000; for compensation of the syndicate managers and subscribers and for commissions, taxes, expenses of receivership and general readjustmnt expenses, not exceeding approximately $130,000; to the treasury of the new company, $390,000. Under the new plan, the outstanding securities will be as follows: Stock issued and outstanding, 1,650,000 shares, or $4,950,000; stock in treasury, 50,000 shares, or $150,000; stock reserved to provide for conversion of bonds, 300,000 shares, or $900,000; total, $6,000,000; convertible bonds issued and outstanding, $750,000; convertible bonds in treasury, $150,000; cash in treasury, approximately $390,000; other indebtedness, none.

It is said that arrangements have been made with the holders of the alleged claims against the company, aggregating over $165,000, for the adjustment of these claims in a manner favorable to the new company, and that the expenses of the readjustment will be materially reduced by these arrangements and other savings.

OTHER PLANS

A committee known as the Stockholders' Protective Committee, of which Frank D. Pavey is chairman, has issued recently a circular under date of Feb. 29, in which still another plan is outlined for the reorganization of the corporation. In a circular accompanying the plan of the Pavey committee, certain objections are made to the plan of Trippe & Co. Following this, and under date of Mar. 11, Trippe & Co. have caused to be published a notice in which they state that all information in their possession affecting the reorganization of the company will be given to any stockholder, but that they do not intend to answer the statements contained in the Pavey circular; further, that the plan under which they, Trippe & Co., are acting, has the support of stockholders owning a large number of shares and that they have every reason to believe that their reorganization will be successfully completed.

It will be remembered that on July 31, 1911, E. R. Wooley, former president of the company, explained in a circular to the stockholders the benefits which the company was to derive by combining the Pioche properties in the Amalgamated Pioche Mines & Smelters Corporation, and terminating the dispute and litigation in which the camp was involved. It was stated in the circulars of Dec. 15, 1911, that the present board of directors considers that this combination was desirable and of benefit to the company, but that it cannot approve all the methods employed by the former management to accomplish this end, nor all of the transactions connected therewith, as to the character and effect of which the former board, it is said, was not fully informed.

In December it was stated that the company's mines in Utah are being operated by lessees, and that the Day mine is being worked by the Day-Bristol Co. It is said that the Bristol mines cannot be operated profitably until the problem of transferring the ore to the railroad is solved. Further, considerable development is said to have been done on the Amalgamated company's properties with gratifying results, and this development, it is claimed, should be immediately pushed so that the extent and character of the orebodies may be determined, with a view of erecting suitable reduction works.

The Nevada-Utah Mines & Smelters Corporation has about 10,000 stockholders, and this wide distribution of the stock has caused a considerable interest to be manifested in the affairs of the company since they were first brought into prominence, recently, by the circulars issued in the summer of 1911 by E. R. Wooley, then president.

Premier Diamond Mine

Johannesburg Correspondence

The 1911 report of the Premier Diamond mine, in the Transvaal, shows that 8,325,000 loads, each of 16 cu.ft., of blue ground were crushed and washed. This is a reduction of 1,000,000 loads from 1910. The value per load recovered was 3s. 5.3d. against 3s. 2.5d. in 1910, but the yield per carat per load was only 0.213 against 0.230 in 1910. The reduction in grade apparently continues each year with depth and presents a serious problem. The increased value of yield was due solely to an advance of 15% in the value of stones won, and this was due to the recent rise in the diamond market. Every 24 hours 29,055 loads are treated. The cost per load in 1911 was 2s. 0.99d. and the cost per carat was 9s. 9.3d. The total yield of diamonds was 1,774,206 carats, a decrease of 371,617 carats from the previous year.

Operations were hampered by the removal of 740,022 tons of "floating reef," a waste rock broken from the walls and inclosed in the blue ground. Another 750,000 tons remain to be removed. Shortage of native labor accounts for the reduced scale of operations; the profits were £531,276, of which dividends absorbed £300,000; diamonds on hand are valued at £311,367. The recruiting of 12,169 natives cost £40,836 or 67s. per head, whereas in 1910 recruiting cost only 34s. 10d. per head.

In some of the gold mines of the Rand natives were recently costing £5 per head to recruit and compound, and recruiting costs have risen to 1s. 3d. per head per shift. At the Premier, natives find their own food and are paid an average of 2s. 8.7d. per shift. A total of 729 whites were employed, £209,123 being paid in salaries and wages.

The Premier mine has yielded £5,541,975 in profits; of this the equipment has cost £1,646,665. The government of the Transvaal has taken £1,675,785 and dividends to shareholders have absorbed £1,420,000; diamonds in hand amounted to £400,000; trading, reserve funds and cash balance have absorbed the remainder.

South African Notes

Johannesburg Correspondence

The year 1911 has been a disastrous one for shareholders in Rhodesian and Congo stocks. The shares in the Chartered Co., which administers Rhodesia, have fallen £1,309,158 in value; Tanganyikas, which own four-tenths of the Congo copper mines, fell £1,702,196; Globe & Phoenix, the show mine of Rhodesia, is down £700,000 in valuation. The Shamva mines, the coming hope of Rhodesia, have lost £406,000; "Eldorados" fell £281,000, and owing to the approaching exhaustion of all its known orebodies, "Giants" lost £196,000. Rhodesia dividends for 1911 totaled £954,613. One of the oldest and most noted mines in Rhodesia, the Surprise, which originally showed 4500 ft. of profitable oreshoot, has been let to leasers owing to unsatisfactory developments.

The Consolidated Langlaagte is one of the Rand's few coming mines. The older portion of the mine has been worked successfully for many years; a new mine is being developed south of a large longitudinal dike which caused an upthrow of nearly 1000 ft., and a new mill of 200 stamps is being erected. In the new mine there are 930,572 tons of profitable ore assaying 8.71 dwt fully developed, and 453,992 tons developed assaying 2.43 dwt. In this mine so much gold occurs in the quartzite partings between the banket-pebble leaders, that sorting waste is impossible and all mine rock is milled.

Notice for Meetings Insufficient

At the recent meeting of the Randfontein Central, unfavorable comment was made on the fact that only one week's notice of meeting was given, thus rendering it impossible for European shareholders to investigate the reports or to criticize or be represented in any way. A strong agitation has grown up, to have annual meetings transferred to London, and as a compromise several groups have agreed to defer date of meetings some months after the annual reports are published, to enable foreign shareholders to take any action they wish. Most annual meetings held in Johannesburg have been merely formal affairs.

The affairs of the East Rand Proprietary mines still afford a topic of discussion. The "Corner House" has decided, if possible, to take over the real direction of affairs and to allow the author of the present state of affairs to remain as chairman, as an impotent figurehead. The chairman of the Randfontein Central Mines, which is an amalgamation of all the Randfontein mines, reported that during 1911, 745 stamps, out of 1000 erected, crushed 2,159,032 tons for a yield of £2,661,280, or 24s. 7.8d. per ton, while working costs were surprisingly low, being 16s. 8d. per ton. The gross profit was £854,241. He stated that there was a shortage of 5000 natives and that the percentage of sorting has dropped to 5.61%, being another example of the policy of milling waste to make a show of keeping costs down and stamps running, and hence the grade was below the average. The payable reserves total 5,658,859 tons, assaying 7.29 dwt., with 1,000,000 tons assaying 2.83 dwt. He stated that the full requirements of the Rand mines were 297,000 natives, and that there was a shortage of 34½%, whereas last year the shortage was 29%. Recruiting, however, has been better recently, one group having practically all the labor necessary and owing to a dry season good results are expected for the coming year. There is, however, some danger of a great shortage of water for milling and domestic purposes next winter, owing to the shortage of rainfall this season to date. The government figures show for 1911, 24,344 whites and 189,259 colored workers employed at the Rand mines.

Government Statistics

The government mineral statistics have been issued. In the Transvaal, 24,456,871 tons were milled for £34,991,620 and a gross profit of £11,725,870. In the Witwatersrand district, 23,888,258 tons were milled for £23,542,479, there being 9432 stamps and 216 tube mills at work. The yield was 27s. 11d. per ton, or 7d. less than in 1910, and costs 18s. per ton, or 5d. more than in 1910. The gross profit was 9s. 7d. per ton, or 11d. less than in 1910, a total of £11,415,861. Practically 490,000 tons were crushed for an extra profit of £200,000. Dividends totaled £7,763,086. Tin-ore production showed a decline of £14,000 to £314,021, due to exhaustion of the Groenfontein tin mines and of the Swazieland tin fields.

Mineral Production of Quebec, 1911

The preliminary estimates of the 1911 mineral production of the province of Quebec show an increase in value from $7,323,281 in 1910 to $8,567,143 in 1911. The most valuable item on the list is asbestos, 99,352 tons, $2,939,006; followed by cement 588,283 bbl., $1.931.181; bricks, 130.297 M., $1,135,501; limestone, $1,081,059; granite, $308,545; lime, $284,334; copper and sulphur ore, 38,554 tons,

$240,097; marble $143,457; gold, 590 oz. and silver 23,000 oz., valued together at $23,300; and other miscellaneous products amounting to $480,663. The average value of asbestos declined during the year from $33.09 to $29.58, owing to overproduction, but the industry is now in satisfactory condition. Stocks fell from 41,159 tons on Jan. 1, 1911 to 31,420 tons on Jan. 1, 1912. Most of the copper ore comes from the McDonald mine, but the Eustis Mining Co., and the Ives mines near Eastman also contributed. The entire silver production and part of the gold comes from these copper ores.

Investigation of Alleged Smelting Trust

WASHINGTON CORRESPONDENCE

On receiving from the House of Representatives the Martin resolution relating to the smelting industry, and inquiring what information the Department of Justice has in its possession with reference to the existence of a smelting trust, Attorney-General Wickersham last week gave to the press a statement, in which he said that a year or more ago he instituted a careful inquiry into the smelting situation and found that the various companies were actively in competition with one another and that there was no reason to believe in the existence of a trust, such as has been charged.

The statement was followed by a communication from the Attorney-General to the House in official form, conveying the same information with greater detail. Attorney-General Wickersham called attention to the methods he had followed in his inquiry, and practically expressed the opinion that there was no basis for action concerning the trust. His reply is as follows:

> In reply I am directed by the President to state:
>
> (1) The Department of Justice has no evidence in its possession of the existence of a smelter trust in the United States in violation of the act approved July 2, 1890, entitled "An act to protect trade and commerce against unlawful restraints and monopolies and acts amendatory thereof."
>
> (2) The Department of Justice has in its possession no evidence that the American Smelting & Refining Co. constitutes in itself a trust or any part of a trust in violation of said act and acts amendatory thereof.
>
> (3) Some complaints have been made to the department touching the operation of the American Smelting & Refining Co. as the same might be affected by the antitrust act. One complaint bearing on that subject was made some months ago and was referred to the United States attorney for the Southern District of New York for investigation. That official subsequently reported to the department that he had conducted an investigation before a grand jury in his district in June, 1911, for the purpose of ascertaining whether or not there existed a combination between the American Smelting & Refining Co., the Federal Mining & Smelting Co. and the United Verde Copper Co. in the form of an agreement between those companies made in the latter part of 1910 providing for a limitation of their output or a fixing of the price, and that after examining the officers and books of the companies and other witnesses he was unable to find evidence of the existence of such an agreement.
>
> (4) It is not considered compatible with the public interests to state what other, if any, steps have been taken to investigate the existence of any smelting trust.

Representative Martin, the author of the resolution, since hearing from the Attorney-General, has expressed the intention of drawing up a resolution calling for a Congressional investigation of the alleged smelting trust and requiring also an investigation of the reasons why Attorney-General Wickersham reached the conclusions he did and the circumstances under which his investigation was carried on.

Mason Valley Mines

The second annual report of the Mason Valley Mines Co., covering the year ended Dec. 31, 1911, shows that the year has been one of progress for the company. President Thompson states that to date, with one blast furnace in commission since January, 1912, matte containing over 1,824,000 lb. of copper has been produced. Custom ores are being received daily and this business is expected to increase steadily.

ADDITIONAL EQUIPMENT

Much new equipment was added during the year at the mines. This includes: An Ingersoll duplex compressor, with a capacity of 1216 cu.ft. of free air at 100-lb. pressure, driven by a General Electric 200-hp. induction motor. The present arrangement of the two compressors makes it possible to use either or both as required. Six additional Waugh drills were purchased, making a total of 12. Electric haulage has been installed throughout No. 4 tunnel level, this equipment consisting of one 4-ton Jeffrey locomotive and one 25-kw., 250-volt, direct-current generator. Twelve 2-ton ore cars were provided for ore haulage. A crushing plant was installed in the upper terminal building in which is a Blake-type jaw crusher with a 15x30-in. opening. A belt-conveying system, driven by a 50-hp. induction motor, transports the ore from the crusher to the orebins. The aërial tramway is the Otto friction-grip system; it is 6250 ft. long and has a capacity of 100 tons per hr. All mine machinery is operated by electric power purchased from the Truckee River General Electric Company.

Development work during the year has been confined principally to equipping the mine and preparing the necessary chutes, raises, crosscuts, etc., for the economical handling of ore. Drifting for the year amounted to 451 ft.; crosscutting, 491 ft.; raises, 1326 ft., total; 2268 ft. The total amount of tunnels and drifts is now 9466 ft.; crosscuts, 2856 ft.; winzes and shafts, 371 ft.; raises, 2443 ft.; total openings, 15,136 ft. Several hundred feet of diamond drilling done in the North Excelsior claim gave encouraging results and are said to warrant continuing the work.

The mine is being worked by the shrinkage-stope system. After being mined, all ore and limestone are delivered through chutes to ore pockets in No. 4 tunnel level, from whence it is transported, crushed, and carried by aërial tram to the loading terminal near Mason.

WATER

Water for smelting and domestic purposes is secured from several sources all situated on the smeltery property near Thompson. Two hot springs with a combined flow of 40 gal. per min. are one mile east of the smeltery, and by electric pumping supply water to the smeltery. Two flowing wells have also been developed; one is 300 ft. deep and flows 20 gal. per min. and one at 550 ft. flows 120 gal per min. These are 6500 ft. south of the smeltery and the water is pumped to the storage reservoir by electric pumps. A shaft well sunk to 40 ft. depth developed 70 gal. per min.; this is now available but not in use. Water rights have been secured covering the use of the water in a slough extending for two miles across the property. The Gregory ranch property controls valuable water rights from the Walker River.

A large concrete storage reservoir, holding 300,000 gal. has been constructed at a point sufficiently high to provide gravity pressure for circulation. All water from springs and wells is run into this and the circulating water from the furnaces, transformers and compressor is pumped back to the reservoir, thus minimizing losses.

The new smeltery, begun in November, 1910, was completed about Jan. 1, 1912, and the first furnace was successfully blown in on Jan. 6, as recently described in the columns of the JOURNAL.

SINTERING PLANT

A Dwight & Lloyd sintering machine has been installed and will be used in sintering ore fines, concentrates and flue dust. A disk-cable conveyor takes the flue dust from the dust chamber, a distance of about 300 ft. to this sintering machine.

The report shows total current assets, Dec. 31, 1911, $229,035, as against $147,-449, total current liabilities.

The exportation of cryolite (Na_3AlF_6) from Greenland in 1910 was about 6000 metric tons (*Journ. Four Elect.*, Jan. 15, 1912) of which only a few tons came to the United States.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

T. A. Rickard, of London, is in San Francisco.

W. C. DeCamp is at Creede, Colo., in charge of the Creede Triune mines.

Oscar H. Reinholt is now at Pasadena, Calif., and is acting as secretary to C. H. Merritt.

Edward W. Rabb is confined to his bed at Denver, Colo., with an attack of appendicitis.

C. W. Purington has terminated his connection with the Orsk Goldfields, Ltd., in Russia.

William H. Hendrickson is now manager for the Horn Silver Mining Co. at Frisco, Utah.

Julius H. Barnes, of Duluth, Minn., recently made an examination of the Keating mine, in Montana.

Timothy W. Sprague recently returned to Boston from a trip to Colorado on professional business.

Kirby Thomas has returned to New York after a six weeks' trip to Missouri, Arizona and Mexico.

E. C. Felton, president of the Pennsylvania Steel Co., has returned from a trip to the company's mines in Cuba.

Joseph E. Gay, president of the various Stanton copper properties, on Mar. 11, celebrated his 80th birthday in the best of health.

D'Arcy Weatherbe has become a partner in the firm of Bainbridge, Seymour & Co., Salisbury House, London Wall, London, England.

Arthur Fallon, of Denver, Colo., recently made an examination of a low-grade gold deposit in Montana, not far from Virginia City.

Howland Bancroft left Denver March 16 for Los Angeles. After a short stay there he will go to Arizona, returning to Denver early in April.

Henry S. Fleming, for a number of years secretary of the Bituminous Coal Trade Association, has been chosen chairman in place of L. N. Lovell, deceased.

Robert E. Cranston has opened offices in the First National Bank Building, San Francisco, and is prepared to examine and report on mines or undertake their management.

Julian Kennedy, of Pittsburg, has been appointed consulting engineer for the Brier Hill Steel Co., Youngstown, Ohio., and will have charge of the erection of the new plant.

Paul Danckwardt has resigned as superintendent of the plant of the Black Hills Smelting Co., at Galena, S. D. It is reported that friction with the management of the company was the cause.

H. D. Glashan, of the Bureau of Water Resources of the U. S. Geological Survey, is making a trip through northern California obtaining data on water volume of the rivers and smaller streams.

Howard S. Smith, of San Francisco, returned from London on the "Mauretania" this week and proceeded to Austin, Nev., where he is to investigate the affairs of the Austin-Manhattan Mining Company.

John Curnow, superintendent of the Arizona Commercial Co.'s mines, at Clifton, Ariz., was badly injured, Mar. 6, by falling down the Yavapai shaft of the mine. At latest accounts he was slowly improving, but was still in a precarious condition.

J. N. Porter, who opened the first mine in the Iron River district, Menominee Range, and who for several years had charge of all of the mines in both the Iron River and Crystal Falls districts, has assumed charge of the mining operations of the Iron River Ore Co., at its recently opened Buchholtz mine.

F. C. King, for the past 3½ years assistant superintendent of the reduction division of the Cananea Consolidated Copper Co., at Cananea, Sonora, Mexico, has accepted a position on the mtealIurgical staff of the Southern Department of the American Smelting & Refining Co., at Aguascalientes, Mexico.

Frank L. Crobaugh, Cleveland, Ohio, has disposed of that portion of his chemical business which consisted of the sampling and analyzing of iron ore in shipments for storage, for the purpose of adjustment between the buyer and seller, and will not hereafter have the organization for carrying on that class of business. He will continue, however, to operate as an analytical and metallurgical chemist.

Recently prominent officials and engineers of the Inspiration Consolidated Copper Co. have been visiting the company's mines in Arizona, the Inspiration and the Live Oak, and conferring on the plans for future development and construction. The party included W. B. Thompson, president of the Company; W. D. Thornton, vice-president; George E. Gunn, of the Gunn-Thompson Co.; W. H. Aldridge, acting manager; Dr. L. D. Ricketts, consulting engineer; C. H. Repath, consulting construction engineer, and J. L. Mauch, associated with Mr. Repath. Besides the above mentioned, were T. R. Drummond, local manager of the Inspiration mine; J. M. Callow, consulting metallurgical engineer, and F. J. Brule, construction engineer, who will have immediate charge of construction work. Mr. Thornton and Dr. Ricketts have returned to Cananea, and Messrs. Gunn and Thompson have gone to Superior to visit their Magma mine.

OBITUARY

Horace P. Wilcox, a mining engineer, of Hamilton, Ont., died in New York, Mar.13, aged 38 years. He was visiting New York on business.

John Dickey Culbertson died at Sewickley, Penn., Mar. 13, aged 67 years. He was born at Wheeling, W. Va., and had been engaged in the iron trade all his active life. He was for many years connected with the Riverside Iron Works, at Wheeling. For 13 years past he had been vice-president and treasurer of the National Tube Co. He left a widow and two sons.

Federico Stallforth died at Wiesbaden, Germany, Feb. 16. He was born in Germany and went to Mexico about 1860. In 1862 he settled at Parral, Chihuahua, and established the firm of Stallforth & Co., which grew up to be a large dealer in mining machinery and supplies and an important banking house. Some years ago he returned to Germany, leaving the business in charge of his nephews.

Francis Hendricks died in New York, Mar. 17, aged 74 years. He was born in New Jersey and passed all his active life in the copper business. He was a member of the firm of Hendricks Brothers, owners and operators of a copper rolling mill, at Belleville, N. J., which is the oldest plant of the kind in the United States, having been originally installed by his grandfather in connection with the old Schuyler mine—later known as the Arlington—at Arlington, across the Passaic River from Belleville.

George H. Turner, Torrington, Conn., vice-president of the American Brass Co., died in New York, Feb. 29. He was a native of Prince Edward Island and was about 45 years of age. Practically all of his business life was spent in the metal industry. He was at first associated with Wallace & Sons, Ansonia, Conn. When the factory of this firm was purchased by the Coe Brass Co., in 1895, Mr. Turner became connected with that company, where he continued until seven years ago, when he removed to Torrington. He became a strong factor in the business and held the office of secretary of the Coe Brass Co., and was a vice-president of the American Brass Co. since Jan. 1, 1912, when the subordinate companies were taken over by the holding company.

Societies and Technical Schools

American Institute of Mining Engineers —The New York section of the institute will hold a meeting at the Engineering Societies' Building, 29 West Thirty-ninth St., New York, on Tuesday, Mar. 26, 1912, at 8:15 p.m., at which Prof. James F. Kemp will present an illustrated lecture on "Iron Mines in Swedish Lapland."

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Mar. 14—Despite the large amount of oil in storage in California fields the prices for crude at the well are reported to have been increased both by the Standard and the Union to a minimum of 35c. per bbl., an increase of 5c. The offer was made tentatively by the Union, to the Independent Agency, to pay 35c., but the matter had not at last accounts been definitely settled. It is not unlikely that some of the members of the agency foresaw that the Standard must raise its price from the maximum of 30c. for low-gravity, and make a reasonable price for refining oil, which it has done. Whether the agency will take advantage of this and stand out for a price above 35c. from the Union, is not made known, but there is a strong inclination on the part of some of the members to demand 40c. An increase of 10c. on the price of the last year would enable the agency members to make a profit on investment and operation, and in order to continue production without risk of loss to many, that is as low as the price for California crude at the wells should be permitted to go.

Denver

Mar. 15—An additional flow of water has been developed in the deep drainage tunnel and it is thought that the Gold Dollar vein system has been opened. It was struck in a formation of disintegrated granite within the lines of the St. Thomas claim, and developed an additional flow of about 2000 gal. per min. It is estimated that the flow from the portal is now 12,000 gal. per minute.

In addition to the $900,000 order of J. J. Hill and the $500,000 order of the Denver & Rio Grande R.R. for steel, at the works of the Colorado Fuel & Iron Co. at Pueblo, it is now stated that the Santa Fé R.R. will spend $2,000,000 in new shops, a roundhouse and other improvements at Pueblo, and that some of this money will be spent in double-tracking the road between Denver and Pueblo. It is believed here that the revival in the steel industry will renew activities in the Boulder tungsten mines at Nederland.

Snowslides continue to run in the San Juan mining region and on Mar. 14 four men were killed at the Black Bear mine in Ingram basin, by a slide which carried away the mine buildings, boarding house and commissary.

One of the most stubbornly contested fights that was ever waged in this state, for the control of a rich and dividend-paying mine, was brought to a close recently when Allen L. Burris was reëlected president and general manager of the El Paso Consolidated Gold Mining Co., by 1,367,000 votes as against 1,001,000 for the Bernard faction; the shares voted represented all but 82,000 of the issued stock of the company. The report for the year ended Dec. 31, 1911, shows a cash balance on hand of $105,619, and dividends paid for that year, $61,250. The shareholders are to be congratulated on the outcome. This company has contributed about $80,000 to the construction of the deep drainage tunnel.

Butte

Mar. 13—The effect of the policy of increasing the output of copper from the mines of the Anaconda company is demonstrated by the February figures, which show an increase for that month of over 1,000,000 lb., compared with January, and about 3,000,000 lb., compared with December. The output of the Washoe smeltery, and the works at Great Falls, amounted to 27,450,000 lb. of copper for February, compared with 26,350,000 lb. in January, and 24,450,000 lb. in December. The total output of the Butte district during February was 28,950,000 lb., of which the East Butte company produced about 1,200,000 lb., and there was a miscellaneous production of 300,000 lb., not included in the Anaconda or Great Falls figures. It is probable that there will be a further increase in production for March, as February was a short month.

Salt Lake City

Mar. 14—The furnaces smelting ore in the vicinity of Salt Lake, Mar. 15, were as follows: The American Smelting & Refining Co. was running four furnaces at Murray, on lead ore, exclusive of the furnace on matte concentration. This company has accumulated and stockpiled a large tonnage of lead ores, about 45,000 tons. A large portion of this consists of sulphides. The United States Smelting Co. was running five furnaces and treating its usual tonnage. The wet concentrator was being operated, and the Huff electro-static plant was treating about 50 tons per day of zinc middlings. The Garfield copper smeltery, of the A. S. & R. Co., was running two blast furnaces and four or five reverberatories. The tonnage treated varies between 2000 and 2300 tons of ore per day. The reverberatory furnaces, which have been equipped to burn California crude oil, are understood to be giving satisfactory results. It is reported that negotiations are pending between this company and the Salt Air Beach Co. for the purchase of a tract of land along the shore of Great Salt Lake, near Garfield. The International Smelting Co. has three reverberatory furnaces in blast, at Tooele, treating about 600 tons of copper ore per day. The second lead furnace is practically ready to be warmed up. A good-sized tonnage of lead ore has been accumulated. In addition to lead ore received from Park City, the Cœur d'Alene, Bingham, etc., from five to eight cars of tailings per day are being received from the Prince company, near Pioche.

It has been announced that the International company has acquired land in East Chicago, Ind., on which a lead refinery will be built soon.

A new business of direct interest to the mining industry is promised for this section soon. The Utah Powder Co., composed of Utah and Pennsylvania men, has secured a tract of 80 acres, suitable for a powder plant, near Centerville, about 12 miles from Salt Lake City, and expects to begin the manufacture of explosives during the coming spring or summer. Arrangements for raw materials have already been made and machinery will be purchased soon. It is believed that the mining industry in this state and neighboring districts, of which Salt Lake City is a center and source of supplies, will furnish a market for the product.

Orders signed by President Taft, Mar. 4, for the withdrawal of nearly 2,000,000 acres from entry in this state, have been received by the local Land Office. This is the largest temporary withdrawal in the history of the state. The first order calls for the withdrawal of 1,354,240 acres in Emery and Wayne Counties, supposed to contain petroleum. The second order withdraws 620,160 acres supposed to contain coal, in Utah, Carbon, Emery, Sevier and Sanpete Counties. Under the head of temporary withdrawals, all the lands will be closed to entry until the U. S. Geological Survey can make investigation and reclassification. The coal lands in question extend from Colton on the north, along the east side of the Wasatch Range to a point below Richfield. The supposed petroleum lands are southeast and southwest of the San Rafael swell, near the head waters of the Fremont River and tributary streams. Small tracts of land, near Echo, in Summit County, and near Parowan, in Iron County, withdrawn as coal lands, have been restored to entry.

Deadwood, S. D.

Mar. 15—The winter of 1911-12 will go down in history as one of the most severe ever experienced in the Black Hills. The first snow fell about Oct. 15, and up to the present between 8½ and 9 ft. have fallen. At times the temperature has been unusually low, and there has been but little thawing weather since early in December. The entire snowfall of the winter still lies upon the northerly exposed hillsides, something unusual in this section, which is not at a great elevation. A few days ago one of the railroads operating in the Bald Mountain district had occasion to open some track which had not been used during the winter, and in some of the cuts the snow was found to be 17 ft. deep on the track. This heavy snowfall, which will, no doubt, be augmented by the customary April storms, practically assures a splendid water supply for the coming summer.

The destruction of the Mogul mill was a serious blow to the mining industry, throwing nearly 100 men out of employment, including the mill employees and railroad men engaged in hauling to the plant. However, the mill will soon be rebuilt, and meanwhile the mines are being operated at part capacity. The directors of the Mogul company for some time have had under consideration the construction of a plant convenient to one of the properties containing a large tonnage of low-grade ore. This material is too low in grade to stand shipment, and it is believed that such a plant would be able to handle the ore at a profit. In this event the Pluma plant will continue to operate.

Negaunee, Mich.

Mar. 16—The U. S. Circuit Court of Appeals, sitting at Cincinnati, Ohio, has handed down a decree requiring George J. Maas, of Negaunee, to convey to Margaretha Lonstorf, of Milwaukee, Wis., a one-sixth interest in the fee of the Negaunee mine, of which George Maas held a one-half interest. The Negaunee mine is operated by the Cleveland-Cliffs Iron Co., and has an orebody estimated at 14,000,000 tons. The case had been appealed from the decision of Judge Knappen of the U. S. Court in Marquette, whose decision was similar to the one given at Cincinnati. The trouble grew out of alleged misrepresentations made by George Maas to Mrs. Lonstorf, who is his aunt. In 1898 Mrs. Lonstorf and her sister, Mrs. Maas, each owned an undivided one-third interest in the Negaunee mine. George Maas, who has conducted considerable exploration work for iron ore, diamond-drilled the property and added to the holdings by securing options on other tracts lying to the west and northwest Later, when he turned the properties over to the Cleveland-Cliffs Iron Co., it is alleged that he withheld important facts from Mrs. Lonstorf when he paid her $100,000 for her share of the holdings.

Phoenix, Ariz.

Mar. 10—There is apparently a noteworthy awakening of interest in the mining districts of the southwest, due partly to the exclusion of operators and investors from the Mexican fields but chiefly to the rise in the price of copper and to the present availability of the zinkiferous ores. An unusually large number of engineers have been making investigations in the older camps of Arizona and New Mexico and several important negotiations are under way as a result.

Some of the long quiescent districts have been reinvestigated this winter and it is expected that in some cases operations will be renewed. Many of the negotiations pending are for smaller properties, indicating that the general public is again disposed to take a hand in the mining game. At present, more than formerly, the negotiations and investigations are being conducted under the direction and advice of mining engineers of good standing. It is expected that the present year will witness an increase in operations generally throughout the southwest.

Hailey, Idaho

Mar. 14—On the whole, mining conditions in the Wood River district remain quiet. Two determined efforts, backed by capital and competent geological advice, are being made to reopen former producers of silver-lead ore. In one of these operations it has been found that the galena zone, at depth, has been succeeded by contact metamorphic rocks, resulting from the alteration of slates and limestones, through the influence of dikes of acid igneous rock. The interesting part is that the silver and lead have disappeared and that the metamorphic rock carries some free gold, but whether the latter will be found in bodies of economic importance remains to be seen.

Some development like this for the region is possible. There is a general family resemblance among the different ore occurrences, and this has been shown particularly in the manner of the "petering out" of the original galena bonanzas.

Toronto

Mar. 15—The Amalgamated Asbestos Corporation will hold its annual meeting at 11 a.m. on Wednesday, Mar. 20, and at 11:30 a.m. on the same day, a special general meeting of the shareholders will be held to consider a notice of entry made by the Royal Trust Co., trustee for the bondholders, demanding the immediate surrender of the property. A scheme for reorganization has been proposed which will make a drastic cut in the present holdings of the bondholders and shareholders, by which it is hoped to place the company on a more substantial footing.

Hon. W. T. White, Canadian Minister of Finance, delivered the annual budget speech on Mar. 13, in the course of which he announced that there would be no tariff changes in view of the policy of establishing a permanent tariff commission to which all tariff questions would be referred for investigation. He said that while many changes had been asked for, there was no case of such urgency that it could not wait until the commission had pronounced upon it. Further, he stated that he had no proposition to bring forward as regards the renewal of the iron and steel bounties. Earlier in the session it was the general expectation that the strong agitation on the part of the iron and steel interests for the reimposition of the bounties as a temporary measure of relief, would be successful, but the proposal was vigorously opposed by the Western representatives, whose constituents are largely free traders, and was also objected to by a section of the protectionists, who are disposed to prefer an increase in the tariff to the bounty system.

A bill aimed at the coal companies who have brought miners into Nova Scotia to take the places of strikers has been introduced into the Nova Scotia legislature, in the form of an amendment to the Employers Liability Act. It provides that it shall be illegal for any employer to bring any workman into the province during a strike, or lockout, or within 20 days previous to a strike, or lockout, without having given notice to such workman of the strike or lockout.

Porcupine

Mar. 15—A London dispatch states that the first report of the Northern Ontario Exploration Co., of which Bewick, Moreing & Co. are general managers, has been issued. Of the 100,000 issued shares of this company, 40,000 are held in Canada. The operations in Porcupine and elsewhere, since incorporation in January, 1911, yielded £81,481 profit; £40,000 have been written off from the cost price of the shares, since only a limited amount of development work has so far been accomplished. Cash in the banks and cash receivable amounts to £101,000, while other assets were acquired at a cost of £103,000. The whole balance of profit is being carried forward to the current year, for the development of new enterprises in Alaska and other places. From these figures it is evident that the company has disposed of the balance of its holdings of Hollinger stock, since the cash on hand has been increased from £85,000 to £101,000. Not long ago the company had 6000 out of the original 50,000 shares of Hollinger, in the treasury. The company's Porcupine properties have not, so far, developed anything of importance.

The Mining News

The Current History of Mining

Alaska

Reports from Ruby City indicate that the camp will be a busy one during the coming season. A number of new strikes have been made.

Imhoff & Salisbury—A stamp mill has been ordered for this property, and will be transported soon to the proposed mill site in the Moose pass.

Williams-Gentzler—George Leekley, Valdez, who holds an option on this property at the head of Mineral Creek, is contemplating the erection of a stamp mill.

Newsboy—This mine is under lease to McGillvray & Fisher, who will install a small mill and a hoist.

Reliance—A 3-stamp mill is being installed on this property, at the head of Dome Creek. W. L. Spalding is in charge.

McKinley Lake—On this property, in the McKinley Lake district, operations have continued throughout the winter, owing to the mild weather. A tunnel is now in 125 ft., and some ore recently encountered assays $14 per ton.

Herschberger-Buell—Ore from this property is averaging $50 per ton. The mine is under lease to Doctor Overgaurd, of Fairbanks.

Chicagoff—New machinery has recently been installed on this property near Sitka.

Cliff—The machinery at this mine is again in operation and a recent run of three stamps showed a return of $800 in gold. The property is near Valdez; B. F. Millard is president.

Arizona

Gila County

Old Dominion—Lining of the Kingdon shaft with concrete is progressing, and the second section of 145 ft. has just been completed, making a total distance of 305 ft. from the collar that has been finished. About 20 men are employed, working two shifts, and the work advances at the rate of about 12 ft. vertically per day.

Needles—This group of 27 claims, and 13 adjoining claims, have been bonded to W. F. Kennedy, of New York. They are situated four miles west of Miami and are joined on the east by the Barney group, now being explored, and the Montezuma group, which is being churn-drilled by the Southwestern Miami company. They are joined on the south by the Schultze group, under option to the South Live Oak Development company.

Gibson—The Gibson Copper Co. is working the mine, 16 miles west of Globe, with 12 men under T. Henderson. It is preparing to make its second shipment of chalcopyrite ore, since the mine reverted from the Summit Copper Co. The ore comes from the south 400 level on the Pasquale vein and will probably assay over 20% copper. The south drift is being extended on this level and an 8-in. streak of ore is reported in the face.. Drifting has been started on the 500 level, which is reached by a raise from the crosscut on the 600 level. The ore is hauled by teams eight miles to Miami where it is loaded on cars and shipped to the Old Dominion smeltery at Globe.

Globe-Ray—This development company has started work on the property formerly owned by Robert Goodwin, 22 miles southwest of Globe. Sultan & Wayne, and John C. Gibson are interested in the company. The mine was at one time under lease to Thomas Farish and associates, who shipped 400 tons of copper ore to the Old Dominion smeltery, that netted about $10 per ton, but it was closed down in 1907. The claims are traversed by a fissure vein in the Pinal schist, opened by an inclined shaft 280 ft. deep, from which 600 ft. of drifting have been done at four levels. Four men are repairing and unwatering the shaft, preparatory to resuming work in the mine. The equipment consists of an 8x10 steam hoist, a blower, a Cameron sinking pump and the necessary buildings.

Southwestern Miami—Hole No. 2 is 900 ft. deep and is in silicified schist. The 6¼-in. tools and casing are now being used. Hole No. 3 is in schist and is 170 ft. deep. The two new churn-drills will be shipped soon by the Star Drilling Machine Co. All drilling tools will be furnished by the Union Tool Co., of Los Angeles. A car of casing and all necessary cables, etc., has been ordered, also a steel derrick 59 ft. high that can be erected over a hole while the machine is running so that if it becomes necessary to drill an unusually deep hole, it can be accomplished without difficulty or delay. This derrick will be about 20 ft. higher than the one on the drilling machine. Plans have been drawn for the erection of a new warehouse, an addition to the office building, a building for storing samples, and six tent-houses for the workmen.

Barney—Hole No. 1 is 1250 ft. deep and still in the red, hematite-stained schist formation that it encountered at 1100 ft. Water, which was encountered in the dacite formation at a depth of 960 ft., is still flowing out over the top of the casing and is being used by the drilling machines.

Superior & Boston—The east drift on the 12th level on the Great Eastern vein has been advanced 30 ft. from the crosscut and is breasted in chalcopyrite ore for its full width. The width of the ore is unknown as the hanging wall is not exposed. The ore is reported to assay 3½% copper and about 40% iron, the chalcopyrite being imbedded in a gangue consisting mostly of hematite. Discovery of ore in this part of the vein is considered important. The west drift is in 160 ft. and is breasted in shattered, iron-stained diabase. The crosscut, which has been continued beyond the Great Eastern vein to strike the Old Dominion vein, is in 350 ft. The crosscut being driven southeastward from the shaft is in 85 feet.

Five Points—This mine, 15 miles west of Globe, is being developed by seven men under A. T. Hammons, manager for the Manitou Copper Co. The Cracker Jim shaft is being sunk and is now 130 ft. deep. It is proposed to crosscut at 200 ft. The ground is traversed by two fissure veins in the granite porphyry, from which some high-grade copper ore has been shipped in the past.

Pinal County

J. Jay Sullivan, of Phoenix, is negotiating with Pittsburg men for the sale of his vanadinite mine near Florence. The property has been extensively developed.

Yuma County

Bonanza—Reports state that this and the Golden Eagle property, nine miles southeast of Salome, have passed into the hands of H. W. Stevens, W. J. Martin and associates. The mines are in the Harquahala Mountains, and are extensively equipped, including a 40-stamp mill.

Arkansas

Red Cloud—The contract for the new mill for this mine in the Yellville district has been let to F. W. Watts, of Joplin, Missouri.

California

Amador County

Plymouth Consolidated—The Pacific shaft is being unwatered. After pumping to 140 ft., two 550-gal. water skips were put in operation.

South Jackson Mining Co.—This incorporation succeeds the South Jackson Gold Mining Co., and has paid its indebtedness. The sinking of the shaft and the installation of an electric hoist will proceed. V. S. Garbarino will have charge of the surface improvements. The directors are: Jeffry Schweitzer, San Francisco; J. E. Davis, Sutter Creek; F. W. Ruhser, Adam G. Huberty and C. P. Vicini, Jackson.

Calaveras County

Chapman—Work on the new gallows frame has begun, and it is reported that a new mill building will be built. A bank of good gravel has been opened. I. N. Chapman, Alameda, is principal owner. D. Cavagnaro is superintendent.

Kern County

A large deposit of magnesite is reported to have been found recently, about 10 miles east of Mohave, within half a mile of the Sante Fé railway, by J. A. Durnell, B. M. Dennison and others, most of whom are residents of Tehachapi.

Merced County

Yosemite Dredging & Mining Co.—L. K. Vaughan has sued this company for $7800, alleged to be due as salary under an agreement by which Vaughan was to receive 3% of the stock and a salary of $200 per month, for locating the company on the dredging land. He received the stock.

Nevada County

It is reported that the Great Western Power Co. contemplates extending its line to Nevada City and Grass Valley, thus competing with the Pacific Gas & Electric Co. in supplying power to the mines in these and other districts in Nevada County.

Plumas County

Bear—The mine has been taken over by C. Gatewood, of Genessee, and George Howard, of Sacramento, who will develop the property and install a plant for treating the ore, if the results justify. H. G. Goodhue is owner.

Shasta County

The town of Kennett, where is situated the Mammoth copper smeltery, was partially destroyed by fire, believed to be incendiary, on Mar. 10. Only the business section on the east side of the railroad was burned. The loss totaled $82,000, on which there was $33,000 insurance. The smeltery and other property belonging to the Mammoth company were not damaged.

Mount Shasta Power Corporation—This is a new incorporation, organized by J. W. Lilienthal, attorney, of San Francisco, for Eastern men. Electric power will be generated from the Pit River. The articles of incorporation are filed at San Francisco. The capital stock is $10,000,000.

Sierra County

Black Barn—Alfred Burgan has uncovered gravel carrying much coarse gold, on this claim near Downieville.

Croesus—The richest ore struck in many years has just been encountered in a new shaft which is being sunk at this old mine near Alleghany.

Rainbow—Modern machinery, is being installed at this Alleghany mine, preparatory to sinking on the original Rainbow shoot.

Kate Hardy—Another rich find has been made on the Mountain House-Goodyear Bar serpentine belt. W. M. Beggs and associates, of San Jose, are the owners.

Brandy City—A plant has recently been installed to treat the black sand from the tailings of the hydraulic mine. C. H. Gowman, of Los Angeles, representing the company operating this separating device, has just made an inspection of the plant.

Siskiyou County

Mono—The office of the company will be removed from San Francisco to Yreka. A modern cyanide mill and classifier will be installed. The present owners have expended about $37,000 in labor and equipment, and have the mine in good shape for production. The North American Mining & Development Co. is the owner and S. J. Silva is general manager.

Trinity County

Globe Mining Co.—This company has secured a favorable decision in the U. S. District Court, at San Francisco, in the contention with the Trinity County Gold Mining Co., regarding the ownership of mining claims.

Tuolumne County

Stamps are dropping at properties in this county as follows: Harvard, 60; Dutch, 20; App, 60; Jumper, 40; Eagle Shawmut, 100; Clio, 10; and 40 at Black Oak.

Harvard—Sinking the main shaft is progressing and the placing of concrete mortar blocks under the stamps is under way. The installation of a cyanide mill is contemplated. H. W. Gould, Jamestown, is superintendent.

Mexican Diggings—V. H. Kleppinger, of Allentown, Penn., has taken an option on 160 acres of the Prereira ranch, including this old mine, near Jamestown, and expects to interest Eastern men in its development.

Colorado

Clear Creek and Gilpin Counties

McClellan—The creditors of this tunnel company are planning to sell the property to protect claims amounting to about $80,000. The tunnel is driven 7100 ft. and in another 1100 ft. will cut the Freeland vein system. Nearly $500,000 have been expended on the work. George B. McClellan is manager.

Newhouse—Two hundred tons of ore per week are being shipped to the Jackson concentration mill from the Dyke vein, cut by this tunnel. Five tons are concentrated into one, making the product worth $35 per ton. The leading mines are now giving leases on a 10% royalty, and this is stimulating mining.

Cripple Creek District

Ajax—This mine is now one of the leading producers of the Battle Mountain section, and the February output is stated by Supt. E. A. Colburn to have been 48 cars of $28 ore. The mill is said to be handling 3000 tons per month.

Mary McKinney—In February, seven cars of $25 ore were shipped on company account and 18 cars by leasers. From the new level the drift on the vein is in 60 ft., and shows 3 ft. of ore, stated to run $60 per ton.

Elkton—The main shaft is being sunk another lift of 100 ft., giving 170 ft. in height of stoping ground on the main vein.

Gold King—In a winze from the sixth level, lessees George Roerig & Co. are reported to have made a good strike of sylvanite ore.

Granite—The 1000-ft. level, under water for three years, has been drained by the deep tunnel, and Supt. Daniel McCarthy has cut a vein in the Dillon claim, in which a 4-in. streak is said to run as high as 17 oz. of gold per ton, the rest of the vein giving, by assay tests, over 1 oz. of gold per ton.

American Eagles—Five cars of smelting ore, averaging $60 per ton in gold, have been shipped from this mine of the Stratton estate. It is said to be the richest shipment in five years.

Specimen—This Stratton's estate property, under lease to Argall & Johnson, is producing four cars per month of screenings, containing 1½ to 2 oz. of gold per ton.

Pharmacist—The February ouptut from a block on the first level of this mine was five cars of 1-oz. gold ore. The vein is 3 ft. wide. Matha & Co. are lessees. Thomas Ward is manager.

Lake County—Leadville

Siwatch—The breast of the tunnel is 4400 ft. from the portal, and crosscuts are being driven east and west, the latter being 700 ft. long.

Pioneer—This mine, at Empire, produced 110 tons of ore last month that yielded 30 oz. gold bullion, and 50 tons of concentrates worth $40 per ton. In February, 40 tons of ore, running 4½ oz. gold per ton, were shipped from the upper workings of the Empire tunnel, and 20 tons of 3½-oz. gold ore were shipped from the Americus.

Fairplay—In this mine, in Stray Horse Gulch, the new strike has now been driven on for 40 ft., and the ore is 4 ft. thick; two cars shipped are said to average 1 oz. of gold per ton, with some silver and lead.

Ibex—The lessees are shipping steadily and are doing well. From the fourth level, No. 2 shaft, James Barnes has sent out a car of ore that returned 8 oz. of gold per ton. From No. 1 shaft, the Jacketts lease is shipping a car per day of zinc-carbonate ore.

SUMMIT COUNTY

Wilson—The King Solomon Mining, Tunnel & Transportation Co. recently secured this shaft and mill, situated in the flat between the towns of Robinson and Kokomo, and have resumed operations with 50 men.

TELLURIDE

Many mines throughout the state are going to erect their own mills this year. The Wild Boy mine near the Alta mill on Gold King Creek is to have a small mill in the spring and W. M. Herrington, the manager, will install a tramway to connect the mine with the mill. George Pickett, manager of the Suffolk mill, will install a cyanide plant in the spring for the Suffolk and Favorite ores; the San Bernardino, which has 4 ft. of mill ore which will not pay to ship, will have to install a mill for treatment at the mines.

Idaho

COEUR D'ALENE DISTRICT

Gettysburg—Ore has been encountered at this property in the old No. 3 tunnel. The strike shows 7 ft. of good milling ore, containing several streaks of high-grade, shipping ore. The property is in the Mullan district, between the Morning and Gold Hunter mines. Work was resumed recently, the burning of the surface structures during the forest fires in 1910 having stopped all work. The ore has not as yet been encountered in the lower tunnel which is in nearly to the vein.

Alice — The mill is being rapidly overhauled and should be ready to handle ore from the mine in about two weeks. The work of unwatering the mine is progressing rapidly and little trouble is being experienced. The 600 level is now accessible and ore is being hoisted.

Black Horse—The ore at this property continues to improve in the raise being driven. This raise is up 200 ft. above the tunnel level and is entirely in ore, the exact width of which is not known. A drift will be run on the same orebody to determine the length. A shaft will be sunk on another body of ore which has been encountered in the lowest tunnel. The mill cannot handle all the ore now being mined.

Northern Light—The shaft is down 160 ft. Seven men are employed and are making about 2 ft. per day. A crosscut will be started at 180 ft. depth, in the hope of cutting the vein within 50 ft. of the shaft.

Michigan

COPPER

Franklin—During February the mill stamped 9000 tons of rock and received a mineral yield of about 220,000 lb. This company is at present handling about 620 tons of rock per day, but this is to be increased as fast as additional men can be taken on and underground conditions warrant. About 30 drills are in use and will be increased to about 50 when necessary.

Lake—This company is sending the rock from its stockpile to the Trimountain mill; production has not been regularly started but by the time the stockpile has been cleaned up it is probable that things will be in readiness so that production from the underground openings can be maintained.

Osceola—Charles M. Turner has secured a temporary injunction from Judge Weist, of the court at Lansing, restraining the company from holding its annual meeting. Some of the contentions made by Mr. Turner recently were that the management is mining rock from the Kearsarge branches while working the old mines would be more advantageous to the stockholders; also that the proposed changes in the milling of the rock are not warranted and would not be economical in face of the money involved.

Adventure—The crosscut from the 15th level of No. 5 vertical shaft has been extended about 450 ft. from the shaft and is breasted in the horizon of No. 2 lode, from which the rich drill core was extracted; results are being waited with interest.

Seneca—T. L. Chadbourne, Jr., of New York, is soliciting proxies for the annual meeting. The Chadbourne family is reported to own 1121 shares, constituting the largest minority interest, and for that reason are seeking representation on the board of directors.

Victoria—The report for the year ended Dec. 31 shows: Total receipts, $273,008; total expenditures, $210,659; balance of receipts over expenditures, $62,349; surplus previous year, $1694; total surplus, $64,043; copper sold, 1,030,993 lb.; received for copper sold, $126,497; copper on hand, Dec. 31, 272,338 lb. Air-hammer drills were gradually installed during the year, and for the last four months all stoping machines have been air-hammer drills. It is stated that these machines have materially reduced stoping costs.

IRON

The E. J. Longyear company, which is diamond-drilling on land of the Pittsburg & Lake Superior Iron Co., under option to Minneapolis men, has now two drill crews and three drill outfits at work. The drills are situated southeast of the village of Palmer, and the drilling consists in deepening holes that were started several years ago. L. D. Cooper, of the Longyear company, is in charge of the work.

American—At this mine of the M. A. Hanna Co., situated west of Ishpeming, important developments are underway on the lower levels. On the ninth level a drift is being driven west to develop the extensive holdings taken over from George Maas, which were diamond-drilled by him. The shaft is being gradually deepened and will soon be finished to the 13th level; plats are being cut as the shaft is sunk.

Wisconsin Mining Co.—This company has been organized at Iron River, under Utah laws. The company is largely composed of local men, and the officers are as follows: President, James Long; vice-president, A. T. Wooster; secretary, J. B. Weimer; treasurer, Frank Singler; James Pardee and the above officers make up the board of directors. The authorized capital is $100,000, divided into 1,000,000 shares of the par value of 10c. An option has been secured on the MacFarland property, north of Iron River. This 80-acre tract has been explored before, but not thoroughly.

D. M. & M.—Local men in Iron River are exploring these lands in Sec. 33-T. 43-R. 35, and Sec. 4-T. 42-R. 35, situated about two miles west of the Hiawatha mine. Nine diamond-drill holes have been sunk by the McPherson Exploring Co. to depths of from 150 to 200 ft., and ore of fair grade is reported to have been cut; the overburden is shallow, being usually less than 40 feet.

Davidson Ore Co.—At the Gleason shaft of this company, which is a subsidiary of the New York State Steel Co., one mile north of Iron River, a new wooden headframe has been erected. Plans are being made for a new engine and boiler house at the property, to be of brick and steel. Rudolph Ericson is superintendent.

Iron River Ore Co.—This company, which is exploring the Buchholtz property west of Iron River, reports the shaft to be down 367 ft., and that 60 ft. of ore have been cut; a test pit 500 ft. south of the shaft is down 107 ft., with the bottom in ore. A drill is operating on the western end of the property, and the McGreevy Iron Co., which is drilling the quarter-section lying just west of the Buchholtz, reports that ore has been cut. Capt. J. N. Porter is in charge.

Minnesota

MESABI RANGE

St. Paul—This mine at Kewatin, operated by the Corrigan-McKinney company, is commencing repairing operations for the coming season. Drilling will be started by the E. J. Longyear Exploration Co., with three or four drills.

Elizabeth—This company, operating the Elizabeth mine at Chisholm, has been taken over by the Claire Iron Co., which is controlled by the M. A. Hanna Co. The equipment is being overhauled and repaired for active operation this season. The boiler capacity has been doubled, so the property should be in a position to handle all water encountered.

Buffalo—The new 9x12-ft. shaft which is being sunk has been stopped on account of water. The shaft is down about 70 ft. and sinking pumps are being installed, after which the work will be pushed to completion. This shaft will be used for water-discharge lines, steam lines and for carrying the electric power underground, and will not be used as a hoisting shaft either for men or ore. This property is at Hibbing and is operated by the Rogers Brown Ore Company.

Webb—The company has just completed six new houses at the mine; with other indications, this points to a large tonnage for this season. The Shenango Furnace Co. operates this property.

Montana

BUTTE DISTRICT

Tuolumne—During 1911 the company produced 30,499 tons of ore containing 4,261,705 lb. of copper, 96,373 oz. of silver and 45 oz. of gold. Only first-class copper ore was mined and the average copper content was 7.15%, and of silver 3.23 oz. The 3-compartment shaft was sunk 177 ft. to the 1800-ft. level; 1362 ft. of crosscutting, 1196 ft. of drifting and 866 ft. of raising were done during the year. A new hoist was installed and a steel hoist-house and cooling tower erected, also a steel head-frame and 600-ton, frame orebins. No shipments of ore from the new orebody on the 1800 level have been made yet as the ventilation is poor; to obtain good air a raise is being put up from the 1800-ft. level to connect with workings of the North Butte company. After this, mining will be commenced there. At a meeting of stockholders, Mar. 11, the following directors were reëlected: Edward Hickey, Jere Clifford, Daniel Shields, R. J. McDonald, J. W. Pratt, N. J. Bielenburg and Thomas F. Murray, of St. Paul. Mr. Hickey was reëlected president; R. J. McDonald treasurer; Mr. Bielenburg, vice-president; J. J. Harrington, secretary.

East Butte—The improvements in the surface plant are being rapidly carried toward completion, and a few months more should see everything in working order with increased efficiency.

La France—The plan of reorganization provides for the formation of a new company, the Lexington Mines Co., which will purchase at a foreclosure sale the first-mortgage bonds of the present company. Present indebtedness consists of $2,000,000 first-mortgage bonds and $500,000 overdue coupons. The new company will have a capital of 100,000 shares of common stock, par $10, and no bonded or other indebtedness. Of the new stock, 25,000 shares will go to the reorganization managers in payment of property, 25,000 shares will be sold for cash at par and 50,000 shares will be reserved for future sale.

LINCOLN COUNTY

Kalispell-Lincoln—The company expects to install a stamp mill this summer. A mill test recently made is stated to have returned over $100 per ton in gold. J. J. Hibbard, of Libby, is manager and he has been working a force on development for the last year, except for a few weeks in the winter. The mine is about 35 miles south of Libby.

Montana Smelting Co.—William Jennison, receiver for this company, operating the Snowshoe mine, has practically discontinued operations at the property. The owners expect to straighten the company's financial affairs soon. They recently made a payment of $3000 on an extension of the property contracted for last fall. The shaft is the deepest in the district, having been sunk to 500 ft. during the last year.

Hazel T.—The company has men at work in the lower tunnel, which it is expected will soon crosscut the vein at a depth of 300 ft. The property consists of the Shaughnessy Hill group of claims. In the upper workings some silver-lead shipping ore is shown; in places this is 25 ft. wide. The property is eight miles southwest of Libby, and John H. Town, of Libby, is manager.

Victor-Empire—Work is progressing on a new and lower tunnel on this silver-lead property, 12 miles southwest of Libby. Several oreshoots were encountered in the upper tunnel and the showing encouraged the driving of a tunnel lower down the mountain. P. S. Rose, of Libby, is the secretary and is in charge of the work.

Mountain View—W. H. Graham and Paul D. Pratt have taken a bond on this group of claims, in the West Fisher district, 40 miles from Libby. The claims have produced some rich specimens, but have not been extensively developed. Pratt and Graham are visiting the property now and will decide upon operations, but they expect to begin shipping ore during the summer. Some machinery will probably be installed.

Nevada

COMSTOCK LODE

Mexican—According to Superintendent Symmes, the mill, for five weeks ended Mar. 2, handled 1971 tons of ore, the gross assay value, from head samples being $41,766. During February, it is estimated that ore worth $34,497 was treated, and that the net bullion yield for that period will be $26,465. Three bars of bullion, estimated to contain $8000, were shipped to the smeltery last week.

Ophir—On Mar. 12, the company shipped 34 tons of concentrates to the Selby Smelting Co., this having been recovered from approximately 1000 tons of ore treated at the Kinkead mill, being a part of Run 38. The shipment had an assay value of $25,000, or over $700 per ton. It is expected that the entire run, with the bullion cleanup, will net between $50,000 and $60,000. The ore recovery from the mine last week was 250 tons averaging $30.85 per ton.

Con. Virginia—A 3-compartment raise in the ore streak has been started on the 2400-ft. level, and is three sets above the sill floor. Ore of milling grade continues on the west wall of the formation, and is about 3 ft. wide, the vein being 8 ft. wide at that point. The balance of the material is low-grade quartz.

C. & C.—The first shipment of new pumps, consisting of three horizontals, a sinking pump and a motor, were received last week from the Byron Jackson Iron Works, and their installation will be started at once. The first station to be equipped will be the new 2310, and the other pumps when they arrive will be placed on the 2500, and at the head of the old joint Ophir-Mexican winze. The latter pump will aid in pumping out the north-end mines from the 2500- to the 2900-ft. levels.

Ward—Another increased flow of hot water has been secured in the north drift on the 2450-ft. level of the shaft, and is being pumped to the Sutro tunnel drain.

Crown Point—A cleanup was made last week at the Yellow Jacket mill, to which plant ore shipments have been made continuously since Jan. 25. A 25-ton car of concentrate was shipped to the smeltery.

ESMERALDA COUNTY

Atlanta—It is rumored that a new company, to be headed by George Wingfield, is being formed to take over this property, and to conduct development work at depth, this work to be commenced from the deepest available level of either the Goldfield Consolidated or Goldfield Merger Mines Company.

NYE COUNTY

Tonopah ore shipments for the week ended Mar. 7 were: Tonopah Mining, 3550 tons; Tonopah-Belmont, 2250; Montana-Tonopah, 962; Tonopah Extension, 1015; West End, 775; McNamara, 520; total, 9072 tons, and $226,800 estimated value.

Montana-Tonopah—The oreshoot on the 350-ft. intermediate level is 200 ft. long and 15 ft. wide and averages over $100 per ton. It is still lengthening on its eastern and western course and it continues upward for 125 ft. The new vein on the 615-ft. level is 3 ft. wide and is of high grade. The company's monthly profits for the first three months of this year will amount to double the average monthly profits of last year.

Mizpah Extension—The company is sinking a winze from the 1000-ft. level in a quartz vein 12 ft. wide, showing 16 in. of high-grade ore. The north crosscut on the 1150-ft. level is in the footwall side of the eastern extension of the Belmont company's Lillie Belle vein.

Tonopah Mining—The company's net profits for February amounted to $147,933 from 14,326 tons of ore crushed, of an average grade of $19.45 per ton.

Tonopah-Belmont—The main shaft is being retimbered from surface to the 1000-ft. level and production is being maintained through the Desert Queen shaft. In the east drift on the 12th level the Belmont vein shows a full face of smelting ore and the winze from this level, over 100 ft. deep, is all in ore of smelting grade.

Keane Wonder—The mine and mill are closed temporarily on account of the breaking of the cable of the bucket tramway that delivers the ore a distance of one mile to the mill. The cable had been in constant use for about three years. The new one will be about 11,000 ft. long, weigh 26,000 lb. and will cost $7280, which, with rail, freight and wagon haul from Rhyolite will make the cost $8410. Including the cost of construction and loss through delay, the total cost of installing the new cable will be about $10,000.

New Mexico

GRANT COUNTY

Apache Box—A. E. Shirley, of Shelton, Ariz., has filed a suit at Silver City, involving the ownership of these mines in the western part of the county. The mines are said to contain the largest known deposit of gold-bearing ore in New Mexico. Several million tons of $3 ore are claimed for the property.

SOCORRO COUNTY

Much local interest has been aroused in the proposed railroad from Silver City to the Mogollons and on north to the coal fields. Should the project be consummated, the severest handicap of this district would be overcome as the costly 90-mile wagon haul has been detrimental to the economical operation of many of the properties.

Ernestine—The last bullion clean-up for February resulted in 6785 oz.; concentrates for the same period, 7000 lb. The total output for the month was 24,825 oz. of gold and silver bullion and 15 tons of concentrates. The Allis-Chalmers batteries recently placed in commission are operating satisfactorily.

Deadwood—A new crankshaft for the oil engine has been shipped and should arrive in Silver City soon. Everything at the plant will be in readiness to receive it on arrival and it is likely that by Mar. 25 the mill will be in full operation.

Oregon

LANE COUNTY

West Coast—A $6000 brick of gold was brought down from these mines recently by G. T. Hogg, manager, and was forwarded to the assay office in Seattle. The company is one of the largest operators in the district, but at present is operating only the Champion mine, from which this gold was obtained. The mill on the property has been running intermittently all winter. When the snow goes and the Musick mine can be operated, it is expected that the output of the mill will be greatly increased. The ore from the Musick is sent to the Champion mill by an electric tramway over a mile long.

Combination—The Clark brothers, owners of this property, are doing some development work with the view of putting in a new type of mill in the spring. The ore is silver-gold.

South Dakota

BLACK HILLS DISTRICT

Mogul—Fire recently damaged this company's cyanide plant at Pluma to the amount of $75,000. The loss is fully covered by insurance. The sand-leaching department, precipitation room and Moore-filter plant were saved, practically unharmed. The rolls and chilean mills are in fair shape. The crushers, settlers, Dorr thickeners, ore bins, elevators and over half of the building, which was constructed of pine, are a total loss. It is the company's intention to rebuild the plant as soon as settlement is made with the insurance companies. Insurance to the amount of $155,000 was carried. At present 100 tons per day are being shipped to the Lundberg, Dorr & Wilson cyanide plant, at Terry, and other arrangements for treating additional ore are pending.

Homestake—Water was turned into the hydro-electric plant on Spearfish Creek, a few days ago, and on Mar. 15 the full available head was turned into the ditch and through the tunnel, the generating station, pipe lines, etc., being given a good test.

Black Hills Smelting Co.—Paul Danckwardt has resigned as superintendent of this company's property and plant at Galena. Pending the selection of a new superintendent the work of completing the plant is proceeding, and it should be ready to blow in soon, although the directors may decide to postpone starting until later in the spring.

Texas

Explorations for copper near Quanah, Hardeman County, are being made and good results are reported. The ore is in a clay formation which is said to run from 3 to 5% copper. The treatment is a difficult problem.

Utah

JUAB COUNTY

Tintic shipments for the week ended Mar. 8 totaled 205 cars. During February, 134 cars, or approximately 6700 tons, in excess of shipments during February, 1911, were shipped out of the camp.

Chief Consolidated—Shipments are being made from the orebody opened in December. During the last week, 16 cars of good ore were shipped, compared to 14 cars for the week preceding.

Carisa—A cave-in occurred recently from the 200- to the 400-ft. levels in the shaft. Retimbering must be done for this distance.

Dragon Consolidated—The orebody opened on the 600-ft. level is reported to be 12 ft. wide, the ore carrying lead, silver and copper. Only one wall of this body has been found. The ore is thought to be a continuation of the Iron Blossom orebody, and the Dragon has about 4000 ft. of undeveloped limestone country.

Eagle & Blue Bell—A car of lead carbonate ore running 40% lead has been shipped from the 700-ft. level. Shipments during February amounted to over 1000 tons, largely from between the 1200- and 1300-ft. levels. The shaft is below the 1200 level, and drifting will be done to tap the ore below the 1300 level.

Mammoth—During February, 48 cars of ore were shipped, which brought about $850 per car.

May Day—Raising has been done from the 700, and at 60 ft. above the level a new body of silver-lead ore has been opened. So far this has been of milling grade.

Swansea Consolidated—This company expects to ship from 25 to 50 tons of ore per day from its new discovery, the ore carrying iron and silver. This ore will bring about $8 per ton.

Yankee Consolidated—The company finds that it has more dump ore than was at first estimated and there is a sufficient tonnage for two months.

SUMMIT COUNTY

Park City shipments for the week ended Mar. 8 amounted to 4,457,980 pounds.

Ontario—The Crowther Leasing Co., operating on this property, proposes to remodel the old Ontario mill soon and to treat the stope fillings and other low-grade ores from the various levels.

Little Bell—Development is being done in new ground between the 600- and 700-ft. levels. Drifting is being done to the south and east of the section that has produced much high-grade ore.

Daly West—During 1911 the mill was run only one shift per day, because of limited hoisting capacity. The ore mined during the last year came largely from the ground between the 1700- and 1900-ft. levels. During the present year, the 900, 1200 and 1550 levels will be further developed. Development included 8573 ft. of drifts, raises and winzes. In order to avoid damage suits with farmers, the Daly West, Daly-Judge and the Silver King Coalition have bought 700 acres of land for impounding the tailings from the mills of the three companies. Ore sales during the year amounted to 22,918 tons of concentrates, 6237 tons of zinc concentrates, and 7083 tons of crude ore, bringing a total of $821,688.

Washington

Oriole—A contract has been let for sinking another shaft at this mine, at Metaline Falls. The ore is silver-lead, and is of good grade. F. M. Davis is manager.

United Copper—The 75-ton stamp mill at this mine is producing $20,000 per month. Conrad Wolfe, Spokane, is president.

San Poil—Work on the large reduction plant for this mine in Ferry County is progressing, and it is hoped to have it in operation early in the spring. The plant will have a capacity of 125 tons per day.

Canada

BRITISH COLUMBIA

Shipments and receipts in tons in the Boundary district for the week ended Mar. 7 were as follows:

Mine	Week	Year to Date
Granby	23,179	217,891
Mother Lode	8,710	77,045
Rawhide	5,571	17,918
Jack Pot	327	3,517
Athelstan		340
Emma		1,165
Others	476	2,413
Totals	38,596	323,619
Smelteries		
Granby	24,090	263,560
B C Copper Co	14,040	106,039
Total	38,130	369,599

Granby—Toronto dispatches state that operations at the Hidden Creek property continue satisfactory, and that from 10,000,000 to 12,000,000 tons of ore can safely be counted on; further, that the intention is to build a 2000-ton smeltery at Goose Bay.

ONTARIO

Brandon Oil Syndicate—The well at Milton was shot on Mar. 12, and a large quantity of oil thrown 100 ft. into the air. The hole has been capped and the pressure of gas is estimated at 150 to 200 lb. Pumping will begin in a few days, and another well will be drilled about 1200 ft. away. A large number of leases have been secured by operators on lands in the neighborhood.

ONTARIO—COBALT

Cobalt shipments for the week ended Mar. 15 were: McKinley-Darragh, 276,052 lb.; La Rose, 143,119; Temiskaming, 86,450; Townsite, 84,000; O'Brien, 77,568; Buffalo, 59,567; Kerr Lake, 41,543; total, 768,299 lb. Bullion shipments were: Nipissing, 125,746 oz.; Crown Reserve, 15,000; total, 140,746 ounces.

Dr. Reddick—This Larder Lake company has assigned to D. Smiley Sawyer, of Ottawa, being unable to meet current liabilities. The liabilities are estimated at $1200, and the movable assets at $50,000.

Right-of-Way—This company has taken an option for five months on properties in the Silver Mountain district, near Port Arthur. Manager Rex Taylor will soon be placed in charge of development work there.

Nova Scotia—The mill has been shut down, as after six months' trial it has been discovered that the pan-amalgamation of low-grade ores and the cyanidation of the tailings is not profitable. For ores in the diabase the process gave good results, but when material from the Keewatin and conglomerate had to be treated, it was found impossible to secure a sufficiently high extraction. A meeting of the directors will soon be held to determine whether the mill shall be transformed to admit of concentration, or whether the contracts for ore shall be abandoned.

ONTARIO—PORCUPINE

The South Porcupine Board of Trade has issued invitations requesting attendance and participation in a celebration and banquet, to be given under its auspices on Mar. 30, the occasion being the official opening of the stamp mill of the Dome Mines Company.

McIntyre—The mill is running steadily. Three shafts are supplying ore from the 200-ft. level. The management proposes to increase the number of stamps to 40 and to add a cyanide plant.

Pearl Lake—The shaft house on this property is nearly completed. It is 30 ft. square and 60 ft. in height, and will be used for hoisting from the bottom of the main working shaft.

Gold Crest—This company will soon sink its shaft to the 100-ft. level. A plant, comprising two 60-hp. boilers, a 5-drill compressor and electric-lighting equipment, has been ordered.

Swastika—At the annual meeting, held recently in Toronto, details for the future financing of the property were explained. Frank Armstrong, of New York, has contracted to take 145,000 shares of the treasury stock, at 45c. per share. The payments for these are to be extended over one year at the rate of $6800 per month, which will cover the working expenses for that period.

Mexico

CHIHUAHUA

Molly Gibson—This company, owner of the Providencia mines, north of Parral, is planning to erect a 100-ton concentrating mill as soon as conditions permit. Dr. W. C. Spencer, of Boston, is president.

JALISCO

An English syndicate is negotiating through W. J. Lohman, of St. Louis, Mo., for a group of mines near Ahualuco, on the Amparo belt.

OAXACA

Cubilete—This company, in the Taviche district, through its consulting engineer, P. A. Babb, has placed an order with the Fraser-Chalmers Co., of London, for the machinery for a 150-ton cyanide plant. The machinery includes 1500-lb. stamps of the South African type; tube mills of especially heavy construction; Paterson tanks for continuous agitation of the slimed ore, and Oliver filter. Zinc dust will be used for precipitation. Tables for concentration of certain of the heavier ores will be provided. Henry Valle is manager of the company. The Taviche district is producing about 100,000 pesos per week in shipping ore. The Cubilete mill should be ready by Oct. 1, and will be the first mill in the district. The San Juan and San Martin properties will begin construction work soon on their cyanide plants.

SONORA

The exportation of graphite from Mexico through the port of Nogales for the three years ended June 30, 1911, was 7397 tons, worth $285,206. The grade of the material was approximately the same each year, the carbon, all graphitic, constituting 86.75%. The graphite is the product of several mines near La Colorado, owned and operated by an American company. The graphite bed is about 10 ft. thick and the mining is done principally by pick and shovel, almost no explosives being necessary.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Mar. 20—The coal trade is irregular and confused, being affected chiefly by strike rumors. The anthracite situation is unchanged from last week, but it is still believed that some settlement will be reached and that there will be no strike—or at least only a short suspension. The public, however, seems to have gone strike crazy, and dealers are securing all sorts of prices for coal. It is a profitable time for them just now.

In the West the interest is centered in the new wage conference, which meets in Cleveland today. It is not very easy to foresee the results of this meeting, but it is quite possible that an agreement will be reached. Meantime the trade is in a nervous and disorganized state.

Nothing new has developed in the German or the English strikes, but the business situation in Great Britain is growing serious. The French strike has been settled.

The Southwestern Interstate Coal Operators' Association reports shipments for the year ended Dec. 31 as follows, in short tons:

	1910	1911	Changes
Missouri..........	1,901,967	2,447,477	I. 545 510
Kansas..........	3,328,569	4,823,929	I. 1,495,360
Arkansas..........	1,437,739	1,495,379	I. 57,640
Oklahoma..........	2,167,014	2,603,762	I. 436,748
Total..........	8,835,289	11,370,547	I. 2,535,258

The shipments reported to the Association include over 90 per cent. of the coal mined in the four states named.

Lake Coal Rates—In Washington, Mar. 19, the Interstate Commerce Commission decided two cases, involving coal rates from the Virginia and Pittsburg districts to Lake ports. In the Pittsburg case the shippers won a victory, the commission ordering a reduction of the rate on bituminous coal from 88 to 78c. a ton from Pittsburg to Lake ports. In the cases respecting rates from Virginia and West Virginia fields to Lake ports, the commission upheld proposed advances from the Thacker districts from 97c. to $1.06½ a ton, and from the Pocahontas districts from $1.12 to $1.21¼ a ton, made by the Norfolk & Western, on the ground that they did not impose an unjust or unreasonable charge for the service rendered. The commission ordered the Baltimore & Ohio, the Chesapeake & Ohio, and Kanawha & Michigan, however, to maintain their present rates from the Fairmont, Kanawha and New River districts, which are, respectively, 96¾c., 97c. and $1.12 a ton. The proposed advances to $1, $1.06½ and $1.21¼ a ton were not to be justified.

IRON TRADE REVIEW

New York, Mar. 20—The iron and steel markets continue strong in demand. The spring building requirements promise to be large, both in structural steel and the smaller material. Mills are generally busy, and seem to be rather well satisfied with prospects for the coming two or three months. While there have been no marked advances, there is a general firming up of prices, and new orders are no longer placed at the extreme low points.

The more marked feature of the week has been the development of increased demand for pig iron. This extends to foundry iron as well as to steel-making irons. Bessemer and basic have been in large demand from merchant furnaces, and sales of foundry in Eastern territory have increased. In pig iron also there has been a firming up of prices and a withdrawal of concessions.

A setback to the furnaces has been the sharp advance in coke prices. Part of this is due to strike rumors, and it is doubtful if the advance holds, at least to its full extent.

Coal-strike rumors seem to have little depressing effect on the iron trade, and the general belief is, apparently, that a settlement will be effected without any serious delay.

Baltimore

March 18—Exports for the week included 110 lb. selenium to Rotterdam; 394,780 lb. structural steel, 56,412 lb. nickel-steel plates and 802,860 lb. iron castings to Panama. Imports included 300 tons ferromanganese from Rotterdam; 10,775 tons pyrites from Huelva, Spain; 10,900 tons iron ore from Cuba.

Birmingham

March 18—There is a stronger feeling among pig-iron manufacturers here, and prospects are improving. The general disposition is not to increase production yet, though it may soon be necessary. There is some No. 2 iron in the yards yet, but other grades have been pretty well cleared out, and pipe iron is actually scarce. The basis of $10.50 per ton for No. 2 foundry is being firmly held.

The cast-iron pipe foundries keep very busy, and shipments of pipe are being made all over the country. Foundries and machine shops report some improvement in business. Scrap iron is more active.

The blowing in of the second battery of 70 byproduct coke ovens at the Tennessee company's plant, at Corey, in the western part of the Birmingham district, has already had effect as a reduction in cost of coke is announced. There are two more batteries of ovens nearing completion and the byproducts are in good demand.

Chicago

Mar. 18—The tone of the iron market, in general is firmer, but there is no pronounced increase of sales in any particular line. Pig iron continues, so far as the foundry market is concerned, to sell in small to medium-sized lots, with inquiries frequent as to large tonnage requirements for the last half. Sales are gradually extending into the third quarter and last half, but most of the melters are supplied up to the middle of the year, so that they are cautious about closing for further needs, especially at furnace agents' prices. The demand of the sellers is for a premium over the prices now current, $14 on Northern No. 2 and $10.50 on Southern No. 2, Birmingham, which means $14.85, Chicago.

An increase in the demand for quick-delivery iron is noted in some quarters, which means that the melters are operating on very short headway between purchases and actual use of the iron. There seems in general a distrust of the future among the melters, which is met by a firm stand by furnace agents as to deliveries beyond the first half. For such deliveries the selling agents will not shave prices.

Structural material is finding a better market as the spring advances. Building and bridge material is much in demand and prices are firm at 1.28@1.35c. for material up to 15 in., the tendency being to demand the higher prices on orders that require prompt shipment. Railroad business is still light, though increasing. Steel and iron bars both are somewhat stronger, with soft-steel bars selling at 1.25@1.33c., and iron bars 1.15@1.20c. Billets remain quiet at $26.50 for open-hearth forging billets. Plates are in very good demand, with the price 1.30@1.33c. for ¼-in. tank plates; sheets are selling well at unchanged prices. Wire goods are in demand for spring needs.

Cleveland

March 18—It is understood that ore-handling charges on the Lake Erie docks the coming season will be lower.

Pig Iron—The market is more active and stronger, but there is no quotable change in prices.

Finished Material—New orders are coming in more freely on bars, structural steel and some other lines. Prices on bars and plates are firmer. Specifications on contracts are again coming in more freely.

Philadelphia

March 20—A feeling of general expectancy pervades pig-iron circles in this territory. It grows out of the activity in other markets. The heavy shipments in progress are depleting furnace stocks. The encouraging feature this week is a batch of inquiries for steel-making irons. Close inquiries shows that the inquirers have very little iron under contract and have a good deal of work to cover. A symptom indicative of stronger quotations is manifested in the withdrawal in many instances of minimum quotations. Southern makers are canvassing this territory without much result up to date. The general feeling is that by holding a little, makers can easily command 25 or 50c. per ton more. Some furnaces have only a limited supply of coke under contract and coke is hardening in price rapidly. Recent developments have brought out urgent inquiries for additional No. 3 foundry to protect some cast-iron pipe contracts that may be closed within a month. No. 2 X foundry is quoted at $15 @ 15.25 with a chance of $15.50 before Saturday. Basic is $14.50 now with a chance to go higher. Low phosphorus is moving in small prompt-delivery lots at $19, with $19.50 quoted on a recent inquiry.

Billets—Billets are still quoted $22.40 @ 23.40. Business is light notwithstanding consumers have very little stock outside of two or three instances.

Bars—Iron and steel bars do not respond to the general improvement. Quotations 1.22½@1.25c. for ordinary and 1.27½@1.33½c. delivered for refined.

Sheets—All sorts of work into which sheets enter is more abundant than it has been for many months; as a result much business has come in within a week, of an anticipatory character.

Pipes and Tubes—Much new work is now ready for the placing of contracts. Some buyers discover they have delayed too long, as prices have been marked up on all kinds of pipe, notably galvanized.

Plates—The week's business consists mainly of small orders for local building work. Quotations have been advanced on this character of work. The 1.30c. rate holds good on most business.

Structural Material—While the volume of business has been moderate for the week quite a lot of held-up work is now being heard from. A good deal of bridge work is to be undertaken in the Atlantic coast states very soon, mostly in small orders. A large export order has been secured for Asiatic delivery.

Scrap—More interest is shown in the scrap market than for many weeks. Prices continue low and decidedly in buyers' favor. Dealers say they have not gotten rid of much stock but they are anxious to, as they have a large supply of material which they want room for as well as buyers.

Pittsburg

Mar. 19—Interest in pig iron continues in the local market. There have been no large single lots sold, but there has been continued small buying, with prices still tending to advance.

The coal situation has become very serious. Evidently there was much less stocking than was the case prior to the suspension of two years ago, and relatively fancy prices are now being paid, up to $1.60 for slack and $1.75 for mine-run, at mines, Pittsburg district. Connellsville furnace coke has been selling at $2.10 for a week. Prices are likely to advance, rather than decline, and a suspension of mining is, of course, a certainty. The effect will be to curtail iron and steel production, but consumption is likely to be affected still more, and the net result will probably be unfavorable to the iron and steel industry.

Demand for finished-steel products has increased, on the whole, but in some departments has decreased. Specifications for steel bars, for instance, are altogether unsatisfactory, the agricultural implement interests not taking hold as expected. Evidently they are thinking more of politics than of good crops. Taken altogether, the finished-steel situation is not nearly as good, in the second half of March, as was expected even so late as February. Prices are almost wholly unsatisfactory, the whole situation in a nutshell being that prices do not respond to demand as has always been the case in the past.

Bars are quotable at 1.10c., plates at 1.10@1.15c. and structural shapes at 1.12½@1.15c. Some of the mills are quoting decidedly higher prices than others, and it is the lowest-priced mill which makes the market for all who want to sell. There is considerable comment upon the fact that while the Carnegie Steel Co.'s stiffness in the matter of structural shape prices has been well advertised, the American Bridge Co. continues to sell fabricated steel at very low figures, the net result being that the United States Steel Corporation is as actively in the market for structural business as ever.

Pig Iron—There has been continued buying of bessemer iron in relatively small lots, chiefly by the steel-casting concerns. In the past week half a dozen lots have been taken, ranging from 1000 to 2500 tons, and aggregating over 10,000 tons, all at $14.25, Valley, to which the market advanced after the recent large sales of about 125,000 tons on the basis of $14, Valley. Basic iron has sold at $13, Valley, and at a trifle above that price, in moderate-size lots. The American Rolling Mill Co. is inquiring for 10,000 tons and the Colonial Steel Company for 5000 tons. The Wickwire interest at Buffalo took 12,000 tons of basic on the Algoma Steel Co.'s large inquiry, the balance of the iron being still unplaced. A sanitary-ware interest has been buying local iron, for second quarter, having lately bought about 2500 tons of Southern for a plant at Louisville. We quote: Bessemer, $14.25; basic, $13 for early delivery and $13.25@13.50 for extended delivery; No. 2 foundry, $13.25; malleable, $13@13.25; forge, $12.75, all at Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market continues very quiet, with prompt and forward quoted at $41, Baltimore.

Steel—Mills making openhearth steel in this district are still desirous of booking business; while bessemer steel is almost out of the market. There is not much inquiry, except that a few sheet and tin mills have tentatively sounded the market for second half, without any business resulting. We quote f.o.b. Pittsburg district mill: Bessemer billets, $20; sheet bars, $21; openhearth billets, $19.25@19.50; sheet bars, $19.50@20; f.o.b. Youngstown district mill bessemer billets, $19.25@19.50; sheet bars, $20@20.50 per ton.

Sheets—Business is coming in more freely, and a number of important sheet interests are practically filled to July 1. This is particularly the case with mills making specialties, such mills quoting relatively high base prices and full extras for all special finishes. There remain a few mills quoting very low prices on ordinary sheets: Black, 1.80c.; galvanized, 2.80c.; blue annealed, 1.35. The price quoted on black is occasionally shaded. A meeting of the Association of Sheet & Tinplate Manufacturers will be held in Pittsburg on Friday to discuss general trade conditions.

St. Louis

Mar. 18—The coal troubles are seriously affecting the iron market, and the general expectation of a strike and stoppage of supplies is holding back buyers. Prices are nominally unchanged, but sales have been few.

Iron Ore Trade

The movement of Lake Superior iron ore from Lake Erie docks to furnaces in February was only 39,259 tons. These light shipments were due to the severe weather. There were many interruptions to railroad traffic, and the ore piles were frozen so deeply that it was almost impossible to handle them.

It is understood that the unloading charges on iron ore at Lake Erie docks are to be reduced from 15c. per ton, last season's rate, to 8 or 9c. The old charge was considered too high. Other changes in ore rates are said to be under consideration.

British Ore Imports—Imports of iron ore into Great Britain in January were 681,240 long tons in 1911, and 578,409 in 1912; decrease, 102,831 tons. Imports of manganese ore were 64,858 tons in 1911, and 33,253 in 1912; decrease, 31,605 tons.

Foreign Iron Trade

Swedish Iron Trade—Iron and steel production in Sweden for the full year was as follows, in metric tons:

	1910	1911	Changes	
Pig iron............	604,300	633,800	I.	29,500
Wrought iron......	150,500	146,700	D.	3,800
Converter ingots...	97,900	93,800	D.	4,100
Open-hearth ingots	370,700	364,400	D.	6,300

In 1911 there were in operation 96 blast furnaces, 212 puddling furnaces, 18 bessemer converters and 52 open hearth furnaces. Exports for the year were as follows:

	1910	1911	Changes	
Pig and scrap......	143,500	158,400	I.	14,900
Ingots, blooms, etc.	70,400	67,400	D.	3,000
Bars and wire rods.	150,700	169,300	I.	18,600
Other finished.....	56,700	23,200	D.	33,600

The total exports were 421,300 tons in 1910, and 418,300 in 1911; a decrease of 3000 tons.

British Blast Furnaces—On Dec. 31 there were 318 furnaces in blast in Great Britain. The average number active in the last quarter of 1911 was 314. There were 11 new stacks building at the close of the year.

METAL MARKETS

New York, Mar. 20—The metal markets showed some spectacular movements during the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Jan. 1912..	$ 1,915,202	$ 5,165,543	Imp.	$3,250,341
" 1911..	923,676	9,540,830	Imp.	8,617,154
Year 1912..	1,915,202	5,165,543	Imp.	3,250,341
" 1911..	923,676	9,540,830	Imp.	8,617,154
Silver				
Jan. 1912..	6,027,905	4,358,009	Exp.	1,669,896
" 1911..	5,651,076	3,551,426	Exp.	2,099,650
Year 1912..	6,027,905	4,358,009	Exp.	1,669,896
" 1911..	5,651,076	3,551,426	Exp.	2,099,650

Exports from the port of New York, week ended March 16: Gold, $47,500; silver, $1,396,215, chiefly to London. Imports: Gold, $786,225, principally from France and Mexico; silver, $108,945, largely from Central America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Demand for India has declined a little. In New York more gold was taken for shipment to Argentina.

The net imports of gold into India in February were £5,174,600, being more than double those reported in February of last year.

Iridium—There is nothing new in this market. The price is $64 per oz., New York.

Platinum—The market continues quiet, with only a moderate business. We continue to quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Mar. 16, that prices are unchanged at 10 rubles per zolotnik for crude metal, 83 per cent. platinum at Ekaterinburg, and 38,500 rubles per pood for the same grade at St. Petersburg—equal to $37.60 and $37.73 per oz., respectively. These prices are nominal and subject to negotiation. The stock of platinum held by speculators is rather large, but they are not pressing sales, as higher prices are expected.

Silver—The market is without feature. Price continues steady and no great fluctuations are indicated. A corner in India for the next settlement has advanced the price of spot silver, but the future quotation indicates that the general situation does not participate in this local settlement price in India.

SILVER AND STERLING EXCHANGE

Mar.	14	15	16	18	19	20
New York....	58½	58⅜	58¼	58⅜	58½	58½
London...	26 15/16	26⅞	26 13/16	26⅞	26 13/16	26 15/16
Sterling Ex..	4.8720	4.8720	4.8720	4.8735	4.8740	4.8735

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

LONDON

Mar.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
14	64 13/16	65 9/16	68¾	191¼	187¾	15 15/16	26⅜
15	65 1/16	65¾	69	191¾	188¼	16 1/16	26¼
16	....	......	......	......	......	......	......
18	64 13/16	65 9/16	69	191½	187¾	16 1/16	26
19	65	65 11/16	69	191¼	187⅞	16 3/16	26
20	65⅞	66 9/16	70	189¾	187	16¼	26

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

NEW YORK

Mar.	Copper		Tin	Lead		Zinc	
	Lake Cts per lb.	Electrolytic Cts. per lb	Cts. per lb	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
14	14½ @14¾	14.40 @14.45	42⅜	4.00	3.97½ @4.00	6.65 @6.75	6.50 @6.60
15	14½ @14¾	14.42½ @14.47½	42⅜	4.00	3.97½ @4.00	6.55 @6.75	6.40 @6.60
16	14½ @14¾	14.45 @14.55	42⅜	4.00	3.97½ @4.00	6.65 @6.65	6.40 @6.50
18	14⅝ @14¾	14.55 @14.60	42¼	4.00	3.97½ @4.00	6.55 @6.65	6.40 @6.50
19	14⅝ @14¾	14.55 @14.70	42¼	4.10	4.07½ @4.10	6.50 @6.60	6.35 @6.45
20	14⅝ @14⅞	14.65 @14.75	42	4.10	4.07½ @4.10	6.50 @6.60	6.35 @6.45

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—At the close of our last report all of the principal agencies were asking 14.60@14.62½c., delivered, usual terms, for electrolytic copper and the market, although dull, had a firm undertone. On Mar. 14 a good demand, especially from domestic sources, developed, which in the course of the next day or two cleaned up all of the copper that the agencies were willing to sell at their previous price. The demand continuing, the price naturally advanced, but in this movement there was considerable irregularity, both among the agencies and among transactions during the same day. Some agencies quoting the top price were able to realize it while others were selling for less. On Mar. 18 the market became very well established on the basis of 14¾c., delivered, usual terms. On Mar. 19 some rather large business was done at the previous price during the morning. In the afternoon certain sellers advanced to 14⅞c., delivered, usual terms, and consummated some important business at that price, while others were offering at ⅛c. less up to the close of the day. On Mar. 20, however, the market became 14⅞c. all around, with sales at that price. Altogether the transactions of the week have run to a fairly large total. The circumstances have been rather peculiar inasmuch as several sellers of Lake copper have reported but insignificant business in that kind of metal, which has been offered at 14¾c. right along. Europe participated in the movement of this week, but contrary to the usual practice did not take the lead. The close is strong at 14⅝@14⅞c. for Lake copper; 14.65@14.75c. for electrolytic copper in cakes, wirebars or ingots, while casting copper is quoted nominally at 14¼@14½c. as the range for the week.

The London standard market remained practically stationary until Mar. 19, but on Mar. 20 a sharp advance took place, the close being firm at £65 17s. 6d. for spot, and £66 11s. 3d. for three months.

Copper sheets have been advanced 1c. and are now 20@21c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire has also been advanced to 15¾c. base, carload lots at mill.

Copper exports from New York for the week were 3533 long tons. Our special correspondent gives the exports from Baltimore at 1613 tons.

Visible stocks of copper in Europe, Mar. 15, are reported as follows: Great Britain, 36,370; France, 6610; Rotterdam, 3500; Hamburg, 7600; afloat from Chile, 2450; afloat from Australia, 5500; total, 62,030 long tons. This is a decrease of 980 tons from the Feb. 29 report.

Tin—The market advanced on Mar. 14 on the London Metal Exchange and held this advance fairly well throughout the week. The frequent and violent fluctuations of former times seem, since the new contract went into effect, to have become a thing of the past, and dealings at the Exchange have dwindled to almost insignificant proportions. The New York Metal Exchange is benefiting greatly by this state of things, as transactions in Straits tin—and these of fair proportion—are now almost of daily occurrence. Consumers in this market are buying good-sized quantities for future delivery. The market, both in London and here, closes lower but steady at £189 15s. for spot, and £187 for three months, and 42c., respectively.

Lead—The A. S. & R. Co. having evidently relieved itself of surplus supply, advanced its price to 4.10c., New York, on Mar. 19, but even at the advance outside sellers have not seen fit to enter the market. The situation at St. Louis is peculiar, because some buyers seem willing to pay more than the price at which the leading seller for the moment is supplying its customers, and also because of the disappearance of the ordinary difference between the New York and St. Louis price, which adds to the mystery of the situation in this metal. The close is firm at 4.07½@4.10c., St. Louis, and at 4.10c., New York.

The scarcity of lead in London, to which reference was made last week, is becoming still more acute, and prices have again advanced, the close being cabled at £16 5s. for Spanish lead, and 2s. 6d. more for English.

Spelter—The market for this metal during the week of Mar. 13-20 has been unsettled at a material recession in price, but probably it has not become so weak as appears on the surface. There were signs of a reversal a week ago when some sellers who had been able to collect some spelter available for early delivery by operations releasing previous sales of bonded spelter, and otherwise, found that they were unable to realize on tonnages the fancy prices obtained for occasional carloads. On Mar. 14, a rather large tonnage of April-May spelter was sold at about 6.55c., St. Louis. On Mar. 15, a leading buyer sounded the market with requests for offers on a round lot of April spelter and, so the story goes, was offered so much that he withdrew to observe things. Since then, spelter for early delivery in rather large quantities has been offered down to 6.45c., and lower. The events of the week have put this market more nearly on an even keel, and the spread in prices according to deliveries has largely disappeared, although now and then a premium is still realized upon occasional carloads required for immediate shipment. The close is unsettled at 6.35@6.45c., St. Louis, and 6.50@6.60c., New York.

The London market is weaker, the close being cabled at £26 for good ordinaries, and £26 5s. for specials.

Zinc dust is quoted at 7⅛@7¼c. per lb., New York.

Base price of zinc sheets is $8.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

At the annual meeting of the Granby Mining & Smelting Co., in St. Louis, it was voted to construct a zinc smelter at Roselake, a suburb of East St. Louis, where the company recently acquired property. The following officers and directors were reëlected: Elias S. Gatch, president; Norris B. Gregg, vice-president; Kennett Burns, secretary, of Chicago, H. O. Edmonds, of Chicago, and J. H. Grover.

Other Metals

Aluminum—The market is quiet and prices are off a little. Current quotations are 19@19¼c. per lb. for No. 1 ingots, New York. A recent German quotation is 12 marks per 100 kg., equal to 12.98c. per lb. for No. 1 ingots.

Antimony—Business is a little better. Cookson's has been advanced to 7⅝c. per lb. Other brands remain unchanged, Hallett's being quoted at 7⅜@7½c., while 6¾@6⅞c. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is firm and rather active, but current prices are a little lower. The New York quotation is $45 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $44.50 for domestic orders, and $42 for exports. The foreign market is stronger, and the London price has been advanced 5s., to £8 12s. 6d. per flask, with £8 10s. quoted from second hands.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 16—The base price paid this week for 60% zinc ore was $53@54 per ton. The base price paid for 80% lead ore was $50@51 per ton; the highest price paid was $52 per ton.

SHIPMENTS, WEEK ENDED MAR. 16

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Shullsburg	1,079,600	87,400	....
Mineral Point	973,140	.....	....
Galena	650,800	. ..	....
Benton	619,100	....	261,300
Hazel Green	509,700	....	....
Platteville	452,850	. . ...	......
Cuba City	219,140	83,570	225,300
Harker	78,990	....	....
Linden	66,750	....	64,200
Highland	59,600	....	....
Total	4,709,170	170,970	550,800
Year to date	40,822,680	1,149,140	3,636,780

Shipped during week to separating plants, 1,348,370 lb. zinc ore.

Joplin, Mo., Mar. 16—The highest price paid for zinc-sulphide ore was $58, the base per ton of 60% zinc was $52@55. Zinc silicate sold on a base of $25@28 per ton of 40% zinc. The average price, all grades of zinc, is $50.30. As high as $54.50 per ton was paid for lead, but later purchases were shaded to $52. The average price, all grades of lead, was $53.50 per ton.

SHIPMENTS, WEEK ENDED MAR. 16

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,138,550	....	850,060	$130,575
Joplin	1,940,160	......	273,510	59,765
Duenweg	1,106,100	......	76,400	30,820
Alba-Neck	1,056,100	......	......	29,570
Oronogo	841,630	......	62,320	17,877
Galena	494,860	......	70,400	14,765
Cave Springs	423,200	......		11,000
Granby	63,070	495,760	[illegible]690	9,180
Miami	254,060	.....	[illegible]7,690	8,200
Quapaw	252,410	......	......	6,310
Spurgeon	121,330	170,000	......	5,585
Carl Junction	179,970	......	......	5,130
Carthage	194,610	......	.	5,059
Jackson	164,830	......	.....	4,120
Wentworth	64,270	......	......	1,606
Lawton	60,470	......	.....	1,570
Stott City	59,080	......	......	1,477
Aurora	......	66,000	......	985
Totals	11,414,700	731,760	1,423,870	$343,594
11 weeks	107,624,970	6,133,660	16,884,980	$3,014,102

Blende val., the week, $294,238; 11 weeks, $2,461,562
Calamine, the week, 11,255; 11 weeks, 85,769
Lead value, the week, 38,101; 11 weeks, 466,771

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41 85	$44.90	$40 55	$43.54	$55 68	$58.92
February	40 21	45.75	39 16	43 31	54 46	52.39
March	39.85	......	38.45	......	54 57	......
April	38.88	......	37.47	......	56 37	......
May	38.25	......	36 79	......	55.21	. ....
June	40.50	......	38.18	......	56 49	......
July	40.75	.... ..	38 36	......	58 81	......
August	42 50	......	41 28	......	60 74	......
September	42 63	......	41 29	......	59 33	......
October	42.38	......	40.89	......	54.72	......
November	45.40	......	43.25	......	57 19	......
December	44.13	......	40.76	......	62 03	......
Year	$41.45	......	$39.90	.....	$56.76	......

Note—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Report of $58 base price for zinc-sulphide ore was made. Such price was paid for under-grade ore heavy in iron, and out of the class of ore upon which prices are quotable. Buyers of ore heavy in iron frequently make these freak bids rather than tell the producer no deduction will be made under 4% of iron content. One lot of ore sold last fall at an equivalent of $60 base, and if such quotations were to be used as the market there would be no regularity of quotations and no dependence could be placed upon them.

Other Ore Markets

Manganese Ore—The price for domestic ores, as fixed by large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent., or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess phosphorus and silica.

These prices are put at a high level to encourage exploration for manganese deposits in the United States. Most of the manganese ore used here is imported—from India, Brazil and Russia—and is bought abroad on the open market, usually at prices below those quoted.

The latest quotations in Great Britain are: Indian or Brazilian ore, 50 per cent. manganese, 19@19½c. per unit; 45 per cent., 17½@18c. Caucasian, 50 per cent., 16@16½c.; 48 per cent., 15½@16c. per unit.

Chemicals

New York, Mar. 20—The general market shows some increase in activity.

Copper Sulphate—A good demand is manifest. Prices are unchanged at $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Nitrate of Soda—The spring business is opening. A heavy demand in Europe and high ocean freights have contributed to an advance in prices. Quotations are now 2.32½c. per lb. for spot nitrate, and 2.30c. for futures.

Arsenic—Spot supplies are still scarce. Mexican production is limited and Canadian shipments are very slow in coming forward. Quotations are higher at $3@3.12½ per 100 lb. for white arsenic.

Sulphuric Acid—The Interstate Commerce Commission has decided that present rates for the transportation of sulphuric acid in carloads from the Tennessee Copper Co.'s plant, Copperhill, Tenn., to certain points in North Carolina, South Carolina, Georgia and Florida, are unreasonable, and lower maximum rates are prescribed for the future. Reparation is awarded for past overcharge.

Petroleum

Exports of mineral oils from the United States in February were 99,219,249 gal. For the two months ended Feb. 29 the total exports were 225,392,186 gal. in 1911, and 231,409,456 gal. in 1912; an increase of 6,017,270 gal., or 2.7% this year.

MINING STOCKS

New York, Mar. 20—On Mar. 14 there was an upward turn on the Exchange. The Curb was active on industrial stocks, but mining stocks were slow and irregular.

Mar. 15 there was active trading on the Exchange, but very slight changes in quotations. On the Curb trading was slow and mining shares showed few changes. There were sales of Homestake at $86.50@89.50 per share.

Mar. 16 there was some reaction on the Exchange and quotations were generally lower. On the Curb business was irregular. The copper stocks were in some demand at fractional recessions, while other mining stocks were firm, but not active.

Mar. 17 the Exchange showed recovery from the reaction of the previous days. Amalgamated Copper touched 74½, while Steel Common also gained. On the Curb coppers were rather quiet, with the exception of Ray Central. Porcupines were active, and other mining stocks sold fairly well. Standard Oil stocks and Lehigh Valley Coal Sales Co. advanced.

Mar. 19 the advance on the Exchange was fairly well held. On the Curb there were active dealings in Lehigh Valley Coal Sales Co. at an advance. Mining stocks were rather slow, with the exception of the coppers. On Mar. 20 the Exchange continued generally firm, but the Curb was rather irregular.

Boston, Mar. 18—After a brief period of dullness and a downward tendency in mining shares the market has come back again and now shows a fair amount of activity as well as strength. The persistent strength of Amalgamated shares has considerable to do with this for that issue is selling at a new high on the present move.

The feeling is growing that copper shares are in for a great big broad active time and at material advances. The fact that big interests do not attempt to create a bull market in copper shares acts as a deterrent so far as the outside public is concerned.

The soliciting of proxies for the annual meeting of the Mayflower Mining Co. has resulted in giving the brokerage house of Fitzgerald, Hubbard & Co. control through the St. Mary's Mineral Land Co.'s ownership of 25,000 shares of Mayflower. These two interests will amalgamate and throw over 60,000 of the

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Dec.	Jan.	Feb.
Alaska shipments.	4,995,008	3,701,010	....
Anaconda	23,500,000	26,350,000	27,450,400
Arizona, Ltd..	3,100,000	3,200,000	3,020,000
Balaklala	....	....	....
Copper Queen......	8 365,265	6,748,264	6,046,860
Calumet & Ariz....	4,486,000	4,544,000	4,452,004
Detroit....	1,969,313	1,941,970	2,008,370
East Butte..	1,498,000	1,520,000	....
Mammoth.........	1,721,404	1,665,319	....
Mason Valley......	....	600,000	....
Miami	2,500,000	2,600,000	....
Nevada Con.....	4,679,674	6,309,228	....
Old Dominion......	2,610,000	2,044,000	2,039,000
Ray...............	2,660,000	2,476,945	2,140,000
Shannon...........	1,255,858	1,550,000	1,300,000
South Utah...	267,514	189,678	....
United Verde*	2,000,000	2,000,000	....
Utah Copper Co...	9,039,557	8,156,612	....
Lake Superior*....	17,500,000	17,500,000	19,000,000
Non-rep. mines*	8,500,000	8,400,000	....
Total production.	100,647,593	101,497,026	....
Imports, bars, etc..	21,101,256	31,790,590	....
Total blister..	121,748,849	133,287,616	....
Imp. in ore & matte	5,159,997	8,340,740	....
Total....	126,908,846	141,682,356	....
Brit. Col. Cos.:			
British Col. Copper	....	....	....
Granby	....	1,607,558	....
Mexican Cos.:			
Boleo..............	2,645,640	2,315,040	2,204,720
Cananea	3,706,000	3,552,000	....
Moctezuma	2,864,464	2,732,867	2,687,712
Other Foreign:			
Cape Cop., S. Africa	701,120	784,000	786,440
Kyshtim, Russia...	1,570,000	....	....
Spassky, Russia...	721,280	795,200	....
Famatina, Argen..	217,280	172,480	....
Tilt Cove, Newf'd..	....	153,257	109,059
Exports from:			
Chile..............	5,824,000	8,064,000	6,720,000
Australia	11,200,000	7,056,000	7,164,000
Arrivals in Europe from other count.†	16,331 840	13,144,320	10,868,680

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
II, 1911.........	109,828,297	50,518,998	45,111,019
III..............	130,532,080	66,080,789	59,081,127
IV........	118,085,223	52,407,650	62,129,599
V..............	126,962,544	64,543,963	61,978,557
VI..............	124,554,312	61,655,561	71,460,519
VII...........	112,167,934	56,982,582	74,880,658
VIII.......	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X..............	118,255,442	64,068,307	60,084,349
XI....... ...	111,876,601	68,039,776	67,049,279
XII...........	122,896,697	65,988,474	79,238,716
Year, 1911.	1,431,938,338	709,611,605	754,902,233
I, 1912..	119,337,753	62,343,901	80,167.904
II..............	116,035,809	56,228,368	63,148.096

VISIBLE STOCKS

	United States	Europe	Total
III, 1911........	156,637,770	233,385,600	390,023,009
IV....	162,007,934	223,014,400	385,022,434
V..............	165,555,908	212,284,800	377,840,708
VI.	165,995,932	202,540,800	368,536,732
VII..	157,434,164	195,932,800	353,366,964
VIII...........	137,738,858	191,891,840	329,630,698
IX.............	133,441,501	191,228,800	324,670,301
X..............	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912.	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III......	62,939,988	141,142,400	204,082,388

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

100,000 shares against the Fay management. Fluctuations of this stock, as well as of Old Colony, have been within narrow limits the past week.

Butte & Superior has risen almost $3, during the week close to $28 per share.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1	....	$0.005
Algomah, Mich	Jan 22		1 00
Alpha Con, Nev	Feb. 21	Mar. 13	0 05
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah	Feb. 6	...	0.01
Boston Ely, Nev	Jan. 18	....	0 50
Challenge, Nev	Mar. 5	Mar. 26	0 05
Crown Point, Nev	Mar. 28	Apr. 19	0 05
Crown Point, Utah	Feb. 15	Mar. 11	0 005
Ely Con., Nev	....	....	0.05
Exchequer, Nev	Feb. 14	Mar. 6	0 05
Hancock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0 05
King David, Utah	Feb. 13	Mar. 6	0 005
Lehi Tintic, Utah	Feb. 29	....	0 01½
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
Ojibway, Mich	Jan. 10	....	1 005
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0 10
Sierra Nevada, Nev	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz	Jan. 15	....	1 00
Tintic Central, Utah	Mar. 9	Mar. 27	0.005
Tintic Standard, Utah	Jan. 8	Feb. 5	0 00
Union Con., Nev	Feb. 20	Mar. 12	0 15
Utah, Nev	Jan. 19	Feb. 9	0.05
Wabash, Utah	Mar. 19	Apr. 10	0.10
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York 1910	New York 1911	New York 1912	London 1910	London 1911	London 1912
January	52.375	53.795	56 260	24.154	24 865	25 887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	...	23.690	24.324	......
April	53.221	53.325	...	24 483	24.595	......
May	53 870	53.308	.....	24 797	24.583	...
June	53 462	53 043	....	24 651	24 486	...
July	54 150	52 630	...	25.034	24.286	...
August	52 912	52.171	....	24 428	24.082	...
September	53 295	52 440	......	24.567	24 209	..
October	55 490	53.340	..	25.596	24.594	...
November	55 635	55 719		25 680	25.649	..
December	54 428	54 905	...	25.160	25.349	..
Year	53 486	53 304	.	24 670	24 592	...

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1911	New York Electrolytic 1912	New York Lake 1911	New York Lake 1912	London, Standard 1911	London, Standard 1912
January	12 295	14 094	12 680	14 337	55.600	62.760
February	12.256	14 084	12 611	14.329	54 974	62 893
March	12 139	...	12 447	.....	54 704	..
April	12 019	.....	12.275	..	54 034	.
May	11 989	......	12 214	.	54.313	..
June	12 385	......	12 611	..	56 365	.
July	12 463	.....	12.720	..	56 673	.
August	12 405	...	12 634		56 266	..
September	12 201	...	12 508		55 253	..
October	12 189	..	12 370	.	55 170	
November	12 616		12 769		57 253	
December	13 552		13 768		62 068	
Year	12 376		12 634		55.973	

New York, cents per pound. London, pounds sterling per long ton of standard copper

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	
February	41 614	42 962	August	43 319	
March	40 157		September	39 755	
April	42 185		October	41 185	...
May	43 115		November	43 125	....
June	44 606		December	44 655	..
			Av Year	42 281	..

Prices are in cents per pound.

LEAD

Month	New York 1911	New York 1912	St. Louis 1911	St. Louis 1912	London 1911	London 1912
January	4 483	4 435	4 334	4 327	13 009	15.619
February	4 440	4 026	4 266	3 946	13 043	15 738
March	4 394	.....	4 238	..	13 122	..
April	4 412	.	4 262		12 889	.
May	4 373	..	4 223	..	12 984	
June	4 435	.	4 292	..	13 260	.
July	4 499		4 397	...	13 530	....
August	4 500	.	4 406	......	14 260	
September	4 485	.	4 356	.	14 714	
October	4 265	.	4 139	......	15 332	
November	4 298		4.181	..	15.821	
December	4 450		4 332	....	15 648	
Year	4 420	.	4 286	......	13 970	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York 1911	New York 1912	St. Louis 1911	St. Louis 1912	London 1911	London 1912
January	5 452	6 442	5 302	6.292	23.887	26.642
February	5 518	6 499	5 368	6.349	23 276	26 661
March	5.563	.....	5 413	......	23 016	....
April	5 399	...	5 249	.....	23 743	....
May	5 348	....	5 198	.....	24.375	....
June	5 520	.....	5 370	.....	24 612	...
July	5 695	......	5 545	......	25.006	...
August	5 953	.....	5 803	..	26 801	...
September	5 869	......	5 719	...	27 750	..
October	6.102	......	5.951	......	27.256	...
November	6.380	......	6.223	......	26.795	.
December	6.301	......	6.151	......	26.849	..
Year	5.758	.....	5 608	....	25.281	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer 1911	Bessemer 1912	Basic 1911	Basic 1912	No. 2 Foundry 1911	No. 2 Foundry 1912
January	$15 90	$15.12	$14 40	$13.32	$14 75	$14.00
February	15 90	15.03	14 50	13.28	14 81	14.01
March	15.90	......	14 65	......	14.96	.....
April	15 90	......	14 65	......	15 00	.....
May	15 90	......	14 30	......	14.72	....
June	15 90	......	14.06	......	14.56	......
July	15 90	......	14.03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	....	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	.....
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	.....	$13 94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Mar. 19

Name of Comp.	Bid.
Acacia	.05¾
Cripple Cr'k Con.	01⅞
C. K. & N.	16
Doctor Jack Pot	06
Elkton Con	.59¾
El Paso	.70⅜
Findlay	.04
Gold Dollar	.13
Gold Sovereign	.02
Isabella	.12⅞
Jack Pot	.05
Jennie Sample	.04¼
Lexington	01
Moon Anchor	008
Old Gold	03¼
Mary McKinney	.54½
Pharmacist	.01¼
Portland	90½
Vindicator	71½
Work	.01

SALT LAKE Mar. 19

Name of Comp.	Bid.
Beck Tunnel	.16
Black Jack	.16
Carisa	‡.15
Cedar Talisman	.01¾
Colorado Mining	30½
Columbus Con	‡.22
Daly-Judge	‡10.00
Grand Central	.63
Iron Blossom	1 30
Little Bell	.35
Lower Mammoth	.04¼
Mason Valley	12.00
May Day	.15
Nevada Hills	2.30
New York	‡.03
Prince Con	1 15
Silver King Coal'n	1 55
Sioux Con	.05¼
Uncle Sam	25
Yankee	‡ 15

TORONTO Mar. 19

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡7 05	Pearl Lake	22
Hudson Bay	‡70.00	Porcu. Gold	47
Temiskaming	.39	Porcu. Tisdale	03
Wettlaufer-Lor.	69	Preston E. D.	11
Apex	06	West Dome	50
Central	4 12½	Standard	24
Doble	65	Foley O'Brien	34
Dome Exten	54	Rea	78
Hollinger	13 25	Crown Chartered	28
Imperial	05½	Swastika	24

SAN FRANCISCO Mar. 19

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV & CAL.	
Alta	08	Belmont	10 40
Belcher	74	Jim Butler	65
Best & Belcher	19	MacNamara	27
Caledonia	3 95	Midway	38
Challenge Con.	.31	Mont.-Tonopah	2 37½
Chollar	09	North Star	33
Confidence	1 05	West End Con.	90
Con. Virginia	75	Atlanta	23
Crown Point	76	Booth	11
Gould & Curry	17	C.O.D. Con	11
Hale & Norcross	34	Comb. Frac	18
Mexican	3.55	Jumbo Extension	45
Occidental	60	Pitts.-Silver Peak	1 37
Ophir	1 45	Silver Pick	12
Overman	2 00	St. Ives	33
Potosi	09	Tramp Con	‡ 01
Savage	27	Argonaut	2 25
Sierra Nevada	29	Bunker Hill	‡5 50
Union Con	1 15	Cent. Eureka	‡ 30
Yellow Jacket	1 10	So. Eureka	‡5 00

N. Y. EXCH. Mar. 19

Name of Comp.	Clg.
Amalgamated	74½
Am. Agri. Chem.	61⅝
Am.Sm.&Ref.,com	77
Am. Sm.& Ref., pf.	104¾
Am. Sm. Sec., pf. B	86¼
Anaconda	39⅞
Batopilas Min	1¼
BethlehemSteelpf	59¾
Chino	26⅛
Federal M.& S., pf.	40½
Goldfield Con.	4⅞
Great Nor., ore ctf	40
Homestake	90½
Miami Copper	24
Nat'nalLead,com.	55¼
National Lead, pf.	107½
Nev. Consol	19½
Pittsburg Coal, pf.	80
Ray Con.	17⅞
RepublicI&S.com	21¼
Republic I & S, pf.	73
SlossSheffi'd,com.	45
Sloss Sheffield, pf.	‡100
Tennessee Copper	38¼
Utah Copper	57½
U. S. Steel, com	66⅞
U. S. Steel, pf.	111½
Va. Car. Chem	53

N. Y. CURB Mar. 19

Name of Comp.	Clg.
Barnes King	‡.12
Beaver Con.	47
Braden Copper	5¼
B. C. Copper	4½
Buffalo Mines	1¾
Butte & Vipond	‡ 53
Butte Coalition	‡23
Caledonia	.68
Con. Ariz Sm.	9/16
Davis-Daly	15/16
Diam'field-Daisy	13
Ely Con	5/16
Florence	64
Giroux	4⅜
Gold Hill Con.	¼
Greene Cananea	8⅛
Greenwater	08
Guggen. Exp.	206
Inspiration Con.	18¾
Internat. S. & R.	‡128
Kerr Lake	2 3/16
La Rose	4
McKinley-Dar-Sa.	1 11/16
Min. Co. of A. new	3½
Nev. Utah M. & S.	1/16
Nipissing Mines	8⅛
Ohio Copper	1 7/16
Pacific Sm. & M.	¼
Porcupine T'nsite	‡ 03½
Precious Metals	‡1⅜
Ray Central	2⅛
Red Warrior	‡1½
South Utah M.& S.	11/16
Standard Oil (Old)	825
Stand'd Oil of N.J.	363
Stand'd Oil Subs.	475
Stewart	1⅛
Tonopah	8
Tonopah Ex	2⅛
Tri-Bullion	¼
Tularosa	⅝
United Cop., pfd.	15
Yukon Gold	3⅜

LONDON Mar. 20

Name of Com.	Clg.
Camp Bird	£1 10s 0d
Delores	1 10 0
El Oro	0 18 0
Esperanza	1 12 6
Mexico Mines	7 2 6
Oroville	0 6 0
Stratton'sInd.	0 3 1½
Tomboy	1 0 7½

BOSTON EXCH. Mar. 19

Name of Comp.	Clg.
Adventure	7⅛
Algomah	5½
Allouez	41⅛
Am. Zinc	27¼
Ariz. Com., ctfs.	4¼
Bonanza	40
Boston & Corbin	7¾
Butte & Balak.	4
Calumet & Ariz	63¼
Calumet & Hecla	450
Centennial	19¼
Con. Mercur.	.06
Copper Range	56¾
Daly West	6
East Butte	12⅞
Franklin	13⅛
Granby	35¾
Hancock	31⅛
Hedley Gold	18⅛
Helvetia	1¼
Indiana	14½
Island Cr'k, com.	43¼
Island Cr'k, pfd.	87
Isle Royale	27¾
Keweenaw	1¼
Lake	36
La Salle	5
Mass	7½
Michigan	2½
Mohawk	56
New Arcadian	4⅛
New Idria Quick	8
North Butte	28¼
North Lake	6¼
Ojibway	6 3/16
Old Dominion	49
Osceola	112
Quincy	79
Shannon	12¼
Shattuck-Ariz.	20
Superior	27½
Superior & Bost.	3 9/16
Tamarack	28
Trinity	5⅞
Tuolumne	4
U. S. Smelting	38¾
U. S. Smelt'g, pf.	48½
Utah Apex	2 13/16
Utah Con	16¼
Victoria	4½
Winona	6¾
Wolverine	108½
Wyandot	2¼

BOSTON CURB Mar. 19

Name of Comp.	Last
Ahmeek	255
Bingham Mines	3½
Boston Ely	1 11/16
Boswyocolo	08
Butte Central	6¼
Cactus	13
Calaveras	1¾
Chief Cons	1½
Corbin	2¼
Cortez	1 1/16
Crown Reserve	3 1/16
First Nat. Cop.	2⅜
Majestic	59
Mazatan	½
Moneta Porc.	15
Nevada-Douglas	3 11/16
New Baltic	4
Oneco	2¾
Raven Copper	.38
Rhode Island Coal	20
San Antonio	3
S. W. Miami	7
South Lake	6½
Trethewey	.65
Union Mines	‡½
United Verde Ext.	.36
Vulture	5

‡Last quotation.

Issued Weekly by the
Hill Publishing Company
John A. Hill, Pres. and Treas. Rob't McKean, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue, 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page
Editorials:
The Metals 629
Is there a Smelter's Trust?........ 630
Conservative Mine Accounting.... 631
The Steel Corporation Report..... 631
A New Iron Ore Deposit in Pennsylvania? 632
Investigation of Alleged Smelting Trust 632
Correspondence and Discussion:
Use of Vanadium Bearing Sands ....Sulphur in Sulphide Ores.... Where Should the Primer Go? ....The Davis-Biram Anemometer....Screening Ore Samples.. 633
Calumet & Arizona and Superior & Pittsburgh 634
Details of Practical Mining:
*The Franklin 10-Ton Skip.... Maintaining Grade in Driving ....*Safety Catch for Cage.... Vertical Stadia Wires....*Stoping at the Calamon Mine....Engine Foundations....*Collapsible Air Ducts for Mine Fires.... *Acid Treating Filter Leaves.... Volatile Matter in Coal.... *Graphic Method of Illustrating Extraction Tests....*A Chilled Iron Stamp Shoe....Covering for Cement Floors........ 635
Notes from Current Literature...... 641
Developments at Stratton's Independence 643
Potash in Borax Lake, California.... 643
East Rand Proprietary Affairs...... 643
Water in California Oil Fields...... 644
Bill for Mining Inquiry............ 644
Marketing of California Oil......... 644
Rand Mines Blacklisted............. 644
*A Visit to Porcupine..W. R. Ingalls 645
Artificial Gold 647
White Marble in Colorado........ 648
Mineral Production of Great Britain 648
Tasmania Mineral Production, 1910.. 648
*Flume Construction in Colombia. R. D. O. Johnson 649
Leucite Hills of Wyoming........ 651
Abangarez Report 651
Lake Superior Iron Ore in 1911...... 652
Titanium and Vanadium Alloys..... 652
Asbestos in the United States....... 652
Electrolytic Dissociation and Solvation ....Harry C. Jones 653
New Diamond Diggings in the Transvaal 657
*Otto Internal Combustion Locomotive........J. B. Van Brussel 657
The Steel Corporation in 1911...... 658
United States Potash Works 660
*A New Tube Joint for Electric Wires 660
Retreatment of Rand Tailings...... 660
Patents 661
Personal, Obituary and Societies.... 662
Editorial Correspondence 663
Mining News 665
Markets 671
*Illustrated.

The Engineering and Mining Journal

Vol. 93. MARCH 30, 1912. No. 13.

The Metals

In copper, spelter and lead, the metals, other than iron, of most interest to producers in this country, there have lately been interesting and spectacular movements. While we have from time to time referred to these, it is worth while once again to summarize the situation.

The advance in copper has continued until the goal of 15c., which had long been looked at so fondly but seemed to be at an unattainable distance, has not only been reached but also has been passed. Boomers are now talking of a still higher price and are deprecatingly hinting of "a runaway market, which, of course, would be unfortunate as previous experience has shown." We do not believe that there need be any fear of a real runaway market.

The spectacular advance in copper has indeed some amazing features. It is undeniable that there has been an improved, nay even a crazy, demand from manufacturers in this country, but granting that, such a pyrotechnic advance as we have had in the face of the serious industrial disturbances abroad, and the increased production in this country, fails to inspire confidence, especially when the statistics be examined.

Such as examination shows that the average of domestic deliveries in 1911 was about 59,000,000 lb. per month; of foreign, about 63,000,000 lb.; a total of 122,000,000 lb. There is no reason to suspect a noteworthy recent increase in European consumption, which during 1911 was already at high-water mark, and we have learned from previous experience that when our monthly shipments to Europe jump to 80,000,000 lb., as they did in December and January, the meaning is over-buying from there, irrespective of whether it be subsequently reflected in the reports of visible supply or not. Assuming that actual consumption in the United States is now going on at the rate of 10 per cent. increase over the average of 1911, and that the European consumption has been maintained, there is an actual requirement from our refineries of about 128,000,000 pounds per month, but that figure was about the amount of their monthly production in 1910, before the curtailment was inaugurated, and since then several important new mines have begun producing, e.g. Miami, Chino, Ray, Bonanza, Mason Valley and Braden, which are now turning out about 12,000,000 lb. per month, while Utah has made a noteworthy increase.

During 1911, when the prospects for copper seemed gloomiest, we pointed out repeatedly that the new production would come gradually, not suddently, and would not come so early as anticipated, wherefore increasing consumption would have a fair chance to eat into the accumulated surplus. The events have borne out that forecast, but now we have the condition where the new production that has been coming gradually is actually looming large. In January, 1911, the production of the smelters was about 139,000,000 lb., and their February production was probably nearly as large, allowing for the shorter month. In November, December and January the refiners reported a total of 354,000,000 lb.; the smelters a total of 377,000,000 lb. The flood of increased production from the smelters has not yet fully reached the refiners, but some of it has, and the conclusion cannot well be escaped that crude copper is being, to some extent, piled up at the refineries.

When the first advance in copper culminated at about 14.30c. early in January, one leading seller, continuing to offer this metal liberally, sold the market down to 13.75c. Some of the other large agencies at that time withdrew from the market, and the needs of consumers continuing large, they were soon starved into paying the price demanded by those sellers who had remained out of the market, and then the price advanced further. The *bona fide* character of this advance is not to be denied, but it is incredible that there has been such an increase in consumption as to absorb the current production, and more, and there is certainly ground for suspicion that operations in the metal market have been connected with speculation in the stock market. If there has been a reserved supply of crude copper, it must of necessity come out sooner or later. Until the statistics of the Copper Producers Association show a monthly production of upward of 130,000,000 lb., we do not think that they will be of any broad significance except as to deliveries.

An explanation of the crazy buying of copper by domestic manufacturers is that having become frightened they are now doing what for more than four years they have refused to do, namely, covering their requirements for a long way ahead and assuming the carriage of part of the accumulation which the producers have heretofore had to shoulder alone, but if this be the case, the psychology that has delayed such action until the new supply of copper is actually with us is indeed amazing. At the moment, the market is very sensitive to the demands for relatively small quantities.

Up to the end of January the price for lead was 4.45c. New York, which is regarded as about a normal figure, perhaps a little low. Suddenly the American Smelting & Refining Co. cut its price to 4c. and took possession of the market, independent sellers being unwilling to let go of their product at that price. Here we had a reversal of the usual practice, which is a maintenance of price by the big seller and cutting by outsiders. Dismissing the trivial explanations of the action by the A. S. & R. Co., we may assume that it cut the price in order to dispose of a surplus stock. It was very particular about not allowing any of its product to fall into speculative hands, evidently desiring to see it transferred to the yards of manufacturers, whence it would not return into the market. About the middle of March, having apparently accomplished its purpose, the A. S. & R. Co. advanced its price to 4.20c. Outside producers, not having been selling lead in the meanwhile, stock in their hands probably increased to some extent as they decreased with the A. S. & R. Co., but such action was limited inasmuch as a large part of the lead of all producers goes into consumption upon contracts based upon the average monthly quotation, wherefore, the independent producers had the reservation only of their uncontracted supply.

The present position in lead seems to be that inasmuch as it is cheaper than what is considered to be the normal average price, just as copper and spelter are dearer than their respective normal averages, speculative interests are anxious to buy and carry lead. This attitude, of course, is with reference to the probable general movement, not with reference to temporary fluctuations week to week, or even month to month. There are no important new supplies of lead in sight, changes in the tariff are probably still far distant, and with the gradual improvement in general trade, which is now reasonably to be anticipated, the real consumption of lead ought sooner or later to restore the price for it to the natural level.

We have on several occasions discussed the remarkable situation lately existing in the market for spelter. During the last fortnight there has been a recession in the price for this metal, which has been due, we think, in part to the fictitious basis upon which the domestic market was previously resting, and in part to the weaker tone in Europe. Whether it be because of increased production abroad, or decreased consumption, owing to labor difficulties, or to both causes, the position of spelter in Europe has of late been distinctly less strong than it was a little while ago. In this country the market has continued to be intrinsically very strong, naturally producing a high level of price, but some speculative interests not content with this were greedy for more, and by reckless bids for deliveries known to be unavailable established fancy prices that were, however, realized on but small quantities. The point was reached naturally when other interests became able by international operations to release spelter previously smelted in bond and sold for export and upon offering liberal quantities to the boomers at the prices they were bidding established that there was no market for tonnages at such figures, and the bubble was, therefore pricked. This led to a nominal recession in price, and the market has lately had the appearance of being weak, but in fact it is still much stronger than it looks, the intrinsic position continuing sound. Yet it is not to be denied that spelter at anything over 5.5c. fetches a fine price and the natural consequence is the stimulation of new production that sooner or later extinguishes extraordinary profit.

Is there a Smelters' Trust?

A representative in Congress secured recently the passage of a resolution inquiring of the attorney-general what he had done toward prosecuting the so called smelters' trust. The attorney-general promptly replied that his department had been unable to discover any such trust and had found free competition to exist in the smelting business. The inquiry from the House of Representatives was, of course, directed toward the American Smelting & Refining Co. The attorney-general said in effect that it was not a monopoly, being simply a big company, and had not violated the Sherman law so far as he could find out. This was in substance what had previously been reported by a Federal grand jury having the A. S. & R. Co. under investigation.

Of course, every sensible person acquainted with the mining industry has been aware that competition exists in the smelting business and to an extent in fact that has seriously cut into profits in certain districts, e.g. Utah, where the A. S. & R. Co., the U. S. company and the International company have plants. In Colorado the Ohio & Colorado company is a competitive buyer, in the Southwest there is the Copper Queen and in the East there is the Pennsylvania Smelting Co. Each of these concerns is too strong to be driven out of the field, and recognizing that nobody would attempt it. Besides these smelting companies there are in certain districts concerns employing hydrometallurgical processes, such as chlorination and cyanidation, that compete for some kinds of ore. Modern conditions of transportation have given the ore market a national width. Lead ore is carried from Idaho to Pennsylvania, silver ore from Cobalt to Denver, copper matte from California to New York. Nor is the producer of ore limited to the metallurgical companies. There are no bars against the acquisition of knowledge and skill in the art, nor in spite of the spook of a money trust is there any prohibition against raising funds for metallurgical plants. Thus we find constantly that concerns like the Goldfield Consolidated and the Nipissing Mines adapt or invent processes and treat for themselves ores that formerly they shipped to smelters. The smelters, thus deprived of profitable supplies, have to cut rates on other ores in order to draw in the quantity needed to keep their plants in economical operation.

So long as we have a science and art of metallurgy and a profession of metallurgical engineers and so long as we have the free scope of individualism that has made industry in the United States a gigantic thing, there will be competition in ore treatment. If it appears that the American Smelting & Refining Co., or any other company, handles the larger part of certain classes of ore the reason is that competition, possibly indirect competition, has so reduced the margin on such ores that investors know that any further attempt to capture them in general would merely spell ruin. Rival concerns like the Ohio & Colorado, United States and International that see some possibly profitable branches have been quick to seize upon them, the big mining companies that develop adequate supplies of ore that can be beneficiated more cheaply than by consignment to the smelters promptly build their own works, the visionaries who erect works at Tintic, Ogden, Sandpoint, etc., on the hypothesis that the big smelters plunder the miners acquire some costly knowledge of the economics of metallurgy and the bones of their furnaces are soon added to the other derelicts of the desert.

Conservative Mine Accounting

The last report of the National Lead Co. contains a brief reference to a mining investment that is instructive, inasmuch as it deals with an operation in which no public participation was invited, of which no shares have ever been on the market, and as to which there is no question about deferred charges, etc. It has been merely a straightforward business undertaking.

In 1897 the St. Louis Smelting & Refining Co., a subsidiary of the National Lead Co., acquired property in the disseminated lead district of southeastern Missouri. It was fortunate in acquiring good property, and in connection with it built a concentrating mill, which at its time was the last word in mill construction in that district. The total investment was nearly $1,500,000. The property became productive in 1899. At the end of 1905 it had returned one-half of the investment. It is now indicated that at no distant date the parent company will begin to receive a revenue from this investment, from which we understand that the original outlay has now been returned, after the lapse of 12 years.

Here is an enterprise in which there has been no need for sophistry in distinguishing between expenditures on operating and on capital account. The investing company put its money into the venture and figured that it had to get back its principal before it could reckon that it was making anything. If all mine accounts were kept in this way there would be more stability to mining as an industry, but not much chance for adventurous promoters in the stock-market.

The Steel Corporation Report

The affairs of a corporation which has gross receipts amounting to over $630,000,000 in a single year naturally require an elaborate report, and this the Steel Corporation has furnished for the year 1911. The statements in this report are very full and generally clear, though in some parts a careful analysis is needed to get at the essential figures The main difficulty to be found is that in some cases there is a certain amount of complication between the affairs of the Corporation itself and its subsidiary companies; and the reader wonders if a more compact organization might not be feasible and advantageous. Moreover, the financial statements occupy so much space that there is no room to go into actual costs of manufacture.

The Corporation is primarily a maker and seller of finished steel, though its operations cover the whole range of operations leading up to that point. It is a miner of iron ore and coal, a maker of coke and pig iron, as well as a steel maker and finisher, and a seller of cement and some other byproducts. Outside of its steel operations it sells a considerable quantity of iron ore and coke. Although its make of pig iron was not quite sufficient to supply its steel furnaces and it bought some bessemer and basic iron on the open market, it sold 310,000 tons of pig; but this was mainly foundry iron from Alabama.

The year covered by the report was one of some depression in trade, and the total production of finished steel was 11.7% below that of 1910. In November, under the stimulus of lower prices, business became very active, but the revival came too late to make up for the earlier depression. The deliveries of finished steel to domestic buyers showed a decrease of 18.6%, though this was partly made up by a gain of 41.4% in the export business, the foreign trade being the heaviest ever reported.

The gross earnings, as above given, were reduced by working expenses and repairs, general expenses and taxes to a net of $104,305,466, from which payments for interest and sinking funds, and for "extraordinary replacements" left a balance of $55,300,297 available for dividends, this balance being about 8.75% of the gross receipts. The report does not make it quite clear how the discrimination between ordinary and extraordinary repairs are made. One statement gives "ordinary maintenance and repairs" at $37,882,851, and "extraordinary replacements" at $7,077,414. On the other hand, the income account charges to "depreciation and extraordinary replacement funds" $18,229,060.

The surplus was sufficient to pay the usual dividends of 7% on preferred and 5% on common stock, and to leave an undivided surplus of $4,665,495; but it was not sufficient to permit any appropriation for the additions to property which are really necessary to keep the Corporation in line with its competitors. Such expenditures were made in 1911 to the amount of $54,603,081, the money being supplied largely from the sale of bonds of the subsidiary companies.

The report gives full particulars of the Corporation's fuel resources, its ownership of coal lands and mines, but is much less specific as to its iron-ore reserves. A brief history of the Great Northern ore leases and their prospective cancelation is included in its general statement. There is also brief reference to the government suit for the dissolution of the corporation.

Upon the whole, the report is as satisfactory as might have been expected. At any rate, it shows that in a year of comparative depreciation and low prices all obligations could be met and the rate of dividends maintained.

A New Iron Ore Deposit in Pennsylvania?

Several of the daily papers last week heralded an alleged discovery of iron ore in Ayr township, Fulton County, Penn., the estimates of its quantity ranging from 500 to 1000 million tons, much of which was said to be of bessemer grade. According to these reports, the discovery was made by J. N. Crossland, of New Florence, Penn. In looking for an extension of the Broad Top coal seam, he came across a strange geological formation in what is known as Meadow Mountain. Soon afterward he discovered float ore and "after careful investigation reached the conclusion that there were valuable deposits of iron ore in the mountain and vicinity." The newspaper reports proceeded further to say that "More than 50 assays have been made from samples taken from as many different places by eminent chemists, including the chemist of the University of Pittsburgh, showing an average percentage of metallic iron, ranging from 57 to 63 per cent."

These reports naturally excited widespread interest, but in spite of diligent inquiry we have been unable to discover any iron-mining engineers, or ironmasters, who had previously been aware of this occurrence. We communicated with Mr. Crossland, and in reply to our dispatch received from Hayden, Evans & Hayden, of Greensburg, Penn., owners of the deposits, a letter under date of Mar. 25, comprising the following statements:

> The ore discovery reported in the newspapers is a fact and all accounts we have read have been substantially correct. The property contains vast deposits of mineral wealth and our claim is for one billion tons, at least, of high-grade iron ore, consisting of black hematite, brown hematite, red hematite and carbonate of iron. The ore lies in three mountains, viz., Meadow Ground Mountain, Lowrie's Mountain and Dickie Mountain, which form a spur of the Blue Ridge range. The acreage is from twelve to fifteen thousand. The property has been undergoing exploration by Mr. Crossland, our engineer, since October, 1911. Colonel H. C. Demming, state geologist of Pennsylvania, has examined that part of the property known as Lowrie Mountain. Mr. F. B. Peck, professor of geology and mineralogy in Lafayette College, Easton, Penn., leaves tomorrow to make an investigation of the ground. The method of exploration thus far has been by core drills and blast mines. We have had more than 50 analyses made of specimens taken from widely removed sections of the property which show from 57 to 63% iron, with only traces of sulphur and phosphorus.

Col. Henry C. Demming informs the Journal as follows:

> I made a brief investigation of the iron-ore deposits in Ayr township, Fulton County, Penn., two years ago. While there is an abundance of iron ore there, principally brown hematite, in my opinion the estimated deposit of commercial ore is far short of one billion tons, and the quality much less than stated in some daily papers. Selected samples may contain 60% metallic iron, but it is doubtful whether any of the orebodies will average 50%. It is barely possible that the geological fault in that vicinity is due to a mighty upheaval, with iron beneath, but that ought to be confirmed by careful investigation with core drills and over a wide area of territory. In 1881 Dr. J. J. Stevenson, geologist, University of New York, made a careful survey there.

Dr. George Otis Smith, director of the U. S. Geological Survey, is quoted by the daily papers as saying:

> It is, of course, quite possible that such a discovery has been made, but the weight of probability lies against it. The State of Pennsylvania has been thoroughly explored and all available bodies of ore are believed to be known. Indeed, the work has been regarded as so well done and so nearly completed that the U. S. Geological Survey has done no work there for years in iron. We continue to work on the coal deposits, but in the matter of iron, that is a work left entirely to the State geologists.

Dr. David White, of the staff of the U. S. Geological Survey, is reported as saying:

> I can imagine that in Pennsylvania there may be regions so little known that such a deposit might exist there. It is true that farmers do not always recognize the value of deposits they may encounter, and the geologist may not have happened to pass that way. The region is in the line of similar deposits. We have known of some occurrences of iron ore in Pennsylvania where it was so thin and so silicious that it was not available commercially, and it may be that some such deposit has been found. Ultimately, when the orebodies of the Southern Appalachian and the Lake Superior regions have been exhausted, we shall return to the thin and silicious ores that have been passed by in Pennsylvania and make use of them.

Prof. J. F. Kemp is quoted as follows:

> I do not believe that such an immense body of ore as has been reported can have escaped the notice of the many prominent geologists who have carefully gone over the ground. Many geological maps of this region by the best authorities are in existence, but they show no indication that such a deposit exists. The geological formation of the country itself tends to disprove the story that such a large deposit of ore can be present in that locality.
>
> I am also inclined to doubt that any very large quantity of ore exists with so high a percentage of extractable metal as the reports indicate. It is possible that a few sporadic cases show so high a test, but I cannot see how more than 1,000,000,000 tons of the so called ore can be found to have tested out at 60% iron.
>
> Before making too decisive a statement on the discovery I wish to wait until a thorough investigation of the claim is made by the best authorities. Personally I have never been over the exact ground where the ore is said to be deposited, but I am more or less familiar with geologic formations in Pennsylvania as a whole and I cannot see how this immense deposit has escaped notice for so long.

The newspaper reports about this discovery have been of a character to arouse skepticism. An enormous tonnage of ore cannot be safely estimated on the basis of superficial exposures and a small number of samples.

A distinguished mining engineer and geologist of Pennsylvania characterizes the reported occurrence as being improbable and practically impossible, calling attention to the fact that the iron-ore deposits of the Trenton limestones are limonites, of the Clinton red fossil ore, and of the Oriskany brown hematites, all of which are well known deposits and generally small, of relatively low grade and rather high in phosphorus.

It is evident that these deposits must await more extensive engineering and geologic examination before the claims for them may safely be accepted.

Investigation of Alleged Smelting Trust

WASHINGTON CORRESPONDENCE

Representative Martin, of Colorado, has introduced his resolution calling for the investigation of the smelting trust by a committee of Congress. Mr. Martin has had this action in mind ever since the reply of Attorney General Wickersham to the inquiry of the House concerning the trust, in which the latter denied that any such organization exists and asserted that the companies are in actual and live competition.

In speaking of his resolution, Mr. Martin says:

> The reply of the Attorney General to my original resolution was astounding. He boldly tells the House that a smelter trust does not exist and declines to say what steps, if any, are being taken to ascertain the existence of such a trust which I have charged as being one of the most audacious of all illegal combines. I am now asking for a Congressional investigation of the trust, and in the event this resolution is adopted it will necessarily throw some light upon the financial and political relations of the Guggenheims. Not only will the Guggenheim "barrel" run like slag from a furnace in lining up Taft delegates in Colorado, but in the event of his nomination the same barrel will be used to debauch the electorate of the state.

Mr. Martin makes the direct charge that the Attorney General is shirking his duty in not prosecuting so powerful an "ally of the administration" as the smelter trust. He absolutely denies the assertion of the Attorney General that there is no smelter trust, and that competitive conditions prevail in the industry. If this were true, he says, it would be better worth investigating than other trusts in order to ascertain how these conditions have been kept up.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Use of Vanadium Bearing Sands

In the JOURNAL of Feb. 17, 1912, A. D. Banfeild asks whether the Patea sands, containing 0.15 to 18% vanadium (and also some iron) may be used as a source of vanadium, with particular reference to the manufacture of vanadium steels. I have been professionally interested in the chemistry and metallurgy of vanadium for several years and will be glad to furnish any information I possess.

From the nature of his question it seems reasonable to suppose that he wishes especially to know whether the ore can be directly smelted into ferrovanadium. There are several reasons why this is not commercially possible at present. Aside from the question of economical work there are several chemical and metallurgical factors to be considered. In the first place, the present practice demands that the carbon content of the alloy be low, and as vanadium will form carbides when carbon is present in small quantities, vanadium carbides will be formed from the carbon introduced to reduce the iron. Again, vanadium acts strongly as either acid or base, and it is entirely probable that the slag would contain most, if not all of the vanadium in the charge.

J. ROSS CORBIN.

Denver, Colo., Mar. 13, 1912.

Sulphur in Sulphide Ores

Under Stuart S. McNair's article in the JOURNAL of Mar. 16, 1912, is an editorial note which says in part, "the method fails when barium is present in the ore, unless some sodium carbonate is used in the fusion." Without investigating that point, it may be pointed out that many of the accepted methods for pyrites at present are intentionally mapped out so that sulphur combined with barium is not found or reported, as such sulphur is not available for acid making.

I may add that there should be a better understanding on this point in drawing pyrites contracts, as the buyers' and sellers' chemists are constantly disagreeing on sulphur when barium is present, and investigation usually shows that one has obtained total sulphur, and the other sulphur excluding that carried as barium sulphate.

While the sulphur in calcium sulphate is, I believe, largely wasted, so far as the acid maker is concerned, this sulphur is usually reported with sulphide sulphur.

Although somewhat out of a fertilizer chemist's line, is it not also true that in blast-furnace work if pyrites is used as a sulphur carrier barium sulphate is wasted sulphur. I believe that the classic statement is, "barium sulphate is reduced to sulphide, which as such enters slag and matte, making the one heavy, the other light." This is, however, quoted from memory, and is subject to correction. A. F. W.

Baltimore, Md., Mar. 22, 1912.

Where Should the Primer Go?

Referring to the article on high explosives, written by A. E. Anderson, which appeared in the JOURNAL of Feb. 3, 1912, and to the letter dated, Candor, N. C., Feb. 6, 1912, by Percy E. Barbour, which appeared in the JOURNAL of Feb. 17, 1912, on the question—"Where Should the Primer Go?": The paragraph on position of primer, referred to by A. E. Anderson, deals particularly with gelatin dynamites when used in holes in stopes or drifting work in ore mines where the gelatin is detonated by means of fuse and blasting cap. In these places it is often advisable to place the primer in the bottom of the hole with the business end of the blasting cap pointing toward the main charge of explosive. The main reason for this is, that in lighting the fuse, the first fuse lighted will, as a rule, burn to the cap and detonate that charge of the explosive before any other charges are detonated.

It sometimes happens that when the primers are all placed last in the bore hole, that the charge of explosive detonating first will break the rock in such a manner as to throw out into the muck some of the primer cartridges. These primer cartridges would then detonate in the muck pile. In order to overcome this, some of the miners in the ore mines of Colorado use the method of placing the primer cartridge in the bottom of the bore hole. Wherever this method is followed one should use a fuse which has little, if any, side spit, and thus eliminate the liability of igniting the explosive. Gelatin dynamites, however, are not easily ignited.

If electric fuses were used for detonating the charges and these detonated by means of blasting machines or power circuits, the primer cartridge should be placed in the bore hole last, or next to last. As a rule, with the exception as noted above, the primer cartridge should be placed in the bore hole last, or next to last, whether fuse and blasting cap are used or the charge is detonated by electric fuses.

Several years ago tests were made by the du Pont company to determine whether it would be better to place the primer cartridge in the bottom of the bore hole, in the center of the charge or in the top of the bore hole. From results obtained, no difference in execution of the explosive was noted, except that the business end of the detonator should always point toward the main charge of explosive. From an economical standpoint and also to eliminate the liability of igniting the explosive in the bore hole, it is best to place the primer in the bore hole last, or next to last.

F. H. GUNSOLUS.

Manager, Technical Division, E. I. du Pont de Nemours Powder Co.

Wilmington, Del., Mar. 20, 1912.

The Davis-Biram Anemometer

We have received a cutting on the Davis-Biram anemometer, from the JOURNAL of Feb. 17, 1912, and notice a clerical error in the description of the instrument. The large dial is given as being 13 in. in diam. This should be 3 inches.

Since the particulars of this apparatus were given to Mr. Seager, a shutter arrangement has been fitted to this anemometer which reduces the port holes, and in testing for velocities, say above 30 ft. per sec., the shutter is slid over the port holes. The results then have to be multiplied by 2. For lower velocities, the shutter, of course, is slid back and the port holes are fully opened. It is thus possible with the Davis-Biram anemometer to obtain readings of low velocities and also high with the same instrument.

JOHN DAVIS & SON (DERBY), LTD.

Derby, England, Mar. 12, 1912.

Screening Ore Samples

Doctor Dewey's comment on screening ore samples, in the JOURNAL of Mar. 16, 1912, reminds me of a way of hastening screening operations, I once saw in a small laboratory in the Southwest. The sampler bucked away on the ore until five or six assay tons out of about a 12- to 18-a.t. sample had gone through the screen, then threw the remainder away! The "graphite method" of ore analysis is all that beats this, I think.

HENRY WOODMAN.

Philadelphia, Penn., Mar. 21, 1912.

Calumet & Arizona and Superior & Pittsburg

The reports of the Calumet & Arizona and the Superior & Pittsburg Copper companies for the year ended Deç. 31, 1911, show a total production of 49,945,905 lb. of refined copper, 453,947 oz. of silver, and 18,114 oz. of gold. The precious metals were valued at $24.15 per ton of refined copper, and the net cost per pound of refined copper after deducting the value of the precious metals was 7.34 cents.

As the companies are at present constituted, the Superior & Pittsburg has 2,000,000 shares of stock authorized, of which 1,499,792 are issued, and of which 1,387,946 shares are held by the Calument & Arizona company. The Calumet & Arizona has 650,000 shares authorized, of which 31,956 are held for exchange for the outstanding Superior & Pittsburg stock, while 21,488 are treasury stock.

The Calumet & Arizona company alone produced 21,476,739 lb. of copper; 216,987 oz. of silver; and 9329 oz. of gold. The copper sold for 12.4922c. per lb., and the net cost, after deducting precious-metal contents, was 8.33c. There were 1038 men employed, 562 at the mine, and 476 at the smeltery.

New Smeltery to Be Built

In order to meet changing ores in the properties controlled by the company a new smeltery is planned; grading has been done and active construction commenced. The plans contemplate a complete sample mill; 58,000-ton bedding system; two 48-in. by 40-ft. furnaces with 60x180-ft. dust chamber; a steel stack, 350 ft. high and 25 ft. in diam., lined with acid-proof tiling; four 19x100-ft. reverberatories, with foundation and building for fifth; twelve 21-ft. Herreshoff roasters with dust chambers; and six Great Falls converters 12 ft. in diam. The plant should be in operation by Aug. 1, 1913. In August, 1911, two additional converter stands were put in operation, and during the year the practice was taken up of lining the shells with basic lining. The results at first were indifferent, but are now satisfactory. The process is being worked under agreement with the Peirce-Smith Converter Co. In those shells still run on acid lining, mill tailings have been substituted successfully for siliceous ore.

Development work by the Calumet & Arizona company amounted to 26,196 ft. during the year: 18,754 ft. of drifting; 6039 of raises; 25 of stations; and 1378 of drilling. In the Irish Mag shaft everything above the 750-ft. level has been abandoned, and work confined between the 850- and 1150-ft. levels. On the 950-ft. level a new body of oxide and sulphide ore has been discovered, but except for this, all the work has been on old bodies or extensions of bodies stoped to the Copper Queen side lines by the Copper Queen company. Surface work through the Irish Mag shaft has also been discontinued, hoisting being carried on through the Oliver shaft.

In the Oliver shaft oxide ore has been found in the 1050-ft. level of the Senator claim, and the 1250-ft. level of the Buckeye, while new sulphide ore has been found in the 1250-ft. level of the Senator claim, and the 160-ft. level of the Oliver. Diamond drilling was done from the 1350- and 1450-ft. levels of the Gibraltar, which proved that mineralization extends several hundred feet below the present workings, but found no ore.

No work was done on the Courtland exploration, and only assessment work on the Copper Giant. In April, the option on the Superior mine was given up.

Option Taken in Ajo District

In the latter part of the year option was taken on 22 claims in the Ajo district, 42 miles south of Gila, on the Southern Pacific road. The property is that of the New Cornelia Copper Co., and drilling is now being carried on, in hope of finding a large body of disseminated ore. There were 265,831 wet tons of ore mined in 1911 (244,067 dry tons), and 266,607 tons shipped. Of first-class ore there were 231,135 tons smelted, and of fluxing ore, 42,474 tons. The copper recovery per wet ton of ordinary ore was 89.747 lb., and of fluxing ore, 12.25 lb. On the dry basis the recovery from the two classes was 4.884 and 0.670%, and the contents 5.154 and 1.059% respectively.

In the Superior & Pittsburg mines development work amounted to 25,222 ft. during the year: 63 ft. sinking; 18,092 ft. drifting; 6416 ft. raising; 97 ft. stations; 554 ft. drilling. A connection was made with the 1000-ft. level of the Cole shaft and 1350-ft. of the Oliver shaft of the C. & A., after which stoping was steadily carried on in the oxide orebody of the Granville claim, which is developed for about 350 ft. on the 900-ft. level.

In the Briggs shaft developments have been most encouraging. The main drift to the southeast has cut sulphide ore, pyrite, or leached mineralized ground for nearly the whole length of 860 ft. In one place 60 ft. of ore assaying from 5 to 6% of copper was cut. One narrow seam has been developed for over 200 ft. in length, with continuous ore of good grade. In addition to these richer bodies, there are great areas of nearly solid iron pyrite assaying from 2 to 4% copper. A good sulphide orebody has also been found northeast of the Briggs shaft. The ore has been developed over 100 ft. long by 35 ft. wide, with an average grade of 8%. The Briggs orebodies are scattered over a thoroughly mineralized zone 2400 ft. from north to south, and 1000 ft. from east to west. It is proved that the rich orebodies of the Bisbee district persist to the most southern point yet reached by development.

The Junction shaft was sunk to 1837.5 ft., cutting sulphide ore at intervals from 1700 ft. to the bottom, and in a small station cut on the 1800-ft. level. This proves that the orebodies extend at least 300 ft. below the present lowest (1500-ft.) working level. Two drill holes were put down to prove the south orebody below the 1500-ft. level, but owing to the complexity of the ground, results were negative.

In the Hoatson shaft work has been largely confined to systematically cutting up the ground adjoining the large oxide orebody, considerably increasing its known size, and resulting in finding several small outlying bodies of oxide ore Most of the stoping during the year has been in the large orebody.

During the year, the only Superior & Pittsburg mine from which pumping was done was the Junction, 1,579,255,906 gal., of which 35,280,000 were from the Copper Queen mines. After March, 1912, when the connection between the Oliver and Hoatson shafts is completed, the Junction will do the deep-level pumping for all the Bisbee mines.

There were 229,903 wet tons of ore mined (205,603 tons dry), 229,985 wet tons shipped, and 230,620 wet tons of Superior & Pittsburg ore smelted. The recovery of copper was 123.719 lb. per wet ton. The production amounted to 28,469,166 lb. of copper, 236,960 oz. of silver, and 8785 oz. of gold. The value of the precious metals amounted to $21.20 per ton of refined copper, and the net cost, after allowing for gold and silver, was 6.60c. per lb. of fine copper. The selling price was 12.4922c. There were 344 men employed.

The joint income of the two companies was $6,842,683 from sale of metals, and $48,590 from miscellaneous credits. Expenses at mines and smeltery were $3,514,933; construction, $39,008; salaries, office, and general expenses, $81,135; freight, refining, and marketing, $683,954; leaving net earnings on production of $2,572,242. From this, expenses on outside properties and payments on options not exercised of $53,446, less miscellaneous credits of $6525, were met, leaving earnings of $2,525,321 net.

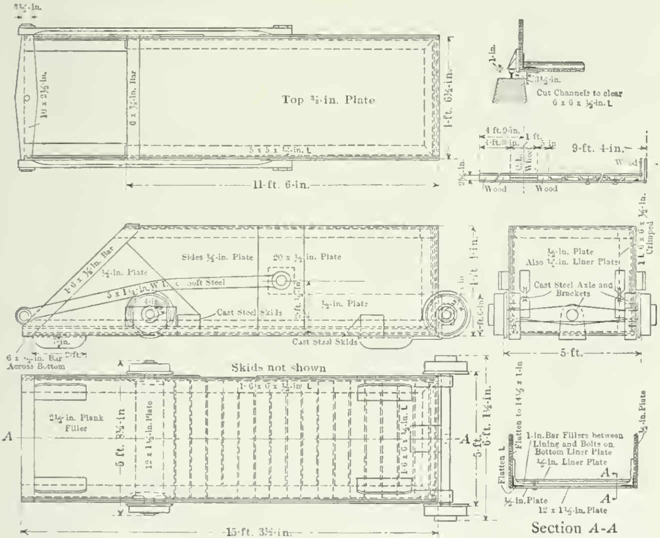
By Senate bill 3045, which was passed by the Senate, sent to the House and then referred to the House Committee on Public Lands, provision is made for agricultural entries on oil and gas lands of the United States, exclusive of Alaska, under existing homestead and desert-land laws. The rights to oil and gas on these lands are to be reserved by the United States.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

The Franklin 10 Ton Skip

A new hoisting engine has been erected at the No. 1 amygdaloid shaft of the Franklin mine, near Houghton, Mich., which is to raise a skip from a maximum depth of 5000 ft. An air cylinder is connected tandem with each of the two steam cylinders of the engine. In hoisting, these air cylinders are not used. In lowering, no steam is admitted to the steam cylinders, but the weight of the descending skip turns the engine backward and a braking resistance is obtained by the compression of air in the air cylinders. This air is discharged into large receivers where it mixes with steam from the boilers and is fed back to the hoist to assist in raising the skip. There is but one hoisting compartment in the shaft, so in order to raise the desired tonnage, a skip of 223 cu.ft. or 10½ tons capacity is required. This skip is by far the largest in the Lake Superior copper country.



THE 10-TON SKIP FOR THE FRANKLIN MINE

The front wheels of the skip, as shown in the accompanying illustration are carried by bracket axles which are bolted to the body of the skip, the clearance between the inside face of a wheel and the body being about one inch. A reinforcing plate through which these bracket-axle bolts pass stiffens the body of the skip at that point. The body is also reinforced at the draft lugs.

Because of the small clearance of the front wheels it is necessary to bend the bridle strap so that it will clear the wheels.

At that part of the bottom of the skip on which the ore from the loading pocket will fall when the skip is being filled a wooden lining is used which extends a little below the reinforcing plate for the bracket axles. The rest of the bottom is reinforced by steel channels, every other one of which is inverted; all are riveted together as shown in the section A-A in the illustration.

The skip is equipped with skids that will take the weight in case a wheel breaks, and also with guide shoes that run over a concrete stringer in the shaft and which guide the skip in the event of its jumping from the rails. The rear through axle is pivoted and is carried in sleeves which allow a play of 1½ inches.

The front and back wheels are alike and are made of manganese steel, while the increase in the tread necessary on the rear wheels for dumping the skip is obtained by a separate hub that is carried outside the main wheels and on the same axle.

This hub is a cheap steel casting as it does not have to take much wear, and is entirely independent of the main wheels. At the rear are lugs for attaching below the skip a truck for lowering timbers. The skip weighs about 6½ tons. The skip track is 5 ft. gage and is made of 80-lb. rails carried on concrete stringers of the Mohawk type.

Maintaining Grade in Driving

In driving and tunnel work the miners unconsciously tend to work on an upgrade toward the face at a steeper angle than is desirable for drainage or for favoring the tramming of loaded cars. Too much grade is disadvantageous because the grade favoring loads is so great that the cars tend to run faster than considerations of safety should permit; greater effort is required to move empty cars up the grade; natural ventilation is interfered with, the results being especially noticeable at the face; and, in some cases, the unnecessary loss of ore in the backs above the drift may be undesirable.

The grade of drifts in some of the older mines of Cornwall is as great as 5%, often 7%. At the present time a drift is rarely driven at a greater grade than 1%, which is twice the grade recommended by some authorities.

To avoid driving at too great a grade, a template should be provided which the miners can use as often as they desire and without losing much time. Such a template may be made by cutting a board of convenient width and thickness so that it is exactly 100 in. long. The edges should be planed true and parallel. A line is then drawn from the upper corner of one end to a point 1 in. below the upper corner of the opposite end and the board sawed along this line. The board is then turned over, and a level-tube let into the edge, which is so adjusted that the bubble will be in the center of the tube when the edge of the board is in a horizontal plane.

In use, the template is laid upon the floor of the drift with the narrower end toward the face. Then if the grade of the floor is 1%, the bubble will be in the center of the tube.

Safety Catch for Cage

By H. L. Botsford[*]

Many devices have been designed to prevent accidents to mine cages from the breaking of the hoisting rope. They may all be divided into two general classes: safety stops, and safety brakes. The former aim to stop the cage instantly, by some positive means, such as the slipping of bolts into holes in the guide timbers. This class of safety catch would be satisfactory if the cage could always be stopped just at the instant the rope broke, on an ascending cage, and before the cage had acquired any appreciable downward velocity. Should the catches refuse to work until the cage had gained considerable momentum, or should the rope break while the cage was descending, and the speed of the cage should not be entirely checked before the hoisting rope failed, the stresses produced in the safety catches would be too severe for them to resist successfully. Even should the catches be able to stand the strain, there yet would be great danger of bodily harm to the occupants of the cage.

These serious objections to the safety stops, are not so inherent in the second class of safety catches. Safety brakes are designed with the aim to gradually arrest the momentum of a descending cage, without danger to the occupants of the cage, or to the safety-catch mechanism. In one type of safety brake wedges are made to grip the guide timbers, when there is no tension in the hoisting rope. The motion of the descending cage forces them tighter and tighter against the guides until the cage is stopped. This type has not proved satisfactory. In a second type of safety brake, friction shoes are forced against the guides by the action of compressed carbonic acid gas against plungers. The gas is stored in cylinders under a pressure of several hundred pounds per square inch. This type has given good service at the mines of the Rand. It may be used with steel guides. In a third type of safety catch, or brake, much used in America, cams or "dogs" are made to engage the guides, one on each side of each guide. These cams have toothed or grooved surfaces, which cut into the guide timbers. They are quicker in their action than the friction blocks described above, although they may properly be classed with safety brakes because their action is to stop the cage by the resistance which they meet in deforming or cutting the guides. Obviously they can only be used with wooden guides.

This type of safety catch depends for its action upon springs which force the cams against the guides when the tension in the hoisting rope is released. While the weight of the cage is supported by the hoisting rope the cams are drawn back from the guides, and in no way interfere with the free running of the cage.

Much variation is shown in the design of cams, and in the choice of springs. The springs may be of the laminated, spiral, or the helical type. The laminated spring is but little used. In many mining districts one type of cage construction is used almost exclusively.

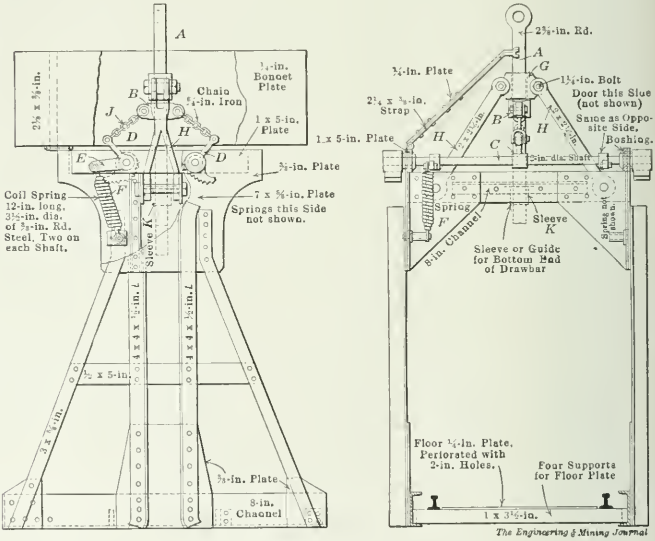
In the accompanying illustration a cage long in use in the copper country of Lake Superior is shown. In this construction the cage is hung by two hanger forks *H* from the draw-bar sleeve *G*, through which the draw-bar *A* is free to slide. While the cage is hanging on the hoisting rope the yoke *B* on the draw-bar carries the weight of the cage.

The springs *F* have one end fastened to the side plates of the cage and the other end to the lever *E*, keyed to the cam-shaft. The cam-shafts are connected to the yoke *B* by the lever arms *D* and the chains *J*. If the chains *J* are of the proper length, the cams will be turned back from the guides, when the draw-bar is raised to its full height, that is when the yoke *B* is in contact with the draw-bar sleeve *G*. This is the position the draw-bar assumes while the cage is suspended on the hoisting rope. The springs *F* are now under tension, and should the hoisting rope break, or the cage be rested upon landing chairs, these springs will rotate the cam-shafts sufficiently to bring the cams into contact with the shaft guides. Any downward movement of the cage will now force the cams into the guides, until they meet with sufficient resistance to support the weight of the cage.

The lower end of the draw-bar passes through the sleeve or guide *K* which prevents it from binding in the sleeve.

The design of the cams themselves is a very important detail in cage construction. They should be so shaped that when they once come in contact with the guide timbers, any downward motion of the cage must force them deeper and deeper into the guides. As to the relative merits of cams with notched or grooved faces, and those with projecting teeth, much may be said in favor of each. The sharpened teeth will be more certain to cut into the guides at the start, while the other type makes a stronger construction.

Regardless of the type of cage, the safety catches should be tested regularly at least once each month. This is conveniently done by hoisting the cage a few feet above the collar of the shaft, and suspending it there by a hemp rope fastened to a convenient timber in the headframe. The hoisting rope should now be slackened a few feet and the hemp rope severed. This gives the cage a free drop until the catches work, or the slack in the hoisting rope is taken up. With safety catches in good order they should not permit the cage to drop more than a few inches.



A Lake Superior Type of Mine Cage

Compared with steam pumping, bailing possesses some distinct advantages where it does not interfere with hoisting of ore; initial cost of machinery is less, a heavy loss in steam condensation is obviated, repairs and upkeep are lower and there is no danger of the unwatering plant being flooded.

---

[*] Mining engineer, Creighton Mine, Ont.

Vertical Stadia Wires

By Douglas W. Jessup*

The use of vertical instead of horizontal stadia wires is a novel way of obtaining measurements. I have never seen this method described in books on surveying, nor until lately in practice. The rod or tape is held in a horizontal position, not vertically as in the common practice of stadia measurements, and at right angles to the line of sight of the instrument. The reading, multiplied by the cosine of the vertical angle plus the constant of the instrument, will give the approximate distance.

In order to use this method, it is essential that the two vertical stadia wires be placed in the diaphragm of the telescope parallel with the vertical center wire, and equally distant on each side of it, preferably so adjusted that this distance divided into the focal length of the object glass is equal to one.

The rodman in giving the sight will find it convenient to use a tape, holding it across his chest and at the height of the instrument, folding two pieces of white paper over the tape, one at the zero mark, and adjusting the other along the tape. When the distance becomes too great for the rodman to stretch his tape, one end is fastened to some convenient point, or the end of a stick and extended out as far as necessary.

This use of the vertical stadia wires is not so accurate or satisfactory as using the horizontal wires, but it affords good results under certain conditions. The disadvantage lies in that it is difficult to hold a tape at right angles to the line of sight. The advantages are in its affording better opportunities in giving a sight, not clearing the brush and etc., and it may be used at odd times with a tape when a rod cannot be obtained, the rodman finding it much more convenient to stretch out a tape in a horizontal position than in a vertical one. At times it is also more rapid. This method was satisfactorily used in a railroad survey, involving switchbacks up a mountain side.

---

*Mining engineer, Bingham, Utah.

Stoping at the Calamon Mine*

By C. P. Corbett Sullivan†

The following is a brief description of the modifications that have recently been introduced in the method of stoping adopted by the Calamon silver-lead-zinc mine at Posadas, Spain.

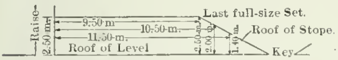


Fig. 1

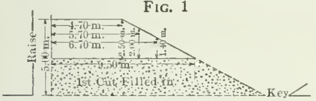


Fig. 2

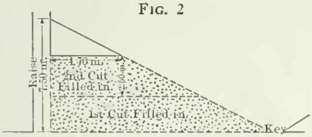


Fig. 3

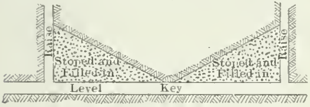


Fig. 4

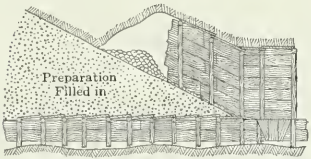


Fig. 5

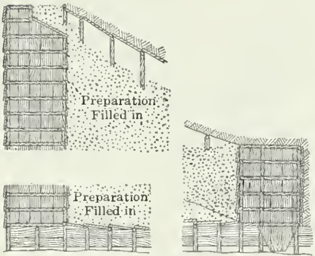


Fig. 6

Eng. & Mng. Journal

Cut and Fill Stopes at Calamon Mine

The operation of preparation is always easy, as it is limited to the construction of inclines. To make these, the first cut is started and carried out until a length of 9½ m. is reached. At a distance of 10½ m. a set 2 m. in height is put in, at 11½ m. another 1.4 m. high is put in and the cut brought to a finish with a total length of 14 m. along the floor. The roof of the stope forms, with that of the level, the apex of a right-angle triangle, in which the former is the hypothenuse, the latter the perpendicular, and the last full-size set, the base, as shown in Fig. 1 of the accompanying illustration. When this has been filled in the usual way, the second cut is started 5 m. above the back of the level and is driven horizontally until 4.7 m. in. When 5.7 m. long, a set 2 m. in height is put in, and at 6.7 m. another, 1.4 m. high is put in, and the drift carried on with the roof at the same inclination to join the cap-piece of the last full-size set at 9½ m. from the raise in the first cut, as shown in Fig. 2. This must, as usual, be filled in before the third and last cut can be stoped away, which is commenced witn a total height of 7½ m. and the roof brought down with a uniform drop to meet the roof of the second cut where it starts to descend, as shown in Fig. 3. The same routine is gone through in the other half only in an opposite direction; the 30 m. run from raise to raise, resulting in two incline planes of 53.57% rise and 14 m. horizontal base, which diverge from the respective extremities of a key left in the center, 1.4 m. long, as shown in Fig. 4. This concludes the preparation. The same operation is necessary in the other slopes.

The inclinations of the planes were naturally derived from the angle of repose of the broken material, which was found to be 33°; the angle was selected less than this so that the material would not feed into the bins of its own accord, for if it did it would subject the timber to needless wear and tear. It was, moreover, anticipated that some broken material in the end would be beneficial by saving the time and cost necessary to build up temporary staging essential for drilling purposes. Had the angle of repose been approached too closely the filling would probably have run down as well as the ore.

In stoping the key is first taken out perpendicularly until 2½ m. high, then an intermediate level of the same height is driven up the incline to hole with one of the raises. The broken material is, as the end is advanced, raked down the incline to the bin with *legones*, in accordance with the trammers' requirements. A *legone* is a toothless hoe, and is generally used for filling the baskets constructed of *esparto* grass, hemispherical in shape, and provided with two handles. These *espuertas* or baskets are laid on the instep and the ore raked into them. They are useful in the incline and give much better results than would be obtained with shovels.

In Fig. 5 is shown the first cut being taken out; the others are taken out in a similar way. It will be noticed that the central bin is not built in a similar way to the raises. This is not done until one side has been holed and the next is a few meters in, which prevents them getting shattered by close blasting. As soon as one has holed, the next one is started in the opposite direction.

---

*Excerpt from an article entitled "Stoping at the Calamon Mine," Bull. 88, I. M. M.

†Mining engineer, Wilkie Hotel, St. Stephen's Road, Bayswater, London, England.

The rest is carried on in exactly the same way, with the exception of the last three cuts on each side, which hole into the floor of the level in a similar way to the raises. This is generally done by laying down sollars 6 m. long, one on each side of the floor of the level and parallel to it, with two corresponding cap-pieces along the roof inside the other set and at right angles to them, which are kept in position with uprights and cross pieces. This allows the stope to hole safely with the level. These timbers when finished are removed and used elsewhere. In filling ends it is only necessary to board up the excavated side of the central bin, construct a chute in the part of the raise into which the stope was holed, supply it with waste from the level above and let the water run in. This is almost invariably sufficient, though it is customary for the miner working in the other section of the stope to go occasionally and ascertain that the material is running down well, and if not, to set it in motion. Fig. 6 shows a cut being filled in. The hydraulic method of filling is used. It is stated that the saving affected by this method of stoping over and above the cost of the method previously used was about 58,000 pesetas, a figure equivalent to two months' profit.

Engine Foundations

Engine foundations perform two functions; they hold the engine bed rigidly in place and they absorb vibrations. The foundation must, therefore, be heavy and bulky and it must have a substantial and firm bearing in the earth. Concrete is by far the most available and best suited material for this purpose. It is not only a comparatively inexpensive material but it is also exceedingly convenient to handle and to mold into the necessary form. Moreover, states R. B. Dale in *Power*, with intelligent supervision, the foundation may be built without the use of skilled labor. However, sufficient time must be allowed for the concrete to set before a load is placed on the foundation.

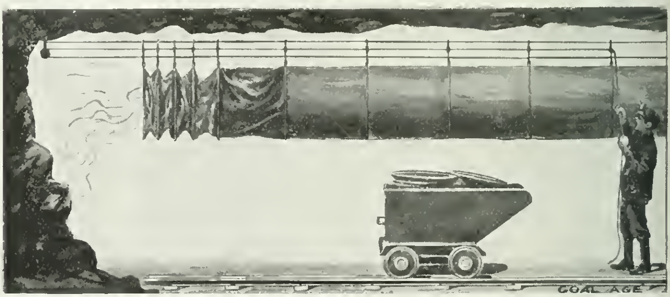
The engine base is held to the foundation by means of anchor bolts. These are mild-steel rods several feet long with a square nut and anchor plate at one end and a hexagonal nut at the other. The foundation is usually built and the anchor bolts set in the places indicated for them on the engine builder's setting plans before the engine has been shipped so that the foundation may be ready to receive it when it arrives. The anchor bolts are hung from a template which is securely fastened to the top of the forms for the concrete, and the anchor plate is completely buried in the concrete. A small wooden box, tapering from the lower end to the upper end, is made to surround the anchor bolt; this allows for a slight adjustment of the bolt so that it will fit into the cored holes provided for it in the engine bed. This precaution is necessary because it is almost impossible and, in any case, too expensive, to set them so that an accurate fit is obtained.

When the engine arrives and after the concrete has properly set, the engine is moved to its foundation where it is set in position. Small iron wedges are driven under the edge of the engine bed until the engine is level, thus leaving a space of ½ in. or more between the engine base and the top of the concrete. The hexagonal nuts on the upper ends of the bolts are then tightened, after which cement grout is run under the engine base and allowed to set. When the grout has set the wedges are removed and the nuts on the anchor bolts are again tightened as much as possible.

In order that the foundation may perform to the fullest extent its function as an absorber of vibrations, the vertical hole through which the anchor bolt passes is not filled with grout. This allows the bolt to stretch or elongate throughout its entire length whenever subjected to shock. It may be said to act somewhat in the manner of a spring. If the anchor plate is of ample area, no advantage in holding-down force is obtained by grouting the bolt for its whole length as the bond between the steel and the concrete is comparatively slight. Any lateral movement of the engine on the foundation is prevented by the friction between the engine bed and the top of the foundation. The greater the initial tension in the bolts, the greater is this resisting force. If a slight movement should take place this resisting force would increase enormously because the tension in the bolts would increase as they are stretched to accommodate themselves to the new position. Shearing strains which are liable to occur in the bolt between the top of the foundation and the engine bed, if it is completely bedded in the grout, are also prevented.

Collapsible Air Ducts for Mine Fires

The usual way of supplying air to the men fighting a mine fire is by the use of props, boards and brattice cloth, but where the cross-section of the heading is too narrow to permit of the erection of such a side airway, air conduits can be used. These may be made of cloth, and can be folded up like Chinese lanterns as is shown in the accompanying illustration. They are easily carried from place to place. These cloth conduits, which are described by Gustav Ryba in *Zeitschrift des Zentral-Verbandes der Bergbau Betriebsleiter Oesterreichs*, are made and sold in Vienna. In order to prevent the collapse of the cloth cylinders with consequent obstruction of the air, they are stiffened by steel rings within. According to the data furnished by J. Jicinsky, a mine manager, 100 yd. of horizontal air conduit can be laid in 15 min. The ventilation may be obtained from a small portable fan, driven by hand or other power.



Austrian Device for Approaching Fires

The use of such conduits is by no means restricted to fighting mine fires. They can be used for ventilating raises, the work of driving which is perhaps the most trying that a miner has to endure in the usual every-day work at a mine, because of the heat and bad air. In driving long drifts, especially when tortuous, some means of ventilation is desirable both from the standpoint of comfort of the miners and from that of costs. In such crooked drifts the powder gases are very slowly diffused and if some means of accelerating ventilation is not provided much time may be lost by miners waiting for the smoke to clear before returning to the face.

A similar device was in use about two years ago at one of the Goldfield Consolidated mines in Nevada when a long tortuous drift was being driven. The air was supplied by a fan at the shaft station and was led to the working face through a light galvanized-iron pipe. The use of canvas pipe as a means of ventilation has been previously noted in this department of the Journal.

Details of Metallurgical Practice

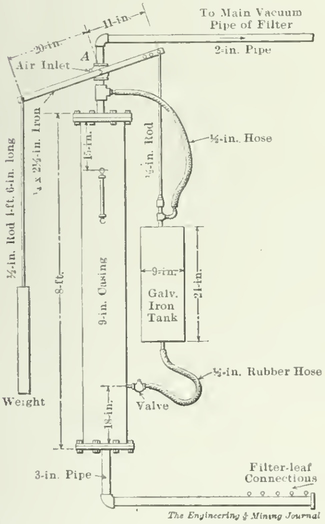
Records of Experience in Ore Dressing, Cyaniding and Smelting

Acid Treating Filter Leaves

By C. H. Fox*

The accompanying sketch shows a device for assisting the acid wash of filter leaves. It is in use at the West End mill, at Tonopah, Nev. The leaves are placed into the acid tank and connected to a 3-in. pipe by means of the usual filter couplings. This pipe leads to the bottom of a drum 8 ft. high, made from 9-in. casing. A 2-in. pipe connects the top of the drum with the main vacuum pipe of the filter.

A stop and drain valve, placed in the pipe above the drum, automatically controls the vacuum and air inlet. This valve is fitted with a lever. A weight is suspended from one end and a galvanized-iron tank from the other. This tank is fitted with two pieces of ½-in. rubber hose, one at each end The upper hose leads to the top of the drum and connects with the 2-in. pipe between the stop and drain cocks and the drum. The lower one is fitted with a valve and connects with the drum about 18 in. above the bottom.



Auxiliary Apparatus for Acid-treating Filter Leaves

After the filter leaves have been placed into the acid bath and connected to the pipe leading to the bottom of the drum, the valve in the pipe between the top of the drum and the filter vacuum pipe is opened. The acid is then drawn through the filter leaf and up into the drum. The level of the acid in the drum is for a time shown in the gage glass. As the acid rises in the drum some flows through the lower hose into the galvanized-iron tank.

After a level has been reached at which the weight of the acid in the tank exceeds the weight on the other end of the lever, the tank drops and closes the valve at the top of the drum. The vacuum is shut off and air admitted through the air inlet *A*. The acid returns to the acid tank by gravity. When nearly all the acid has returned to the acid tank, the weight of the galvanized-iron tank has decreased and the excess weight at the other end causes it to rise.

The vacuum is once more turned on and the cycle repeated. Practice has shown no saving of time is gained, but a much more thorough washing of the leaves is obtained.

Volatile Matter in Coal

The following method seems to do away with the personal equation in determining the volatile matter in coal, writes Frank E. Lathe.

Weigh 1.0 gram of sample into a previously weighed porcelain crucible. Cover, and fasten the cover in place with thin iron wire. Place in the bottom of a 20-gram crucible (as used in fire assaying) and fill the large crucible level full with wood charcoal, well broken up. Cover the crucible with a scorifier, and place in a muffle for half an hour at a temperature of 1000-1100° C. Remove from muffle, allow to cool in charcoal then reweigh crucible: The loss in weight represents the amount of moisture and volatile-combustible matter.

Graphic Method of Illustrating Extraction Tests*

By H. K. Picard[†]

There is herein suggested a graphic method of reporting the results of extraction or concentration tests on ore samples, which has been found particularly suitable when a large number of products result. The method has been in use in my laboratory for some time past, and is generally approved by those interested. So far as I am aware, nothing similar has been published, though it is quite possible that like devices are employed in other laboratories and works.

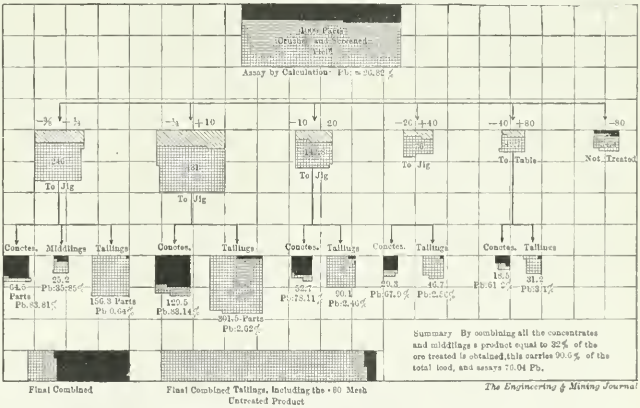


Chart Showing Recovery of Lead Concentrates

As an example I give a concentration test on a lead ore where the number of products is not excessive; even in this simple case it will be admitted that the graphic method is easier to follow than would be a list of figures detailing the results of such a test. For instance, a middling product which assays 30% lead at once gives the impression that it is too rich to be ignored and will require re-treatment. But reference to the graphic statement shows that the amount of this product is so small as to render re-treatment inadvisable or unnecessary, and that it may be mixed with the bulk of the concentrates without appreciably lowering their value.

---

*Tonopah-Belmont Development Co., Tonopah, Nev.

*An article entitled "A Graphic Method of Illustrating the Results of Extraction Tests," Bull 89, I. M. M.

[†]Mining engineer 11 London Wall, London, England

A sheet of squared paper divided into tenths is most suitable for the diagrams required in the graphic method of illustration. Each square is taken to represent a convenient weight of ore, say 1 lb. or 1 gram, according to requirements. A parallelogram is drawn containing a number of squares equal to the weight-units taken for the test. In the example given 1000 lb. of ore were taken, and are shown by 1000 squares at the top of the sheet. The tenor of the ore in lead is represented within this figure by a wash of solid color occupying squares equal to the amount of metal present. In this instance the ore assays 26.8% lead, and therefore 268 squares are colored. The sample was then crushed and graded into the products shown, the size of each figure again being proportional to the weight. The lead tenors of each grade are similarly shown, except that, not being final products, the amounts of metal are represented by cross-shading. The —80 grade was not further treated, and thus became a final product; its lead contents are therefore shown in solid color.

Following the diagram, each grade was separately concentrated, yielding the products indicated—these again being shown relatively to their weights; and, being final products, their lead contents are represented in wash. All the lead originally present is thus divided up and shown in the final products, the sum of whose weights and contents is equal to that in the original ore taken.

In the example, purposely selected for its simplicity, there is obviously no difficulty in deciding what to do with the products; but with complex ore yielding various middlings of differing values, the diagrammatic method will be found of assistance in deciding whether such products should be rejected, re-treated, or mixed with some other product. Two or more metals can be shown by employing different colors. With gold or silver ores the amount of metal would be too small to show proportionately, but the relative amounts may be indicated if some convenient unit be selected. Thus the small squares may be taken to represent 1 grain, 1 dwt. or 1 gram per ton, according to the richness of the ore or concentrate.

The size of the unit to be adopted in any particular case will be determined by the smallest product to be shown. This must be of appreciable dimensions, and should conveniently occupy not less than ten squares. A unit square of 1/10 in. has usually been found suitable. The suggested method is applicable to operations other than concentration, though it is in regard to the latter that it has been found specially useful.

A Chilled Iron Stamp Shoe

The lower edges of ordinary steam-stamp shoes quickly wear away, resulting in the formation of a convex face. This wearing continues until the lower portion of the shoes becomes quite round and therefore inefficient. Instead of crushing the ore, the shoe rams it or pushes it away, resulting in a great decrease in the output of the mill. But when the shoe is so formed that the outer edge of the wearing face is harder than the middle portion, the sharp particles of quartz or other rock will wear away the middle of the face as fast as the outer edge. The action of the stamp is more effective when the bottom face of the shoe is slightly concave. Shoes of cast iron, formed by pouring the metal into a mold having a chilling member, have been found most effective, and to have the longest life. They virtually consist of a central core and an outer shell, the shell being much harder than the core. A patent (U. S. pat. 1,012,664) has been granted to Charles L. Lawton of Hancock, Mich., covering shoes of this type and methods of casting them.

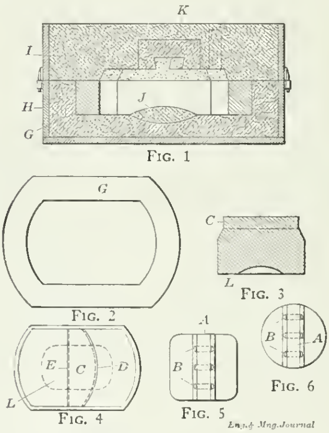


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6

Details of Shoes and Casting Flask

In the accompanying drawings, Fig. 1 is a transverse section of a mold for such a shoe; Fig. 2 is a plan of a chill; Fig. 3 is a cross section of a shoe with section lines to indicate the relative hardness of the metal and Figs. 4, 5 and 6 are plans of different forms of shoes of this type.

The shoes may be of any desired form. Figs. 4, 5 and 6 show shoes that are of different cross sections. Any desired means may be employed to secure the shoes to the stamps, ribs *A* provided with boltholes *B* being shown in Figs. 5 and 6, while in Fig. 4 the rib *C* has a curved side *D* and a straight side *E*, inclined toward each other so as to furnish attaching means for the stamp head. The chill *G* may be of any desired thickness, depending upon the depth and degree of hardness desired.

The flask *H* may be of the usual construction, and the sand *I* may be either "green" or "dry."

To insure slow cooling of the middle or core of the shoe a pad *J* of asbestos, properly prepared sand, or other good non-conductor of heat, may be placed in the bottom of the mold. A portion *K* of the mold may be of dry sand to properly form the rib *C*. According to the claims of the inventor the output of ore per stamp when equipped with a shoe having a hard outer edge and softer middle portion, and the life of the shoe, are both much greater than those of a shoe of uniform hardness equal to or even greater than the hardness of the outer edge of the shoe of this invention, owing to the fact that the shoe of uniform hardness becomes rounded while the shoe of his invention remains slightly concave or flat.

This shoe may be used until worn away, while the usual shoe of uniform hardness throughout often becomes practically useless when less than one-fourth of its volume has been lost. The depressions *L* in the bottom faces of the shoes may be of any desired dimensions.

Covering for Cement Floors

Although there may be no danger of permanent physical disorders arising from working on cement floors, some feel more fatigued at the end of a day's work than where a softer floor covering is employed, states H. C. Sundell in *American Machinist*. Still where cement floors are already laid it is not always possible immediately to change to a more desirable surface, even though the men show signs of weariness.

A good way to offset the undesirable features of cement floors is to lay, at such places where men stand at their work, sheets of 3-ply roofing felt which can, in warm weather, be cemented to the floor with the same kind of cement used in making the joints on the roof. This covering lies flat, is easily swept, is pleasant to work on and wears surprisingly well considering the character of the material. At places where men spend a great part of their time the covering will give good service for 10 or 12 months. The price too, is greatly in its favor, as the cost is less than $3 per hundred square feet.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Zinc Dust as Precipitant

The problem of the physical constitution of zinc dust was recently taken up by M. T. Murray (*Journ.* Chem. Met. and Min. Soc. of So. Africa, December, 1911). Screening tests showed the following: None of the material remained on a screen with aperture 0.0197 in.; 94.54 per cent. of the whole passed the smallest screen used (aperture 0.0030 in.). The average diameter of the particles was calculated as 0.0011506 in., which corresponds to a surface of 144.8 sq.ft. per lb. of material; this is about three times the surface exposed by 1 lb. of filiform zinc. Under a microscope, zinc oxide and other impurities were seen to be present, but quite separate from the metallic particles which were approximately spherical and retained their bright metallic luster even after several weeks' exposure to the atmosphere. H. A. White stated that a threefold increase of surface was insufficient to account for the greatly increased rate of precipitation by zinc dust compared with that obtained in the usual extractor boxes, so that there must be another factor involved.

Electric Reduction of Aluminum

On the Continent the electrical smelting of aluminum is now exclusively effected in furnaces having conductor melting bottoms and several electrodes, while the melting bath is kept liquid exclusively by the electric current says the *Mining Journal*, Feb. 24, 1912. The cross-section of the furnaces is in all cases rectangular, and they are provided with a series of anodes. There are practically only two types of furnaces used, which are distinguished from one another by the different strength of the electrodes and the construction of their melting bottoms. One type has four rows of electrodes with from six to eight electrodes per row, and the melting bottom is composed of compressed carbon, into which four large iron plates are inserted as conductors. A drawback of this type is that, when the furnace is blown in, strong tar vapors are developed. With the second type of furnaces the melting bottom is only partially used as a conductor, and the total number of electrodes is ten. For each electrode there is a corresponding anode of equal size. In all cases the bottom is slightly inclined toward the gate of the mold. Each electrode must be so arranged that it can be regulated by itself independently of the others.

Each factory jealously preserves the secret of the composition of the melting bath used by it, but in all cases the density of the bath must be inferior to that of the metal, so that the latter can accumulate at the melting bottom. Cryolite melts at 1000°, but it is possible to reduce the melting point to 915° by an addition of Al_2O_3 (up to 5%), or even to 800°. by the addition of fluoride of calcium or aluminum. The density of cryolite is 2.92 in its solid and 2.08 in its liquid condition, against 2.6 and 2.54 respectively for the density of aluminum. It is not advisable to have more than 25% of aluminum (in the form of alumina) in the melting bath. The flux most commonly adopted is fluoride of calcium. The following figures (ascertained by practical experience) regarding the production of aluminum are of interest. Efficiency of the smelting process: Theoretically 42 grams per kilowatt-hour, practically 30 grams per kilowatt-hour; efficiency, 71%; from 50 to 55 kg. aluminum may be reckoned a fair capacity per furnace and per 24 hr. The voltage used is from 8 to 10 volts; density of current from 1.5 to 3 amp. per sq.m. cross-section of electrodes. The consumption of alumina per kilogram of the finished aluminum is theoretically 1.888 kg., and practically 2 kg. Further costs, in addition to those of handling and current, are those necessitated by 100 grams of cryolite and 900 grams of anodes per kilogram of aluminum.

Heating by Blast Furnace Gases

A recent abstract from *Stahl und Eisen* (*Chem. Trades Journ.* Feb. 4, 1912) discusses the utilization of blast-furnace gases for the drying of molds and the heating of drying ovens in the iron foundry. Blast-furnace gas is superior to either solid fuel or producer gas for these purposes, since the latter fuels cause deposits of ash, soot, or tar. A way is suggested of reducing a danger always present when blast-furnace gas is used for drying purposes. The refined gas is at once odorless and poisonous, and a man may easily be overcome by it before its presence is noticed. It is impossible to prevent entirely leakages from pipes and burners, and it has, therefore, been found necessary to mix the gas with something that will give it an easily noticeable smell. Calcium carbide has been adopted for this purpose. The gas, in its passage through the pipes, is caused to pass over a wire basket containing lumps of carbide, which absorb moisture from the gas and give off acetylene. The cost is trifling, especially as the heating value of the gas is somewhat increased. Means must be provided for shaking periodically the basket to free it from accumulations of calcium oxide.

Testing Mine Air

Owing to the difficulty the average assayer is having in making the tests of mine air prescribed by the Transvaal government, Dr. J. Moir republishes his method for CO_2, in the Journal of the Chemical, Metallurgical and Mining Society of South Africa (Jan., 1912).

The stock solutions must be made with recently boiled distilled water, and kept in amber bottles with vaselined stoppers. They are as follows: *Sodium Carbonate*—Ignite chem. pure Na_2CO_3 then weigh out 2.120 grams and make up to 200 c.c., with distilled water. This gives an $\frac{M}{5}$ or $\frac{N}{10}$ solution. *Alcoholic phenolphthalein*—Dissolve 2.120 grams in 200 c.c. absolute alcohol. This gives an $\frac{M}{30}$ solution. From these make up the working solution, which keeps only half a day. *Working solution*—In a clean 200-c.c. bottle place 2 c.c. of the sodium-carbonate solution, and 6 c.c. of the phenolphthalein solution, then 192 c.c. of the boiled distilled water. Use narrow pipettes and do not blow in them.

Sample the air in the required place by blowing into a clean 200-c.c. bottle with a bellows. The nozzle must be narrow enough to enter the sample bottle; if necessary use a rubber tube on the bellows to achieve this end. The operator must keep his face away from the entrance valve of the bellows. Replace the stopper of the bottle.

Take a measuring glass delivering 12.0 c.c. of working solution, fill it and empty into the bottle, and shake continuously for two minutes. If the pink changes to yellow or becomes colorless the air is bad (over 0.2% CO_2). If it only fades slightly, the air is good. If the pink nearly disappears the CO_2 is about 0.2%. Do not expose the main working solution to the mine air more than is necessary.

The solution strength and quantity are calculated to test for 0.2% of CO_2 at a net elevation of about 3000 ft. above sea level; for a net elevation of 5500 ft. use 11.8 c.c., at 500 ft. net, 14 c.c. For other set standards of purity, alter the quantity of solution in direct proportion. If the color is discharged before one minute of shaking, it is a safe asumption that the CO_2 in the air is over 0.3 per cent.

The Schumacher Briquetting Process

The Schumacher process for briquetting iron flue dust, or flue dust mixed with fine ores, has come into large commercial use in Europe and a small plant is already in operation in the United States by the Cambria Steel Co., at Johnstown, Penn. The process rests upon the observation made by Doctor Schumacher in 1908, that blast-furnace flue dust, possessing of itself no binding or cementing properties, acquires strong cohering properties if mixed with a small amount of certain salt solutions, this amount being so small that the resulting cementing appears to be rather by catalytic action than by mass action of the chemicals added, says Dr. Joseph W. Richards, in a paper presented at the New York meeting of the American Institute of Mining Engineers. For instance, fresh blast-furnace flue dust mixed with 0.25 to 2% of its weight of magnesium or calcium chloride in solution, set in a short time (from 15 to 60 min.) forming a hard cemented briquette.

Alkaline solutions appear to have no such action, and, if present, they interfere with the action of the magnesium and calcium solutions. There is an excess of cementing and setting power, and strongly cementing flue dusts will carry as much as three times their own weight of the fine ore or similar material, and yet produce a satisfactory briquette.

The Cambria Steel Co's., plant consists of two presses, one of which is of the mechanical type, with hydraulic safety regulators, the other is a Ronay hydraulic press. The mixture fed to the presses was: Warm flue dust, cold Mahoning ore and a cold 30% solution of calcium chloride. The mixture as fed to the press was just warm to the touch. The bricks from the press were hot and steaming. The first press consumed 35 hp. with an output of 7 tons per hour, the second press 25 hp with an output of 4 tons per hour. The flue dust carries from 18 to 20% of coke which is all carried into the mixture, said mixture being 70 of ore to 30 of flue dust. There is from 5.5 to 6% of coke in the finished briquette, the saving of which is sufficient to pay for the entire cost of the briquetting of the dust. The briquettes are decidedly porous, as one absorbed 11.5% of its weight of water, representing 27% of voids. Briquettes one day old, hard dried, gave a compressive strength of 445 lb. per sq.in. Several hundred tons of the briquettes were seen in the ordinary furnace bins ready for use and appeared to have borne transportation to that point and dropping 10 to 20 ft., also the subsequent action of snow and ice for several weeks, without deterioration. Only a few were broken and but little dust was made.

Annealing Temperature for Brass

Experiments have recently been conducted on the proper temperatures for annealing brass in order to attain the best combination of strength and ductility (*Metal Industry*, Feb., 1912). This temperature has been determined to be between 600 and 700° C. It has been shown that the atmosphere of the annealing furnace, whether oxidizing or reducing, does not appear to affect in any well marked manner the properties of the brass.

[However, it is interesting to note that in the annealing of copper, sulphur fumes from coal containing large quantities of sulphur seem to be absorbed by the copper and to render it short.—EDITOR.]

The Bessemer Laboratory of the Royal School of Mines

The equipment of the recently opened Bessemer laboratory, in the Royal School of Mines, London, seems worth noting. According to the *Engineer*, Feb. 2, 1912, it is as follows:

> The building is 121x250 ft. Along one side runs a gallery provided with tip trucks running on rails, which will take the ore to the nine 10-ton bins or to the dry-crushing plant which occupies the highest position at the end. Here there are Blake and Dodge crushers, from which a 12-in. picking belt conveys the material to a steel-plate sampling floor or to the stamp house. This house contains one two-stamp 350-lb., one five-stamp 950-lb., and one Huntington mill, with feeders, etc. It is entirely inclosed and has double windows and double walls with an air space between, and is thickly lined inside with felt. All this is done with the object of reducing the noise as far as possible, and in this it is successful. The vibration when the stamps are running is not great. From the crushers the material may be taken to a long series of concentrators and separators of various kinds and nearly all of full size. There is a Bunker-Hill sizing screen, a two-compartment hydraulic classifier, a 4-ft and a 6-ft Frue vanner, two No. 5 Wilfley tables, a 20-ft. Acme table, Ulrich and Wetherell magnetic separators and so on. Besides all this there is a complete cyanide plant; in fact all the plant that is necessary to demonstrate the usual processes of crushing, sampling, concentrating, magnetic separating, cyaniding, chlorinating, pan amalgamating, and so on, are to be found, with further plant for studying the floatation process of separation, and the drying, roasting and smelting of ores.

Distillation of Alloys in Vacuo

It has recently been determined that when conducting a distillation of copper alloys at about 1200° C. *in vacuo*, zinc, lead and arsenic are quantitatively distilled off, while copper is not seriously affected at this temperature. These results were communicated by Thomas Turner at a meeting of the Institute of Metals in London, Jan. 16 to 17, 1912, and in the opinion of Sir Gerard Muntz give promise for a method by which impure copper may be refined. Iron remains behind with the copper, while a distillation which is quantitative for zinc will carry over only about 10% of the tin present.

Prevention of Cyanide Poisoning

In addition to keeping cyanide antidotes always on hand, the Transvaal Mining Regulation Commission advocates the following preventive measures: (1) Provision of an adequate supply of wholesome drinking water about plants and assay offices, the same to be distinctly labeled "Drinking Water"; (2) the replacement of strong cyanide solution used in the precipitation boxes by water previous to the zinc being handled; (3) the effective hooding of the dissolving bath in which the gold precipitate is treated, and the use of some form of mechanical agitator in order to eliminate the necessity of raising the hood.

Galvanizing Aluminum

In a process for galvanizing aluminum, patented by Mix and Genest, the previously cleansed aluminum is scoured in the ordinary manner and then dipped into a heated acid solution, and simultaneously subjected to the action of reducing agents, such as alcohol, which prevent a too rapid reaction (*Chem. Trade Journ.*, Feb. 17, 1912). After being in this solution for a brief time the aluminum is transferred to an ordinary galvanizing bath. According to experiments, galvanizing thus executed is both durable and can be given a remarkable polish.

Evaporation from Reservoirs

Careful observations and calculations were made by Edwin Duryea, Jr., or worked up by him from Weather Bureau reports, on the evaporation at Lake Tahoe, Calif. (*Eng News*, Feb. 29, 1912). He finds the maximum yearly evaporation would probably be 40.15 in., the minimum 20.52 in. and the average 30.52 in. He deduces that for power and irrigation projects, it would be safe to assume a 36-in. evaporation.

Developments at Stratton's Independence

Denver Correspondence

Stratton's Independence mine, under the management of Philip Argall & Sons, is looking better than at any time for many years, for a discovery was made in hitherto unprospected territory, which opens up unlooked for and great possibilities, not only to the mine, but to the whole district.

Following the phonolite dike south toward the granite on the 200-ft. level of Stratton's Independence, in search of milling ore, a high-grade streak was discovered last October on the east side of the dike. A large amount of ore was stoped out above the level, and a drift was advanced further south and a crosscut driven west, when another vein was found on the western side of the dike. This was stoped to a height of 80 ft., and in this latter stope at 40 ft. above the level the prospecting developed a pipe of rich ore passing into the granite at about 45°. This pipe was followed up to the first level, and in places was 16 ft. wide by about 20 ft. high. It is estimated to have produced about $50,000, with about half this in sight at present, and ore was struck on the first level last week.

Development showed two veins in the granite on the second level, 20 ft. apart, and the big pipe of ore was formed at the intersection of these small veins above, averaging about 30 in. in width. One of the veins has recently been discovered 100 ft. below the third level, and crosscuts are being driven into the granite on the fourth and fifth levels to intersect this new vein system, which obviously is of great importance. Regarding the low-grade ores of the mine, the mill, now that warm weather has arrived and the water lines are thawed out, is running smoothly, treating about 10,000 tons per month, handling dump rock of about $3 grade, as well as about 50 tons per day of mill dirt from the mine, which will average about $5. In fact, the mill has been thoroughly tuned up and is steadily giving definite and profitable results.

This discovery in all probability would never have been made but for the low-grade milling operations carried out by this company. Indeed, this discovery is only one of many that have been made by following up mineralized dikes and veins too low in grade to pay except on the new milling basis, i.e., treating ore at the mine at $1.20 per ton. In developing ore for the new mill, abandoned stopes and prospecting drifts that could not be operated profitably a few years ago, are now giving highly profitable returns in the mill, and an occasional big pocket of rich ore as above described.

Hence it will be seen that when low-grade milling is thoroughly established, the real output of the district will begin, as in following the low grade, even if it only pays expenses, the higher grade and occasional bunches of rich ore will be opened. It is generally conceded by those well posted in the district that the earnings for the last four months are equal to 30% per annum on the capital of the Stratton's Independence company.

Potash in Borax Lake, California

According to official announcements, the two Federal bureaus engaged in the search for potash—the Bureau of Soils of the Department of Agriculture, and the Geological Survey of the Department of the Interior—are in receipt of promising telegraphic news from their field representatives. A bulletin issued jointly by the two bureaus discusses this new potash discovery as follows:

A potash deposit of apparently great importance has been discovered at Borax or Searles Lake in the northwestern corner of San Bernardino County, California. It is situated about 20 miles from the station of Searles on the Owenyo branch of the Southern Pacific R.R. The lake is shown on a map in Water-Supply Paper 224 of the Survey, "Some Desert Watering Places in Southeastern California and Southwestern Nevada."

This lake or playa is the last remaining pocket of a once much greater lake which has almost dried up and its central depression contains a large body of crystalline salts known to consist of common salt and sulphate and carbonate of soda with smaller quantities of borax. This salt body is saturated with brine, and interested persons stimulated by the governmental search for potash recently secured an analysis of old sample material from this brine. The result being significant, the lake was visited jointly by representatives of the Geological Survey and of the Bureau of Soils who took brine samples from six wells distributed over the salt flat. Analyses of these samples have been made by the coöperative laboratory at the Mackay School of Mines, at Reno, Nev., and show an average of 6.78% of potassium oxide (K_2O) in solution. The average salinity of the brine is 43.82 grams of solids per 100 c.c. Comparison of the results indicates that the brines are nearly uniform throughout the flat.

The probable importance of the deposit is due to the occurrence of the potassium salts in soluble form in a natural saturated brine, and under climatic and other conditions especially favorable to its separation and recovery by solar evaporation. Existing data give reasonable assurance that the brine-saturated salt body is at least 60 ft. thick and covers an area of at least 11 square miles. Assuming the salt body to contain 25% by volume of the brine, the total amount of potassium oxide is estimated at over four million tons. This estimate is believed to be conservative, and the available tonnage may well be expected to exceed ten million tons, which would supply the country, at the present rate of consumption of potash, for 30 years. At any rate it appears that this locality constitutes an important source of potash in probably readily available commercial form. Methods of separating potash from brines are now under investigation by the Bureau of Soils.

In connection with this, in a message to Congress on Mar. 26, President Taft urged the immediate enactment of the amendment to the mining laws, introduced recently by Senator Smoot and authorizing the President by withdrawals to save from private exploitation the valuable potash deposits recently discovered in the West. President Taft's message also notes that these potash claims "may be acquired at any time under the placer-mining law by private interests, which will have contributed nothing to their discovery. Similar results will follow future discoveries at government expense."

East Rand Proprietary Affairs

Johannesburg Correspondence

The affairs of the East Rand Proprietary Mines still engage attention. The government is prosecuting the late manager, S. Penlerick, for sending in false declarations of gold recovered. Sir George Farrar, at an informal meeting in London, on Jan. 13, defended his actions with regard to the property, putting the blame on his technical advisors. He blamed the unexpected rise in working costs from 15s. 6d to 19s. per ton for reduced profits. The representative of the Corner House group announced that the reëlection of Sir George Farrar as chairman would not be opposed by them, and apparently the rival interests have been wholly or partially reconciled.

The chairman gave a revised estimate of the ore reserves. In the annual report of 1910, it was stated the ore reserves totaled 10,250,000 tons, valued at 28s. per ton, or, excluding low-grade ore, 7,718,000 tons, valued at 32s. 4d. per ton. The values he furnished, though apparently these had not then been checked by the new management, are: 7,129,838 tons, 32s. 3d.; 1,231,944 tons, 17s. 10d.; 1,686,652 tons, 15s. 9d.; 4,961,756 tons, 8s. 11d. He stated that development during 1911 had shown 9.8 dwt. over 26.4 in. for 34,896 ft., and that a new overlap portion of reef had been traced over 2400 ft., showing payable orebodies on three levels where driving was being started. He stated that the monthly tonnage treated for the present would be 175,000 tons, and that development was four years ahead of the mill.

At that date shares stood at 75s., having fallen from 100. At present shares have dropped to 52, on persistent rumors that the mines are not in a satisfactory condition as regards ore reserves or prospects in depth, and that further large capital expenditure will be required. Last month showed a profit of £67,000, as against over £100,000 last year and £85,000 recently. No information has been furnished to shareholders as to the results met with by the Cinderella Consolidated in driving through this company's Hercules and Angelo Deep section to connect at the 4000-ft. level.

Since writing the above, the report of the new managing director, Ross Skinner, has been published. He states that the payable ore reserves on Dec. 31, 1911, are really only 6,716,605 tons, worth 28s. over 55 in., and that there exist in the mines 11,150,397 tons, worth 10s. 2d. per ton over 55 in. All ore under 4.3 dwt. has been classed as unpayable, and ore of that grade is included only when occurring in wide stopes. Despite the enormous sums spent in excess development in 1910, the ore reserves were encroached upon for 841,000 tons during 1911, and development work in sinking inclined shafts in the west section must now be pushed ahead.

The most ominous feature of the report is the statement that recent development work, mostly in the lowest level, has shown only a small percentage of payable ore, only 39% of ore developed in the Angelo mine being payable. Large sums must be provided to contend with increase of water in depth, as the neighboring mine to the west, the Witwatersrand Deep, has now to pump 3,000,000 gal. per day. The Hercules 7-compartment shaft must also be sunk from 3000 to 4000 ft., which will involve the expenditure of about £30,000.

The most damaging statements are made with regard to the policy pursued by the late manager. During 1911, it is stated that 205,000 tons of ore, assaying only 1.9 dwt. per ton, were mined and sent to the mill, with 36,426 tons of unpayable ore from surface dumps. Also, during 1910 and 1911, about 78,000 tons of waste packing from old stopes were taken out and crushed to fictitiously lower the costs, and in order to maintain the grade the blocks of high-grade ore were unduly drawn upon. Comment on these revelations is almost needless; sufficient to say that were the truth known, the East Rand Proprietary company is not the only one on the Rand about which similar revelations might have been made in the past, if not at present.

Water in California Oil Fields

San Francisco Correspondence

The oil-well operators representing the west-side fields of Kern County, which are seriously affected by the infiltration of water, have organized an association that will undertake in a practical way to cure the evil as far as possible. The oil men are now inclined to depend chiefly on their own resources rather than to wait for state aid.

Mr. Storms, the state mineralogist, went to the field and made careful inquiry as to the situation. The present problem is an economic one and his suggestions were in line with the results that followed. Careful estimates were made of the area, the acreage holdings of individuals and companies, and the total production affected; the amount of money necessary to carry on the work under the present law was approximately estimated, and the method of obtaining it discussed. The oil men interested then formed the Kern County Oil Men's Protective Association.

A plan was adopted, as outlined in advance of the meeting, held at Bakersfield, Mar. 9, to raise the money to employ a commissioner to act in accord with the state law of 1909. The law provides for the appointment of a county water commissioner to be paid by the county, but it does not require that the commissioner shall be appointed, nor does it fix the compensation. The appointment was made, but the compensation allowed by the county was inadequate. Under the latest plan the members of the new organization have agreed to levy assessments according to their acreage holdings and production, not to exceed 2½c. per acre per month and not to exceed $^{1}/_{15}$ of 1c. per bbl. per month. The commissioner selected is the incumbent under appointment of the Kern County board of supervisors. He will perform his labor under the state law and by authority of the county, and extend the scope of his work through the aid of the association. Under the rules it will be his duty to file with the association an exact log of each well; the executive committee of the association will be expected to settle differences between the commissioner and the contributor or producer. It will also be the duty of the commissioner to be present at the time of the shutting off of the water in each well and at the time it is later tested for water, and he must file a report with the committee immediately.

Since the rules adopted by the association affect only the voluntary contributors to the plan there is believed to be no legal objection to their execution. Should an offender refuse to become a party to the plan or to submit to reasonable requirements of the commissioner the latter has the power of the statute to deal with the offender. The amounts of individual assessments for raising funds will not be made public, nor will any private information that it may be necessary to obtain. The entire plan was adopted without dissent. W. N. Forker, the present county water commissioner, was appointed commissioner for the association by the following named executive committee: D. S. Ewing, Timothy Spellacy, S. A. Johnson, H. W. Thomas, T. H. Minor, W. H. Hill, T. M. Young, B. T. Dyer, M. J. Laymance, J. D. Spreckels, Jr., and J. A. Crites.

Bill for Mining Inquiry

A dispatch from Washington under date of Mar. 26 states that the creation of a commission on mining industry to make an exhaustive study of mining conditions in the United States was proposed in a bill introduced in the House by Representative Foster, of Illinois, Chairman of the Committee on Mines and Mining. The commission would consist of 11 members, two Senators, two Representatives, two mine operators, two representatives of the miners, two mining engineers, and one representative of the Bureau of Mines.

The commission would be required to report within two years, and to make a report on general conditions of labor, safety, conservation of resources; the relation between employers and employees, and seek to "discover the underlying causes of dissatisfaction in the mining situation."

Marketing of California Oil

The proposal of the Union Oil Company of California to issue certificates for the entire amount of accredited oil in storage equal to approximately 11,000,000 bbl. at a guaranteed price of 35c. per bbl., has been accepted by the Independent Agency. The certificates will be ready for issue about Apr. 10. The Union agrees to purchase all the oil of the agency members other than itself up to 50% of the whole offered within 30 days after certification, and to carry storage oil without charge. The storage oil is to participate in current sales to the amount of 200,000 bbl. per month. This will relieve the agency of a burden of approximately $30,000 per month storage charges. Should more than 50% of the whole be offered, the acceptances will be pro-rated.

Rand Mines Blacklisted

A Reuter dispatch of Mar. 5, 1912, says that on that date in the Union House of Assembly at Cape Town, Mr. Burton, Minister of Native Affairs, said that the mortality among the tropical natives was so high in the Goerz, Eckstein, Robinson, General Mining and Rand Mines groups that the government had decided to forbid those groups further to import tropical labor.

A Visit to Porcupine

By W. R. Ingalls

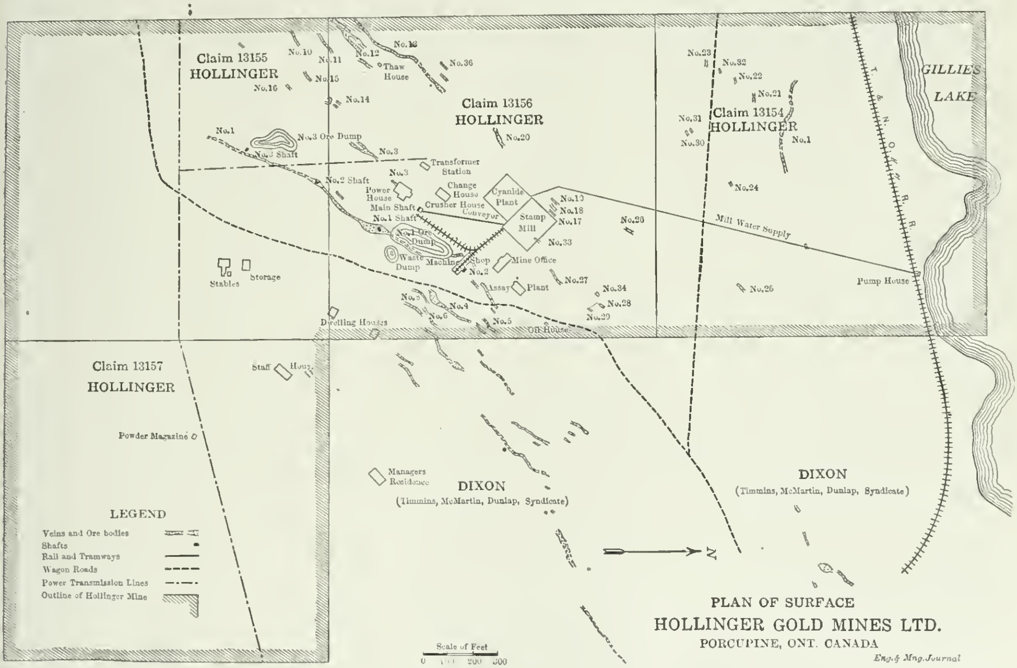
A brief account of the developments at the Hollinger and Dome mines, the mills that are under construction, and some general remarks respecting the district.

The Provincial Government of Ontario built a railway running from North Bay toward Hudson Bay, for the purpose of developing the "north country." as it is called, in an agricultural way. About 75 miles north of North Bay a cutting for the railway disclosed a vein of silver ore, which was the beginning of the Cobalt mining district. This discovery conferred great wealth upon the Ontario government, and its railway has ever since been a prosperous thing. Inasmuch as it is well recognized that "to him that hath shall be given," it was quite in the natural course of events that another mining district—Porcupine—should be discovered, northwest of Cobalt and not very far from the provincial railway, a branch from which was run into the new district last year. It is now possible to go from New York to Porcupine in a Pullman car in about 34 hours, with only one change, namely at Toronto, where a close connection is made.

Porcupine is situated on the northern side of what is called "The Height of Land," i.e., its waters flow to Hudson Bay. We are apt to think of it as being in the semi-Arctic region, but in fact it is not very far north, being only at latitude 48° 30′, and being south of the trans-continental railway line of the Grand Trunk-Pacific, now under construction. The Slocan district of British Columbia is further north, and at a much greater elevation. Although the winter at Porcupine is long and severe, there is no great hardship about it. In fact, the Hollinger and Dome mills were steadily under construction during the last winter. In summer, I am told, there is some very hot weather, and in the virgin country the mosquitoes and black flies are vexatious nuisances.

I shall not undertake to describe the geography and topography of Porcupine, nor the geology, all of which has been done repeatedly by many writers. The principal town is South Porcupine, which after destruction by fire last summer was rebuilt in a phenomenally brief time. It has the usual appearance and comforts (or discomforts) of the new mining camp, and represents the investment of considerable money, which has come from Toronto, Montreal, New York and elsewhere, with the expectation that it will be returned out of the mines of the district.

At the present time there are four mills in the district, one in operation and three under construction. The McIntyre has 10 stamps dropping. The Dome has a 40-stamp mill about ready to begin operation. The Hollinger has a 40-stamp mill under construction, and the Vipond has a plant with four Hardinge mills. All will probably be in operation before the middle of this year. The mines of the district that have large developments of ore are the Hollinger and the Dome. Nothing very definite is yet known publicly about the others.



PLAN OF SURFACE
HOLLINGER GOLD MINES LTD.
PORCUPINE, ONT. CANADA

The Hollinger Mine

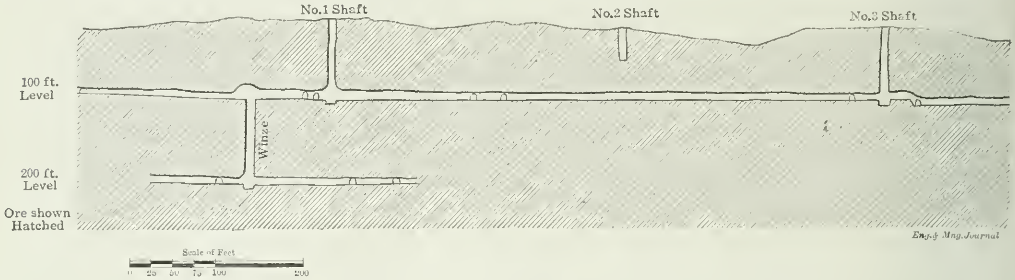
The Hollinger property is owned by the Hollinger Gold Mines Limited, which is under the management of P. A. Robbins. This company in the publication of its first annual report, a few weeks ago, commendably adopted the policy of publicity, and makes no bones about showing the mine to visitors and informing them fully about it. The mineralized belt is in a shear zone of schist, which originally was probably quartz porphyry. This schist is cut by irregular veins of quartz. There are no selvages, no slickensides and no banded structure. The quartz in a face sometimes appears as a solid mass, sometimes as blotches mingled with schist. Sometimes there is no quartz, only schist, in which event the vein can be followed only by assay. The schist in the vein is gold bearing. Sometimes there are tabular seams of quartz drooping out into the country rock, and becoming barren, although in appearance this quartz is quite like that of the vein proper. The schist is profusely mineralized with pyrite, and pyrite is also disseminated through the quartz masses. "The schist walls of the main vein do not usually carry payable values, except where contiguous to rich sections of the vein, and in such cases the schist seems to be more or less silicified, pointing to the silica-bearing solutions as having also provided the gold," says Mr. Robbins.

The property is crossed by a series of nearly parallel veins, standing nearly vertical and not very far apart. Openings have been made in the veins numbered 1, 2, 3, 4 and 8. The No. 1 vein is the main vein. According to Mr. Robbins, it has been exposed upon the surface for a distance of approximately 900 ft., averaging 9.4 ft. in width and $32.96 per ton in gold. On the 100-ft. level there is a continuous orebody for a length of 1000 ft., averaging 8 ft. in width and $31.54 per ton in gold. On the 200-ft. level the vein has been opened for a length of 350 ft., averaging 9.3 ft. in width and $49.30 per ton in gold. It is interesting to note that the wider parts of the main vein are usually the richest.

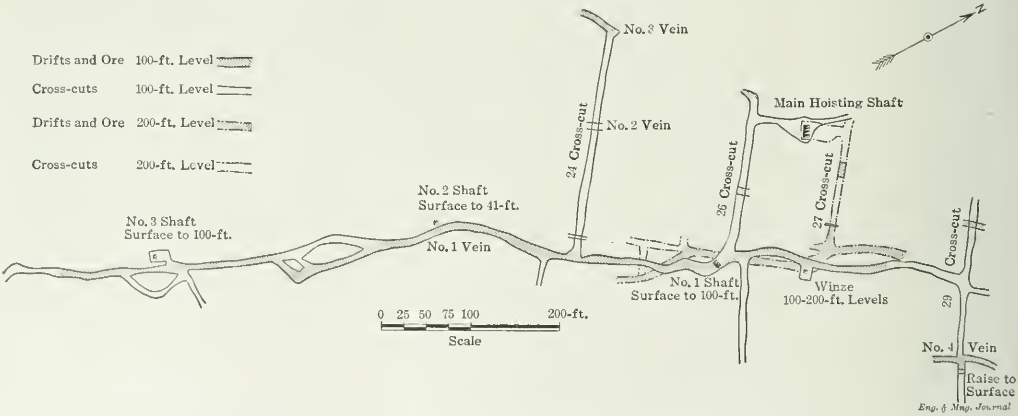
The other veins are lenticular, consisting of successions of chimneys and kidneys of quartz, which will necessitate a large amount of crosscutting and diamond drilling to discover their orebodies underground. It is also interesting to note that the pay ore goes right up to the surface. Generally speaking, the surface showing may be taken as an indication of what may be expected at depth. There is no evidence of surface enrichment.

The Hollinger mine has been sampled by Mr. Robbins and his assistants in an intelligent and conscientious way. Samples were chipped across all veins at intervals of 5 ft. In the underground workings the veins where exposed were channeled in the regulation way. Wall samples were taken by 6-ft. holes, drilled into each wall at regular intervals of 10 ft., and at intervals of 5 ft. where walls were in quartz or showed high value, the first 3 ft. and the last 3 ft. of each hole being kept as separate samples. The sampling is considered to have shown that the occurrence of visible gold does not necessarily mean payable grade, while on the contrary good ore is commonly found where no visible gold has been observed. The quartz where streaked by fine lines of pyrite in the cleavages is generally more consistent in gold content than the clear masses carrying occasional spectacular showings. It will be particularly interesting to have a comparison between mill returns and the stoping map in the case of this mine.

There is no question about the Hollinger being a real mine from which a good deal of gold will be derived. This is said without any reference to the current valuation of its shares on the market. Mr. Robbins in beginning his report declined to make a positive estimate of the ore proved by the development work, but further on indicated an expectation of 462,000 tons. The prime question is how deep does pay ore go in these veins? Steps have already been taken to sink to the depth of 400 ft. without delay. It is estimated that when the mill is completed the total investment in mine development and in plant will be about $700,000, including property to the value of $112,000 lost in the fire in 1911.



Stope Section, No. 1 Vein—From First Annual Report, Hollinger Gold Mines, Ltd.



Plan of Principal Workings, Hollinger Mine, Porcupine, Ont.

THE HOLLINGER MILL

The Hollinger mill, now under construction, is a design of A. G. Kirby, of Cobalt. The equipment will comprise 1500-lb. stamps, tube mills, Dorr classifiers, 40 Deister slime tables, four Dorr pulp thickeners, four Trent agitators, two Moore filters, two Merrill clarifying presses and two Merrill precipitation presses. Experimental tests have indicated that a high extraction of the gold in the ore may be made by a combination of concentration and cyanide treatment. The process decided upon is substantially as follows: Coarse grinding, stamping in cyanide solution, tube milling, concentration followed by amalgamation of concentrate, and cyanide treatment of both gangue and concentrate residues. According to Mr. Robbins, however, the management is not firmly tied to this process, but has given itself wide latitude in the mill for alteration. The mill building is a frame structure, the timber for it having been cut largely by the company on the ground. The initial mill will have a crushing capacity of 300 tons per day, while the cyanide plant will be capable of treating 500 tons per day. It is estimated that the cost of the mill will be $275,000. Everything in the mill will be driven by electric power, which will also be used in hoisting from the mines, this power being supplied by the Porcupine Power Co. on terms that look exceedingly favorable, considering the newness and remoteness of this district.

THE DOME MINE

Everything about the surface of the Dome mine indicates a confidence in what exists underground. The houses and miscellaneous buildings are all of brick, while the mill, rock house, power house, store house, laboratory, etc., are either of steel and concrete or of steel and brick. The mill was nearly completed at the time of my visit, and very likely will be in operation before this article is printed. It comprises 40 stamps and four tube mills, and is estimated to be capable of treating between 350 and 400 tons per day. The process is substantially stamping, amalgamating on plates, sliming in tube mills, and cyanide treatment of the slime. The mill has been designed and built by the Merrill Metallurgical Co., San Francisco, and is as good an example of modern mill construction as will be found anywhere.

The Dome Mines Co. has published no estimates of the amount of ore that it has developed. The orebody at this place is of massive character, having been developed, chiefly on the 50-ft. level, over a rather large area. Eight shafts have been sunk to depths varying from 45 to 200 ft. On the 50-ft. level drifting and crosscutting have been done to the extent of 1310 ft. Prospecting to further depths has been done by diamond drilling, holes having been put down aggregating 9046 ft. In the first official report of the company it was stated that "The diamond-drill work indicates a large body of ore of good milling value, and such ore has been cut at various depths to 1000 ft. It will be necessary to do a large amount of sinking and drifting on this orebody before it will be possible to state intelligently the size of same, and what will be the average value of the ore to be milled. However, sufficient work has been done to justify the management in equipping the property with the most permanent type of buildings and machinery, with the view to extending the plant as the further development of the mine may warrant." The balance sheet of the company at Nov. 30, 1911, shows that since the beginning of operations the cost of the plant, equipment and development of the property after deducting the amount ($309,000) collected as insurance, is $860,000. By the time the plant is completed the total investment will doubtless be well over $1,000,000.

The Dome mine is in the charge of H. C. Meek, formerly of the Sudbury district, as superintendent, with Henry Hanson as mill superintendent, and W. W. Mein as consulting engineer.

GENERAL

The widespread occurrence of gold in the Porcupine district and the development of two mines that probably will be profitable (on the basis of the money that has been put into them) leads to the hope that other good mines may be developed, which hope is not unreasonable. The accomplishment during the last year has been rather wonderful, considering the setback by the fire, the hair-breadth escapes from which and the dramatic dangers, are naturally still the subject that comes easily to the tongue of the pioneers. The mining companies have taken such precautions against recurrence of loss in this way as has been possible.

At Swastika, north of Cobalt, on the main line some mining is being done, but Gowganda, Larder Lake, and the other scenes of prospecting languish from their difficult accessibility. Looking at this region broadly there seem to be chances for the discovery of numerous mines from the facts that the existence of gold, silver and nickel has been proved while but relatively little prospecting has yet been done. I mean by this that it is a promising region for the legitimate prospector. It is not a region in which gamblers in mining stocks can successfully try to pick winners. The development of two good mines and the existence of gold over an extensive area are promising. We may expect to see active prospecting in this field and also in the new country that will be opened by the Grand Trunk Pacific Railway.

Artificial Gold

The disclaimer recently issued by Sir William Ramsay, in which he definitely contradicts the rumor that he has reported favorably on a process for manufacturing gold, shows that speculators are already taking advantage of the fact that modern scientific opinion regards the transmutation of metals as an open possibility. The gradual disappearance of scepticism in this matter was explained to a representative of the London *Standard* by an eminent scientist, as follows:

The absurdity of a transmutation of metals was adopted as a scientific dogma in the eighteenth century, but since 1869 certain things that have been discovered have shown that the dogma was premature, just as it would still be premature to say that transmutation will ultimately be achieved. In 1869 the Russian chemist Mendeléeff arranged the elements in the order of their atomic weight, and from this arrangement conceived the hypothesis that they had all been evolved from some common original substance. For the elements thus arranged fell into families, each member having similar but accentuated properties as the atomic weight increased, and therefore the old idea that the simple elementary substances stood absolutely apart one from another had to be abandoned. The hypothesis that an unknown substance or element, provisionally called "protyle," underlies their differences was suggested to account for the affinities.

Now, this was a considerable revolution in opinion. The discovery of oxygen in 1774 had overthrown many conceptions previously entertained by scientists, and it had come to be supposed that the search for the transmuting "philosopher's stone," which occupied the mediæval alchemists, was an entire delusion. This "philosopher's stone" meant some substance by means of which the elements, and indeed everything, could be turned into gold, and though probably a good deal of honest research was undertaken in connection with the idea, all sorts of frauds accompanied its exploitation.

But since the whole method of mediæval science had been generally discredited—whether accompanied by honest or by dishonest experiments—the revival of the "original substance" idea in 1869 was a very considerable revolution in opinion. However, the idea of artificial gold might not have entered the minds of modern speculators at all seriously if radium had remained undiscovered. But it was found that radium undergoes a sort of spontaneous decomposition, and that among the emanations which it gives off a totally different element, namely, helium, is included.

Here, then, within the last decade science has been brought to admit by facts that a spontaneous transmutation of elements does take place in nature. Therefore scientists can no longer deny that the transmutation of such elements as lead, gold, copper, nickel, platinum, silver, mercury, cadmium and so on, and even the creation of artificial gold, are possibilities of future experiment.

However, I think one may say that scientists still maintain the improbability of this achievement, although the state of scientific knowledge as it stands at the moment seems to oppose no insuperable barrier to it. But one may speculate whether a universal method of transmutation would be discovered. It appears to me that we shall conceivably be able to note affinities between certain elements, and even to transform one into another. But the idea that gold will be the first artificial element to be constructed is probably a delusion, even if it is not a fraudulent delusion. A universal process of transmutation would throw our whole economic life into the most extraordinary quandary, and the difficulties created by the discovery of a way to make gold artificially would alone be very disastrous. But the other minor transmutations, not bearing so directly upon our standard of values, might be scientific benefits without becoming the basis of too profitable exploitations.

White Marble in Colorado

DENVER CORRESPONDENCE

In Colorado there are many deposits of white marble that will undoubtedly receive more attention as time passes and marketing facilities improve. The largest operation at present is that of the Colorado-Yule Marble Co., which has been working for six years in the development of a deposit on the Crystal River, in Gunnison County, 350 miles southwest of Denver on the western slope of the Rocky Mountain Range. The quarry was originally 10 or 12 miles beyond the railroad, and a broad-gage road had to be built from Redstone to Marble. The marble deposits consist of two mountains of fine white marble on either side of Yule Creek. The deposit is 4500 ft. long, and a depth of 230 ft. has been indicated by drill cores. It dips into the mountain at an angle of 53°. A large finishing mill, 1600 ft. long by 70 to 100 ft. in width, has been built and equipped with the latest improved machinery, including Corsi wire saws. Three quarry openings are now producing 1500 cu.ft. daily, and besides shipments to Western cities, the marble is also being used in Chicago and St. Louis.

About 17 miles east of the Colorado-Yule quarries are situated the marble deposits of the Colorado-Highland Marble Co., which was recently organized to develop 455 acres of patented land, containing white and blue-gray marble. The Colorado-Highland deposits are a part of Mt. Hayden. The company will start to work on a small scale this year, but it is the ultimate intention to construct six miles of railroad, and equip the quarries with proper machinery, and a hydro-electric plant. The company is composed, for the most part, of Denver men, J. M. Hollister being president.

Mineral Production of Great Britain

Advance proofs from the Home Department, just received, give the production of minerals in Great Britain during the year 1911 from workings coming under the Coal Mines and the Metalliferous Mines acts.

These figures do not in all cases represent the total output for the year, since quantities of some important minerals—such as iron ore, limestone, sandstone, slate and clay—come from open workings under the Quarries act, the figures for which are not yet available. All the figures are in long tons.

OPERATIONS UNDER COAL MINES ACT

The total production of coal in 1911 was 271,878,924 tons, which compares with 264,417,588 tons in 1910; an increase of 7,461,336 tons, or 2.8 per cent. The production of other minerals from workings classed as coal mines was as follows:

	1910	1911
Barium compounds	5,970	8,940
Clay and shale	441,786	404,223
Fireclay	2,484,069	2,482,846
Igneous rocks	374	444
Iron pyrites	8,551	8,446
Iron ore	7,979,750	7,888,898
Limestone	16,128	17,149
Oil shale	3,130,280	3,116,803
Sandstone and ganister	125,153	138,339

Changes were not considerable, the only important decrease being in iron ore.

METALLIFEROUS MINES ACT

The production of minerals from these mines may be divided into two classes, metalliferous and non-metalliferous. The production of metalliferous minerals was as follows:

	1910	1911
Arsenic	2,153	2,144
Arsenical pyrites	744	1,170
Copper ore and precipitate	4,160	3,244
Gold ore	6,154	2,752
Iron ore	1,851,351	1,823,795
Iron pyrites	829	1,648
Lead ore	28,493	23,864
Manganese ore	5,467	4,987
Tin ore (dressed)	6,624	6,545
Uranium ore	76	67
Wolfram (tungsten) ore	271	260
Zinc ore	11,238	17,652

In addition to the dressed ore given above, 1721 tons of undressed tin ore were reported in 1911. The total output of iron ore from both classes of mines was 9,831,101 tons in 1910, and 9,712,693 tons in 1911; a decrease of 118,408 tons. The nonmetalliferous products were as follows:

	1910	1911
Barium compounds	36,979	33,610
Bauxite	3,792	6,007
Chalk	418	314
Chert, flint, etc.	4,413	5,066
Clay and shale	113,022	128,470
Fluorspar	43,488	31,587
Gypsum	217,917	232,510
Igneous rocks	65,154	59,461
Lignite	......	120
Limestone	381,067	404,705
Ocher, umber, etc.	6,339	5,592
Rock salt	205,423	210,087
Sand	12,323	16,375
Sandstone and ganister	134,044	96,292
Slate	99,514	110,608

Of the more important minerals increases were shown by clay and shale, gypsum, limestone, rocksalt and slate. There were decreases in barium compounds and sandstone.

MEN EMPLOYED AT MINES

The number of men employed at mines in 1911 was as follows:

	Coal mines	Metalliferous	Total
Underground	863,512	17,490	881,002
On surface	203,701	11,535	215,236
Total	1,067,213	29,025	1,096,238
Total, 1910	1,049,407	28,676	1,078,083

There was an increase in 1911 of 17,806, or 1.7%, in the number of employees at coal mines; this increase being slightly less than that in output. The increase at the metalliferous mines was only 349, or 1.2%. Taking the total number of men at the coal mines the average raised in 1911 was 258.5 tons per man.

Tasmania Mineral Production, 1910

The official returns of Tasmania for the year 1910, show a total production of £1,432,193, of which the chief items were as follows: Gold, 37,048 oz., £157,370; silver-lead ore, 51,227 tons, £247,576; blister copper and copper ore, 8864 tons, £566,972; tin ore, 3701 tons, £399,393; coal, 82,455 tons, £48,609. The state of Tasmania voted an appropriation of £200 to aid prospectors in developing their finds, on the £-for-£ principle, no single appropriation to exceed £50, but only one application was made for assistance, and after it was granted, the miner was unable to reach his destination owing to heavy rains. The Tasmania Gold Mine, Ltd., employing 533 men, produced 21,771 oz. or 59% of the gold production.

The *Boletin* de Ministerio de Agriculture of the Argentine Republic, for December, 1911, gives a full report (in Spanish) of present conditions in the Comodore Rivadavia oil fields. There is a copy, which will be loaned, on application, in the Bureau of Manufactures, at Washington, D. C.

Flume Construction in Colombia

By R. D. O. Johnson*

An account of the methods used in constructing two flumes in Colombia. Good results were obtained from native labor by planning the work so that the operations were merely mechanical. The contract system worked best.

In a region where entire dependence both for common and semi-skilled labor must be placed upon the peon, it devolves upon the engineer in charge to devise apparatus and to employ methods of work that will require a minimum draft upon the limited supply of gray matter possessed by the operatives.

Best to Plan Work for Peon

The native carpenter will perform some simple tasks, such as edging boards, as well and as rapidly as will the skilled and high-priced carpenters of the United States. But if he is called upon to read a drawing or to do much accurate measuring, the responsibility will weigh heavily upon him. His movements will become distressingly slow and the amount of work he will accomplish in a day will be so small as to render the ultimate cost of the work greater than it would have been had the high-priced carpenter from the States been imported to do the same work.

The engineer must think for the peon, even to the smaller details. The work should be rendered as simple as possible. In so far as is possible, the burden of all responsibility except that of the quantity of his work, must be lifted from his shoulders to get the best results from his labor. When from the problem of his labor every requirement has been eliminated but the necessity of machine-like movement, he can be successfully "hustled" and the product of his labor will be satisfactory both as to quantity and quality. By employing such methods the cost of carpenter work in this country will probably not be far from 30 to 50% cheaper than in the States. But give the native carpenter a blueprint, impress upon him the necessity of accurate measurement and careful work, "call him down" a few times for his mistakes and he will soon shift the scene of his labors to a mine operated under native management where the pole-and-vine method of construction is in vogue.

These observations resulted from my experience while equipping the property of the Santa Rita Mining Co. A part of the work for this company consisted in building an 800-ft. flume having the inside dimensions of 2 ft. 6 in. by 2 ft., and a 400-ft. flume having the inside dimensions 5x4 ft. The boards were all 1½ in. thick and 12½ ft. long, making the flume boxes average 12 ft. in length. The bottom of each box of the smaller flume was made up of one 12-in. board and two 10-in. boards, each side of two 10-in. boards and one 8-in. board making nine boards for each box. The number and dimensions of the boards varied in a few instances to accommodate narrower boards which were more convenient and economical to cut. Since it cost as much to edge and to handle a 6-in. board as it did a 12-in. board, the use of narrower boards was not frequently allowed.

Contract System Advantageous

All boards were sawed by hand, the sawyers working in pairs. The sawyers were at first put at day's pay, but it soon became evident that the lumber would cost $40 per M. It always pays to put the peon on contract where possible. As the peon knows nothing of the measurement of lumber by the board-foot unit and as it appeared to be a hopeless task to explain it to him, some other basis for a lumber contract had to be devised. The work of the best pair of sawyers was taken as a guide and a schedule of prices was worked out for each particular size of board or timber needed. The prices were calculated on a cost of $18 per M, the prices being raised to a small extent for the thin and narrow boards and cut down for the large boards and timbers. This scale of prices was accompanied by simple specifications as to the kind of timber acceptable, full dimensions, bark edges, worm holes, rotten spots, etc.

Preparations for Flume Construction in Colombia

Contracts were given to each pair of sawyers for a limited number of boards and timbers on the basis of the specifications and price schedule. Each sawyer was charged 25c. gold per day for his board, the cost to the company being somewhat below this figure. It was found desirable to give small contracts rather than large ones. Boards were inspected each day and a record of the work of each pair of sawyers kept. Failure to keep to the specifications was met with the penalty of severe docking. The prices were found in practice to be about right as, on the contracts, the better sawyers could make about 50% more than the ruling day's pay for sawyers, and the poorer ones were either eliminated or had to be content with less than the ruling rate.

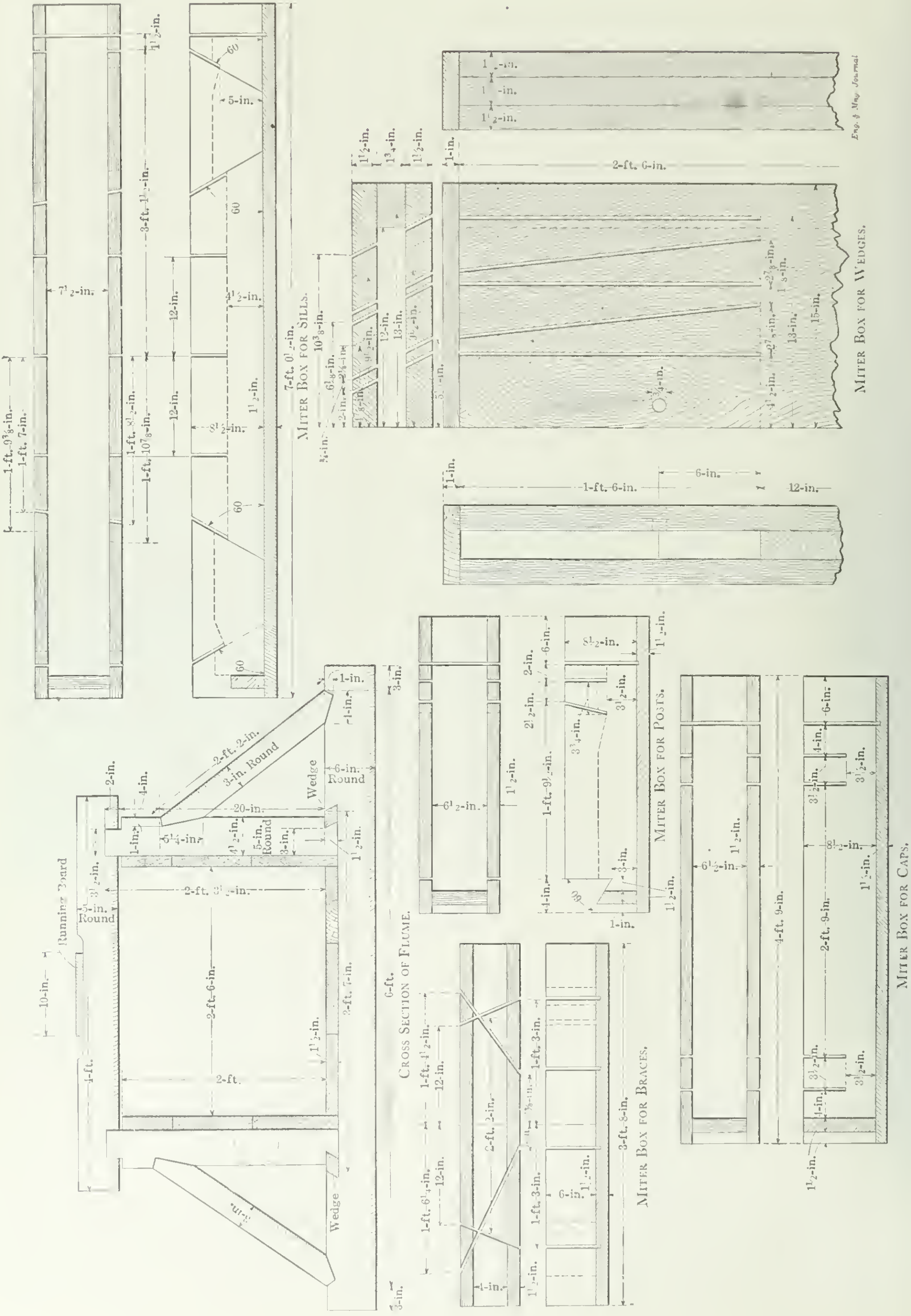
In searching for bunches of good trees, so that the cost in time and labor in handling the logs would be less, the sawyers would sometimes go to great distances from the sites of the flumes, making the cost of collecting the boards excessive. To obviate this difficulty a price of from one to three cents per board, depending upon the size, was added to the contract price and the sawyers were required to deliver their boards to the flume sites.

All boards were brought to dimensions and edged on a contract of 5c. per board. The boards were not tongued and grooved, reliance for tightness of the flumes being placed upon careful edging. As the boards were finished, they were marked and distributed along the lines of the flumes.

As the neighboring woods were full of small and fairly straight trees, it was determined to make the frames out of the

---

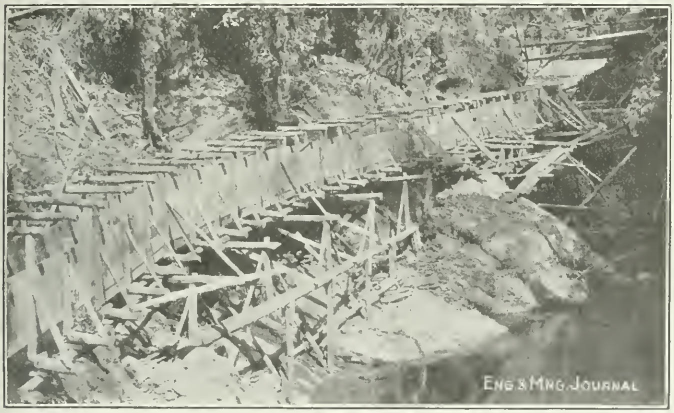
*Mining engineer, Apartado 110, Medellin, Antioquia, Colombia.



Cross-section of Flume and Miter Boxes Used in Construction round timber without even going to the trouble and expense of taking off the bark. The accompanying cross-section of the flume shows the frame, the parts of which are of much more ample diameter than the working stresses would ordinarily require, but the timber was plentiful and the large diameters made up for the bark and the weakening due to the cutting out of crooks and bends.

Miter Boxes Used in Preparing Timber

To reduce the cutting of these frames to mere mechanical operations requiring no measuring or headwork on the part of the carpenters employed in the work, I devised the miter boxes shown in the illustrations. The sills, caps and braces were cut on contract, sills 6c., caps 3c., and braces 1c. each. The cutting of the posts required the combined labor of three carpenters and was not given out on contract. The wedges were made from 1½-in. hardwood boards, 10 in. wide, and sawed into 12-in. lengths. These short sections were inserted in the wedge miter box, welded tightly, and sawed. Each 12-in. section makes four wedges, two rights and two lefts. For the total number of wedges the labor of one carpenter for six days was required.



Flume Constructed by Native Workmen in Colombia

As the sills were completed they were laid out upon the shelf excavated to receive the flume, lined up carefully, spaced and given the proper inclination on the curves. When all the boards had been sized and edged and all parts of the frames formed up and distributed along the line of the flume, four native carpenters and four helpers (peons) laid the flume at the rate of 120 ft. per day. The process was as follows:

The ends of the boards of a box were carefully fitted to the end of the preceding box already laid, the lower side boards were then spiked to the outer bottom boards; the bottom as a whole was then carefully adjusted to the centers of the sills, the posts set up and the wedges started. The center bottom board was then spiked to the sills, the lower side boards spiked to the posts, the caps placed and spiked and the wedges driven up hard. The outer bottom boards were then spiked to the sills and the braces driven into their recesses in the sills and posts and spiked. The posts were not spiked to the sills, so that the wedges could be driven up later if it appeared desirable to do so. The necessary sequence of the operations involved in laying the flume was carefully explained to the carpenters and, with a little practice, they acquired the "swing" and the work thereafter moved off at a satisfactory rate. Little calking of the flume was found necessary. Although ½x3-in. battens were provided, few were used. Exclusive of the work of excavating the shelf and on the two trestles on the line, the cost of the smaller of the two flumes was 45c. per running foot.

Leucite Hills of Wyoming

The occurrence of leucite in Wyoming is of some interest historically, for the reason that von Humboldt concluded that leucite was a mineral found only in Europe, and even as late as 1868 the general impression prevailed that it was known as a constituent of lavas at only three European localities, although it had been found in 1850 near Umria, in Persia. Since then it has been found in Asia, Africa, South America, Australia, as well as the United States. The lavas of the Leucite Hills[1] are all fine-grained rather earthy-looking rocks and in most of them a dark mica in small hexagonal plates is the only mineral that can be recognized by the unaided eye.

In general the leucite-bearing rock contains about 53% of silica, about 12% of alumina, about 11% of potash and about 6% of magnesia and of lime. It is estimated that in the various exposures on the Leucite Hills are 1,973,000,000 tons of leucite-bearing rock, which would contain about 197,000,000 tons of potash. At present this rock is of no commercial value, but a number of chemists are working on the problem of the extraction of this potash. The only grant of land in the territory covered by these deposits were the original odd sections given the Union Pacific Railroad as its original subsidy. The Union Pacific Railroad has agreed to lease under certain conditions and for certain royalties, the right after Sept. 1, 1912 to take rock for potash from several sections of this land. However, there is still Government land open to original entry in this region.

---

[1] Bull. 512, U. S. Geol. Survey.

Abangarez Report

The fifth annual report of the Abangarez Gold Fields of Costa Rica, operating mines in the province of Guanacaste, Costa Rica, states that during the year ended Dec. 31, 1911, there was mined and milled 42,514 tons of ore, which yielded an average of $21.84 per ton, or a total of $928,587. The cost of operation, including mine development amounting to $116,316, all repairs and renewals to equipment, and administration and marketing expense, was $721,997, leaving earnings of $206,590. The surplus for the year is $128,552, the total surplus at present being $226,050. Direct charges to profit and loss were made as follows; depreciation on surface equipment, $81,695 and $46,429, representing 5% of the gross yields, for amortization.

During the year $392,326 was spent on construction work, of which $225,635 represents the amount spent in the construction of a new power plant on the Guacimal River about 12 miles from the mill. It is expected that this power plant will be completed early this year. The completion of this plant should obviate the necessity for using the steam power plant, which, during the last season, has cost the company about $7000 per month for fuel, whenever operated.

The underground development work during the last year increased the ore reserves by 55,000 tons, after allowing for the tonnage milled. There is now approximately 340,200 tons of ore developed of an estimated average assay of $13.29 per ton, which, at the rate milled during the last year, would cover mill requirements for about eight years. While high-grade ore is encountered from time to time, the large bodies upon which the company must depend for future operation, appear to be of moderate value, and owing to the inaccessibility of the property, and the difficulties experienced in securing supplies, the cost of operation is necessarily high. It is only through the treatment of a large quantity of ore annually, therefore, that the company can hope to handle the greater part of its ore reserve at a profit, and, with this end in view, an expenditure of $44,259 was made in additions and improvements to the mill and cyanide plants. The capacity of these plants was increased considerably, and will be further increased during the current year. It is anticipated that the cost for treatment will be materially reduced.

Lake Superior Iron Ore in 1911

The corrected report of the shipments of Lake Superior iron ore, as collected and published by the Cleveland *Iron Trade Review,* shows that shipments from the mines by rail in 1911 were 662,719 tons; making the total shipments 32,793,130 tons, which compares with 43,442,397 tons in 1910, the decrease last year being 10,649,267 tons, or 24.5%. The shipments by ranges, as compared with 1910, were:

Range	1910	1911	Changes
Marquette	4,392,726	2,833,116	D. 1,559,610
Menominee	4,237,738	3,911,174	D. 326,564
Gogebic........ ..	4,315,314	2,603,318	D. 1,711,996
Vermillion	1,203,177	1,088,930	D. 114,247
Mesabi...........	29,201,760	22,093,532	D. 7,108,228
Cuyuna..........	....	147,431	I. 147,431
Baraboo..........	91,682	115,629	I. 23,947
Total...........	43,442,397	32,793,130	D. 10,649,267

The Cuyuna range appeared in 1911 for the first time, the shipments being from the Kennedy mine of the Rogers-Brown Iron Co. There were 184 shipping mines in 1911, compared with 196 in 1910. Of the shipping mines last year 90 were on the Mesabi Range; 38 on the Menominee, 29 on the Marquette, 17 on the Gogebic, 7 on the Vermillion, 2 on the Baraboo and one on the Cuyuna.

The total shipments of ore from the beginning, with the year each range was opened, are given as below:

Range	Year Opened	Total Tons	Per Cent.
Marquette....	1850	99,129,831	18.9
Menominee..	1877	79,361,967	15.1
Gogebic.....	1884	67,739,135	12.9
Vermillion..	1884	31,417,492	6.0
Mesabi.....	1892	246,998,726	46.9
Baraboo..	1903	1,087,938	0.2
Cuyuna	1911	147,431	....
Total...		525,882,510	100.0

The Marquette and Menominee ranges are in Michigan; the Gogebic partly in Michigan and partly in Wisconsin; the Baraboo in Wisconsin; the Vermillion, Mesabi and Cuyuna in Minnesota.

In addition to the shipments given above there were 135,306 tons shipped in 1911 from Canadian mines in the Lake Superior district; 128,628 tons from the Helen in the Michipicoten Range, and 6678 tons from the Moose Mountain.

The largest shipper in 1911 was the Hill, only in its second year. Six mines, all on the Mesabi, shipped over 1,000,000 tons each—the Hill, the Canisteo, the Dale, the Leonard, the Mahoning and Sauntry-Alpena.

STEEL CORPORATION SHIPMENTS

The shipments of the Oliver Iron Company, the mining subsidiary of the Steel Corporation, in 1911 were 17,282,499 tons, or 52.7 per cent. of the total. Nearly one-third of this tonnage came from mines on the Hill leases, which shipped in all 5,499,759 tons. This was 1,729,759 tons more than the agreed minimum for the year; but the corporation was still behind at the end of the year. The total minimum requirements up to the end of the year were 11,250,000 tons; the total mined up to that date was 7,832,138 tons, leaving 3,417,862 tons to be made up. The minimum for 1912 is 4,500,000 tons, so that 7,917,862 tons must be mined this year to come out even.

The great attention given to the Hill leases combined with the general falling off in shipments to make some remarkable changes in the older mines of the corporation on the Mesabi. The Adams decreased from 1,258,295 tons in 1910 to 411,268 in 1911; the Burt from 1,032,815 to 56,506; the Fayal from 1,485,099 to 434,364; the Morris from 1,364,673 to 40,481 tons. The Hull-Rust, which was the leader in 1910 with 3,189,975 tons, fell to 495,977 tons in 1911. These changes were not due to any trouble at the mines; they were made because it was less costly to take the ore from the Hill mines and thereby avoid the payment of heavy minimum royalties on ore not mined.

THE OLD RANGES

On the Gogebic, the most noteworthy changes were the decreased productions of the Newport and the Norrie group. On the Menominee, marked decreases are shown by the Baltic, Florence and Loretto, while the Riverton group and the Zimmerman made handsome increases. On the Marquette, the Cleveland-Cliffs group declined from 955,374 tons to 344,950 tons, and the Maas from 208,103 tons to 24,927 tons. The Negaunee declined from 348,818 tons to 140,406 tons, making the lowest production since 1900. On the Vermillion the Sibley production fell from 206,386 tons to 1899 tons, while the Zenith increased from 283,320 tons to 448,295 tons, making the highest production in its lifetime of 20 years.

Titanium and Vanadium Alloys

The American Iron & Steel Association reports that during the calendar year 1911, 3,679,335 lb. (1643 gross tons) of ferro-titanium alloy were shipped by an American producer to 79 manufacturers of steel in the United States. Of the total quantity shipped, 20 plants, which make ingots but not castings, purchased 525,295 lb.; 44 plants, which make castings but not ingots, purchased 136,425 lb., and 15 plants, which make both ingots and castings, purchased 3,017,615 lb. In addition, 129,440 lb. were exported. The average consumption of ferro-titanium in the manufacture of steel is about 0.4 per cent., or about 8.96 lb. per gross ton.

The association also learns from the Vanadium Sales Co. of America that in the calendar year 1911, it shipped 689,510 lb. of ferro-vanadium to 57 plants in the United States and Canada which manufacture steel ingots or castings.

Asbestos in the United States

The production of asbestos in the United States is rapidly increasing, says J. S. Diller in a U. S. Geological Survey report. It more than doubled in 1911 and the increase was largely in fiber of the serpentine (chrysotile) variety, of which the best grades are spun and woven into fireproof fabrics for theater curtains, motor-brake bands, and the like, where incombustible material must be used. The finest asbestos thread yet spun carries a small percentage of cotton and runs over 2 miles to the pound.

The total production of asbestos in the United States in 1911 was 7604 tons, valued at $119,935, and it came almost wholly from Vermont and Georgia. A little came from Wyoming and Virginia. Canada, however, produced 13 times as much asbestos in 1911 as the United States, and we imported for our manufacturers 62% of all Canada produced and 83% of all exported.

One of the features of the asbestos industry in recent times is the growth of the demand for the lower grades. Being fireproof and an electric and heat insulator, asbestos is extensively used in the building arts, and the interest in this sort of manfacture at a number of points throughout the country indicates that the industry is developing rapidly. The most striking new application of asbestos was made last September in Louisiana, in extinguishing a burning oil well from which 40,000 barrels of oil were escaping daily.

The finest asbestos yet found in the United States, comparing favorably with the best from any part of the world, is in the Grand Cañon of the Colorado in Arizona; it is not, however, easily accessible.

The Peruvian vanadium deposits, the vanadiferous sandstone deposits of southwestern Colorado and the carnotite deposits of Colorado and Utah all occur in the Jura-Triassic sedimentary rocks. Chromium-stained sandstone beds frequently accompany the vanadiferous sandstone and carnotite deposits of Colorado and Utah.

Electrolytic Dissociation and Solvation

By Harry C. Jones*

All substances which form electrolytes on dissolving partially decompose in solution; further, all solvents form compounds (" solvates ") with the dissolved bodies.

It has been seen how Van't Hoff showed that the laws of gas pressure apply to the osmotic pressure of solutions of non-electrolytes.

OSMOTIC PRESSURE A SIMPLE FUNCTION

The young Swedish physicist, Arrhenius, was at this time working in the laboratory of Ostwald in Leipzig, and a little later in that of Van't Hoff, in Amsterdam. In the application of Boyle's law for gases to the osmotic pressure of solutions, Arrhenius recognized this fact that the osmotic pressure exerted by a solution is a function only of the ratio between the number of parts of the dissolved substance present and the number of parts of the solvent. Osmotic pressure is, then, an arithmetical property, depending only upon numbers.

This being true, when we have too great osmotic pressure we must of necessity have too great a number of parts present. There was no escape from this conclusion. Since electrolytes, *i.e*, acids, bases and salts, exert too great osmotic pressure in terms of the number of molecules of these substances present in solution, we are forced to conclude that these molecules break down into parts.

The question, however, was into what do the molecules of such apparently stable substances as hydrochloric acid, potassium hydroxide or potassium chloride break down in the presence of water? They obviously could not break down into the atoms of which these molecules are composed, since these atoms are known to act upon water and some of them, like potassium, with violence; while no such reaction manifests itself when an acid, base or salt like those referred to above is thrown into water.

This was the difficulty which Arrhenius encountered. On referring to the literature bearing upon this problem he found one paper which was helpful. It is electrolytes which show these abnormally great osmotic pressures. Electrolytes in aqueous solution conduct the current, therefore, any suggestion that is proposed to account for these large osmotic pressures must also account for the phenomena of electrolysis, since these are but different properties of the same solutions.

THE VIEW OF CLAUSIUS

The great German physicist who contributed so much to the science of thermo-dynamics—Clausius—had advanced the following hypothesis to account for the facts that were known at his time in connection with electrolysis. It had been shown that an infinitely weak current can electrolyze water to which an acid had been added. Water is one of the most stable compounds known to man, shown in part by the large amount of heat liberated in its formation, which is a good general criterion of the stability of the product of a reaction; and shown further by the fact that high temperatures are required to break water down into its elements—3000° F. being required to decompose half of it into hydrogen and oxygen.

It is a simple matter to show by calculation that an infinitely weak current can never decompose even a single molecule of water, still less enough water to liberate a cubic centimeter of electrolytic gas. To account for this and similar facts Clausius found it necessary to assume that some of the parts in the acidulated water were already broken down into hydrogen and oxygen. The current simply exerted a directing influence on those parts, driving the positively charged to the cathode and the negatively charged to the anode, where they give up their charges and escape as hydrogen and oxygen gas.

Since these parts carried the current they must be charged electrically, and such electrically charged parts in solution, Faraday had called ions or wanderers.

This was the starting point for Arrhenius. It was only necessary to assume that the molecules of the acid, base or salt each break down into two charged parts to account for the abnormally great osmotic pressures exerted by these substances. Each molecule breaks down into a positively charged part or cation and a negatively charged part or anion as follows:

$$\mathrm{HCl} = \overset{+}{\mathrm{H}}, \overset{-}{\mathrm{Cl}}$$

$$\mathrm{KOH} = \overset{+}{\mathrm{K}}, \overset{-}{\mathrm{OH}}$$

$$\mathrm{KCl} = \overset{+}{\mathrm{K}}, \overset{-}{\mathrm{Cl}}$$

There are thus twice as many parts present in the solution as if the molecules were not broken down into atoms. This is the origin of the theory of electrolytic dissociation in solution.

QUANTITATIVE BASIS FOR THE THEORY.

Arrhenius, of course, went much farther than this purely qualitative stage. He worked out methods for measuring quantitatively the amount of the dissociation in solutions which are not sufficiently dilute to be completely dissociated. He furnished a large amount of evidence for the correctness of his theory, and pointed out in advance some of the objections which would be offered to it, and answered them; and this all in his first paper on the subject published in vol. 1 of the *Zeitschrift für physikalische Chemie*, p. 631—the same volume in which Van't Hoff's great paper had been published. He would formulate these two great generalizations found for solutions as follows:

The combined expression of the laws of Boyle and Gay-Lussac for gases is—

$$pv = RT$$

p, is pressure, v, is volume, R, is the gas constant and T, the absolute temperature of the gas. Since these laws apply to the osmotic pressures of solutions of non-electrolytes, the above equation holds for the osmotic pressures of solutions of these substances.

That the equation may be applied to the osmotic pressures of electrolytes, Van't Hoff showed that it was necessary to introduce a coefficient, and the equation then became—

$$pv = iRT$$

The coefficient i was always greater than for electrolytes. The meaning of this coefficient i was what Arrhenius explained by the theory of electrolytic dissociation[1].

Almost as soon as these generalizations were reached, all kinds of objections were offered to them—sensible and senseless—with a large preponderance of the latter. It would lead us far afield to discuss even the more important of these. Suffice it to say that practically every one of these objections has been satisfactorily answered, and these generalizations have done far more than prove themselves. They have predicted a vast number of facts and conclusions which have been verified as the result of subsequent work; and this is the first test of the validity and value of any generalization.

We might conclude then, from what has thus far been said, that the applicability of the gas-laws to the osmotic pressure of solutions of non-electrolytes, and the theory of electrolytic dissociation to explain the results presented by electrolytes, gave us a complete theory of solution, but such is far from the case. These generalizations are necessary but not sufficient.

---

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

[1] i in this formula has not its ordinary engineering meaning, $\sqrt{-1}$.

The generalizations in question hold only for very dilute solutions; for solutions which are far more dilute than those used in the scientific laboratory. Or, as it has been remarked, these generalizations apply only to homeopathic solutions.

A theory of solution to be of the highest scientific value must be a theory not simply of very dilute solutions, but of solutions in general; and must hold especially for those solutions which are used by the chemists and other men of science. This failure on the part of the generalizations reached by Van't Hoff and Arrhenius was quickly recognized and early pointed out; and no satisfactory answer could be given to it. The matter stood thus for a number of years, and it is only in the last decade that the explanations of why it is that these generalizations do not apply to solutions of even reasonable concentration, has been furnished.

SOLVATE THEORY OF SOLUTION

In 1898 a Japanese, Ota, came to my laboratory. Being a mature chemist, I put him at once upon a problem in research. When substances in general are dissolved in liquids the freezing-points of the solvents are lowered. This is well illustrated by the freezing-point of water. This, which is one of the most fundamental properties of solutions, is usually characterized as the lowering of the freezing-point of the solvent by the dissolved substance.

This property had been elaborately studied as far as dilute solutions are concerned, and the change in the lowering of the freezing-point of the solvent with the dilution of the solution was well known. As the dilution of the solution increases the dissociation increases; and since an ion produces the same lowering as does a molecule, of the freezing-point of a given number of molecules of the solvent, the more dilute the solution the greater the molecular lowering of the freezing point of the solvent. By molecular lowering is meant the lowering actually observed on the thermometer, divided by the concentration of the solution expressed decimally in terms of a normal solution.

In a word, the molecular lowering of the freezing-point of a solvent by a dissolved substance, should increase with the dilution of the solution, from the most concentrated to the most dilute.

Ota, almost at once, obtained results directly at variance with this conclusion. He measured the freezing-point lowerings of fairly concentrated and of very concentrated solutions of salts in water, and found that the molecular lowering instead of increasing with the dilution from the most concentrated to the most dilute solution, passed through a decided minimum at a certain concentration. From this concentration the molecular lowering increased with the dilution, but what was apparently abnormal and certainly unexpected, was that from this concentration the molecular lowering also increased, and increased very rapidly with the concentration of the solution.

This was a surprising result, and entirely inexplicable in terms of anything known at that time.

We did what is usually done in such cases, at first we did not believe the results. We thought that some error had been made in the work, and repeated the work from beginning to end, but always with the same result. After several repetitions we were forced to accept the results, and then the important point was to explain them.

WORKING HYPOTHESIS

Before reaching any final conclusion as to the cause of these unexpected results, the first question was to see how general the phenomenon was. Was it shown by only a few substances, and if so, of what kind, or was it a general property of dissolved substances? This could be answered only by a vast amount of experimental work, dealing not with all compounds, since this was impossible; but with all types of chemical compounds.

The result was that after studying somewhat more than a hundred typical substances, and somewhat more than a thousand solutions of these substances, we were justified in stating that concentrated solutions of nearly every type of chemical compound, produced lowerings of the freezing-point of water that were too great in terms of any theory or generalization that up to that time, had been proposed.

The molecular lowerings in concentrated solutions were not only greater than the values calculated from the theory of electrolytic dissociation, but in some cases many times greater. Thus, take a certain very concentrated solution of calcium chloride, the calculated molecular lowering was 2.83° while the molecular lowering found experimentally was 14.32°. The value found experimentally was about five times that calculated from theory.

To take another example. The molecular lowering calculated for a certain concentration of aluminum chloride is 2.88° while the value found experimentally was 21.18.° The experimental value is about 7.4 times the theoretical.

It was obvious from such results that here was something which must be taken into account in dealing with the nature of solution.

Having found that we were dealing here with a general phenomenon, the question, then, that must be answered is what is its meaning? How are we going to explain such abnormalities as those just discussed?

It was found by the French chemist Raoult at Grenoble, that the lowering of the freezing-point of a solvent by a dissolved substance is, like osmotic pressure, an additive property. It depends only on the ratio between the number of parts of the solvent and of the dissolved substance.

This being true, the following explanation of the above results is possible. If the dissolved substance combines with a part of the liquid, forming more or less definite chemical systems with it, just so much of the liquid is removed from the field of action as far as solvent is concerned. The solution is thus rendered more concentrated than we would suppose from the total amount of solvent liquid and dissolved substance present, since a part of the liquid is not playing the *rôle* of solvent, but is in combination with the dissolved substance. There being less solvent present than we would suppose, its freezing-point is lowered more than if all the liquid present were acting as solvent.

When I offered this possible explanaof the results in 1900, I did not believe it was the *true* explanation, and set about to prove its invalidity; but with the result of adding a large amount of confirmatory evidence of its general correctness.

LOWERING OF FREEZING-POINT AND WATER OF CRYSTALLIZATION

The first line of thought that suggested itself in connection with the validity or incorrectness of this suggestion was the following. If dissolved substances combine with more or less of the water they form hydrates, and the complexity of the hydrates would vary with the dilution of the solution and with the temperature. Water of crystallization can be looked upon as water of hydration. It is simply the amount of water that the salt can bring with it out of solution and hold in fairly stable equilibrium at ordinary temperatures. This amount bears a simple relation to the amounts of water with which they are combined in solution, i.e. there should be a relation between the amounts of water with which salts combine in solution, and the amounts which they bring with them out of solution as water of crystallization. Since the lowering of the freezing-point measures the amount of water of hydration in solution, we would expect a simple relation to manifest itself beween freezing-point lowering and water of crystallization, if the suggestion of hydrates to account for the abnormal freezing-points of aqueous solutions was true.

WATER OF HYDRATION AND OF CRYSTALLIZATION SIMPLY RELATED

Here was a more or less crucial test of the hydrate conception. It was only necessary to measure the freezing-point lowerings of a number of concentrations of a large number of compounds with different amounts of water of crystallization, and then compare the freezing-point lowerings with the water of crystallization of the several compounds.

The proper way in which to make such comparisons would be to take all of the chlorides studied, and compare their freezing points with their water of crystallization. Then compare all of the bromides with one another with respect to freezing-point lowering and water of crystallization. In a similar manner the iodides should be compared, and the nitrates are especially important in this connection, since, on account of their general solubility a large number of them were studied. If we plot the following curve diagram the relations in question come out very clearly.

Let the abscissas be concentrations of the solution and the ordinates molecular lowerings of the freezing-point.

The nitrates which crystallize with no water—sodium, potassium and ammonium—fall near the bottom of the diagram; i.e., produce only small lowerings of the freezing-point of water; indeed, the value found is only slightly greater than the calculated lowering.

Next in order, passing up the diagram is lithium nitrate with two molecules of water of crystallization. Then comes the nitrate of calcium with four molecules of water, and then a number of nitrates, each with six molecules of water of crystallization. The curves for all of these substances occupy nearly the same position, just as they would be expected to do, since they all crystallize with the same amount of water. They would, therefore, be expected to combine with nearly the same amounts of water in solution, and, consequently, to give approximately the same lowerings of the freezing-point of water.

When we pass to the nitrates of aluminum, iron and chromium, with eight and nine molecules of water of crystallization, we find their curves near the top of the diagram, showing greatest freezing-point lowerings and, consequently, greatest hydration in solution. Again, this is just what would be expected from the large amounts of water with which they crystallize.

If we examine this diagram we see that there is not a single exception to the relation between water of crystallization and lowering of the freezing-point, that is to say not a single exception among the nitrates to the relation between the amounts of water which substances can bring with them out of solution, and the amounts of water with which they combine in solution.

In a similar manner the freezing-point curves for the chlorides were plotted, and the relations brought out here were just as satisfactory as for the nitrates. The chlorides fell in the same order with respect to water of crystallization and with respect to freezing-point lowering or water of hydration in solution.

What has been said in reference to the nitrates and chlorides, holds equally well for the bromides and for the iodides.[1]

When this evidence came out we had to accept at least tentatively, the suggestion that had been made to account for the large freezing point lowerings produced by concentrated solutions.

OTHER LINES OF EVIDENCE

About a dozen independent lines of evidence were soon discovered, which bore directly or indirectly on this problem, but they cannot be discussed here. Any one who is sufficiently interested in this phase of the work can find them in vol. 60 of the publications of the Carnegie Institution of Washingtion, which generously supported this investigation with financial aid[2].

Every one of these lines of evidence, without a single exception, pointed to the correctness of the conclusion that when salts are dissolved in water they combine with more or less of the water present.

The evidence was so overwhelming in quantity and unambiguousness that there was nothing left but to accept the correctness of the hydrate conception.

A method was worked out for calculating the approximate composition of the hydrates found by the various substances at the different dilutions[3].

THEORY OF SOLVATION

Having shown, then, that when substances are dissolved in water they combine with a part of the water—form hydrates—the question naturally arose, has water a monopoly of the power to com bine with dissolved substances? Or do other solvents also combine with substances dissolved in them.

It is impossible to use the freezing-point method with, for example, the alcohols and many other solvents. They freeze at temperatures that are too far removed from the ordinary to measure accurately. There is, however, another method, utilizing another arithmetical property of solutions, which can be applied to just such problems. When solids are dissolved in liquids the boiling points of the solvents are raised. The amount of the rise is dependent only upon the ratio between the number of parts of the solvent and of the dissolved substance, just as freezing-point lowering depends upon this same ratio.

Knowing the dissociation of the substance in the solvent in question, we have seen that we can calculate the freezing point of its solutions. Just so we can calculate the boiling points of solutions, and, consequently, the rise in the boiling-point of the solvent produced by the dissolved substance.

We can then measure the rise in the boiling point of the solvent, and see whether the results of calculation agree with those of experiment. It was soon found that they do not. The value found experimentally was greater, and in some cases much greater than that calculated.

Just as we interpreted abnormally great lowering of the freezing point of water as due to hydration, just so we interpret abnormally great rise in the boiling points of non-aqueous solvents, as due to a combination between the solvent and the dissolved substance; in a word, the hydrate conception becomes for solvents in general the theory of solvation.

ABSORPTION SPECTRA OF SOLUTIONS

There is just one other line of evidence bearing upon the solvate theory of solution, which will be referred to briefly, because of the importance and unambiguous character of the conclusions drawn from it. In arriving at the conclusion already drawn, it should be stated that one phase of the work alone involved making about 40,000 conductivity measurements.

The work on the solvate theory of solution, for the last seven years, has had to do largely with the power of solutions to absorb light, and about 6000 solutions have been studied from this standpoint.

What does absorption of light by solutions really mean? When white light falls upon a colorless solution, none of the wave lengths of ether that constitute white light find anything in the solution which they can throw into resonance with themselves. They all pass through the solution practically unabsorbed. If, on the contrary, the solution is colored it means that some of the wave lengths of light find something in the solution which they can set vibrating in resonance with themselves. They do so, their energy being expended in setting up these new vibrations; they are consequently stopped; the remaining wave lengths pass on through, and the color of the solution is due to the waves of ether of visible wave length that are unable to set up resonance in the solution.

---

[1] See "Elements of Physical Chemistry," by H. C. Jones, fourth edition, pp. 238-239.

[2] Cf. Amer. Chem. Journ., Vol. 41, p. 19 (1909), and Zeit. für phys. Chem., Vol. 74, p. 325 (1910).

[3] "Hydrates in Aqueous Solution," publication No. 60 of the Carnegie Institution of Washington.

In a blue solution the long wave lengths of light set up resonance and are stopped. In a red solution the short wave lengths of light set up resonance and are stopped.

A moment's thought will show how such a method can furnish evidence for or against the solvate theory.

If the dissolved substance is combined with some of the solvent it is almost certain that it would have different resonance than if free and unconfined. If, by any means we could change the degree of solvation of a colored substance in solution, we ought to be able to detect a corresponding change in the absorption spectrum of the solution.

We are especially well equipped in my laboratory for this kind of work, since we have at hand a suitable concave grating; and the Carnegie Institution has very generously aided us in this field of investigation.

There are a number of ways in which the degree of solvation of a solution can be changed. It can be increased by increasing the dilution of the solution, or lowering its temperature. The solvation can be decreased by increasing the concentration of the solution, by adding a dehydrating agent, by raising the temperature, etc.

Every one of these changes has been followed by a corresponding change in the absorption spectrum of the solution in question.

Absorption Spectrum Depends on Solvent

Just one other bit of spectroscopic evidence will be referred to, because it bears so directly upon the problem in hand. If a substance dissolved in several different solvents combines with the solvents in question forming solvates, then these different solvates will, of course, have different compositions. These different solvates of the substance in question would be expected to have different resonance or different absorption spectra. An examination of the literature when we began our work showed that everything which had been done up to that time negated the above conclusion. It was thought that a substance dissolved in different non-absorbing solvents, always had the same absorption spectrum.

The evidence obtained at that time in favor of the solvate theory was so overwhelming that we did not believe the above statement and hence took up the study of this problem.

Doctor Anderson and I soon found an example of just what we expected. Neodymium chloride dissolved in water had a different absorption spectrum than when dissolved in methyl or ethyl alcohol. This result, with the spectrum plate, is published in vol. 110 of the publications of the Carnegie Institution of Washington.

Since that time, Doctor Strong and I have found so many examples of the effect of the solvent on the absorption spectra of solutions, that it would require too much space even to cite them. We have even been able to detect the difference between the absorption spectrum of a substance in an alcohol, and in its isomer[4].

The spectroscopic evidence due to the investigations of my co-workers, Uhler, Anderson, Strong and Guy is so voluminous, direct and convincing, in favor of the view that dissolved substances combine with more or less of the solvents in which they are dissolved, that, taken with the other evidence, there is at present scarcely any room for doubt as to the general correctness of the solvate theory of solution.

Value of the Solvate Theory of Solution

If the solvate theory of solution is true, the question then arises of what use is it? In the first place, is it antagonistic to the theory of electrolytic dissociation or in harmony with it? It should be stated emphatically that it is in perfect harmony with the generalizations of Van't Hoff and Arrhenius. The latter showed us that electrolytes in the presence of water are broken down into charged parts of ions. The theory of electrolytic dissociation said simply that ions exist in solution without telling us whether or not they are combined with any of the solvent. Indeed, the assumption has generally been made that they were not thus combined—that the ions are "dry," even in the presence of water; and we have seen that the theory in this form applied only to very dilute or "ideal" solutions. If the molecules and ions are combined with any of the solvent, it is obvious that this must be taken into account, otherwise we do not know the real concentration of the solution. Thus, a solution of aluminum chloride prepared by dissolving a gram-molecular weight of the salt in water and then diluting to the volume of a liter is what we ordinarily term a "molecular normal" solution. The freezing-point lowering shows that under these conditions nearly three-fourths of the water is combined with the dissolved substance, and that the solution is really about four times as strong as we have thought it to be.

It is obvious that no theory could apply to a solution four times as strong as we supposed, unless it took this fact into account. The important point is that when the theory of electrolytic dissociation is supplemented by the theory of solvation we have a theory of solutions—of the solutions with which we have to deal in the scientific laboratory—a theory of the solutions which give us natural science.

Importance of Solution

What has been said raises the further question, which, in a sense, is the most important of all. Of what scientific or technical value is that condition of matter which we call solution? Why have men of science striven so long and arduously to learn what is the real nature of solution?

It is because solution is incomparably the most fundamental and important condition of matter. This has already been referred to, but more stress should be laid upon it now that we know something of the nature of matter in the dissolved state.

All chemistry is but a branch of solution in the broad sense in which that term is now used, and which will be discussed a little later. Matter in the pure homogeneous condition is practically inert chemically. It is only when mixed with matter of some other kind—when in solution—that it becomes active. The meaning of this will become clearer when we learn the broad sense in which the term solution is now used.

Solution is almost as important for geology as for chemistry. Many of the rocks were deposited from solution, and a great many rocks were formed from aqueous suspensions; and then take the igneous rocks, these are formed from molten magmas, which are solutions at high temperatures.

Take the biological sciences. We are accustomed to say "without carbon, no life." We could just as well say "without water, no life." Solution is undoubtedly fundamental to most of the biological sciences, if for no other reason, because it is fundamental to life itself. Physiology, pharmacology, botany are all dependent for their existence upon solution, and some of the branches of physics are vitally connected with it.

Without going into any further detail, enough has already been said to justify the statement that solution is the most important condition of matter known to man. And this justifies the stress that has already been laid upon it.

The generalizations discussed above are not the only ones that lie at the basis of modern physical chemistry. There is the Phase Rule discovered by one of our own countrymen, a thoroughly great and characteristically modest man of science, Willard Gibbs. And then the application of Faraday's law of electrolysis to chemical valence; indeed, the explanation or scientific interpretation of valence in terms of Faraday's law, is a fundamental matter.

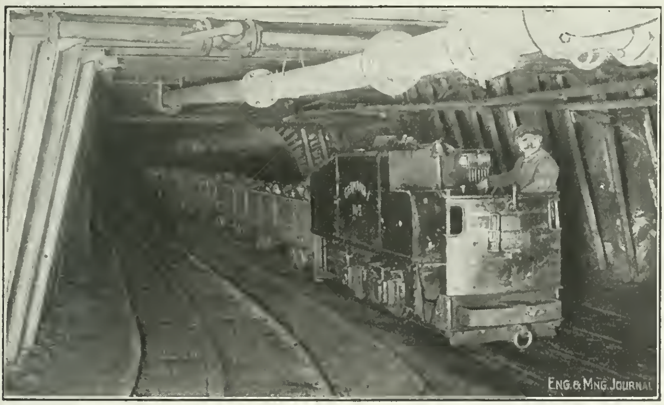
---

[4] Cf. Nos. 130 and 160, Publications of the Carnegie Institution of Washington.

The scope of these papers will, however, scarcely allow of a discussion of these generalizations; at least not of the former. The latter may be taken up briefly, later. Those generalizations already considered at some length lie at the basis of all of the modern developments in physical chemistry. The remainder of these papers will have to do more or less with their applications to special problems.

New Diamond Diggings in the Transvaal

Owing to the exaggerated reports of the new alluvial diamond fields in the Bloemhof-Mooifontein district, Transvaal, which may attract Americans to South Africa, Consul Edwin N. Gunsaulus, of Johannesburg, has reported on the finds (*Daily Consular and Trade Reports,* Feb. 3, 1912.) The original field was near Bloemhof, a small village on the Vaal River, about 200 miles south of Johannesburg. The surface gives no indication of the diamonds, the gravel everywhere being hidden by a cloak of soil, usually, however, only 6 in. to 1 ft. thick. The diamond-bearing gravels at first sight resemble a bed of dirty potatoes, with few big boulders. The most characteristic stones are banded ironstone pebbles; known as the Bloemhof "bantams." Most of the diamonds are small, and in the six months ended Sept. 30, 1911, the output was 10,575 carats, of $286,000 value.



Internal-combustion Locomotive Used at Germania Mine

The original area at Mooifontein, 17 miles from Bloemhof, was thrown open Sept. 13, 1911, and it is estimated that there are at least 10,000 white diggers at work, and as many Kaffirs. With an output of $160,000 per month, the average yield per digger would be about $8. Consequently, despite the great area of the diggings, probably over 11,000 acres, it seems foolish to go expecting to make a fortune. Sanitary conditions are bad, and it seems probable that it will be highly dangerous for unacclimated whites during the hot season.

The Otto Internal Combustion Locomotive

By J. B. Van Brussel[*]

The Germania mines, of the Gelsenkirchener Bergwerks Aktiengesellschaft, have recently put into service their sixty-ninth Otto locomotive. These locomotives furnish a haulage power, varying from 6 to 60 hp., and are driven by strongly built, horizontal Otto engines, running either on gasoline, benzol, alcohol (or, if above ground, also on petroleum), carried upon a frame provided with a pair of springs above each driving axle. The power is transmitted to the axles by gear wheels or by chain gear, put in and out of action by means of friction clutches. The exhaust gases are condensed in a way which insures that no foul air can infect the galleries. The safety of this form of tractor is so far recognized that it is admitted for hauling purposes in firedamp collieries, while the electric form of tractor, having exposed leads for conducting the current, is mostly excluded as being too dangerous.

The Otto mining locomotive carries its own supply of fuel and water, and, on account of the small quantity that it consumes of each, can run for a long time with a moderate supply; the tanks, situated at the upper part of the locomotive, hold enough fuel for a run of from 12 to 16 hours. The consumption of fuel, reckoned on the net ton-mile, necessarily fluctuates a great deal, according to the state of the track, the size of the tractor and the mean load on the engine; under favorable conditions it amounts to about 0.21 lb. of gasoline per net ton-mile, increasing to about 0.28 lb. when the conditions are not favorable.

The accompanying halftone shows an Otto mineral locomotive running in the Germania mines. An 8-hp. locomotive of this type for underground work for 2-ft. gage has the following overall dimensions: Total length, 3 ft. 11 in.; width, 2 ft. 7½ in.; height, 4 ft. 7 in. The engine is an internal-combustion engine, working on the Otto cycle of the horizontal type, and especially adapted to locomotive work. The cylinder is 6¾ in. diameter by 9½-in. stroke. The engine runs at a constant speed of about 300 r.p.m., and transmits its power by means of machine-cut, cast-steel tooth and sprocket wheels, friction couplings, and chains to the axles.

The gearing is arranged so as to give the locomotive two speeds, i.e., four and eight miles per hour. At the lower speed the locomotive is capable of hauling a gross load of about 23 tons, and at the higher speed a load of about nine tons on the level, the tractive energy on the drawbar being 615 and 240 lb., respectively. The service weight of the locomotive is four tons. As fuel, crude or refined benzol, petrol, etc., may be used. The consumption when using benzol is about 0.6 lb. per horsepower-hour. The oil-tank capacity is about 11 gal., and it is large enough for a double shift of 16 hours. The consumption of cooling water is exceptionally small, being about 0.2 gal. per horsepower-hour.

The electric ignition, by means of a spark, takes place inside the cylinder only. Since any escape has to pass a number of filters, it is killed before it reaches the outer atmosphere, thus obviating danger of explosion. The method of traction which this locomotive employs presents points of favorable comparison with other methods. The initial outlay is not excessive, and the locomotive is self-contained, being independent of any central supply station.

It is obvious that such a method of traction, should it establish itself as reliable and efficient, would simplify greatly the problems involved in mining extensions. New tracks or galleries could be opened up in any direction, and the tractor not being confined to one place, would be available immediately for the work of hauling on a new track. A further obvious advantage is that should one tractor be under repair, it would not involve the entire suspension of the traction work of the mine, as necessarily results from the breakdown of a main hauling engine or a failure of current in the case of an electric drive.

---

[*] Engineer, P. O. Box 151, Brussels, Belgium.

The Steel Corporation in 1911

A large production with lower prices and reduced profits. Gross earnings of $615,148,140 and net of $104,305,466 enabled the Corporation to continue dividends of 7% on preferred and 5% on common stock.

Note—Abstract of annual report.

The report of the United States Steel Corporation for the calendar year 1911, covers the usual wide range which the great extent and variety of the interests of the company make necessary.

THE BALANCE SHEET

The general balance sheet of the company, condensed as much as possible, is given in Table 1 herewith.

TABLE I. SUMMARY OF GENERAL BALANCE SHEET

Common stock	$508,302,500
Preferred stock	360,281,100
Steel Corporation bonds	459,623,500
Subsidiary companies' bonds and stocks	162,627,502
Current accounts and liabilities	51,636,059
Reserve funds	23,126,677
Appropriations for new property	40,000,000
Undivided surplus	133,691,195
Total liabilities	$1,739,288,533
Property accounts	$1,460,303,983
Deferred charges	9,208,582
Investments	2,383,885
Sinking and reserve fund assets	13,149,161
Cash and current assets	254,242,922
Total assets	$1,739,288,533

The bonded debt includes $459,623,500 direct obligations of the Steel Corporation, and $160,877,876 bonds of subsidiary companies, of which $78,903,000 are guaranteed. There are $58,908,500 bonds held in the several sinking funds. During 1911, a total of $33,141,000 bonds of subsidiary companies were issued and sold, in payment for purchases of property, payment for construction and payment for maturing issues. Deducting bonds and mortgages paid off, there was a net increase of $23,917,641 in the bonded debt during the year. The total inventory valuations at the close of 1911, excluding inter-company sales and profits, were $153,483,589, an increase of $10,650,204 during the year.

THE INCOME ACCOUNT

The general income account, condensed and freed from duplications as much as possible, is given in Table II, herewith:

The gross receipts for 1911 were less than those of 1910 by $88,812,585. The operating expenses included $488,134,474 for manufacturing and producing cost and operating expenses, including ordinary maintenance and repairs; $16,554,153 for administrative, selling and general expenses; $13,000,481 for taxes and current interest.

Adding to the surplus of the year net receipts on account of depreciation and replacement funds; receipts from bonds of subsidiary companies sold, and amounts realized on investments, a fund amounting to $54,182,912 was formed. From this, payments were made as follows: Additional property, construction and mine developments, $49,130,861; obligations paid off, $4,016,658; advances on account of mining royalties, $876,877; miscellaneous, $278,685; total, $54,603,081. This total was $420,169 in excess of the credits, the additional sum being provided from working assets.

TABLE II. GENERAL INCOME ACCOUNT

Gross sales and earnings	$615,148,840
Rentals and miscellaneous	957,651
Interest on investments	2,804,939
Profits on subsidiary companies' accounts	11,120,839
Total credits	$630,032,289
Operating charges	$517,689,108
Interest, subsidiary companies	8,037,695
Total charges	$525,726,803
Net earnings for the year	$104,305,466
Adjustment of accounts	81,780
Total net receipts	$104,387,246
Depreciation charges	$19,839,099
Interest and sinking funds	29,247,850
Dividends, pref. stock, 7%	25,219,677
Total charges	$74,306,626
Balance, surplus	$30,080,620
Dividends on common stock, 5%	25,415,125
Undivided surplus	$4,665,495

PRODUCTION AND SHIPMENTS

Table III herewith, shows the production for the year, compared with that for 1910. This table gives the total tonnages of finished products for sale.

Table IV gives the shipments of finished products to domestic and foreign purchasers. Foreign or export business was 18.2% of the total shipments of finished steel

No data as to manufacturing costs are given. A calculation, based on the tonnage of finished steel and excluding cement and other byproducts, shows that the gross receipts were $64.92 per ton; the net earnings, $11.07; and the dividends paid, $5.33 per ton. These figures, however, only constitute a general and rough approximation.

EMPLOYEES AND WAGES

Table V, herewith, gives the number of employees and the wages paid for two years.

In continuance of the plan observed in previous years, beginning with 1903, the employees of the Corporation and the subsidiary companies were, in January, 1912, offered the privilege of subscribing for preferred or common stock. The subscription price was fixed at $110 per share for preferred and $65 for common stock.

The allowances for special compensation or bonus to be paid subscribers who retain their stock were fixed at $5 per share per year for the preferred and $3.50 per share annually for the common stock. The conditions attached to the offer and subscription, aside from the features of subscription price and the amount of special compensation or bonus to be paid, were substantially the same as those under which stock has been offered to employees in each of the previous nine years. Subscriptions were received from 36,946 employees for an ag-

TABLE III. PRODUCTION OF WORKS

Products	1910 Tons	1911 Tons
Iron ore mined:		
In Lake Superior Region:		
Marquette Range	830,094	560,685
Menominee Range	1,384,465	1,105,044
Gogebic Range	1,801,480	1,264,734
Vermilion Range	1,338,110	1,182,075
Mesabi Range	17,910,366	14,581,530
In Southern region:		
Tennessee C., I. & R.R. Co.	1,981,301	1,239,563
Total	25,245,816	19,933,631
Coke made:		
In bee-hive ovens	11,641,105	9,491,206
In byproduct ovens	2,008,473	2,629,006
Total	13,649,578	12,120,212
Coal mined, not used for coke	4,850,111	5,290,671
Limestone quarried	5,005,087	4,835,703
Blast furnace production:		
Pig iron	11,645,510	10,593,726
Spiegel	102,260	66,435
Ferromanganese and silicon	83,628	84,736
Total	11,831,398	10,744,897
Steel ingots:		
Bessemer	5,796,223	5,055,696
Openhearth	8,383,146	7,697,674
Total	14,179,369	12,753,370
Rolled and other finished steel products for sale:		
Steel rails	2,118,473	1,568,028
Blooms, billets, sheet and tin-plate bars	682,364	874,474
Plates	929,020	630,512
Heavy structural shapes	656,797	547,186
Merchant steel	1,527,506	1,221,606
Tubing and pipe	868,550	863,670
Wire rods	133,722	118,302
Wire and products	1,490,318	1,613,754
Sheets and tinplate	1,082,787	1,079,046
Finished structural	589,228	518,399
Splice bars and rail joints	235,998	160,855
Spikes, bolts, nuts and rivets	71,326	60,386
Axles	101,066	52,046
Steel car wheels	98,105	36,652
Sundry steel and iron products	148,735	131,332
Total	10,733,995	9,476,218
Spelter	26,777	28,333
Sulphate of iron	33,684	28,381
Universal portland cement, bbl.	7,001,500	7,737,500

gregate of 30,619 shares of preferred and 30,735 shares ol common stock.

IRON ORE AND FUEL

The summary of iron ore property shows that the Corporation owns, leases or otherwise controls 78 mines in the Lake Superior region. In the Southern district it has 21 mines. The acreage and estimated contents are not given.

In Pennsylvania, West Virginia, Ohio, Indiana and Illinois it owes 230,501 acres of coal lands and 24,374 acres of surface. There are 31 coal plants not connected with coke plants; 78 coke plants with 23,947 bee hive and 1172 byproduct ovens. In the South it owns 343,129 acres, on which are 23 mines and 7 coking plants with 2974 beehive ovens; and one plant, with 280 byproduct ovens under construction.

The Carnegie Natural Gas Co. has in Pennsylvania and West Virginia extensive natural gas territory, either owning or having under lease about 188,829 acres and owning 629 miles of pipe lines, six pumping stations and 426 active wells. Extensive natural gas territory and pipe lines are controlled and owned by the American Sheet & Tin Plate Co. in Pennsylvania and by the National Tube Co. in Ohio. The former company has under lease about 32,368 acres of gas territory, and owns one large and four smaller pumping stations and 161 active wells. The National Tube Co. has under lease about 10,823 acres of gas territory and five developed wells.

TRANSPORTATION

The Corporation owns or controls railroad properties having 1363 miles main line, 737 miles branches and spurs, 403 miles second track and 987 miles sidings. The equipment of these lines includes 1193 locomotives and 46,334 cars.

Floating equipment owned includes 81 steamers, 22 barges, 1 scow and 2 tugs on the Great Lakes; 2 steamers and 108 barges on the Ohio River. There are 9 ore docks owned at Lake Superior ports and 8 at Lake Erie ports.

GENERAL REMARKS

The material slackening in the domestic demand for the products of the subsidiary companies, which became apparent in the fall of 1910, continued in a marked degree until the early part of 1911 and to a greater or less extent until the closing weeks of that year. In November, 1911, a substantial buying movement developed, the subsidiary companies' unfilled orders on hand rising to a total of 5,084,761 tons at Dec. 31, 1911. This improvement in business has maintained fairly well since the first of the year and to the date of writing this report. At Feb. 29, 1912, the unfilled order tonnage equaled 5,454,200 tons. In May, 1911, a sharp break occurred in selling prices of nearly all steel products, and prices continued to decline, gradually reaching in the latter part of the year the lowest figures, in respect of most of the commodities, which have been realized in 14 years.

In order to insure to the subsidiary companies operating blast furnaces in the Pittsburg, Valley and Cleveland districts, a supply of coke for a period of years more nearly equal to that which the large investment in furnaces and dependent mills requires, there were acquired from the Pittsburg Coal Co. and the Monongahela River Consolidated Coal & Coke Co. on July 1, 1911, by the H. C. Frick Coke Co., a subsidiary of the corporation, the following coking coal properties: 15,943 acres of unmined coal and 1408 acres of surface situated in Fayette, Greene and Washington counties, Pennsylvania. On this property there are three developed and operating coal mines, three coking coal plants comprising 986 beehive ovens, necessary tenements, equipment, tools, etc., for complete operation of the mines and ovens. A large part of the coal acreage acquired is located on the Monongahela River. A portion of the acquired property also lies immediately in front of the extensive Mingo tract of coal (owned by Carnegie Steel Co.) in Washington County, thus providing a practical means for a large part of the Mingo property to be worked to the river.

TABLE IV. SHIPMENTS OF PRODUCTS

	Domestic	Export	Total
Finished steel...	7,740,897	1,719,272	9,460,169
Pig, spiegel, etc..	399,935	26,728	426,663
Iron ore, coal and coke........	1,587,322	....	1,587,322
Byproducts.....	63,206	492	63,698
Total........	9,791,360	1,746,492	11,537,852
Cement, bbl.....	7,586,758	110,364	7,697,122

TABLE V. EMPLOYEES AND WAGES

Plants:	1910	1911	Changes
Manufacturing..	154,563	140,118	D. 14,445
Coal and coke ...	23,528	21,723	D. 1,805
Iron ore.......	16,956	14,445	D. 2,511
Transportation...	20,758	17,963	D. 2,795
Miscellaneous....	2,630	2,639	I. 9
Total.........	218,435	196,888	D. 21,547
Total annual wages:	$174,955,139	$161,419,031	D.$13,536,108
Av. yearly wage:	$800.95	$819.80	I. $18.85

THE GARY PLANT

At the close of the year nearly all of the manufacturing plant construction heretofore authorized for the Gary, Ind., district had been completed. At the steel plant of the Indiana Steel Co. the sheet bar mill was completed June 29, 1911; the two 12-in. and the 10-in. merchant bar mills about Sept. 1, 1911; the 60-in. plate mill on Nov. 4, 1911. The first battery of the byproduct coke plant, consisting of 70 ovens, went into operation on April 12, and 4 additional batteries at various later dates in 1911. The third unit of openhearth furnaces, consisting of 14 furnaces of 65 tons capacity each, was placed in operation in February, 1912. An addition to the electric power station, consisting of six generators of 3000 kw. each, driven by gas engines, was completed during the year. The several units of the sheet plant of the American Sheet & Tin Plate Co. and of the bridge and structural plant of the American Bridge Co., both at Gary, were completed and commenced operations at various dates during the year.

The output of the Gary steel plant of the Indiana Steel Co. during 1911 was as follows: 707,273 tons of pig iron, 1,036,545 tons of openhearth steel ingots, 281,980 tons of openhearth steel rails and 469,360 tons of various other rolled-steel products. The byproduct coke plant produced 811,804 tons of coke. The production of the sheet plant was 24,556 tons of black and galvanized sheets, and at the bridge plant there were produced 27,371 tons of fabricated steel work.

The actual amount expended to Dec. 31, 1911, at Gary by the several subsidiary companies for acquirement of real estate, development and construction, was $78,258,509 in all.

OTHER NEW PROPERTY

There was purchased in May, 1911, for warehouse purposes the property of the Risdon Iron & Locomotive Works in San Francisco, Calif. The plant had previously been operated in the ship and engine building and repairing business, and had for a long time been offered for sale. The property consists of about 20 acres of land, with considerable water front, is well located and has on it several buildings especially adapted for the storage and warehousing of steel products. It is believed that by carrying on the Pacific Coast large and varied stocks of the products of the subsidiary companies their distribution will be materially expanded. Substantial progress was made during the year on the construction of the new steel plant at Duluth, Min. The expenditures for the plant and the terminal railroads serving the same amounted for the year to $1,437,518. An additional outlay of $1,037,969 was made in payment for coal property in Illinois and Indiana, the purchase of which had been contracted for in previous year, and for the development of the properties.

PENSION FUND

There was set aside from the accumulated undivided surplus the sum of $663,018 for permanent pension fund, reference to which was made in last year's report. Of the foregoing amount $163,018 was paid over in cash to the board of trustees of the United States Steel & Carnegie Pension Fund for use by the board as cash working fund. A like amount for similar purpose was also contributed by the Carnegie Relief Fund. The balance of the appropriation first mentioned, together with the $1,000,000 set aside in previous years for pension purposes, is carried to credit of pension fund in general balance sheet. During the year the Corporation also paid over to the board of trustees $156,301, which was charged to current operations. This amount together with the $200,000 of income received by the trustees from Carnegie Relief Fund (being the income on the $4,000,000 fund created by Mr. Carnegie), and making a total of $356,302, was disbursed by the trustees during the year for pension and relief purposes. At the close of the year there were 1606 ex-employees on the pension rolls.

Hill Ore Leases

In the annual report for 1906 reference was made to the arrangement which had been consummated for a lease of the so called Great Northern Ry. ore properties by the Great Western Mining Co., a subsidiary company of this corporation. In accordance with an option reserved to the lessee to cancel the lease on Jan. 1, 1915, the Great Western Mining Co. on Oct. 26, 1911, formally notified the lessors that the company elected to cancel the lease. To Dec. 31, 1911, there had been mined and shipped under this lease 7,832,137 gross tons of ore; and royalties had been prepaid on account of minimum tonnages for years prior to 1911, covering an additional 2,892,183 tons. It is expected this prepaid tonnage, as well as the minimums called for by the lease for years 1912, 1913 and 1914, namely, 15,750,000 tons, will be mined and shipped prior to 1915, thus making an aggregate of 26,474,320 tons of ore which it is expected will be shipped under the lease prior to its relinquishment on Jan. 1, 1915. This total tonnage is equal to about one year's ore requirements of the blast furnaces of the subsidiary companies (exclusive of those of the Tennessee company) on the basis of the furnaces operating normally full throughout the year.

The Government Suit

On Oct. 26, 1911, the United States government filed a petition in the Circuit Court of the United States for the district of New Jersey against the corporation and a number of its subsidiary companies, alleging that the corporation and its codefendants are in violation of the Act of Congress of July 2, 1890, and asking that they be adjudged to be illegal and that they be dissolved. On Oct. 27, 1911, an official statement with reference to this proceeding was issued on behalf of the Corporation by its chairman which has heretofore been published. The answer of the corporation and codefendants was filed with the Court on Feb. 1, 1912, and a summary of it is sent to each stockholder with the annual report.

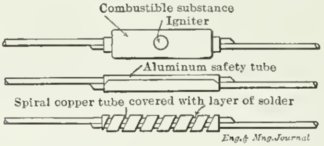
United States Potash Works

A description of a potash-producing plant in the United States is given in a recent press bulletin of the U. S. Geological Survey. This works is in southern California about 30 miles north of San Diego, where it was stated that operations in the commercial extraction of potash from kelp or seaweed would begin about Mar. 1. The plant is owned by the Coronado Chemical Co., which has been working on the kelp-potash problem for several years. It consists of four furnaces capable of treating 6000 lb. of dried kelp per 24 hours, and additional furnaces are under construction with a proposed total capacity for treating 36,000 lb. of dried kelp per day.

A New Tube Joint for Electric Wires

A novel tube-joint for uniting electric wires has recently been invented and patenter by Carl Egnér and Seth Ljungqvist, two Swedish engineers. No blowpipe, lamp or solder-melting furnace is required to make a finished joint.

For outside wires the tube consists of a copper band wound spirally, so that it is oval in cross-section. This tube is tinned and dipped in resin. Over this tube is placed one or two wraps of solder in plate form, the solder being an alloy of 63 parts tin and 37 parts lead. A jacket of aluminum incloses the copper tube and covering of solder, and over the aluminum is a covering of combustible matter similar in composition to the substance of which storm matches are made. The combustible covering is provided with an ignitible substance like that used for safety matches.



Tube Joint for Outside Wires

The tubes are made in sizes corresponding to all standard diameters of wire. To make the joint, the ends of the wire are cleaned with emery paper, dipped in soldering fluid and inserted side by side in the tube, the ends projecting in opposite directions. The combustible material is then ignited by rubbing the coated side of the box in which the tubes are packed on the ignitible part of the outer coating. The heat arising from the burning combustible matter melts the solder so that it runs and fills the space between the wires and the inner copper tube. The aluminum cover, which prevents gases from mixing with the molten solder, remains loose on the joint when the solder is cold. It is removed and discarded. This tube also diffuses the heat over all the length of the joint and prevents the molten solder from running out.

For joining inside wires, a tube of cylindrical section is used, which is provided with an opening lengthwise and perforations to allow the solder to run inside the tube. The ends of the wires are cleaned and inserted from opposite sides, so as to meet in the middle of the tube. The joint is then made in the same manner as the outside wires.

It is claimed that tests made at the Swedish telegraph testing office show that the strength of the joint is only 0.6% less than the tensile strength of the wire, and that the heat does not materially affect the metal even in the case of hard-drawn copper and iron wires. The tubes and plates are so proportioned that there is little loss in conductivity. These tubes are being manufactured in Sweden, and A. E. Sylven, 29 Broadway, New York, is the sales agent in the United States.

Retreatment of Rand Tailings

Johannesburg Correspondence

It has long been recognized that the older tailing dumps along the reef offer some prospect of successful retreatment for their gold contents. The Stark leaching process was a success in certain dumps, which were situated so that the solution pumped over them *in situ* could be collected without undue leakage loss, and I am somewhat surprised that no attempt appears to have been made elsewhere to carry out the process. It will be remembered that the gold was precipitated on scrap iron.

It is known that the gold contents of the older sand dumps range in value from 3 to 6s. per ton, and that the bulk of the gold is contained in the coarser particles of quartz and pyrite, which require regrinding to extract their contents by cyanidation or amalgamation. Hence the failure of attempts to concentrate these dumps on vanners.

Prof. Stanley, of the South Africa School of Mines, came to the conclusion that any successful scheme must include hydraulicking or other cheap means of transferring the sands to treatment, some scheme of hydraulic classification with regrinding of spigot products and their subsequent treatment by cyanide. He has invented and patented a splitzlutte, having vibrating screens in the upper current, which combines hydraulic classification with screen sizing.

This machine, on small-scale operations, separates 90% of the valuable portions of the sands rapidly and efficiently at a cost of 6d. per ton treated; regrinding is estimated to cost in tube mills 7½d. per ton treated, with cyaniding slimes and sands from reground concentrates to cost 1s. 3d. per ton; a total cost of 2s. per ton on the total tonnage treated. Where the sands must be removed for stope-filling purposes, a saving would be effected. It is estimated from the results of the trial plant run at the Robinson mine that 75 to 80% of the total precious-metal contents of 3 to 6s. per ton will thus be recovered, which leaves a large margin of profit. A company, called "Sands Limited," has been formed to exploit the process in Africa and elsewhere.

Mining and Metallurgical Patents

A Classified List of New Inventions

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by The Engineering and Mining Journal upon the receipt of 25 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COPPER

FUSING AND PURIFYING—Process of Fusing and Purifying Copper. Walter S. Rockey and Hilliary Eldridge, New York, N. Y., assignors to Metallurgical Research Co. (U. S. No. 1,018,681; Feb. 27, 1912.)

LEACHING—Process of Treating Copper Ores or Copper-Ore-Mill Tailings. John W. Bennie, Clifton, Ariz. (U. S. No. 1,019,708; Mar. 5, 1912.)

ROASTING—An Improved Method of Chlorinating Roasting of Ores. Helsingsborgs Kopparverks Aktiebolag, Helsingborg, Sweden. (Brit. No. 11,515 of 1911.)

SCRAP—Process of Remelting and Refining Old or Scrap Copper Alloy. Walter S. Rockey and Hilliary Eldridge, New York, N. Y., assignors to Metallurgical Research Co. (U. S. No. 1,019,524, Mar. 5, 1912.)

GOLD AND SILVER

AMALGAMATOR. James G. Scott, Morgantown, Ind. (U. S. No. 1,018,448; Feb. 27, 1912.)

BLACK-SAND-SEPARATING MACHINE. Jacob M. Burch, Wallace, Idaho, assignor of one-fourth to John Lafors, Wallace, Idaho. (U. S. No. 1,017,506; Feb. 13, 1912.)

CONCENTRATOR — Centrifugal Ore and Slime Concentrator. Christoffer A. Christensen, Portland, Ore. (U. S. No. 1,018,898; Feb. 27, 1912.)

CYANIDING—Method and Apparatus for the Precipitation of Gold and Silver from Cyanide Solutions. Daniel Bosqui, Gold Road, Ariz., assignor, by mesne assignments, to Merrill Metallurgical Co., San Francisco, Cal. (U. S. No. 1,018,604; Feb. 27, 1912.)

CYANIDING—Process for the Precipitation of Precious Metals from Cyanide Solutions. James Millar Neil, Toronto, Ontario, Canada, assignor to Alexander M. Hay, Toronto, Canada. (U. S. No. 1,018,438; Feb. 27, 1912.)

FILTER. Charles Edward Singer, Parral, Mexico. (U. S. No. 1,017,476; Feb. 13, 1912.)

FILTER PRESSES—Improvements in Filter Presses for Use in Connection with Hydrometallurgical Processes. C. W. Merrill, Berkeley, Cal. (Brit. No. 2802 of 1911.)

SETTLING TANK. Alexander John Arbuckle, Johannesburg, Transvaal. (U. S. No. 1,020,013; Mar. 12, 1912.)

TUBE-MILL LINER—Feed and Discharge End-Liner for Tube-Mills. Henry C. Holthoff, Mexico, Mexico, assignor to Allis-Chalmers Co., Milwaukee, Wis. (U. S. No. 1,018,320; Feb. 20, 1912.)

IRON AND STEEL

ELECTRIC FURNACES—Improvements Relating to Electric Furnaces. Rochling'sche Eisen- und Stahlwerke, G. m. b. H. & W. Rodenhauser, Volklingen-on-Saar, Germany. (Brit. No. 10,231 of 1911.)

HOT-BLAST STOVE. Walther Mathesius, Charlottenburg, Germany. (U. S. No. 1,018,331; Feb. 20, 1912.)

MANGANESE STEEL — Heat Treatment of Manganese Steel. Winfield S. Potter, New York, N. Y. (U. S. No. 1,017,907; Feb. 20, 1912.)

MANGANESE STEEL — Heat Treatment and Rolling of Manganese Steel. Winfield S. Potter, New York, N. Y. (U. S. No. 1,018,000; Feb. 20, 1912.)

MANGANESE STEEL — Producing Rolled Shapes of Manganese Steel. Winfield S. Potter, New York, N. Y. (U. S. No. 1,017,904; Feb. 20, 1912.)

MANUFACTURE—Apparatus for the Manufacture of Steel. William R. Walker and James H. Gray, New York, N. Y. (U. S. No. 1,018,644; Feb. 27, 1912.)

LEAD, ZINC AND OTHER METALS

ALUMINUM — Method of Treating Aluminum. Auguste J. Rossi, Niagara Falls, N. Y., assignor to The Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,019,531; Mar. 5, 1912.)

ANTIMONY—A Process for the Electrolytic Production of Metallic Antimony from Antimony Ores or Compounds. R. C. V. Whitfield, Chambers, Eng. (Brit. No. 9968 of 1911.)

BORON AND ZIRCONIUM—Improved Method of an Apparatus for Producing Boron and Zirconium. E. Weintraub, Lynn, Mass. (Brit. No. 25,033 of 1910.)

LEAD—Method of Manufacturing Arsenate of Lead. E. O. Barstow, Midland, Mich., assignor to Dow Chemical Co. (U. S. No. 1,014,742; Jan. 16, 1912.)

TIN—Process of Treating Tin-Bearing Material. Josef Weber, Essen-on-the-Ruhr, Germany, assignor to Th. Goldschmidt, Essen-on-the-Ruhr, Germany. (U. S. No. 1,018,734; Feb. 27, 1912.)

TITANIUM—Process of Obtaining Titanic Oxide. George Weintraub, Lynn, Mass., assignor to General Electric Co. (U. S. No. 1,014,793; Jan. 16, 1912.)

TITANIUM ALLOY—Process for Producing the Alloy of Titanium with Lead. Auguste J. Rossi, Niagara Falls, N. Y., assignor to The Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,019,529; Mar. 5, 1912.)

TITANIUM ALLOYS—Process for Producing Alloys of Titanium with Ferrometal. Auguste J. Rossi, Niagara Falls, N. Y., assignor to The Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,019,528; Mar. 5, 1912.)

VANADIUM—Process for Recovery of Vanadium. Byramji D. Saklatwalla, Bridgeville, Penn., assignor to The American Vanadium Co., Pittsburg, Penn. (U. S. Nos. 1,020,224 and 1,020,312; Mar. 12, 1912.)

ZINC—Improvements in Recuperative Zinc Furnaces. A. Folliet Mieusset, Liege, Belgium. (Brit. No. 2250 of 1911.)

MINING—GENERAL

BLASTING—Apparatus for Reducing or Neutralizing the Noxious Fumes Resulting from the Combustion of Nitroglycerin Explosives. Edward Macaulay, Paignton, England. (U. S. No. 1,019,502; Mar. 5, 1912.)

DRILL—Rock-Core Drill. William R. Wallace, Houghton, Mich. (U. S. No. 1,019,206; Mar. 5, 1912.)

DRILL—Rock-Drill. Thomas Francis Carroll, Mount Carmel, Penn. (U. S. No. 1,015,780; Jan. 30, 1912.)

DRILLS—Improvements in Machines for Forging and Sharpening Rock Drills. J. G. Leyner, New York. (Brit. No. 1923 of 1911.)

DRILLS — Mounting for Air-Feed Drills. William Prellwitz, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,019,361; Mar. 5, 1912.)

FLUME GATE. Wilson Polk Harlan, Holtville, Calif. (U. S. No. 1,018,662; Feb. 27, 1912.)

HOISTING—Gear for the Prevention of Overwinding. John Shaw, Kirby Moorside, North Riding, England; John Reginald Shaw, Elmsall Lodge, Pontefract, England, administrator of said John Shaw, deceased. (U. S. No. 1,017,600; Feb. 13, 1912.)

LAMP—Miner's Lamp. William E. Pinkney, Scarbro, W. Va. (U. S. No. 1,016,645; Feb. 6, 1912.)

MINE ALARM INSTRUMENT. Henry White Lee and George Henry Weedman, Mount Morgan, Queensland, Australia. (U. S. No. 1,018,328; Feb. 20, 1912.)

SAFETY APPARATUS for Miners' Trucks. Valentin Stasch, Friedenshütte, Germany, assignor of one-half to The Firm of Gräflich Schaffgotsch'sche Werke, G. M. B. H., Beuthen, Germany. (U. S. No. 1,019,281; Mar. 5, 1912.)

SAFETY STOP FOR MINE CARS. Henry H. Herbold, Thayer, and Charles Hegner, Cainesville, Mo.; said Herbold assignor to said Hegner. (U. S. No. 1,019,249; Mar. 5, 1912.)

SHAFT SINKING—Method for Sinking a Mine Shaft in a Water-Bearing Soil which is Weak or Porous. J. Gevers, Antwerp, Belgium. (Brit. No. 21,788 of 1911.)

WEIGHING MACHINE — Automatic Weighing and Recording Mining-Car Scale. George Goetz, Chicago, Ill., assignor to Streeter-Amet Weighing & Recording Co., Chicago, Ill. (U. S. No. 1,017,747; Feb. 20, 1912.)

ORE DRESSING—GENERAL

CONCENTRATION—Improvements in or Relating to Ore Concentration. E. H. Nutter, London, Eng. (Brit. No. 2383 of 1911.)

CONCENTRATOR—Ore Concentrator. Emil Deister, Fort Wayne, Ind., assignor to The Deister Concentrator Co. (U. S. No. 1,019,884; Mar. 12, 1912.)

CONCENTRATORS—Improvements in Ore Concentrators. Emil Deister, Fort Wayne, Ind. (Brit. No. 22,892 of 1911.)

CRUSHER—Ore Crusher. Ezra A. Mathers, Philadelphia, Penn., assignor of one-half to Daniel W. Harner, Philadelphia, Penn. (U. S. No. 1,017,780; Feb. 20, 1912.)

CRUSHING — Compound Ball Mill. Richard Beneke, Bromberg, Germany, assignor to Limited Company Herm. Lönnert, Aktiengesellschaft, Bromberg, Germany. (U. S. No. 1,017,946; Feb. 20, 1912.)

CRUSHING—Improvements in Crushing Mills. T. J. Sturtevant, Boston, Mass. (Brit. No. 23,394 of 1911.)

CRUSHING—Stone-Crushing Machine. Edgar B. Symons, Fort Wayne, Ind., assignor, by mesne assignments, to Smith Post Co., Milwaukee, Wis. (U. S. No. 1,019,997, Mar. 12, 1912.)

ELECTROSTATIC SEPARATOR. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. (U. S. No. 1,017,701; Feb. 20, 1912.)

PULP DIVIDER—Apparatus for Subdividing Streams of Pulp and Other Liquids. Hans Charles Behr and Charles Friedrich Eduard Oscar Schmitt, Johannesburg, Transvaal. (U. S. No. 1,020,251, Mar. 12, 1912.)

SEPARATION — Improved Mechanico-Chemical Process for the Separation of Ores. Campagne d'Entreprises de Lavage de Minerais, Paris, France. (Brit. No. 8154 of 1911.)

WASHING ORES—Process and Apparatus for Washing Ores Containing Sulphides. O. Malkemus, Benolpe, and Carl Pletsch, Attendorn, Germany. (Brit. No. 15,292 of 1911.)

METALLURGY—GENERAL

ELECTROLYTIC APPARATUS FOR ASSAYING. Herbert E. T. Haultain, Toronto, Ontario, Canada. (U. S. No. 1,018,901; Feb. 27, 1912.)

METAL OXIDES—Process of Making Metal Oxides. Hans Foersterling, New York, N. Y. (U. S. No. 1,019,004; Feb. 27, 1912.)

REDUCTION — Improvement in the Method of and Apparatus for Reducing Ores of Volatile Metals. H. H. Hughes, Springfield, Mo. Brit. No. 570 of 1911.)

ROASTING—An Improvement in Processes for Roasting Sulphide Ores. C. W. Renwick, Isabella, Tenn. (Brit. No. 1267 of 1911.)

ROASTING KILN—Recuperative Roasting Kiln. John Zellweger, St. Louis, Mo. (U. S. No. 1,017,839; Feb. 20, 1912.)

SCRAP METAL—Process of Melting Scrap Metal. Albert E. Greene, Chicago, Ill. (U. S. No. 1,018,418; Feb. 27, 1912.)

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

F. F. Sharpless has gone to Missouri on professional business.

B. R. Bates is now with El Rayo Mining & Development Co. at Santa Barbara, Chihuahua, Mexico.

Charles Janin and Ross Browne Hoffmann were in New York this week on their way to London.

H. Kenyon Burch, of Los Angeles, Calif., was recently in Globe, Ari., on professional business.

Arthur L. Flagg, late of Durango, Mexico., is now with Glenville A. Collins, Spokane, Wash., as associate engineer.

E. Jacobs, of Victoria, B. C., secretary of the Western Branch of the Canadian Mining Institute, has been visiting New York.

Pope Yeatman will go to Chile about the middle of April, expecting to be absent from New York for about three months.

H. W. Hardinge lately returned to New York from mining investigations in Alabama, but is now in the West on professional work.

Morris Levit, salesman for many years for the Joshua Hendy Iron Works, San Francisco, is now assistant manager of the company.

James G. Ross, consulting mining engineer of the Milton Hersey Co., Ltd., Montreal, is in British Columbia on professional business.

E. E. Hedges, of Boston, is at the Laurentian mine, Manitou district, Ontario, of which he is the principal owner, directing operations.

J. F. Erdletz left New York last week on his way to Siberia. His address is care Russian Mining Corporation, Salisbury House, London.

Robert R. Hedley, of Vancouver, B. C., paid a short visit to New York about the middle of March. On Mar. 17, he left Toronto on his return journey to British Columbia.

J. C. Murray, of Toronto, Ontario, editor of the *Canadian Mining Journal*, was in New York, Mar. 22, on his way to Bermuda, where he purposed spending a vacation of two or three weeks.

R H. Flaherty, late of the United States Steel Corporation and now head of the mining department of Mackenzie, Mann & Co., is investigating the iron-ore deposits of British Columbia, in connection with the projected establishment of a large steel plant, at Port Mann.

Franklin Guiterman, general manager of the Colorado department of the American Smelting & Refining Co., has been transferred to the New York office of that company of which he is a director and member of the executive committee. Mr. Guiterman will remain in general charge of the Colorado department, and besides other new duties will be vice-president and general manager of the New Rivers Collieries Company.

OBITUARY

Bert Reed Hicks is reported by cable to have been killed by bandits while on an exploring expedition up the Yangtse-Kiang River in China. He graduated from the Michigan College of Mines in 1909, and was soon after appointed professor of mining engineering in the Imperial College at Ching-tu, Szechuan, China.

Frederick W. McKee died at Pittsburg, Mar. 22, aged 54 years. He was born at Pittsburg and lived there all his life. Of late years he had given his attention to developing a large property which he owned in Winfield township, Butler County. At the time of his death he was treasurer of the Winfield Mineral Co.; treasurer of the Winfield Sand Co.; president and general manager of the Winfield R.R., and a director in the Pennsylvania Clay Products Co. He left a widow and four children.

W. Williams, for many years manager of the Tilt Cove Copper mine in Newfoundland, for the Cape Copper Co., of London, met with a fatal accident at Tilt Cove on March 13. He was dining at home with his wife and family when the snow crushed the house down and all the occupants were buried beneath the ruins and a large pack of snow. A number of miners spent several hours in searching for the buried persons and succeeded in reaching all of them. It was found that Mr. Williams and his son aged 13 years, had been killed instantly and one of the servants was dangerously burned by being pinned against the kitchen stove. She is not expected to survive; but the others are not seriously injured. Mr. Williams was very successful as general manager of the Tilt Cove mine and was popular with the miners. He was a native of England and had a varied experience in mining in England and Wales, in addition to Newfoundland.

Ralph Stockman Tarr, of the Department of Physical Geography at Cornell University, one of the best known geographers in the United States and an authority on glaciers and earthquakes, died suddenly at his home on the Cornell University Campus, Ithaca, N. Y., Mar. 21. Professor Tarr once led a Cornell expedition to Greenland, and he spent several summers in Alaska at the head of the expedition for the United States Geological Survey. In recent years he spent his summers in Alaska studying the glacial region for the National Geographic Society. Professor Tarr was born in Gloucester, Mass., in 1864. He was graduated from the Lawrence Scientific School, in 1891 He was assistant United States fish commissioner, in 1882-83, when he was connected with the Smithsonian Institution. He was assistant geologist of the Texas Geological Survey in 1888 and 1891. He was assistant in geology at Harvard, 1890-91, and was professor of dynamic geology and physical geography, 1897-1906. He was special field assistant of the United States Geological Survey since 1903. He was a member of the Geological Society of America, the Geological Society of Washington, the National Geographical Society, and the Association of American Geographers. He was corresponding member of the Geological Society of London. In addition to several text books, Professor Tarr compiled a "Physical Geography of New York State," and wrote monographs on geographical and geological topics.

Charles T. Harvey, who built the first canal at Sault Ste. Marie, died at the home of his son in New York City on March 13, at the advanced age of 83 years. Mr. Harvey's life was full of achievements which added greatly to the wealth and convenience of the world, but very little to his own fortune. He was born in 1829. His first employment was with E. & T. Fairbanks & Co., scale manufacturers of St. Johnsbury, Vt., in charge of establishing agencies for their weighing machines in the large western cities. While engaged in this pursuit he was stricken with typhoid fever and upon his convalescence his employers sent him into the Upper Peninsula of Michigan to recuperate. Just at that time Congress had authorized a grant of 750,000 acres of land to anyone that would build a canal around the rapids of St. Mary's river at the Sault. His mind was intensely practical and he saw at once the possibilities of wealth in the situation. He interested his employers in the undertaking and through their efforts a company was formed to build the canal. Harvey, though scarcely 24 years old at the time, was placed in charge of construction and prosecuted this work with wonderful vigor. Despite all obstacles the canal was finished and opened to commerce within two years. This was a considerable achievement when it must be borne in mind that the nearest machine shop was several hundred miles away and the nearest telegraph station at Detroit, 450 miles south. As soon as the canal was finished and accepted, Harvey selected the lands in payment for the work, among them being the location upon which was afterward developed the Calumet & Hecla mine. He also engaged in pig-iron manufacture in the peninsula, though this venture was not especially profitable. Later he was engaged in several other engineering works of importance and was active until a few years ago.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Mar. 22—Reports have been in circulation for some time to the effect that some unusually rich ore has been found at the Melones mine in Calaveras County. It is stated that a large pocket of free-gold quartz has been disclosed with indications of its opening into a considerable orebody. The ore is said to be extraordinarily high grade, but confirmation of its exact or approximate grade is lacking. It is said to be not improbable that the pocket is on the old Morgan vein at Carson Hill, which is an adjoining claim, and which was a large producer of nugget gold in the early days. It is rumored that ore worth $150,000 has been taken from this pocket within the last few weeks. Press dispatches state that ore running $4000 per ton has been mined, but this is undoubtedly greatly exaggerated. Official information, however, indicates that a discovery of rich ore has been made, and from the same source it is learned that at present not enough work has been done to show the extent of this ore.

Denver

Mar. 22—The Cripple Creek district as a whole is quiet. The drainage tunnel is completed as far as present funds will allow, and the water in the deep shafts is receding steadily. Regarding the great bodies of rich ore at depth, which the local press was so full of a few weeks ago, when the deep levels were being unwatered, the real truth is, that allowing for the natural rises and depressions of the surface, the bulk of the production below 1000 ft. will be medium- and low-grade ores, from $15 down to $3. There will, of course, be some exceptions. More mills will be built this summer and more low-grade ore will be handled in the district.

The Portland mill will soon be handling 15,000 tons per month, and at present, attempts are being made to treat the concentrates chemically at the mill. The Blue Flag mill has been resuscitated, and operations started Mar. 5 on oxidized ores from the Blue Flag mine. This makes six mills now in operation at the mines: Stratton's Independence, Portland, Ajax, Wild Horse, Cavanagh and Blue Flag; a possible milling capacity of 35,000 tons per month. The winter has been unusually severe, but from now on, lessees will become more active, more old dumps will be turned over and milled, and more small properties will be opened to lease. Cripple Creek is expected to be an active camp this summer.

The deep drainage tunnel at Cripple Creek, otherwise known as the "Roosevelt bore," has been driven a distance of 16,857 ft., at a cost of $576,000. In the report of T. R. Countryman, tunnel engineer, to the directors of the company, the cost of pumping is given at $5000 per vertical ft., and as the tunnel has already lowered the water level 118 ft., the cost of pumping to get the water to this level would have been $590,000 or more than the tunnel cost; as it may be said that the tunnel has practically only commenced to do its work and has already paid for itself, the results of this great work are eminently satisfactory. The rate of subsidence is now about 15 ft. per month, and the total flow from the portal about 16,000 gal. per minute.

Butte

Mar. 20—It has long been realized that there are great possibilities in the Georgetown mining district, in Deer Lodge County, but for the lack of good transportation facilities it has never had an opportunity to be developed to the extent that its mineral resources warrant. The coming of the Butte, Anaconda & Pacific R.R. into the region will change all this, and, in anticipation, much activity is being manifested there. Many new properties are being opened and work resumed on old ones. Electricity for hoisting and other purposes can be furnished cheaply to the mines of that section, as there is a large amount of water power to be had in the adjacent country. At Flint Creek Falls, nearby, there is already a power plant of 2500 hp., which can be increased at any time, and the company owning the plant is ready to sell power to any consumer in Georgetown desiring it. The ore in this region has excellent fluxing properties, and this is one reason that the Anaconda company recently bought the Southern Cross mine, and is extending its railroad there; the ore can be used to great advantage at the smeltery as a flux to mix with the more refractory ores.

The Anaconda company has refused to reinstate a number of Socialist miners, who were discharged recently. Officials of the company are reported to have said that the men were discharged not because they were Socialists, but because they had openly instigated insubordination among the employees. No serious consequences are expected as a result of the strike vote to be taken soon by the union.

Salt Lake City

Mar. 21—The U. S. Assay Office in Salt Lake City, during January, handled 6858 oz. gold and 1355 oz. silver, having a total value of $126,237. During February, bullion containing 5334 oz. gold, and 2167 oz. silver, a total value of $100,352, was received. The business for 1911 amounted to approximately $1,300,000, an increase of about $149,000 over 1909, the largest year preceding. The office receives bullion from Utah and six of the surrounding states, and during the three years it has been established, has handled $3,501,000 worth of bullion, or an average of $1,167,000 per year.

A new road, the Thompson & Ballard R.R., is being planned to develop coal lands in Grand County. Surveys have been made and the total length between the terminals of Thompson and Ballard will be about five miles.

Snowslides occurring at Alta, Mar. 16, slightly damaged the power line of the Columbus Consolidated and carried away several buildings of the Flagstaff mine. No lives were lost. Numerous snowslides have occurred in both Big and Little Cottonwood during the winter, but the damage has been less than usual.

Wallace, Ida.

Mar. 20—The lower tunnel at the Caledonia mine is in 150 ft. farther than the calculations showed the vein should be, and the latter has not yet been cut. It is probable that either the dip of the vein has become flatter or the strike has changed appreciably. The raise from the lower tunnel has cut the vein but drifts 75 ft. west and 150 ft. east failed to open a commercial orebody. The vein is strong, however, and shows low-grade ore. This is not surprising as the Caledonia orebodies are all in pockets. In the west drift a fault was encountered which cut off the vein; the latter was again picked up by crosscutting 50 ft. This fault may be the cause of the present miscalculation of the vein's position. Should the ore in this mine fail to continue with depth, it will be the first time that such a thing has occurred here in a mine which has produced from the upper levels. With more prospecting the orebodies will probably be found and it would not be surprising if they should be found to be the best yet opened in the mine, as the depth now being attained is about the same as that at which the greatest orebodies in the Cœur d'Alene mines have been found.

Deadwood, S. D.

Mar. 21—The proposal to fix the price of ore assays for gold and silver, at $1 per sample, has been urged by Black Hills men, to be put into effect at the U. S. assay office here. It has received the sanction of the director of the mint, providing no additional help will be needed to handle the business, and it is believed that the new price will soon go into effect. This would probably increase the business of the assay office. The present price is $3 per sample, which is rather high for the ordinary prospector. Many men are anxious to get an assay certificate with the government seal affixed, but they have found that they could scarcely afford the cost. Congressman Martin, of South Dakota, has been instrumental in getting the matter before the director of the mint.

El Paso, Texas

Mar. 20—A number of the representatives of the American mining companies operating in Mexico have formally turned over the property and interests of their companies to the charge of the American consuls in the respective districts, acting under the suggestion in the recent proclamation of warning issued by President Taft. This is done particularly as a means of making a record in case of any future claims for adjustment which may arise.

Generally the operating companies are endeavoring to continue activities and they are encouraged in this by the authorities because of the economic necessity of the communities but it is becoming more difficult because of the trouble in getting supplies and powder. On Mar. 20 it was reported that 90,000 lb. of dynamite, consigned to commercial organizations in Mexico, were being held here in compliance with President Taft's proclamation prohibiting explosive materials of all kinds from being taken across the border. Also there is the recurring danger of being "permitted" to "contribute" to the "cause," a procedure that is trying the spirits of the Americans almost to the breaking point. Many of the American mining employees have already left the country either by the advice of the managements or because of choice and this is greatly hampering all operations. Some of the companies have provided facilities for the families of their American employees to leave Mexico and in one case the whole mine staff is in the United States on salary, waiting for the return of safe conditions. It is difficult to get engineers to go into many parts of the country and as a result several negotiations under way when the last "war" started are likely to default. In one case the buyers are asking an extension because of their inability to have the property properly examined, but the owner refuses and will forfeit the payments already made. There is considerable concern as to whether the U. S. Government will adopt and enforce a vigorous policy to secure restitution of property lost by reason of the failure of the Mexican Government to maintain itself or to protect the contract right of Americans in Mexico which are now seriously jeopardized by the political difficulties which now affect a great portion of the country.

The strict enforcement of the recent inhibition on the export to Mexico of any explosives, and the actual closing of the port of Juarez to all exports will certainly and at once put a stop to all mining within the zone controlled by the Orozco force in the north of Mexico.

Cobalt

Mar. 22—The recent discovery of ore in the Keewatin formation of the Coniagas mine is exciting considerable interest, as this is the first time that any body of ore has been discovered in the Keewatin, in that portion of the camp. The drift on the vein has now been driven for a distance of 160 ft. beyond the contact, and the rich ore still continues, and will form an important addition to the reserves. C. W. Knight, assistant provincial geologist, has visited the mine, and states that the rock is undoubtedly Keewatin. About three years ago, at the Hudson Bay mine, a small shoot of ore was discovered in the same formation, but the returns were not sufficient to pay for the expense of working it.

The contract for grading the Elk Lake branch of the Temiskaming & Northern Ontario Ry., 30 miles long, between Earlton and Elk Lake, has been let to the Toronto firm of McCafferty & McQuigge for $180,000. The construction will necessitate the building of two large trestles. The company's engineers have announced a grade of six-tenths of 1% over the country to be traversed.

Toronto

Mar. 23—The Ontario Government has decided to postpone legislation limiting the working day for miners to 8 hrs. There were two bills before the House dealing with the matter, one introduced by Premier Whitney, the other by N. W. Rowell. When the latter measure came up, the Premier stated that he had been in favor of the 8-hr. day, but found that he had been too precipitate, and that there should be careful investigation before such a measure is enacted. The debate was adjourned, but the stand taken by the Government insures the defeat of the bill.

Hon. W. H. Hearst, Ontario Minister of Lands, Forests and Mines, has introduced into the legislature a bill making numerous amendments to the Mining Act. Sanitary provisions are made more stringent, and the responsibility for accidents is placed more definitely upon mine owners. Code signals are simplified, and it is made an offense for any one intoxicated or carrying liquor, to enter a mine. An extension of time for the performance of development work is provided if expiration falls due between Nov. 16 and Apr. 15. Mine owners may acquire the right to bring in water, drain and cut roads or tramways through adjoining lands, on paying compensation as fixed by the mining commissioner.

Porcupine

Mar. 22—Arrangements have been made for carrying on the construction of the power plant at Waweatin Falls, which was started by A. E. Wallberg & Co. This firm got into financial difficulties and was forced to abandon the work temporarily, but it is understood that Montreal men are furnishing the money to carry it to completion. This matter is one of great importance to the future of the Porcupine district, as with only one company supplying power, the rates would probably be higher. At the present time the plant at Sandy Falls is short of power, on account of low water in the river and the leakage from the dam; no change for the better is expected before a general thaw sets in. The mines using electricity have steam power in reserve in case of emergency, and several of them will be run by steam until the electric current is again available.

Operations at the Dome mine have now progressed to the point where the mill is ready to start. The tube mills were turned over yesterday, and some of the stamps would have dropped had it not been for a shortage of water, due to the breaking of one of the pumps. This will, however, be replaced in a short time, and the mill will be treating ore before the end of the week. There are over 1500 tons of ore in the bins, and everything at the mine is in readiness to supply the necessary tonnage. For about a week, more than 150 tons per day will be treated, but this will be increased to approximately 400 tons. On Mar. 30, visitors will be allowed to see the underground workings, which will be the first time anybody has been given this privilege.

Johannesburg

Feb. 8—The output for January was a record one but was obtained by adding nearly £100,000 worth of reserve gold to the month's output, it having been decided by several companies, including the East Rand Proprietary Mines, Ltd., to abandon the practice of keeping reserve gold, which appears always to have been a needless practice, as reserve gold can easily be accumulated in the battery or cyanide works in the form of precipitate in the boxes or gold amalgam on and off the plates. The East Rand Proprietary declared nearly £70,000 of such reserve gold, the retention of which meant a large loss of interest.

The Mining News

The Current History of Mining

Alaska

A large undertaking for the development of placer ground near Cordova is contemplated by Col. John Peter Grant and C. E. Campbell, now at Cordova.

It is reported that a power company is being formed to install a plant in the Knik district; this would be of considerable benefit to the mines in that vicinity.

A gold shipment of $30,000 in bullion was received at the Seattle assay office, Mar. 20, coming from the Nome, Fairbanks and Copper River districts.

Midas—The first shipment of ore from this property near Valdez was made recently, consisting of 260 tons, assaying 12% copper, $3 gold and $4.50 silver per ton.

Golden Hills Consolidated—This company has recently been organized and has taken over two groups of quartz claims in the Willow Creek district. It is the intention to place a crew of 25 men at work soon, and to install a stamp mill. H. D. Cowen, of Seattle, is general manager.

Alaska-Mexican—During January the mill crushed 19,803 tons of ore yielding $65,801 gross and net $31,349. Operating expenses were $31,364; construction, $3087; development, 290 ft. The ore averaged $3.36 per ton.

Alaska-United—During January the mills crushed 39,067 tons of ore yielding $89,073 gross and net $27,047. Operating expenses were $58,048; construction, $3976; development, 597 ft.; yield per ton at Ready Bullion mill, $2.29 and $2.31 at the 700 Claim.

Arizona

Gila County

South Live Oak—The company is preparing to begin exploration of its property with churn drills. Harry Millard, who will have charge of the drilling, has gone to St. Louis to purchase a "St. Louis" churn drill, made by the St. Louis Machine & Tool Co. It will have a 58-ft. derrick, with boiler and engine separate from the rig and is designed for deep drilling. Holes will be started with a 16-in. bit, which is 2 in. larger than the largest size now in use in the district.

Barney—Hole No. 1 is 1355 ft. deep and is still in the iron-stained, silicified schist formation in which it has been for the last 255 ft. This is the deepest hole ever drilled in the district, breaking the record of 1285 ft. made in Hole No. 1 at the Southwestern Miami. The 3-in. casing is being put in and Supt. E. B. Tinker expects to be able to attain a depth of at least 1500 ft. Hole No. 2 is 300 ft. deep.

Inspiration—The experimental mill has been temporarily closed to make some changes preparatory to starting another series of tests. The tests are carried on under the constant supervision of J. M. Callow, consulting metallurgical engineer. Work is progressing on the plans for the concentrator and it is believed that one of the many possible sites will soon be selected. The work on the dam across Pinal Creek has been delayed by the recent rains and consequent high water. The water well on the Inspiration Ranch opened a flow of 750 gal. per minute.

Sho Me—This group of seven claims, south of and adjoining the claims of the Inspiration company, is being developed by Cleve W. Van Dyke, president of the Miami Townsite Co. The claims are traversed by a large fault of which the foot wall is Pinal schist and the hanging wall, Gila conglomerate. A shaft 165 ft. deep, sunk on this fault, is reported to have disclosed about 2 ft. of red, hematite-stained, clay gouge and fault breccia, carrying native copper. The shaft is now being cleaned out and repaired. A second shaft has been started on the No. 2 claim but has been delayed by the recent rains.

Arizona Commercial—The retimbering of the Copper Hill shaft has been completed for 210 ft. below the collar. The present plan is to continue the work to the 400-ft. level and to start development work. Considerable ore has been shipped from this level in the past. Twenty men are employed under Superintendent R. R. Boyd.

Duquesne—This group is being worked by John Shaw with five men. The last shipment of 36 tons assayed 1.02 oz. gold and about 10% lead, netting more than $17 per ton above freight and smeltery charges.

Arizona-Colorado—The mine, three miles north of Globe, now owned by the German Copper Co., is being unwatered preparatory to resuming development work. The property consists of 21 claims, traversed by a strong fissure vein in diabase, quartzite and limestone. The principal opening is a vertical shaft 900 ft. deep, from which crosscuts to the vein have been run at several levels. It is claimed that 50,000 tons of chalcopyrite ore have been developed on the 800-ft. level, assaying 2½% copper.

Maricopa County

Vulture—A new oreshoot has been found in this old mine near Wickenburg. The mine was recently reopened and equipped with a new mill by Boston men.

Pima County

Old Yuma Mining Co.—George H. Dailey has taken an option on this property, in the Amole district, owned by Mrs. W. H Barnes, of Tucson. The mine yields gold and vanadinite.

California

Inyo County

X-Ray—This mine is producing high-grade shipping ore. Three cars of ore are on the dump and one will be shipped for testing. An air compressor and machine drills are contemplated. A. E. Williams is manager.

Estella—A milling and concentration plant and some other machinery have been ordered from the Allis-Chalmers company. Surface buildings are being erected. A vein of lead-silver ore was disclosed several months ago at 3750 ft. in the 400-ft. tunnel. Estella Mining Co. is owner, and R. C. Troeger, Keeler, is president.

Kern County

Four Ace—This company has recently developed high-grade ore at the 300-ft. level of the Santa Ana mine, in new ground. This disclosure is taken as evidence that the ore in this district goes to depth, contrary to general opinion.

United Oil Co.—A new contract with the Standard is reported for 500,000 bbl. of the company's production in the Midway field. The price is said to be 50c. per bbl. without limit as to daily deliveries. The former contract was at 45c. and the daily deliveries were limited to 1000 barrels.

Great West—No. 1 well in Tappo Cañon, in the Piru field, is reported to have 33 gravity, green oil at 1000 ft., and to be pumping 20 bbl. per day. All other oil in the vicinity is black.

Mariposa County

Original—The flumes and ditches for the new electric power house have been completed, and the latter is in course of construction. W. G. Eganhoff, El Portal, is superintendent.

Crown Lead—The new transformer has been installed. The 20-stamp mill has been idle for several weeks, but is now ready to start. G. S. Ireland is superintendent.

Nevada County

Champion—The electric pump is being installed on the 1800-ft. level to lift water from below. From that point the pumps in the Providence will lift the water to the drain tunnel.

W. Y. O. D.—The 5-throw electric pump is in operation. This pump was in course of installation when the fire which destroyed the surface plant several weeks ago, retarded the work. It has a capacity of 500 gal. under a vertical lift of 600 ft., and is operated by a 150-hp. motor. Its position is in the 1100-ft. level. The pump was made by a local manufacturer, and is said to have cost $10,000. The Pennsylvania Mines Syndicate is the owner.

Placer County

Gaylord Mining Co.—The reconstructed dredge, formerly operated in the American River district, at Natoma, is expected to be in operation soon at Whiskey Bar below Rattlesnake bridge on the American River. The dredge was rebuilt by the Union Iron Works. E. C. Gaylord, of Auburn, is manager.

Cache Rock—The Holmes system of gold-saving tables is being installed in this dredge by the Cache Rock Dredging Co.,. that has leased the boat and the placer claims from the owners. A. W. Copps, of Alameda, is general manager, and C. T. Schooler, Forest Hill, is superintendent.

Sacramento County

Union Dredging Co.—The new 9-cu.ft., bucket-elevator dredge, Bucyrus type, has been placed in commission at Blue Ravine, two miles from Folsom in the American River district. The dredge is driven with General Electric motors, and is designed to dig 55 ft. below the water line The first day the run was continuous for 16 hr.; the second day, 22 hr., an unusual start. The ground to be dredged embraces about 250 acres. Benjamin C. Warnick, 131 S. Fourth St., Philadelphia, is general manager, and Andrew Turner, of Folsom, is superintendent.

Shasta County

W. J. Bright is operating a dry-land dredge on the Lanyon land near Copley, the latter town being on the Sacramento River north of Redding and west of the Old Diggings mining district.

Sierra County

Phoenix—Extensive development work has begun at this Sierra City mine. A. Wise has charge.

Standard—This mine in Sailor Ravine is about to be taken over and equipped by a strong company composed of San Francisco, Colusa and Downieville men. J. S. Frye will remain in charge.

Hayes Consolidated—A bond has been given on this Sierra City mine, to a San Francisco company that will install power drills and extend the tunnel at river level to cut at greater depth the veins encountered in the upper workings. Thomas C. Heide is superintendent.

Siskiyou County

Osgood—The lower tunnel is in 100 ft. with 14 in. of good quartz in the breast. Preparations are being made to install machinery. Mr. Harrison of Yreka, is superintendent.

Tuolumne County

If I Can—Grading for the two water tanks is under way. Water will be pumped from the river, and the mill of 200 tons daily capacity will be supplied from the tanks. The Stanislaus Gravel Mining Co. is owner, and E. R. Abadie, Jamestown, is superintendent.

Colorado

Boulder County

United States Gold Corporation—The cyanide mill at Sugar Loaf is nearly completed, and the mine has been developed so that a steady supply of ore will be furnished. Power will be supplied by the Central Colorado Electric Co. George W. Oats has personal charge of the mining and milling operations on the ground, and John R. Wolff is general manager. The capacity is 150 tons per day. The Livingstone property, generally known as the "Potato Patch," has been acquired by the company.

Clear Creek County

Santiago—A strike of silver-lead ore is reported at this mine in the Argentine district. It was made in sinking from the fourth level. An aërial tramway eight miles long is projected, and it is said this will reduce the cost of delivery from $4 to 50c. per ton. Twenty men are employed.

Specie Payment—The mine in Virginia Cañon is to be developed extensively by the Specie Mining, Drainage & Tunnel Co., just incorporated. John Owen, of Idaho Springs, is manager.

Centennial—This mine on Leavenworth Mountain was recently reported as sold to a Boston syndicate; work will be resumed soon.

Cripple Creek District

Cresson Consolidated—The output is about 1500 tons per month of $25 ore, and enough ore is reported broken on the 11th level to keep up this tonnage for a year. This orebody has been shown to exist at the 12th level, 1274 ft. deep, and sinking of the shaft has been resumed. Richard Roelofs is manager.

El Paso—Development is progressing rapidly in the levels drained by the tunnel. A large 20x48-in. cylinder, Webster-Camp-Lane hoist has been ordered, and will be placed at the Nicholls shaft to enable following the water down as it recedes, and to develop the territory at the north end. This will eventually be the main working shaft.

Chickenhawk—Superintendent Walden has taken a lease on the property of the Katinka Co. and has started up the Chickenhawk mill.

Lexington—The annual report of H. J. Anstie, president and general manager, shows a cash balance of $6905 and no debts.

Lake County—Leadville

Nearly all the zinc-producing properties in Leadville are shipping and the tonnage is larger than for some time past; many properties that have never yet shipped any zinc ores are now entering the list. Owing to the tremendous snowfall and heavy condition of the roads not half the tonnage produced is being moved and it will be at least six weeks before this condition is improved.

Yak—The shipments from this tunnel are about 10,000 tons per month with 30 lessees at work and the breast is now in Vegas territory.

Stars Consolidated Mines—The output from the different properties is between 4000 and 5000 tons per month of different classes of ore, chiefly zinc and iron.

Ouray County

Camp Bird—During the quarter ended Jan. 31, 1912, the mill crushed 15,760 tons of ore, yielding gross $466,549 and net $350,682. About 65% of the ore treated was drawn from reserves in stopes, and on Jan. 31, the total ore broken in stopes amounted to 4017 tons.

San Juan County

The Durango smeltery of the American Smelting & Refining Co., which was closed in November, was reported blown in again on Mar. 18, and is expected to run at full capacity all summer, as the ore supply is large. During the idleness caused by the floods which stopped ore shipments, the smeltery has been thoroughly overhauled and improved.

Intersection — Equipment has been hauled to the mine for enlarging the mill. Another battery of stamps is to be added and it is probable that an endeavor will be made to cyanide the coarse tailings by percolation.

San Miguel County

It is stated that nineteen 4-horse teams have been busy during the winter hauling vanadium ore from Paradox Valley in southwestern Colorado to the railway at Placerville, where there are three warehouses for storing vanadium and carnotite ores, that were built by the companies operating in the valley.

Colorado Carnotite Co.—The company is considering the installation of equipment for the concentration of its ores. It is said that recent experiments have been successful in making a chemical concentration of the uranium minerals. O. Barlow Willmarth, general manager, has lately purchased additional claims, which will be developed soon by J. E. Snyder, superintendent.

Primos Chemical Co.—This company treated an average of 23 tons of vanadiferous sandstone daily during 1911, containing an average of 2½% V_2O_5. The mill at Newmire is at present treating 30 tons per day. A new roaster of the Edwards type has been placed in commission. The company is developing extensively on both sides of Bear Creek and has driven in over 1200 ft. on the east side, showing the vanadium-bearing sandstone to be practically continuous. Much of the product is marketed in Europe, where sales of ferro-vanadium at $2.25 per lb., for the metallic vanadium content, are reported. The prevailing price last autumn was $3.50 per lb. Thomas Bradley, New Placerville, is superintendent.

SUMMIT COUNTY

Wellington—A new 25-ton magnetic separator, to treat the zinc middlings said to cover an acre to a depth of 20 ft., has been completed by this company. It is believed that this product can be treated at a net profit of about $4 per ton.

Idaho

BOISE COUNTY

Boston-Idaho—This company is running its two dredges at Idaho City, and reports state that the ground is unusually rich. The company has also taken a bond on the Banner mine, and the caved tunnels are being opened. If conditions warrant, the company will extend its power line to this property.

Twin Sisters—The mine was sold recently to Youngstown, Ohio, men.

COEUR D'ALENE DISTRICT

Snowstorm—An official report issued recently shows the mine to be in excellent shape. At present, 200,000 tons of sulphide ore, averaging 4% copper, are blocked out between Nos. 2 and 3 tunnels, and 45,000 tons of carbonate ore above No. 2 tunnel. Ore is being shipped from the latter regularly. The sulphide ore will be stoped when the first 100-ton unit of the new mill is ready; this will probably be about Apr. 15. The advance in the price of copper is largely responsible for the renewed activity at this property. The ore is a highly siliceous copper ore and was in great demand by smelters before magnesia brick came into such universal use. The new method of treatment, concentration and leaching, is expected to make the mine a large producer.

Sunset—Development at this property is progressing satisfactorily. A night shift has been added to the working force.

Marsh—This mine, at Burke, has completed 300 ft. of two-compartment shaft. A station and skip pocket will be cut and a crosscut driven to intersect the vein. Lumber is on the ground for the erection of an orebin at the mine, and when completed, it is the intention to start the mill. The mill is on Nine Mile Creek, about two miles from Wallace.

Hercules—Work in No. 5 tunnel is being pushed. When completed, the tunnel will be about 8000 ft. long and will utilize about 1900 ft. of the old Humming Bird tunnel. The latter is being widened and retimbered, about 1500 ft. of this work being completed. A feature of the work is a 24-in. ventilating pipe to carry off the gases.

LEMHI COUNTY

D. A. McDonald, H. W. Lohman and O. J. Potter, of Breckenridge, Colo., are prospecting Bohannon Bar with a No. 3 Keystone drill, and a dredge may be installed this summer.

Parker—This company, operating at Parker Mountain, has purchased the 10-stamp mill belonging to the Cinnabar mine and it is being transferred to the property. Judge Stevens, T. R. Jones and F. J. Cowen are the owners.

Illinois

American Zinc, Lead & Smelting Co.—This company is offering to its shareholders 70,000 shares of stock at $26.50 per share, the whole issue having been underwritten by Hayden, Stone & Co. for a commission of $1.50 per share. Of the expected $1,750,000 proceeds of this stock, about $1,000,000 will be used to pay for the new smeltery at Hillsboro, Ill., which is expected to be completed about July 1, and $500,000 will be used for the equipment and construction of a mill at the mine in Tennessee that is now under development.

Michigan

COPPER

Mohawk—No. 6 shaft is down to the sixth level, which corresponds with the ninth level of the other shaft, and it is opening ground of unusual richness for this company. This shaft adjoins the Ahmeek, and the character of the ground corresponds in all respects with that of the Ahmeek at the same depth. It commands much territory and will be a large factor in the future of this property. Conditions underground at No. 5 shaft are showing a material increase in the copper content of the rock.

Hancock—The sinking of the large vertical shaft continues, stringers of copper have been in evidence for some time, and it is expected that the Pewabic lode will be reached at any time. It was first estimated that the lode would be reached at a depth of about 3600 ft., but the lodes affiliated with the Pewabic have been reached sooner than was expected, and it is now believed that the formation has flattened and that the Pewabic lode will be reached at a shallower depth.

Ojibway—The crosscut from the 1600-ft. level of No. 2 shaft has encountered the lode, but has not as yet reached the hanging-wall side. The ground so far broken is of good character and well mineralized.

Osceola—The hearing in the injunction case of Charles M. Turner, who secured a restraining order against the holding of the annual meeting, has been called for Mar. 28, at Lansing, before Judge Weist, of the Michigan Circuit Court.

Mayflower—The report for 1911 shows receipts of $62,148 and expenditures of $23,599, leaving balance, Jan. 1, 1912, of $38,548. During the year 7294 ft. of diamond drilling were done. The following directors were elected for 1912, at the annual meeting: George E. Clarkson, Alton L. Dickerman, H. F. Fay, George P. Gardner, Frederic W. Nichols and Charles J. Paine, Jr. The St. Mary's company owns 25,000 shares of Mayflower stock and is expected to take an active part in the future management of the property.

IRON

Iron County Steel Co.—Operations have begun on the properties at Iron River. At the Lennox mine ore is being hoisted and exploration work is being started, to be carried on at the same time as the mining operations; the property has a shaft and about 35,000 tons of ore, which was blocked out by the Brule company, from whom the property was secured. The Cyr property, consisting of 40 acres, will be explored from the underground workings of the Lennox. At the Corry property, east of the Berkshire mine of the Brule Mining Co., equipment is being delivered. On Sec. 34, southwest of Iron River, a shaft is being started.

Winckler—George H. St. Clair, of Minneapolis, is diamond-drilling on this 60-acre tract, north of Iron River, for a private organization in which he is interested. Ore has been found near the property's north line, which also forms the south line of the Wauseca or Konwinski mine, of the Mineral Mining Co. The property includes the N. E. ¼ of the S. W. ¼ of Sec. 23-T. 43—R. 35, and the West ½ of the N. W. ¼ of the S. E. ¼ of the same section. The other one-half of the latter forty is held by Powers & Geary, of Hibbing, Minnesota.

Lucky Star—At this property, at Negaunee, to be operated by the Breitung interests, arrangements are being made to start shaft-sinking; machinery is being ordered, including a 700-ft. air compressor. It is planned to use small "plug" hammer drills in the sinking. Electric power will be furnished the mine by the Cleveland-Cliffs Iron Co., from its new Carp River plant; the latter company owns a minority interest in the Lucky Star company. The ore shipments will be forwarded over the Lake Superior & Ishpeming Ry. to Marquette, as will probably the coming season's output from the other Breitung mines; this railroad, also owned by the Cleveland-Cliffs company, is completing a new steel and concrete ore dock on Lake Superior, just north of Marquette.

Missouri

GREENE COUNTY

Bray—This zinc-lead property, south of Springfield, is being operated under lease by a Kansas City company, under direction of George Mutscheler.

Badger—This mine near the Bray has been acquired by the Shoto Mining and Milling Co., of Springfield, and is being reopened. A mill has been completed to treat the zinc-lead ore. F. F. Griffin is manager.

Montana

BUTTE DISTRICT

Davis-Daly—On account of the continued improvement, with development, it has been recommended by General Manager Fisher, that all attempts to acquire new property, commenced some months ago when underground conditions were discouraging, be abandoned for the time being, at least. Ore assaying 10% copper was recently encountered on the 1700-ft. level of the Colorado mine. During the last four months, gross earnings have been amounting to between $15,000 and $20,000 per month. These have been practically paying expenses and it is thought by the management that the output for March will leave a small profit in the treasury. Arrangements have been made with the Anaconda company whereby a crosscut will be driven from the 2000-ft. level of the Gagnon mine to develop the practically unexplored western end of the Davis-Daly property. Shaft-sinking was continued from the 1700-ft. level, Mar. 1, and will be continued to the 2000-ft. level.

Pilot-Butte—Considerable development work is being done, most of it with good results. Two veins, running well in zinc and silver, have been opened on the 900-ft. level, one north and the other south of the shaft. Also a crosscut is being driven on the 900-ft. level to intersect the Snowball vein, which passes through the North Butte ground. A body of zinc and silver ore has been opened on the 1300-ft. level in the drift from the Butte & Superior workings through the Pilot ground, assaying 26% zinc, 44 oz. of silver and $1.50 in gold per ton.

JEFFERSON COUNTY

Boston & Corbin—The directors are planning the erection of a concentrator at the property near Corbin, and to this end the mine was thoroughly sampled recently and a car of average ore was sent to the Anaconda sampling works with instructions to forward one-half of the car to the General Engineering Works at Salt Lake City as a check sample; it is hoped in this way to determine the most suitable plant for that character of ore. Returns gave an average of 3.6% copper, 7.1 oz. of silver, and 20c. in gold. It has been figured that the gold and silver will just about pay the cost of mining the ore, leaving the copper as profit, in case the concentrator is built, and it seems likely from these encouraging figures that work will be started soon on its erection.

LINCOLN COUNTY

Blacktail—This gold property will be operated this year by A. M. Balfour and associates, under lease. The property is equipped with a stamp mill and is in the West Fisher district, 35 miles south of Libby.

Big Eight—A small force of men is doing development work on this silver-lead mine in the Troy district.

Lincoln Gold Mining Co.—This company, owning the Sylvanite gold mines, 16 miles north of Troy, has sawed lumber during the winter for the mine buildings which were burned in a forest fire in 1910. An attempt is being made to get the company's affairs in shape to rebuild the mill and to resume operations. J. H. Ehlers of Spokane has charge of the work. The mines were being operated steadily at the time of the fire.

California-Montana—This placer mining company expects to put in a hydraulic plant on Libby Creek this year; it controls about 800 acres of land. The company has been prospecting the ground with a steam drill during the last winter and the reports that have been given out are favorable. W. H. Graham, of Libby, is behind this enterprise.

Nevada

COMSTOCK LODE

Con. Virginia—The annual meeting of stockholders was held last week, and the old management was retained by a large majority. B. F. Shaw was chosen president, and, with Edward S. Spring, Herman Zadig, A. F. Coffin and H. L. Slosson, Jr., constitutes the board of directors. Charles H. Fish retired from the presidency after serving for many years, and was succeeded in the board of directors by Mr. Slosson. Thomas F. McCormick was reëlected superintendent.

Mexican—A cleanup was made of one of the large tanks recently, and the bullion obtained was shipped to the smeltery. During the shutdown for this purpose, a new liner was placed in the tube mill. The tonnage treated at the plant has been increased.

Union Consolidated—A south drift was started last week from the west crosscut at the 2500-ft. station of the joint winze, but was stopped on account of the free flow of hot water. The drift will follow the wide vein opened by the crosscut, and work will be resumed when increased pumping facilities are available. A new pump station is being cut in the winze, between the 2000- and 2500-ft. levels, and the water will be taken out in two lifts. A northwest prospecting crosscut has been started in the north drift from the Mexican side of the mine, at a point about 60 ft. north of the old Patton east crosscut. The vein formation will be explored in that direction.

Best & Belcher—The new hoist and other equipment for the Sutro tunnel station have been installed, and sinking of the joint winze was started a few days ago, three shifts being employed in the work. This winze will be sunk to the 2400-ft. level.

CLARK COUNTY

Quartette—The only work in this Searchlight mine for nearly a year has been exploration in the lower or 1300-ft. level, to cut the oreshoot to the east in the Rambler ground, purchased by the company two years ago for $30,000. Recently a number of leases have been let and some rich ore is being extracted, mostly from the surface or the upper levels. The tailings have been leased to C. H. Jonas, the cyanide plant is being remodeled to treat them, and a slime plant will be added. The new plant will be furnished by the Colorado Iron Works, and will contain a mechanical mixer, Akins classifier, paddle wheel, agitator, Portland filter and belt conveyors. The plant will be in operation by the middle of April. J. E. White is in charge.

NYE COUNTY

Tonopah ore shipments for the week ended Mar. 14 were: Tonopah Mining, 3450 tons; Tonopah-Belmont, 1950; Montana-Tonopah, 1050; Tonopah Extension, 1220; West End, 725; MacNamara, 435; North Star, 40; total, 8870 tons and $221,750 estimated value.

MacNamara—The cleanup of the 10-stamp mill for a 16-day run, ended Mar. 9, produced six bars of bullion worth $9643. The mill is treating 62 tons of ore per day, averaging $16 per ton.

Tonopah-Belmont—During the retimbering of the main shaft, shipments of smelting ore have been suspended, but the regular output of 2000 tons per week is being sent to the mill. On the 1100-ft. level, a south crosscut has cut a new vein showing 9 ft. of good ore. Below the 12th level work has been suspended, owing to the sinking pumps being too small to cope with an increased flow of water, and larger pumps are being installed.

Tonopah Merger Mining Co.—This company has acquired the old Golden Anchor mine, adjoining the Midway on the west, and under the management of John Kirchen, of the Tonopah Extension, will sink the shaft from a depth of 840 ft. to the 1050-ft. level, and develop two large veins in the property. The directors are: Key Pittman, Frank Pittman and R. T. Harris, of Tonopah, J. G. Butler, Jr., of Youngstown, Ohio, and R. C. Hall, of Pittsburg.

Tonopah Extension—The midmonthly cleanup for March resulted in the shipment of 21 bars of bullion, weighing 2645.5 lb., worth $29,100. The mill is now treating 155 tons per day. Next week the company will commence the sinking of a new three-compartment main working shaft, 1600 ft. west of the present shaft and 400 ft. west of its extreme western workings, in which extensive orebodies have been developed.

WHITE PINE COUNTY

Ward—A committee of the minority stockholders has taken an option on this extensively developed lead-silver mine, south of Ely, until May 1, and is negotiating a sale of the property. When the property is operated again, it is proposed to built a short line of railroad to connect with the Nevada Northern R.R., at Ely.

New Mexico

GRANT COUNTY

The total ore shipments from Lordsburg for February, were 4843 tons, a low monthly tonnage. In 1911 about $1,000,000 worth of ore was shipped from Lordsburg. The ore is all delivered to the railroad by teams and unusually bad weather interfered with hauling. Mining is more active here than for years.

Atwood Copper Co.—Preparations have been made to increase the output; heavier machinery has been installed and the shaft is being sunk from the 200-ft. level. Two veins are being worked on this level which has about 550 ft. of drifts and crosscuts on the two main veins. The ore in the smaller vein averages about 4 ft. wide and that in the larger vein is 12 ft. wide. The new hoist, headframe and ore bins are expected to be in commission within two months.

Oregon

Ashland—This gold mine east of Grants Pass has been sold to Minneapolis men. It is developed and equipped with a 10-stamp mill. It was formerly operated by Dr. R. O. Hall, of Los Angeles, and was sold to a Canadian company. It has been idle for two years owing to a cave on the lower levels.

Granite Hill—This property in Josephine County is being overhauled by the Oregon Gold Mines Co., and operations will be enlarged. The mine is on Louise Creek.

Rainbow—The erection of a mill on this property in Baker County is said to be under consideration, again.

South Dakota

BLACK HILLS DISTRICT

North Homestake—The shaft is 620 ft. deep and crosscuts are being run both east and west to intersect veins disclosed by diamond-drilling done from the upper levels.

Custer Peak—Sinking has been resumed at the Jungle mine of this company. Work was suspended at a depth of 90 ft. It is the intention to sink to at least the 200-ft. level. J. H. O'Brien, Albany, is superintendent.

Utah

BEAVER COUNTY

Cedar-Talisman—Carbonate ore is reported on the 500-ft. level, and it is thought that the Stewart vein may have been encountered. A survey of the lower workings has been completed.

South Utah—Development is being done on the 600- and 700-ft. levels. The ore is being taken out through the 600-ft. level on electric trains. The grade of the ore is reported to have improved.

EMERY COUNTY

A. Cameron is shipping carnotite from the San Rafael district. Mr. Cameron, who represents Philadelphia men, has recently purchased the interests of Elmer Dahling in this district.

Charles P. Tasker, of Philadelphia, has installed a drilling rig at Green River, and will exploit the extensive holdings of his company.

JUAB COUNTY

Grand Central—During 1911, 26,216 tons of ore were shipped, bringing $186,302. The balance on hand, Jan. 1, 1912, was $9408. Since Jan. 1, 1912, the shaft has been sunk 125 ft., its present depth being 2325 ft., and a station is being cut on the 2300-ft. level. Ore has been followed 40 ft. below the 2200. No trouble from water has been experienced and none is expected.

Colorado—Development at depth in unprospected ground has been started through the Crown Point.

Iron Blossom—The average daily production for February is given as 360 tons, and the earnings for that month will probably exceed January.

SALT LAKE COUNTY

Utah Copper—The Magna plant and seven sections of the Arthur mill operated at full capacity during February. A record output of 18,300 tons in one day was made.

Bingham-New Haven—Daily shipments of 200 tons are being made, with an additional 100 tons treated in the mill. The ore is said to carry about 3% copper, with about $5 per ton in gold and silver.

SUMMIT COUNTY

Silver King Consolidated—The annual report, for 1911, shows assets of $1,123,037, including a judgment of $737,007 against the Silver King Coalition Mines Co., which, with interest, amounts to about $783,000. Receipts for the year were $100,241. The total number of shares issued is 344,058 out of a total of 500,000. The liabilities, including bonds and convertible notes, amount to $184,424. During the year ended Feb. 1, 1912, 469 dry tons of ore, averaging 40 oz. silver, 37.2% lead, 0.07 oz. gold and 0.6% copper were shipped, and brought smeltery returns of $18,678, the average net value being $41 per ton. Development work was continued in the Andes claim, and the above shipments were made from this ground. New ore has been opened below the 1550 level.

TOOELE COUNTY

Lion Hill Consolidated—The annual report has been issued. During the year, 1859 ft. of development were done. Several cars were shipped for experimental purposes and brought net returns of $13,738, the ore running 105.19 oz. silver, $3.39 gold, and 4.5% lead. Total receipts were $44,653; expenses were $44,604. The balance due from the underwriters should be sufficient to continue development for some months.

West Virginia

United States Coal & Coke Co.—An explosion is reported to have killed 81 men, on Mar. 26, in the Jed coal mine of this company, at Jed, three miles from Welch.

Wisconsin

COPPER

The only work underway on the western copper range is on the Weyerhauser property east of Minong, Washburn County. It is reported that the results are not encouraging. Exploration is by diamond drill.

ZINC-LEAD DISTRICT

Beloit—The property of this leasing company, including mine and mill equipment and a lease on 80 acres near Cuba City, has been sold to Chicago and Milwaukee men, who will resume operations on a larger scale.

Wisconsin Zinc Co.—The company has taken over the Little Bennie tract at Benton and has commenced sinking a new shaft.

Vinegar Hill Zinc Co.—The company has obtained a lease on the Scrabble Creek property at Hazel Green and is drilling it.

Canada

British Columbia

Shipments and receipts in tons in the Boundary district for the week ended Mar. 14 were as follows:

Mine	Week	Year to Date
Granby	25,112	243,003
Mother Lode	8,740	85,785
Rawhide	4,786	22,704
Jack Pot	152	3,669
Athelstan	....	340
Emma	436	4,901
Others	220	2,633
Totals	39,446	363,035
Smelteries		
Granby	25,112	288,672
B C. Copper Co	13,955	119,994
Totals	39,067	408,666

British Columbia Copper—The surface works at the Emma mine have been destroyed by fire. This has necessitated a temporary cessation of operations there. The loss is covered by insurance. More ore of good grade has been found in the Wellington group which includes the Athelestan, Fraction and Jackpot claims. Prospecting is resulting satisfactorily on two of the claims included in the Voigt group, Similkameen district, held under option of purchase. In a crosscut at 90 ft. depth, on No. 14 claim, 8 ft. of ore have been encountered; of this 2 ft. average $34 per ton. Assay returns of samples received in New York are copper 8% and gold 0.55 oz. per ton. Much good ore has also been found on No. 18 claim.

Nova Scotia

Nova Scotia Steel & Coal Co.—The annual statement for 1911 shows profits of $1,019,392, the balance brought forward from the previous year being $500,602. After the payment of dividends, fixed charges, etc., and $73,880 for improvements to plant, a balance of $508,544 was carried forward to profit and loss account. The total reserve fund stands at $1,835,522. In their annual report the directors state that during the latter half of the year the iron and steel trade was much disturbed by American competition, owing to the low rate of duty. The increased efficiency of the plants owing to the considerable expenditures on improvements has reduced the cost of production.

Ontario-Cobalt

Cobalt shipments for the week ended Mar. 22 were: La Rose, 276,400 lb.; Nipissing, 206,560; Right-of-Way, 87,460; Buffalo, 60,600; Crown Reserve, 36,120; McKinley-Darragh, 62,940; Coniagas, 40,780; total, 770,860 lb. Bullion shipments were: Nipissing, 96,906 oz.; Buffalo, 7679; Crown Reserve, 18,791; O'Brien, 9618; total, 132,985 ounces.

Hitchcock—The syndicate which has taken over this property at Elk Lake, on an option providing for the expenditure of $40,000 in development work, has begun operations and is putting machinery in.

Temiskaming—This company has declared its first dividend since the acquisition of the North Dome property in Porcupine. Ballot papers will be sent out with the dividend checks by which shareholders may express their opinions as to the North Dome purchase.

Mann—Fifteen tons of high-grade ore of an estimated value of $40,000, have been shipped from this property, at Gowganda. Free gold occurs in wire form with the silver.

Ontario-Porcupine

Jupiter—Good ore has been encountered on the 200-ft. level of this property.

Porcupine Gold—The No. 3 vein has been cut on the 200-ft. level.

Pearl Lake—The main shaft has reached a depth of 400 ft. and from this point a crosscut is to be driven south to intercept the veins which come in from the McIntyre property.

McIntyre—It is stated that the balance of the treasury stock is to be issued at about $5 per share, in order to provide funds for increasing the capacity of the mill. Mine conditions, however, do not appear to warrant the increase in mill capacity. The property has been partially closed down on account of lack of power.

Porcupine Union—This company, having disposed of sufficient treasury stock to secure adequate funds, is resuming work on three claims in the Three Nations district.

Davidson—The Crown Chartered has met the payment of $28,750 on this claim, due Mar. 9. A winze is being put down from the 100- to the 200-ft. level, and two raises, 50 ft. apart, are being driven.

Ontario-Sudbury

Newton Cryderman, of Sudbury, is conducting explorations in the new Groundhog gold district, about 90 miles north of Sudbury. The oreshoots are reported small but rich in gold. The district will be accessible to the new route of the Canadian Northern Railroad.

Gosselin—Twenty-five men have been sent from Sudbury to begin operations on these claims, at West Shining Tree, and an equal number will follow when the camps are ready. Surface sampling shows an average of $11.90 per ton. Testpits will be sunk and diamond-drilling undertaken.

Mexico

Baja California

Gulf Copper Co.—The company owns the El Toro mine on Angeles Bay, Gulf of California, northwesterly from Guaymas, Sonora. J. H. Baker, San Diego, Calif., is president and C. E. Anthony is engineer. An adit is being driven to tap the old workings.

Chihuahua

Grandeña—This mine at Santa Barbara will soon be reopened, using for ore beneficiation, a new zinc-treatment process, developed by the manager, Sewall Truax, who has been engaged for several months in experiments at Cañon City, Colorado.

Mexico

Esperanza—During February the mill crushed 15,612 tons of ore yielding gross $102,539 and net $4273. Operating expenses were $92,145; depreciation, $5000; other expenses $1121; estimated profit $3042. Development work totaled 1301 ft. The small return is stated to have been due to the low grade of ore treated and low tonnage. The first half of March is said to show a satisfactory increase in both grade and tonnage.

Nuevo Leon

Zinc exports during February were suspended, due to the rise in ocean freight rates.

Soledad—This mine at Sabinas has again resumed operations after a short shutdown and is shipping about 1500 tons of lead ore per month.

Fraternal—This and the Minas Viejas properties are working at full capacity.

Dolores—The property at Vallecillo, which has been operated almost continuously since 1840, has been taken over under lease by James Morlan. The mine is under water up to the fifth level and during the last five years the mill has run on the old tailings dumps. The present intention is to unwater the mine and to work the stopes left in zinc ore by the former owners. According to the records these were important. Additional boiler and pumping capacity has been ordered and will be installed soon. The former management, which up to a few years ago was still working with a Cornish pump, was unable to lower the water. It is hoped that the new installation will result in a new lease of life for this important district.

Sonora

Santa Gertrudis—The Camp Bird company, owner, reports that during the quarter ended Jan. 31, 1912, developments continued to be satisfactory. The oreshoot on the 18th level is extending farther west than on the level above. The San Guillermo and Contra Tiro shafts are down to the 19th level and crosscutting to the vein is in progress. The present capacity of the mill, 600 tons, is to be increased to 800 tons per day. Estimated profit for the quarter was £53,924.

Asia

Chosen

Oriental—During January, 25,524 tons of ore were crushed, yielding $125,794 gross and net $45,188. Operating costs were $77,851; development and other charges, $2754. The Kuk San Dong 40-stamp mill was hung up all month on account of labor and fuel shortage. The East Candlestick 10-stamp mill was hung up seven days because of labor shortage in the mine.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Mar. 27—While the main interest still centers in the wage controversies, the markets have generally quieted down a little and are in better shape. It is now generally accepted that there will be some stoppage of mining on Apr. 1, both East and West; whether it will amount to a strike in either case is the question. Conferences continue, but in neither case has an acceptable compromise been reached. The whole matter remains in uncertainty.

Railroad conditions are better, and coal is moving more freely, though transportation is not yet satisfactory.

Inquiries for export are again reported, but a prospective—or at least possible—scarcity of coal here, and high ocean freights are against large shipments abroad.

The English strike continues, with no prospect yet of an early settlement.

The coal production of South Africa in 1911 was as follows: Cape Colony, 89,023; Natal, 2,682,029; Orange River, 482,690; Transvaal, 4,343,680; total, Union of South Africa, 7,597,422 short tons.

Fuel exports of Great Britain two months ended Feb. 29 were: Coal, 10,936,159; coke, 222,040; briquettes, 310,183; coal sent abroad for use of steamships in foreign trade, 3,066,978; total, 14,535,360 long tons, an increase of 1,181,237 tons, or 8.8%, over last year.

German Coal Trade—Exports and imports of fuel in Germany in January, metric tons:

	Exports	Imports	Excess
Coal	2,452,695	769,901	Exp. 1,692,794
Brown coal	5,246	691,830	Imp. 586,684
Coke	425,812	60,171	Exp. 375,641
Briquots	216,098	16,547	Exp. 199,551
Total	3,099,851	1,418,449	Exp. 1,681,402
Total, 1911	2,558,373	1,261,344	Exp. 1,297,029

The exports this year included 1853 tons coke to the United States.

Coal production of German Empire month of January, metric tons:

	1911	1912	Changes
Coal	13,527,215	14,565,606	I. 1,038,391
Brown coal	6,319,544	6,865,208	I. 645,664
Total mined	19,846,759	21,430,814	I. 1,584,055
Coke made	2,231,865	2,340,366	I. 108,501
Briquets made	1,789,128	1,922,021	I. 132,893

Of the briquettes reported this year 1,497,060 tons were made of brown coal or lignite.

Belgian Coal Trade—Coal production in Belgium for the year 1911 was 23,125,140 metric tons, a decrease of 702,000 tons from 1910. Imports of fuel were: Coal, 7,315,024; coke, 671,533; briquettes, 381,087; total, 8,367,644 tons, an increase of 1,156,312 tons. Exports were: Coal, 5,168,017; coke, 1,027,081; briquettes, 529,626; total, 6,725,444 tons, an increase of 174,235 tons.

IRON TRADE REVIEW

New York, Mar. 27—Business in the iron and steel markets is still on a large scale. Specifications on contracts are generally good, and new business is inclined to be better. The railroads are ordering more, especially in cars and bridges. Sheets and plates are active, though bars and wire are rather easier, so far as selling is concerned. Mills are beginning to stand out for higher prices, and quotations have firmed up in some degree, without showing marked advances. Third-quarter business is not making much show yet, buyers being unwilling to contract on advances which the mills are inclined to ask. The exception is in structural steel, in which there is a sharp competition for the larger orders. Fabricating concerns are naming very low figures to secure contracts.

Pig iron is again active. In Eastern territory both foundry and basic are being bought well. In the Central West basic is in good demand and some sales of bessemer are being made. In the pig-iron market, as well as in finished material, there has been some firming up of prices; here, likewise, there is some hesitation over third-quarter contracts on the price question.

An adjourned conference on the steel-rail question was held in New York, Mar. 21, delegates from a number of railroads and from the rail mills being present. No conclusions were reached after a long discussion and a committee was appointed to see if common ground could not be found to formulate new specifications.

Baltimore

Mar. 25—Exports for the week included 3,368,180 lb. steel billets to Liverpool; 882 lb. selenium and 1,024,200 lb. galvanized pipe to Hamburg; 2,687,400 lb. steel rails and 132,281 lb. angle-plates to Antilla, Cuba. Imports included 30 tons spiegeleisen and 3610 tons ferromanganese from Middlesboro, England; 4400 tons manganese ore from Batum, Russia; 23,165 tons iron ore from Cuba.

Birmingham

Mar. 25—While Southern furnacemen are holding their product for $10.50 per ton, No. 2, foundry, there are reports of sales at $10.25 right along. The manufacturers in this section of the country are selling more than their make. The records show that from Dec. 1 to Mar. 1 there were no less than 50,000 tons of pig iron removed from the accumulated stocks of iron in Southern furnace yards, while since Mar. 1 it is estimated that the amount has been increased to at least 75,000 tons. At that rate it will not be many weeks now before the yards will be bare and the market will be strengthened considerably. Inquiries for pig iron are numerous, especially for delivery during the last half of the year. While purchasers are willing to pay $10.50 per ton, No. 2 foundry, the manufacturers are not yet willing to make a price for the product. There is still considerable furnace repairing going on and all arrangements are being made to increase the output when it is needed, with no immediate prospects of such a condition.

The home melt is holding up well, cast-iron pipe plants doing well and shipping pipe at a lively rate. The steel industries in Southern territory are doing fairly well. Scrap iron is a little better, too, while the brass foundries are doing well on furnace repairing. Charcoal iron holds at $22@22.50 per ton with the demand a little slow now.

The Tennessee company has blown in a furnace in the Birmingham district on foundry iron.

Coal operators in the Southern territory are not expecting any labor troubles next month, very few union miners working in this part of the country.

Chicago

Mar. 25—The iron market is considerably firmer in tone. Sales of pig iron are larger than for several weeks and there is a general feeling of encouragement over the numerous inquiries, some for large tonnage requirements in the last half. There has been yet, however, no increase in prices. Southern No. 2 brings $10.50, Birmingham, or $14.85, Chicago, and Northern No. 2 $14, at furnace.

Sales run from 200 to 1000 tons—a few up to 2000 tons, and are chiefly of coke iron, though charcoal is fairly active at $16.50. The demand is uniformly manifest throughout the trade, indicating general betterment of trade conditions among the melters. For the last-half needs, 25 or 50c. above current prices is asked, and selling agents are confident that they can be obtained. The demand for small lots, for early delivery, is gradually giving way to larger orders and more distributed deliveries.

In the market for iron and steel products there is more activity, with larger contracts made for structural material on bridge and building work generally. Beams and channels up to 15 in. hold to 1.28@1.35c., with the average price about 1.30c. Bars are firm at 1.25@1.33c. for soft steel and 1.15@1.20c. for iron bars, with the demand increasing. Railroads seem to be coming surely though gradually into the market; sales of rails are light and of track fastenings good. Billets are quiet at $26.50@27 for openhearth. Plates are in better demand at about 1.30c. for ¼-in. tank plates, and minor lines are in good condition. Business generally is improving; all indications are for a slow but solid increase of sales.

Cleveland

March 26—It is stated that Corrigan, McKinney & Co. have made contracts to move ore from Duluth to Cleveland at 55c., with an unloading charge of 15c., making 40c. net to vessels. The charters provide that if the unloading charge is decreased a corresponding decrease shall be made in the rate. As it is now pretty sure that the unloading figure will be 8c., the total freight rate will be 48c. per ton.

Pig Iron—A number of inquiries have been received for basic in small and large lots. Prices are nominally unchanged but are perceptibly firmer.

Finished Material—A number of orders have been received. They are generally small, but aggregate a good tonnage. Prices are a little firmer, but not generally advanced. Little contracting has been done yet for third quarter.

Philadelphia

Mar. 27—The improved buying movement in pig iron indicates at every point a continuance of the activity of the past week. Quotations are firm; concessions are the exception and inquiries are on the increase. After a long lull in demand basic iron is once more active though most of the business for the week is the result of inquiries and negotiations which originated from two to four weeks ago. Taking a conservative view of the situation it is probable that a large tonnage covering all kinds of crude iron will be closed before Saturday or early next week, in which several of the better grades of Southern iron will participate. While the tone of the market is stronger there is nothing to indicate a general buying movement beyond the reasonable requirements of the consuming trade. Foundry No. 2 is moving as about last week; on quotations close to $15, with forge at $14, sometimes a little better, and basic at about $14.25. More liberal offerings of Southern iron are being made.

Billets—Billets are selling more freely owing to the appearance in the market of a large number of small buyers.

Bars—Owing to the opening of the spring trade bars are somewhat more active for immediate delivery and an improvement is reported at nearly all mills. There is no effort made to exact outside quotations when business is in danger of slipping to some other mill.

Sheets—The volume of business in sheets is maintained, especially the duplication of orders from the larger buyers. Galvanized is more active than any other kind.

Pipes and Tubes—Tubes maintained their strong hold but the orders of the week are rather trifling. Merchant pipe is quiet. Cast pipe is very active and mills are working practically to capacity.

Plates—Prices have been advanced on all small business and the advance is regarded as permanent. Some inquiries which have been hanging fire for perhaps a month have resulted in orders this week.

Structural Material—Orders for bridge work are limited mostly to small quantities for summer delivery. Prices are notably stronger; the latest quotations show that the manufacturers think about $2 a ton advance a fair value. Large buyers in the market express the belief that the present nominal advances will not be held.

Scrap—Scrap is hardening in price, especially in steel and No. 1 railroad as some quiet buying has just been closed which cleaned up the immediate stocks.

Pittsburg

Mar. 26—The volume of specifications for finished-steel products since last report has been larger than at any previous time this year and has probably been larger than at any time during the November-December movement. Some of the important steel interests find their actual bookings of orders larger than at any time for nearly two years, and the general position is probably in conformity with this experience.

The business being entered at this time is regarded as of the most solid character and is believed to represent a well established movement, being quite different from that which occurred toward the close of last year, when buyers were covering against contracts which were about to expire. The steel mills of the Pittsburg district and eastern Ohio are operating at practically full capacity, for the first time since the early summer of 1910, and many of them are already making new records for output.

Prices are showing an advancing tendency, though not a rapid one. Throughout this improvement, which has extended almost without a break from the first improvement last August, the mills have shown a remarkable lack of backbone, prices often yielding even in the face of increased demand, but at this time the actual conditions are tending to force prices upward, as the existing capacity is practically all engaged. A number of paper advances have been made in the past fortnight, mills advancing their open quotations but being willing to make concessions from these quotations in the case of good orders. The net outcome, however, is a slightly higher realized average on the fresh sales. A few low-priced contracts expire April 1, and it may be estimated roughly that the average realized price on shipments of bars, plates, shapes, sheets and wire products will be fully $1 a ton higher than the average in the quarter just closing.

Pig Iron—The pig-iron market has been rather quiet since the somewhat spectacular movement in bessemer and basic iron, but there is a strong undertone, as the merchant furnaces are well sold up and the fuel situation is such as to preclude any idle furnaces blowing in at this time. Prices of pig iron are fully maintained at the slightly advanced level. There are reports of small lots of bessemer and basic sold for third quarter at advances, but the general policy of consumers is not to buy ahead at this time. For prompt and near delivery we quote: Bessemer, $14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; forge, $12.75@13, f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market continues quiet, with the price quoted at $41 for prompt or forward, f.o.b. Baltimore.

Steel—Specifications on billet and sheet bar contracts have been excellent. Prices are somewhat stiffer. We quote, f.o.b. Pittsburg district mill: Bessemer billets, $29; sheet bars, $21; openhearth billets, $19.25@19.50; sheet bars, $19.50@20; f.o.b. Youngstown mill: Bessemer billets, $19.25@19.50; sheet bars, $19.50@20. Rods are about $25, Pittsburg.

Sheets—The American Sheet & Tin Plate Co. has withdrawn all prices on galvanized sheets under 2.90c. for 28 gage, and finds it is losing very little business from taking this stand. It is practically filled up for second quarter, and is not naming prices at all for third quarter. The independent mills are stiffening up somewhat. The sheet mills are operating at fully 85 per cent. of full capacity, some of the plants being operated at capacity. We quote: Black sheets, 28 gage, 1.80@1.85c.; galvanized, 2.80@2.90c.; blue annealed, 1.35@1.40c., for 10 gage; painted corrugated roofing, $1.33@1.35; galvanized, $2.46@2.50 per square.

St. Louis

Mar. 25—The inquiry for iron improves with the advent of spring conditions. The demand for finished products seems to be much better and while this has not reacted on the pig-iron market to any extent, yet it will probably be felt later. While there is little chance of any immediate advance in iron yet prices are a little stiffer all around, as there has been enough buying to take care of the iron which producers were most anxious to get moving. Southern No. 2 foundry is being quoted at $10.25@10.50, Birmingham, or $14@14.25, St. Louis. Northern No. 2 is quoted at $14.25@14.75, St. Louis.

The coke market is very strong and supply scarcely up to the demand. Good 72-hour foundry coke is bringing $5.10@5.25, St. Louis.

Iron Ore Market

The movement of Lake iron has at last fairly started, on an open market, no agreement as to prices having been made, though the quotations seem to be fairly uniform. A considerable tonnage—reported as between 1,500,000 and 2,000,000 tons—has been placed. The prices are, f.o.b. Lake Erie ports, $3.75 per ton for Old Range bessemer and $3.50 for Mesabi bessemer, base 55% iron and under 0.45% phosphorus; $3.05 for Old Range nonbessemer and $2.85 for Mesabi bessemers, base 51.5% iron. The reduction from last season is 75c. per ton on bessemers and 65c. on nonbessemers.

The Interstate Commerce Commission has ordered a reduction in unloading charges at Lake Erie docks from 15c. to 8c. per ton. With this reduction it is understood that carrying charters from Duluth and Superior to Lake Erie ports will be made at about 50c. per ton.

Imports of iron ore into Great Britain, two months ended Feb. 29, were 1,248,298 long tons in 1911, and 1,181,141 in 1912; decrease, 67,157 tons. Imports of manganese ore were 58,092 tons in 1911, and 52,223 in 1912; decrease, 5869 tons.

British Iron and Steel Trade

Exports and imports of iron and steel, and of machinery, in Great Britain, two months ended Feb. 29, are valued by the Board of Trade returns as below:

	Exports	Imports	Excess
Iron and steel	£7,907,437	£2,021,532	Ex. £5,885,905
Machinery..	5,013,298	1,024,516	Ex. 3,988,782
Cutlery and hardware	1,835,863	1,213,216	Ex. 622,647
New ships...	711,714	....	Ex. 711,714
Total......	£15,468,312	£4,259,264	Ex. £11,209,048
Total, 1911..	14,130,575	3,618,439	Ex. 10,512,136

Increase in exports £1,337,737; increase in imports, £640,825. The quantities of iron and steel were, in long tons:

	1911	1912	Changes
Exports............	709,516	780,692	I 71,176
Imports............	265,686	325,736	I. 60,050

Tinplate exports to the United States decreased from 6718 tons in 1911 to 480 tons this year.

Metal Markets

New York, Mar. 27—A very considerable business is reported in the metal markets. Prices have been rather irregular, advancing in some lines, but inclining to weakness in others.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Feb. 1912..	$ 10,589,295	$ 2,937,274	Exp. $7,652,021
" 1911..	424,733	5,805,844	Imp. 5,381,111
Year 1912..	12,504,497	8,078,517	Exp. 4,425,980
" 1911..	1,348,409	15,346,674	Imp. 13,998,265
Silver			
Feb. 1912..	5,121,776	3,780,477	Exp. 1,341,329
" 1911..	4,453,171	3,897,946	Exp. 555,225
Year 1912..	11,149,681	8,138,486	Exp. 3,011,195
" 1911..	10,104,247	7,449,372	Exp. 2,654,875

Exports from the port of New York, week ended March 23: Gold, $1,676,200, chiefly to Argentina; silver, $979,440, principally to London. Imports: Gold, $511,589, largely from Mexico; silver, $23,753, mainly from South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. In New York gold was again taken for shipment to Argentina.

Iridium—There is nothing new in this market. The price is $64 per oz., New York.

Platinum—The market is still rather quiet and prices are unchanged. Dealers quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal.

Silver—The market continues steady; there is no special feature. London dealers have expressed the opinion that if the Chinese-foreign loans that have been pending for some time should be negotiated, the market for silver should show improvement.

SILVER AND STERLING EXCHANGE

Mar.	21	22	23	25	26	27
New York....	58¼	58½	58¼	58¼	58¼	58⅛
London......	26 11/16	26 11/16	26 11/16	26 11/16	26 11/16	26¾
Sterling Ex..	4.8725	4.8725	4.8720	4.8710	4.8710	4.8700

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Mar. 14, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.......	£2,204,400	£1,533,800	D. £670,600
China.......	692,800	400,000	D. 292,800
Total.....	£2,897,200	£1,933,800	D. £963,400

India Council bills in London averaged 16.11d. per rupee for the week.

Gold in the United States, Mar. 1, is reported by the Treasury Department as follows: Held against gold certificates, $1,025,723,369; in Treasury balances, $173,367,028; in banks and circulation, $595,461,630; total, $1,794,552,027, a decrease of $8,730,294 during February.

Coined silver in the United States, Mar. 1, is reported by the Treasury Department as follows: Standard dollars, $565,239,367; subsidiary coin, $167,332,556; total, $732,571,923. Of the dollars, $477,919,000 are held in the Treasury against silver certificates.

Gold and silver movement in France, year ended Dec. 31:

	Imports	Exports	Excess
Gold.	Fr.295,425,000	Fr.139,571,000	Imp. Fr.156,854,000
1910..	231,538,000	173,631,000	Imp. 57,907,000
Silver.	197,556,000	149,802,000	Imp. 47,754,000
1910..	173,990,000	215,051,000	Exp. 41,061,00

Imports of nickel and copper coins in 1911 were 57,000 fr.; exports, 1,044,000 fr., face value.

Copper, Tin, Lead and Zinc

NEW YORK

Mar.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
21	14⅞ @15	14.70 @14.80	42	4.10	4.10	6.45 @6.55	6.30 @6.40
22	14⅞ @15⅛	14.80 @14.90	42⅛	4.20	4.17½ @4.20	6.45 @6.55	6.30 @6.40
23	14⅞ @15⅛	14.95 @15.00	42¼	4.20	4.17½ @4.20	6.45 @6.55	6.30 @6.40
25	15¼ @15⅜	15.10 @15.20	42⅝	4.20	4.17½ @4.20	6.45 @6.55	6.30 @6.40
26	15⅜ @15½	15.20 @15.35	42⅞	4.20	4.17½ @4.20	6.45 @6.55	6.30 @6.40
27	15⅜ @15½	15.32½ 15.35	42⅞	4.20	4.17½ @4.20	6.45 @6.55	6.30 @6.40

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Mar.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
21	66 1/16	66 13/16	70¼	190¼	187¼	16¼	26
22	66¾	67 5/16	71	191¼	188¼	16 3/16	25⅞
23	......	....	.....	......	...	...	....
25	68 1/16	68⅞	72¼	194	191	16¼	25
26	68¼	69 1/16	72½	196	191¼	16 3/16	25
27	68¾	69⅝	73	196	191¼	16⅛	25¼

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. £1 = ± 0.21¾c.

Copper—During the past week, a large business has been done, both for domestic consumption and export. Producers, being well sold up and having but small stocks, have advanced their prices from day to day, and during the same day, and their prices asked have been promptly paid by buyers. On Mar. 26 the price of 15½c., delivered, usual terms, was named and realized in the afternoon and on Mar. 27 the market rested firmly on that basis, but had become more dull. Previously a rather large volume of business had been transacted upon the advance. A curious feature has been the sluggishness in the demand for Lake copper for which some sellers report not even much inquiry and only a few sales. The market closes strong at 15.32½@15.35 for electrolytic in cakes, ingots and wirebars, and at 15.⅜@15½, nominally, for Lake. Casting copper is quoted nominally at 14¾@15c. as the average for the week.

There has been great activity in the London standard market. On Mar. 25, a sharp advance took place to £68 1s. 3d. for spot, and £68 17s. 6d. for three months, and the market closes at £68 15s. for spot, and £69 12s. 6d. for three months.

Copper sheets are 20@21c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire has again been advanced to 16⅜c. base, carload lots at mill.

Copper exports from New York for the week were 8090 long tons. Our special correspondent gives the exports from Baltimore at 2626 tons.

There have been labor difficulties at Butte and threats of a strike, owing to the discharge of some objectionable miners, but at the meetings of the men a conservative spirit has been manifested and our information is that a strike is improbable.

Brass Prices—Brass prices are announced by the American Brass Co., effective Mar. 22: Sheets, high brass, 16¼c. net per lb.; low brass, 17¾c. Wire, high brass, 16c.; low brass, 17¾c. Rods, high brass, 16c.; low brass, 18½c. Brass tubing, brazed, 21c.; open-seam, 19⅝c. Brass angles and channels, 20c. net per lb. Scrap allowances, 10¾c. net per lb. for high brass and 11¾c. for low brass.

Tin—The market was firm throughout the week. Business among dealers in this market was very active and of goodly proportions, and orders cabled to London from here helped along the advance over there. The close is strong at £196 for spot, and £191 5s. for three months, and about 42⅞c. for April tin in this market.

Tin output of the Federated Malay States two months ended Feb. 29 was 7734 long tons; an increase of 742 tons over last year.

Messrs. Robertson & Bense report the receipts of tin ore and concentrates at Hamburg, Germany, in February at 1384 tons, all from Bolivia.

Lead—The perplexity in the situation of lead referred to in our last report has increased this week. On March 22 the A. S. & R. Co. advanced its price to 4.20c., New York, but even at this advance outside sellers in this market have not seen fit to entertain business. In the meanwhile the price at St. Louis has advanced to a full parity with New York and sales of some fair tonnage have been made at that point by outside interests. There seems to be an effort on the part of the leading seller to keep lead out of the hands of speculative interests while it is being freely supplied to consumers. We quote 4.20c., New York, and 4.17½@4.20c., St. Louis.

The scarcity of lead in London continues, and the close is cabled at £16 2s. 6d. for Spanish, and 5s. higher for English lead.

Spelter—Buyers have held aloof and this market has been very dull. Spelter for April delivery has been offered at 6.40c. and some small business has been done at a little under that, while metal for May shipment is cheaper. The quotations of 6.30@6.40c., St. Louis, and 6.45@6.55c., New York, represent the range.

The London market declined on Monday to £25, and closes at £25 5s. for good ordinaries, and £25 10s. for specials.

Base price of zinc sheets on Mar. 20 was advanced 0.15c. and is now $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7⅛c. per lb., New York.

Other Metals

Aluminum—Business is improving and prices are growing firmer, partly on account of a firmer foreign market, as well as larger sales. We quote 19½@20c. per lb. for No. 1 ingots, New York.

It is reported that the Aluminum Company of America has agreed to make certain modifications in its methods, in consideration of which the Department of Justice will take no action against it. It is reported also that the negotiations between the French and English producers have failed; but there is a possibility that they may be renewed.

Antimony—Business is better, and prices have advanced. Supplies of Chinese have been reduced, and the market is firm. Cookson's is now 8c. per lb. and Hallett's 7¾c.; while 6⅞@7c. is named for Chinese, Hungarian and other outside brands.

Quicksilver—The demand is fair, but quotations here are lower. The New York price is $43 per flask of 75 lb., while 62@64c. per lb. is quoted for retail lots. San Francisco is $42.50 for domestic orders and $40 for export. The London price is unchanged at £8 12s. 6d. per flask, with £8 7s. 6d. quoted from second hands.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Spanish Metal Exports

Exports of metals and minerals from Spain, year ended Dec. 31, reported by *Revista Minera*, in metric tons:

Metals	1910	1911	Changes
Pig and manuf. iron	36,855	41,439	I. 4,584
Copper	17,196	17,670	I. 484
Copper precipitate	14,094	13,601	D. 493
Lead	191,387	171,048	D. 20,339
Zinc	2,346	2,615	I. 270
Quicksilver	1,311	1,488	I. 177
Minerals			
Iron ore	8,284,059	7,282,279	D. 1,001,780
Manganese ore	6,322	33,266	I. 26,938
Copper ore	1,016,845	272,425	D. 744,420
Lead ore	3,619	3,473	D. 46
Zinc ore	124,593	121,768	D. 2,825
Pyrites	1,534,640	2,728,516	I. 1,193,876
Salt	496,138	524,110	I. 27,972

In 1910 pyritic ores were classed as copper ore when they carried 1% or over in copper; in 1911 such ores were not classed as copper ores unless they carried 2.5% or over in copper. This accounts for the large decrease in copper ore and the corresponding increase in pyrites.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 23—The base price paid this week for 60% zinc ore was $51@52. The base price paid for 80% lead ore was $50@51 per ton.

SHIPMENTS, WEEK ENDED MAR. 23

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Shullsburg	874,600	....	....
Mineral Point	872,000	....	....
Benton	641,200	....	627,400
Galena	449,200	....	....
Platteville	421,740	....	....
Hazel Green	380,000	....	....
Cuba City	302,000	60,210	....
Harker	167,050	....	....
Rewey	81,000	....	....
Montfort	70,000	....	....
Linden	64,120	....	58,280
Total	4,322,910	60,210	685,680
Year to date	45,145,690	1,209,350	4,222,460

Shipped during week to separating plants, 1,940,280 lb. zinc ore.

Joplin, Mo., Mar. 23—Last week's promise of settled weather and heavy outputting held out only until the middle of this week. The latter part of the week there has been incessant rain, streams are out of their banks tonight and every mine in the district will be facing an increased water proposition on the resumption of work next week. This excess of rain, following a very wet ending of winter, not alone causes heavier pumping expense but the excessive moisture in the earth is endangering operations in a number of mines. Fears are entertained that heavy sliding will occur.

The high price of zinc sulphide ore was $55 per ton, the base price of 60% zinc $48@52. Zinc silicate sold on a base of $26@29 per ton of 40% zinc. Average price, all grades zinc, $48.22 per ton. Lead sold as high as $57 per ton, with the general market $2 per ton higher than last week. Average, all grades of lead, $55.42 per ton.

SHIPMENTS, WEEK ENDED MAR. 23

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,596,870	.....	1,125,650	$125,036
Joplin	1,332,960	...	199,120	40,230
Alba-Neck	893,850	......	126,680	27,553
Galena	374,450		344,820	19,035
Duenweg	652,720	......	32,780	17,887
Miami	278,900	.....	152,000	10,390
Granby	284,100	177,410	8,720	8,960
Oronogo	196,070	......	57,540	8,450
Carl Junction	295,860	......	......	8,135
Cave Springs	193,090	......	61,700	6,550
Jackson	205,840	......	......	5,145
Quapaw	115,300	......	......	2,650
Spurgeon	54,790	65,000	9,240	2,545
Carthage	82,970	......	......	2,074
Sarcoxie	......	138,120	......	1,933
Wentworth	63,670	......	......	1,590
Lawton	52,860	......	......	1,320
Springfield	44,200	......	......	1,150
Totals	8,818,400	370,530	2,118,250	$290,633
12 weeks	116,443,370	6,504,190	19,003,230	$3,304,735

Blende val., the week, $226,092; 12 weeks, $2,687,654
Calamine, the week, 5,558; 12 weeks, 91,327
Lead value, the week, 58,983; 12 weeks, 525,754

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$56.58	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	......	38.45	......	64.57	......
April	38.88	......	37.47	......	56.37	......
May	38.25	......	36.79	......	55.21	......
June	40.50	......	38.18	......	56.49	......
July	40.75	......	38.35	......	58.81	......
August	42.50	......	41.28	......	60.74	......
September	42.63	......	41.29	......	59.33	......
October	42.38	......	40.89	......	54.72	......
November	45.40	......	43.25	......	57.19	......
December	44.13	......	40.76	......	62.03	......
Year	$41.45	......	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Other Ore Markets

Tungsten Ore—Ferberite, wolframite and huebnerite ores, $6.50@7 per unit per ton of 2000 lb. of ore containing 60 per cent. of tungsten trioxide. For scheelite ore, 50c.@$1.50 per unit less. These prices are delivered; a recent offer is noted of $5.50 per unit for huebnerite, 60% WO_3, f.o.b. railroad.

Vanadium Ore—A recent quotation for vanadinite, containing at least 10%, is 75c. per lb. for the V_2O_5 in the ore.

Molybdenum Ore—Recent prices offered for molybdenite, carrying 25% MoS_2, are $25 per ton; for wulfenite, at least 25% MoO_3, $100 per ton, f.o.b. railroad.

Chemicals

New York, Mar. 27—The general market has shown no special change during the week.

Copper Sulphate—Business continues on a good scale. Prices have advanced, chiefly on account of the rise in copper metal. Quotations are $5.10 per 100 lb. for carload lots and $5.35 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is on the increase as spring approaches. Spot nitrate is a little higher, at 2.35c. per lb., while 2.30c. is still quoted for futures.

Arsenic—Spot supplies are insufficient for current demand, and there has been a sharp advance, to $3.50 per 100 lb. for early deliveries. For futures $3 per 100 lb. is quoted for white arsenic.

MINING STOCKS

New York, Mar. 27—On Mar. 21, there was a halt in the upward move on the Exchange, due chiefly to profit taking. Amalgamated Copper continued to rise, however. Trading on the Curb was active. Copper shares sold freely at small advances. Lehigh Valley Coal Sales Co. advanced.

On Mar. 22, there were again some recessions, but advances marked the close. Amalgamated Copper, however, advanced, touching a high level at 78. Mining stocks on the Curb were generally active and strong.

Mar. 23 the Exchange continued strong and some fair advances were made. The Curb was active and generally strong, with a wide range of dealing in mining stocks. Coppers generally advanced, and there were large sales of Cobalt and Porcupine stocks.

Mar. 25 the Exchange continues active and further advances were made. Steel common closed above 70, while Amalgamated Copper went to 81½ at the close. The Curb Market for mining stocks was broad and active. Copper shares were in demand at advancing prices. Cobalts and Porcupines were in demand. Lehigh Valley Coal Sales Co. closed at 232, the highest price yet made.

Mar. 26 and 27 there was a halt in the upward movement, business being lighter and prices less firm. There was no marked recession, however, but rather an uncertainty. The Curb continued active with more dealing in mining stocks, copper shares being especially firm.

Boston, Mar. 26—The week has shown an active and broadening market for copper shares, with many advances in quotations. Today there was a halt and some recession, but this was manifestly due to profit taking, and the market closed firm and more active. Some brokerage houses report larger outside trading than for several years past.

Lake Copper made a new high record, with sales at $44. Calumet & Arizona advanced to $74, and North Butte to $33.25. Calumet & Hecla marked $475. Amalgamated has made a notable advance, in sympathy with New York quotations.

COPPER PRODUCTION REPORTS
Copper contents of blister copper, in pounds

Company	Dec.	Jan.	Feb.
Alaska shipments	4,995,008	3,701,010	....
Anaconda	23,500,000	26,350,000	27,450,000
Arizona, Ltd.	3,100,000	3,200,000	3,020,000
Copper Queen	8,365,265	6,748,264	6,046,860
Calumet & Ariz.	4,486,000	4,544,000	4,152,004
Detroit	1,969,313	1,941,970	2,068,370
East Butte	1,498,000	1,520,000	....
Mammoth	1,721,104	1,665,319	....
Mason Valley	....	600,000	....
Nevada Con.	4,679,674	6,309,228	....
Old Dominion	2,610,000	2,041,000	2,039,000
Ray	2,660,000	2,475,945	2,140,000
Shannon	1,255,858	1,550,000	1,300,000
South Utah	267,814	189,678	283,838
United Verde*	2,000,000	2,000,000	2,250,000
Utah Copper Co.	9,039,567	8,156,612	....
Lake Superior*	17,500,000	17,500,000	19,000,000
Non-rep. mines*	8,500,000	8,400,000	....
Total production	98,146,789	98,896,026	....
Imports, bars, etc.	21,101,256	31,790,590	....
Total blister	119,248,045	130,686,616	....
Imp. in ore & matte	5,159,997	8,340,740	....
Total	124,408,042	139,027,356	....
Miami	2,557,580	2,235,647	2,475,996
Brit. Col. Cos.:			
British Col. Copper	....	....	....
Granby	....	1,607,558	....
Mexican Cos.:			
Boleo	2,645,640	2,315,040	2,204,720
Cananea	3,706,000	3,552,000	....
Moctezuma	2,864,464	2,732,867	2,687,712
Other Foreign:			
Cape Cop., S. Africa	701,120	784,000	786,440
Kyshtim, Russia	1,555,000	....	.....
Spassky, Russia	721,280	795,200	....
Famatina, Argen.	217,280	172,480	....
Tilt Cove, Newf'd	....	153,257	109,059
Exports from:			
Chile	5,824,000	8,064,000	6,720,000
Australia	11,200,000	7,056,000	7,164,000
Arrivals in Europe†	16,331,840	13,144,320	10,868,680

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
II, 1911	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,657
VI	124,554,312	61,655,561	71,460,619
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096

VISIBLE STOCKS

	United States	Europe	Total
III, 1911	156,637,770	233,385,600	390,023,006
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

The Curb has also been broad and active, with large sales and many advances. Rhode Island Coal was dealt in around 30c. per share.

Arrangements are being made to list Ahmeek shares on the Stock Exchange.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1	....	$0.005
Algomah, Mich	Jan. 22	....	1.00
Alpha Con., Nev	Feb. 21	Mar. 13	0.05
Belcher, Nev	Apr. 8	Apr. 30	0.10
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.50
Challenge, Nev	Mar. 5	Mar. 26	0.05
Crown Point, Nev	Mar. 28	Apr. 19	0.05
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Ely Con., Nev	....	....	0.05
Exchequer, Nev	Feb. 14	Mar. 6	0.05
Haucock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
King David, Utah	Feb. 13	Mar. 6	0.005
Lehi Tintic, Utah	Feb. 29	....	0.01½
Leonora, Utah	Apr. 15	Apr. 30	0.0125
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
Ojibway, Mich	Jan. 10	....	1 005
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0 10
Sierra Nevada, Nev	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz	Jan. 15	....	1.00
Tintic Central, Utah	Mar. 9	Mar. 27	0.005
Union Con., Nev	Feb. 20	Mar. 12	0.15
Wabash, Utah	Mar. 19	Apr. 10	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52 375	53.795	56.260	24.154	24.865	25.887
February	51 534	52 222	59 043	23.794	24.081	27.190
March	51 454	52 745	......	23.690	24.324	......
April	53.221	53 325	......	24.483	24.595	......
May	53 870	53.308	......	24.797	24.583	......
June	53.462	53.043	......	24.651	24 486	......
July	54.150	52.630	......	25 034	24.286	......
August	52.912	52.171	......	24.428	24.082	......
September	53 295	52 440	......	24.567	24.209	......
October	55 490	53.340	......	25 596	24.594	......
November	55 635	55.719	......	25 680	25.649	......
December	54 428	54.905	......	25.160	25.349	......
Year	53 486	53.304	......	24 670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14 094	12 680	14 337	55.600	62.760
February	12.256	14 084	12 611	14.329	54 974	62 893
March	12 139	......	12.147	......	54 704	......
April	12.019	......	12.275	......	54 034	......
May	11.989	......	12.214	......	54 313	......
June	12.385	......	12.611	......	56 365	......
July	12 163	......	12.720	......	56 673	......
August	12 405	......	12 634	......	56.266	......
September	12.201	......	12.508	......	55 253	......
October	12 189	......	12.370	......	55.170	......
November	12 616	......	12 769	......	57.253	......
December	13.552		13.768		62.068	
Year	12.376		12.634		55.973	

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	
February	41 614	42 962	August	43 319	
March	40 157		September	39 755	
April	42 185		October	41 185	
May	43 115		November	43 125	
June	44 606		December	44 655	
			Av. Year	42 281	..

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4 435	4 334	4.327	13 009	15.619
February	4 440	4.026	4 266	3 946	13.043	15 738
March	4.394	......	4 238	......	13 122	......
April	4 412	......	4 262	......	12.889	......
May	4.373	......	4.223	......	12 984	......
June	4 435	......	4 292	......	13.260	......
July	4.499	......	4 397	......	13 530	......
August	4 500	......	4 406	......	14.260	......
September	4 485	......	4 356	......	14 744	......
October	4.265	......	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	15.648	......
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	6 499	5 368	6.349	23 276	26 661
March	5.563	......	5 413	......	23 016	......
April	5 399	......	5 249	......	23.743	......
May	5.348	......	5.198	......	24.375	......
June	5 520	......	5 370	......	24 612	......
July	5 695	......	5 545	......	25.006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	......	27 750	......
October	6 102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14 75	$14.00
February	15 90	15.03	14 50	13.28	14 81	14 01
March	15.90	......	14 65	......	14.96	......
April	15 90	......	14 65	......	15 00	......
May	15.90	......	14 30	......	14.72	......
June	15 90	......	14 06	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Mar. 26

Name of Comp.	Bid.
Acacia	.05⅛
Cripple Cr'k Con.	.01¾
C. K. & N.	.16
Doctor Jack Pot	.06⅜
Elkton Con	.61
El Paso	.71¼
Findlay	.04¾
Gold Dollar	.14½
Gold Sovereign	.02½
Isabella	.12½
Jack Pot	.05
Jennie Sample	.04⅞
Lexington	.01
Moon Anchor	.01
Old Gold	.03
Mary McKinney	.53½
Pharmacist	.02
Portland	.91¼
Vindicator	.71¼
Work	.00¾

SALT LAKE Mar. 26

Name of Comp.	Bid.
Beck Tunnel	.14
Black Jack	.15
Carisa	‡.15
Cedar Talisman	.01¾
Colorado Mining	.29
Columbus Con	.20
Daly-Judge	5.50
Grand Central	.65
Iron Blossom	1 30
Little Bell	.36
Lower Mammoth	.04½
Mason Valley	12 75
May Day	.15
Nevada Hills	2.42½
New York	.05¾
Prince Con	1 17½
Silver King Coal'n	1 35
Sioux Con	.04¼
Uncle Sam	.25
Yankee	‡ 15

TORONTO Mar. 26

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡7 05	Hollinger	11 50
Hudson Bay	†70 00	Imperial	07
Temiskaming	47½	Pearl Lake	20
Wettlaufer-Lor.	65	Porcu. Gold	44
Apex	06	Porcu. Tisdale	03
Central	4 62½	Preston E. D	10
Crown Chartered	28	West Dome	40
Doble	‡ 65	Standard	15
Dome Exten.	.56	Rea	70
Foley O'Brien	30	Swastika	23

SAN FRANCISCO Mar. 26

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.08	Belmont	10.00
Belcher	84	Jim Butler	62
Best & Belcher	19	MacNamara	.24
Caledonia	4.40	Midway	.36
Challenge Con	.35	Mont.-Tonopah	2.65
Chollar	.16	North Star	.30
Confidence	1.05	West End Con	1.87½
Con. Virginia	.75	Atlanta	29
Crown Point	.94	Booth	.10
Gould & Curry	07	C.O.D. Con	10
Hale & Norcross	.45	Comb. Frac	.22
Mexican	3.50	Jumbo Extension	44
Occidental	65	Pitts.-Silver Peak	1 35
Ophir	1.45	Silver Pick	10
Overman	2.30	St. Ives	.40
Potosi	12	Tramp Con	‡.01
Savage	.31	Argonaut	2.25
Sierra Nevada	.28	Bunker Hill	‡5 50
Union Con	1.00	Cent. Eureka	.22
Yellow Jacket	1.27½	So. Eureka	‡5.00

N. Y. EXCH. Mar. 26

Name of Comp.	Clg.
Amalgamated	80½
Am. Agri. Chem	62¼
Am.Sm.&Ref.,com	87¼
Am. Sm.& Ref., pf.	107
Am. Sm. Sec., pf. B	87
Anaconda	41⅛
Batopilas Min	1½
BethlehemSteel pf	62⅝
Chino	27⅝
Federal M.& S., pf.	45½
Goldfield Con	4⅞
Great Nor., ore ctf.	41¼
Homestake	91
Miami Copper	25⅞
Nat'nalLead,com.	58
National Lead, pf.	106⅞
Nev. Consol	20⅛
Pittsburg Coal, pf.	81⅞
Ray Con	18½
Republic I&S.com	22½
Republic I & S. pf.	74
SlossSheffi'd,com.	47½
Sloss Sheffield, pf.	105
Tennessee Copper	40
Utah Copper	61⅜
U. S. Steel, com	68⅞
U. S. Steel, pf.	113⅛
Va. Car. Chem	54¾

N. Y. CURB Mar. 26

Name of Comp.	Clg.
Barnes King	‡.12
Beaver Con.	.50
Braden Copper	5⅛
B. C. Copper	5⅝
Buffalo Mines	1¼
Butte & Vipond	‡.53
Caledonia	.68
Con. Ariz. Sm.	9/16
Davis-Daly	1¼
Diam'field-Daisy	12
Ely Con	5/16
Floreuce	‡.64
Giroux	5
Gold Hill Con	5/16
Greene Cananea	9¼
Greenwater	08
Guggen. Exp	212
Inspiration Con	19¾
Internat. S. & R	‡128
LaGrange Placer	2⅞
Kerr Lake	3
La Rose	4
McKinley-Dar-Sa.	1 11/16
Min. Co. of A. new	3½
Nev. Utah M. & S.	1/16
Nipissing Mines	8½
Ohio Copper	1⅛
Pacific Sm. & M	9/16
Porcupine T'nsite	‡ 03½
Precious Metals	‡1⅜
Ray Central	2¼
Red Warrior	‡1½
South Utah M. & S.	1
Standard Oil (Old)	842
Stand'd Oil of N.J.	357
Stand'd Oil Subs.	485
Stewart	1 3/16
Tonopah	8
Tonopah Ex	1¾
Tri-Bullion	¾
Tularosa	¾
United Cop., pfd.	15
Yukon Gold	3⅜

LONDON Mar. 27

Name of Com.	Clg.
Camp Bird	£1 10s 9d
Dolores	1 10 0
El Oro	0 17 9
Esperanza	1 15 3
Mexico Mines	7 2 6
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 1 3

BOSTON EXCH. Mar. 26

Name of Comp.	Clg.
Adventure	6½
Algomah	5¾
Allouez	45
Am. Zinc	27¼
Ariz. Com., ctfs.	4 5/16
Bonanza	40
Boston & Corbin	8
Butte & Balak	3⅞
Calumet & Ariz	73¾
Calumet & Hecla	473
Centennial	21⅜
Con. Mercur	.03
Copper Range	61½
Daly West	6¾
East Butte	13⅞
Franklin	14¼
Granby	39½
Hancock	31¼
Hedley Gold	18
Helvetia	1⅜
Indiana	16⅞
Island Cr'k, com.	43
Island Cr'k, pfd.	‡87
Isle Royale	27⅞
Keweenaw	1⅜
Lake	41
La Salle	‡5
Mass	8
Michigan	3
Mohawk	63
New Arcadian	4¾
New Idria Quick.	‡8
North Butte	33
North Lake	7⅜
Ojibway	6
Old Dominion	51
Osceola	117
Quincy	84
Shannon	14⅜
Shattuck-Ariz	19¾
Superior	29
Superior & Bost	3⅜
Tamarack	29
Trinity	6¼
Tuolumne	4 3/16
Union Mines	2
U. S. Smelting	39¾
U. S. Smelt'g. pf.	48⅞
Utah Apex	3
Utah Con	19
Victoria	4⅜
Winona	6¼
Wolverine	115
Wyandot	2½

BOSTON CURB Mar. 26

Name of Comp.	Last
Ahmeek	278
Bingham Mines	3¼
Boston Ely	1⅞
Boswyocolo	08
Butte Central	6 13/16
Cactus	18
Calaveras	2
Chief Cons	1 15/16
Corbin	2¼
Cortez	1⅛
Crown Reserve	3 1/16
First Nat. Cop.	2¾
Majestic	78
Mazatan	‡½
Moneta Porc.	15
Nevada-Douglas	4
New Baltic	3½
Oneco	2⅜
Raven Copper	45
Rhode IslandCoal	20
San Antonio	‡3
S. W. Miami	7⅜
South Lake	7⅝
Trethewey	65
United Verde Ext.	.55
Vulture	‡5

†Last quotation.

The Engineering and Mining Journal

Vol. 93. APRIL 6, 1912. No. 14.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue, 10,000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Editorials:
  Tube Milling 677
  Electric Power for Mines......... 677
  As to Prospecting............... 678
  Something for Nothing........... 678
By the Way........................ 679
Copper Production and Consumption 680
Chronology of Mining for March, 1912 680
March Dividends 680
Correspondence and Discussion:
  Grinding Analyses and Their Application 681
Where Should the Primer Go?....... 681
Calumet & Arizona Smeltery....... 682
*Preparations for Reopening Plymouth Mines, California.......... 682
Shell Transport & Trading Co. 683
A New Iron Ore Deposit in Pennsylvania? 683
Rescue Car Wanted on Iron Ranges 684
February Operations at Goldfield Consolidated 684
United States Smelting, Refining & Mining Co. 685
Heated Areas in Culebra Cut....... 685
The Situation in Mexico........... 686
Report on the Landslide at Frank, Alberta 686
Details of Practical Mining:
  *Back Sighting in a Winze Survey....Facts about Explosives.... *Scraper for Cleaning Stopes.... Maintenance of Generators and Motors....*Hiawatha Mine Cage ....Rate of Burning of Fuse.... *A Joplin Car for Boulders.... Anchoring New Bolts in Old Foundation....Calculator for the Cyanide Plant....Crushing Frozen Concentrate....Fuel Used in an Oil Engine....Erecting a Steel Stack....*Tailing Gate for Jigs ....Purifying Air for Agitating Pulp 687
*Construction of Argentine Tram. C. A. Tupper 693
Superficial Examination of Ore Deposits 695
Solution and Its Importance. Harry C. Jones 696
Iron Silver Mining Co. 700
*Caving System at Ohio Copper Mine.....Clarence G. Bamberger 701
Electrolytic Detinning 702
*The Mathematics of Copper Sampling ....Edward Keller 703
The Dwight-Lloyd Process in Iron Metallurgy 705
Age Distribution of North German Miners 705
Mining Index 706
Personal, Obituary, Societies...... 710
Editorial Correspondence 711
Mining News 713
Markets 718
*Illustrated.

Tube Milling

The tube mill, since its adoption from the cement industry, has naturally undergone changes to make it more suitable for grinding in cyaniding. The form of lining has been improved so that less time is required to put in a new lining and its life is greatly lengthened. The necessity of stopping the mill to add the pebbles has been overcome by the introduction of the spiral feed. Iron balls have given place to flint pebbles and the latter have in some instances been displaced by low-grade or barren mine rock.

In this connection it is interesting to note that some operators have found that in using mine rock as the crushing medium, it is preferable to give it a preliminary crushing treatment. By this means the sharp corners of the rock are broken off and disposed of before the ore is introduced into the mill, greater efficiency being claimed as a result of this "rounding off." Others tell us that while mine quartz is a good grinding agent it is not effective in protecting the ribbed lining used. It has been suggested that sufficient flint pebbles be used to provide the needed lining by becoming wedged between the ribs, leaving the quartz to do the grinding in the body of the tube. The economies of this scheme over using either all flint pebbles, which are expensive, or all quartz rock, are obvious.

Some phases of tube-mill operation have been investigated and conclusions reached, which admit of no argument, but many points remain concerning which there is much doubt. The advantage of classification to free the pulp from slime before tube milling is generally granted, but the percentage of moisture in the feed for greatest efficiency is still a mooted question. The Rand practice is generally given at about 38% moisture, but at least one operator advocates a percentage as low as 28 for certain conditions.

While it is probably impossible to find a set of rules for operation that will satisfy all conditions, systematic research should establish certain fundamental facts which will permit of more definite control of tube-mill operations. The field is a promising one and investigators should find ample reward for their labors in this direction.

Electric Power for Mines

The increasing use of electricity for power purposes has been a feature of the developments in mining practice during the last few years. It is especially true of the Lake Superior iron ranges, particularly of those in Michigan. Now that electric machinery has been developed to a point where the machines themselves are generally efficient and dependable, its installation is dependent to a large extent on the availability, at a reasonable cost, of the necessary current. In this, some districts are favored more by nature than others. Where electricity for power purposes is not for sale, the cost of installation may be prohibitive for a small, independent company; where water power is available within reasonable distance, the opportunity often presents itself for a power company to step into the breach, provided there are sufficient mines in surrounding districts.

Similar conditions make it possible for a large mining company, operating many mines within a comparatively small area, to develop power for a central plant which shall supply the individual mines. These are the conditions that exist on some of the Michigan iron ranges. The development in electric hoisting machinery, for instance, has, in many cases, made its use desirable. On one Michigan range the Cleveland-Cliffs Iron Co., operating a number of mines, has found it possible to develop from water power, in its own central plant, electric current to supply its mines. On another range, not far distant, a power company has been formed to convert water power into electricity, which will be sold to small, independent mines.

While Porcupine was in its earliest development stage, work was rushed on two hydro-electric plants not far distant; the current from one of these is now being sold to a number of mining properties, some of which are merely prospects. Arrangements have been made to complete the other plant, and these two completed installations will afford competitive rates to the mines of the district, a condition to be desired. In other mining districts such companies have aided many independent mines in reducing power costs and have rendered exploratory work in out-of-the-way places less difficult. Either private or commercial, the central electric power plant for mining purposes is an established fact, and its future is a bright one.

As to Prospecting

We are unconsciously inclined to think of our country as one that has been pretty well prospected, one in which few important discoveries remain to be made. Yet a moment's thought will call to the mind of nearly every engineer certain unprospected corners in every Western state—places where perhaps he has had in mind making a quiet little investigation some day when he had a short respite from routine duties.

That there are plenty of unprospected spots still left in this country, and many others that have merely been "rushed" over, awaiting a calmer and more studied examination, is evidenced by the recent announcement by the U. S. Geological Survey of a potash discovery in California, by the calamine discoveries at Leadville, the salt domes of the Gulf region and the appreciation of the value of the sulphur deposits of the same section.

In telling of a recent visit to the Chilean nitrate fields, Prof. J. F. Newsom, at a recent meeting of the San Francisco section of the Mining and Metallurgical Society, stated that for the most part there were no surface indications of these valuable nitrate beds; one might walk over them for miles without recognizing the presence of anything valuable; the prospectors were compelled to put down holes and test the drillings. Yet these important deposits which do not have any marked surface features maintain an annual production valued at about $100,000,000 at the Chilean coast. On being asked whether he had seen any occurrences in this country that simulated the Chilean formation, Professor Newsom replied that he had not, but that he might have walked over any quantity, as any of us might, and never had a suspicion of its existence. Nitrates have been found in several places in this country, and it is possible that systematic prospecting would reveal commercial deposits.

The results of the Geological Survey's search for potash has indicated what may be revealed by systematic and intelligent prospecting. Many lands that have been gone over in the past may warrant reprospecting for minerals, which changed market and transportation conditions have made valuable; witness, the deposits of the so called steel-hardening metals, such as the tungsten ores of Boulder County, Colorado, and the carnotite deposits of Colorado and Utah; even "porphyry coppers" might be mentioned as an example.

Something for Nothing

Opinions of Lake Superior mining men as to the practicability of applying efficiency engineering to underground mining differ considerably. At one of the copper mines where especial attention has been paid to the subject and considerable money spent in careful attention to details, the results are said to be very satisfactory; the management reports important reductions in cost, although a number of difficulties had to be first overcome, and by no means is the application of scientific management an easy matter to conditions that have existed through several generations of "good" miners.

At one of the iron mines where several months have been devoted to efficiency engineering, the results, while promising, will probably not be so successful as in the first case mentioned. It is contended that the problems in underground mining of variable formations do not permit of the standardization possible, say, in machine-shop practice. It is hoped to develop a detailed clerical system of recording the day's work of each man, so that the loafers can be weeded out, and a more intimate knowledge gained of the problems in each drift and stope. One of the chief difficulties encountered in trying to develop a good working system in the mines is the reluctance of some officials to increase the clerical or engineering forces to take care of the additional work. They are anxious to effect large savings by merely agreeing to adopt the system but without spending any money for a careful introduction of the principles to their particular mines.

In this respect a story is told of a furnace man from Buffalo who came into the Lake Superior country several years ago to purchase a "prospect or exploration." When several propositions had been submitted to him, and had been refused, he was asked what sort of an exploration he wanted. He replied that he wanted one showing a good body of high-grade ore of certain percentages of iron, phosphorus, sulphur, etc., which he named, and that it must be near the railroad, not too difficult to mine, besides several other qualifications; and for this he was willing to pay the price of an "exploration," say ten thousand dollars. The hard-working mining explorer who had been showing him around, bade him adieu at this point. "We haven't any pig-iron mines for sale today," said he.

* * *

The copper market this week became crazy on buying from Europe where some speculative operations seem to have come to a head. We are of the opinion that a slower and more orderly advance in the price for copper would have been better for the industry than what has been witnessed during the last month.

* * *

If the U. S. Geological Survey has been dilatory in some of its investigations and reports, it certainly is subjected to no such charge with respect to the alleged discovery of a billion tons of iron ore in Pennsylvania, which story it exploded inside of a week.

* * *

The practical settlement of the British coal strike after a full month of disturbance to industry is a gratifying event of this week. The American coal strike has not yet created any disturbance, its chief effect so far being only to afford a holiday to the men who have quit work.

* * *

The miners of Butte have showed their good sense by refusing to strike over a grievance that was of so little real consequence as to be scarcely a grievance at all.

By The Way

The inauguration of the 8-hr. shift for underground work in the Lake Superior iron mines will be a welcome change for the men, and probably a wise one for the operating companies. It will be interesting to observe next year its effects on per-ton costs.

Holders of Inspiration Copper who bought it on the theory that with so distinguished a directorate it would have to go up and could not go down, have now the assurance that though it has not gone up, it is a very good thing to hold for investment, says the *Evening Post*. Speculative purchases often turn into investments in that way.

An engineer sends us the following from a Utah paper: "The talk is that there is gold—a good deal of it—at Paria in Kane County, but there is mineral in the water used in mining it by the hydraulic method that prevents the quicksilver from getting action on the gold so as to extract it." It would be quite interesting, writes the engineer, to know what this mineral is that makes amalgamation difficult. We do not know. It may be "green" or "volatile" or "young." However, we do know that gold is capricious, obstinate and elusive, especially in its travel from the promoter's prospectus to the pockets of the stockholders. This fact has been discovered by that "small army of investors of whom," Horace J. Stevens quaintly remarks, "one is born every minute."

Arizona is a great, if young, state and in its copper production it has already outstripped many of its sister states. Leaving the domain of facts, however, we delve into the latest flotation literature that has come to hand. This relates to another "greater copper ledge on earth" found in Yavapai County by "a mining engineer and magazine writer" of Sycamore, Kan., who visited the property "to collect data concerning copper, and the discovery of the company's great ledge." From what the Kansas "expert" wrote we gather that he went out into the sycamore grove and lighted his pipe, whence arose a great smoke. Part of his dream is imparted to stockholders in the following verbiage: "Copper: a red, ductile tenaceous, maleable metal of great and varied use, originally called brass of cypress, copper sand, alacaunte, C group of minerals, mostly soft, included C cuprite, malaconite, malachite, malconite, chessylite, chrycopyrite, olivnite, etc. Black C ore, malaconite, gray C ore, Chalcocite, C Purite, yellow C ore, variety Chalcopyrite, the common ore. . . . The formation of the —— Copper Co. have blended with the iron, lime and porphyry with quartz. Many of the above minerals, but more especially the commoner forms with oxides condensed formation on the top with the iron and lime, with a great amount of carbon and sulphur in the schist formation, with an amalgamated condition of the various mineralizations where gold and silver predominates. The schist formation being soft it stands to reason that when the sulphides appear in the lower rocks, I am led to believe from the geological lay of the uplift that is now held and owned by the —— Copper Co. there is beneath the surface of this great iron-capped ledge a great body of copper ore." We are unable to follow the Kansas wizard into the New Mineralogy, but it must be impressive to the unsuspecting stockholders.

The old, "bred-in-the-bone" Cornishman of upper Michigan is a character that once met is not soon forgotten. While he has a distinct sense of humor, he is funniest when he least intends to be, and this is due in no small degree to his peculiar dialect, the latter being not only difficult to understand, but still more so to reproduce. The following is typical: The boss went up in a raise where two of his old reliable workmen were drilling, greeting them with, "'Ow she coming up, boys?"—"Some slow, Cap'in, some slow." "Well," said he, "ne'er mind, patience and perce'verance will put un through." —And the Captain walked on. Said one of the men in the raise: "'Enry, wo be this Patience and this Perce'verance?" "Damned if I da knaw, lest be they taw bluddy Finlanders in tuther stowp."—Half an hour later found Henry and his partner demanding their pay up to date, just as the Captain stepped into the office. "Well, me sons, wha's matter?" "W'ur leavin', Cap'in; if yaw dha want they taw bluddy Finlanders to put un through, you cun 'ave 'ey; Patience and Perce'verance, 'ay? You cun 'ave 'ey, you cun 'ave 'ey."

For several years more or less secretive mining operations were conducted in the so called "crater," a unique natural feature near Cañon Diabolo, Ariz. Little has been said about these operations or their purpose. A correspondent now reports that they were in fact carried on with the idea of finding a diamond "pipe," similar to those characteristic of South Africa, and not for the purpose of yielding meteoric iron, as was originally stated. He states that "the operations at the crater were undertaken about two years ago by Philadelphia and Phœnix men, and were underway for some time. Drilling was tried but abandoned as impracticable, and later an effort was made to sink a shaft. This work proceeded to about 100 ft., and was stopped because of the great difficulty in controlling the dry, fluid, sand-like material in the crater, which had also baffled the attempts at drilling. At present no work is being done, and the results obtained did not give any encouragement. The report was that the crater, which has a cup-like depression with a distinct elevated rim in an otherwise undisturbed sedimentary region, was filled at the bottom with fine sandy angular material, probably an autoclastic silicious eruptive rock, with some pieces of lava-like rock near the surface. As far as explored, the whole crater filling is of this material. It runs almost like water in the shaft and operations in it were costly and difficult. The surface around the crater is strewn with meteoric fragments, as at Cañon Diabolo, not far away. This gave rise to the popular idea that the crater itself was formed by a gigantic meteorite which had buried itself deep in the earth, comminuting the rock and causing the 'rim,' as a marble would splash in mud. From this idea arose undoubtedly the original report that the explorations were undertaken in the hopes of finding a mass of meteoric iron; the value and availability for commercial purposes, if found, was a question. The operations, however, were conducted with ostentatious secrecy, and the operators now will not admit much as to the plans and work, but the diamond idea is believed to be correct. So far as reported, however, no diamonds have been found in the crater's filling, nor in its vicinity."

It is sometimes hard to understand the presence of the minority stockholder at a meeting where no information is divulged and no luncheon served, says the New York *Times*. He sits in the presence of half a dozen officials of his company, including the secretary, with his pile of proxies, and perhaps two or three other small holders who mistook their formal notification of the meeting to be in the nature of a call to duty. Not infrequently the small stockholder is bursting with advice on matters connected with his company, but he is never allowed to express his views. As for getting anything done, unless he has the backing of an insurgent movement, he might just as well have stayed at home. If he insists on offering a motion his few shares are buried under an avalanche of votes held by the secretary. Altogether, his lot would not seem to be a happy one. A persevering stockholder, who for years past has attended meetings where he was not wanted, explains that his time is not always wasted. "I usually ask some questions and am told that the books are unfortunately across the river or uptown," he said. "I make a motion or two and hear the chairman announce that I have lost by 256,000 to 50, or something like that. But my requests go on the record, and when the minority have to go into court to get what they think they are entitled to, we have evidence that information to which we were entitled was denied."

Copper Production and Consumption

Messrs. Aron Hirsch & Sohn, Halberstadt, Germany, publish the following estimate of the production and consumption of copper in 1911, the figures being in long tons:

	Production	Consumption
United States	437,300	316,791
Other No. America	80,150	
South America	58,100	3,000
Europe	126,720	640,009
Australia	41,600	......
Japan	55,000	20,000
South Africa	7,000	......
Other Africa, Asia, etc.	10,500	6,500
Total	869,370	986,300
Total, 1910	857,150	933,290

According to this estimate the world's consumption of copper exceeded the production by 76,140 tons in 1910, and by no less than 153,010 tons in 1911. The estimated stocks held at the close of 1910 were 143,777 tons, while at the end of 1911 they were 100,695 tons. The diminution of these visible stocks during 1910 was 23,684 tons; during 1911 it was 43,082 tons. In the figures of production and stocks no account is taken of scrap or old metal which enter into the consumption.

Chronology of Mining for March, 1912

Mar. 1—Dissolution of the Butte Coalition company was effected, the control of its property passing to the Anaconda company.

Mar. 2—President Taft issued a proclamation respecting the troubles in Mexico, advising American residents to keep out of them.

Mar. 4—The Supreme Court announced its decision to review the action of the Ninth U. S. Circuit Court of Appeals, which denied relief to the farmers of Deer Lodge Valley from the fumes of the smeltery at Anaconda, Montana.

Mar. 7—The Camp Bird mill, in Colorado, shut down temporarily because of danger of snowslides. Fire partially destroyed the Mogul cyanide plant in the Black Hills, South Dakota, entailing $75,000 damage, covered by insurance. An explosion in the mine of the Diamond Vale Collieries Co., at Merritt, B. C., killed seven men.

Mar. 10—Fire partially destroyed the town of Kennett, California.

Mar. 11—The McIntyre 10-stamp mill, at Porcupine, commenced operation, becoming the first regular producer of bullion in the district.

Mar. 13—An underground fire did slight damage in No. 2 Kearsarge shaft of the Osceola Consolidated Mining Co., in Michigan.

Mar. 14—A snowslide killed four men at the Black Bear mine, in the San Juan region, Colorado.

Mar. 15—Water was turned into the hydro-electric plant of the Homestake Mining Co., in South Dakota.—The Arizona Commercial Copper Co. went into the hands of a receiver, in default of interest on a $1,000,000 bond issue.

Mar. 16—An explosion was reported to have killed 45 men in the Italianka coal mine, in Russia.

Mar. 18—The smeltery of the American Smelting & Refining Co., at Durango, Colo., was blown in after a shutdown since November.

Mar. 20—An explosion in the Chant No. 2 mine of the Sans Bois Coal Co., at McCurtain, Okla., killed 74 men.

Mar. 26—An explosion at the Jed Coal & Coke Co.'s Jed mine, two miles from Welch, W. Va., reported to have killed 81 men.

Mar. 30—Slides are reported to have started at Turtle Mountain, near Frank, Alberta.

March Dividends

The accompanying table shows the dividends of the American mining, metallurgical and coal companies, paid during March, 1912. The dividends reported amount to $17,388,642, as contrasted with the $29,844,356 shown in the JOURNAL for March, 1911. This tremendous falling off is not real, being due to $14,500,000 being shown last year as the Standard Oil disbursement for March, to which we have nothing this year to correspond.

Standard Oil was interesting because of its bigness. The subsidiaries we have dropped from the list for several reasons. It is hard to tell where oil producing ends and transportation and manufacturing begin. Many independents are as large as the subsidiaries, but do not wish to report earnings and dividends, while the California oil region is so important that a separate table later in the month seems necessary.

On the side of straight metal mining in the United States, the figures are distinctly encouraging, this year's figures being $4,983,399, against last year's $4,878,308, while Canada and Mexico this year pay $1,354,100, as against last year's $603,808. It is unfortunate, of course, that such figures can only be comparative, and not absolute. Thus, there is, in the payments by the Superior & Pittsburg and Calumet & Arizona, a certain amount of duplication, while the disbursements of Cananea Central and Greene Consolidated, are the basis for the payments by Greene Cananea among the holding companies. However, after making all allowances for duplication, the figures are a decided tribute to the solidity of the American mining industry.

Calumet & Hecla increased its dividend from $6 to $8 per share, a return of about 6.75% on the present price of the stock. Champion was another Michigan company to delight its shareholders, declaring two $1 dividends in March, a total of $4 per share in the first three months of the year. Quincy also paid, but simply at its usual rate of $1 quarterly.

In Utah, Opohongo paid its second dividend. Utah Copper continued at the rate of $0.75 quarterly, disappointing those who had been prophesying and buying for an increase, as well as those who are continually crying "bad management."

Federal Lead was forced to cut its preferred dividend to 1½% quarterly, while Yukon Gold continues paying at the reduced rate instituted in December.

Greene Consolidated, after an absence of four years from the list, "came back" with a payment of $600,000. Cananea Central also paid $360,000, so that Greene-Cananea, the holding corporation, was able to return $618,828 to its stockholders, the remainder going largely to cover previous administration expenses. New York & Honduras Rosario also paid in this month, after a year of silence.

UNITED STATES MINING COMPANIES	Situation	Per Share	Total
Bingham-New Haven, c.	Utah	$0.10	$22,869
Bunker Hill Con., g.	Calif.	0.07½	15,000
Bunker Hill & Sull., l.s.	Ida.	0.15	49,050
Calumet & Ariz., c	Ariz.	1.00	596,353
Calumet & Hecla, c.	Mich.	8.00	800,000
Champion, c.	Mich.	2.00	200,000
Colorado, l.s.g.	Utah	0.03	30,000
Doe Run, l	Miss.	1.50	98,675
El Paso, g.	Colo.	0.01	21,500
Federal M. & S. l., pfd.	Ida.	1.50	180,000
Frontier, z.	Wis.	2.00	2,500
Hecla, l.s.	Ida.	0.02	20,000
Nevada Con., c.	Nev.	0.37½	749,389
North Star, g	Calif.	0.10	25,000
Opohongo, g.s.l.	Utah	0.01	8,990
Quincy, c.	Mich.	1.00	110,000
St. Joseph, l.	Mo.	0.15	150,000
Success, z.	Ida.	0.01	15,000
Superior & Pittsburg, c.	Ariz.	0.30	449,938
United Verde, c	Ariz.	0.75	225,000
Utah Copper, c.	Utah	0.75	1,173,635
Yukon Gold, g	Alas.	0.07½	262,500

COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES	Situation	Per Share	Total
American Coal	Penn.	$0.75	$37,500
Am. Sm. & Ref., com.	U. S.-	0.66⅔	333,333
Am. Sm. & Ref., pfd.	Mex.	0.16⅔	583,338
Crucible Steel Co.	U. S.	1.75	427,630
General Asphalt, pfd.	U. S.	1.25	164,129
General Chem., com.	U. S.	1.50	122,268
Greene-Cananea, c.	U. S.	0.25	618,820
Harbison-Walker, com	U. S.	0.50	90,002
Inter. Nickel, com.	U. S.	5.00	579,130
Inter. Sm. & Ref.	U. S.	2.00	200,003
National Lead, pfd.	U. S.	1.75	426,433
National Lead, com.	U. S.	0.75	151,914
Phelps, Dodge & Co.	U. S.	2.50	1,125,000
Texas & Pacific Coal.	Tex.	1.50	37,500
U. S. Steel, com.	U. S.	1.25	6,353,781

CANADIAN, MEXICAN AND CENTRAL AMERICAN COMPANIES	Situation	Per Share	Total
Cananea Central, c	Son.	$0.60	$360,000
Crown Reserve, s	Ont.	0.05	88,441
Greene Consol., c	Son.	0.60	600,000
Hedley, g.	B. C.	0.50	60,000
Kerr Lake, s.	Ont.	0.25	150,000
Lucky Tiger, g	Mex.	0.05	35,767
N.Y. & Hon. Rosario, g.	C. A.	0.15	22,500
Rio Plata, s	Mex.	0.10	37,392

The Temiskaming Mining Co. paid its first dividend since the purchase of the North Dome mine, which it is now considering selling.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Grinding Analyses and Their Application

In regard to H. Stadler's work on grinding analyses, I am at a loss to understand how he arrives at the relation between energy units, and mesh aperture.

J. C. F.

New York, March 24, 1912.

[In Mr. Stadler's original paper[1] on the subject this phase was covered and the following explanation is taken from this source.

The area of fracture, over which the cohesion of the molecules has to be destroyed, multiplied by a coefficient determining the resistance which the molecules oppose to their separation by the exercise of stress (crushing, tensile, shearing, etc.), represents the *force* required to cause the fracture. To perform mechanical work this force must run through a *distance*, represented by the deformation which the body can stand before reaching the breaking point.

It is immaterial that the distance of deformation varies in a heterogeneous body and since relative values only are desired even the exact extent of deformation is unnecessary. It is only essential to make sure that this factor is a constant function of the diameter of the particles to be crushed.

Mechanical work is the product of a force times the distance through which it moves, but as in the regular scale of reduction by volume, the diameters of the particles decrease at the same ratio as the area of fracture increases, the mechanical work required for reducing the volume (or weight) of the unit from one grade to the next following is a constant for each grade, called the crushing or energy unit (E. U.). The same conclusion is reached by Kick's law: "The energy required for producing analogous changes of configuration of geometrically similar bodies of equal technological state varies as the volumes or weights of these bodies."

The volumes of the particles decrease from grade to grade at the same ratio as the number of particles—constituting in their total the value of the unit—increases and the product of the volumes into the number of particles of that grade is therefore a constant for each grade. As in conformity to the above law the amount of energy absorbed is proportional to the volume of the body to be crushed, it follows also that the total energy required for reducing the weight of the unit is constant for each grade.

The ordinal numbers of any arithmetical progression given to these grades represent consequently the relative values of the energy which must be spent upon producing these respective grades from the initial unit and the mechanical value of the grade. For obtaining the mechanical value of mixed sands it is only necessary to multiply the percentages of the grades by the number of the energy units of the respective grade and add the products.

To illustrate this method of calculating the mechanical efficiency of a given crushing machine, the example in the accompanying table is given, the following data also being used: Tube mill dimensions, 22 ft. by 5 ft. 6 in.; speed, 30 r.p.m.; power consumed, say 100 hp.; banket-ore feed, 6.75 tons per 24 hr.; duty, 290 tons per 24 hr. In the first column the grades given are those of the Mines Trial Committee; in the second column the mechanical value of the mean grade in energy units.

STADLER'S METHOD OF COMPUTING TUBE MILL EFFICIENCY

		Feed		Discharge	
	E.U.	Analysis, Per Cent.	Total E.U.	Analysis, Per Cent.	Total E.U.
+12	13	27.6	3.59	....	.....
+20	15	15.7	2.36	....	.....
+30	17	13.7	2.33	7.4	1.26
+50	19	19.9	3.78	22.5	4.28
+80	21	15.5	3.26	29.0	6.09
+120	23	2.0	0.46	6.0	1.38
+200	25	1.6	0.40	7.7	1.93
—200	28	4.0	1.12	27.4	7.67
Total..	..	....	17.30	....	22.61

By reference to the table it will be seen that the total mechanical value of the discharge is 22.61 E. U. from which must be deducted 17.30 E. U., the mechanical value of intake, thereby obtaining 5.31 E.U. as the work done per unit (say 1 ton). The work done by the tube mill in 24 hr. is obtained as follows: Reduction of pulp feed, 1539.9 E.U. (290x5.31); reduction of banket ore, 202.5 (6.75x30); total, 1742.4 E.U. Assuming that the power consumption was 100 hp., the relative mechanical efficiency is 17.42 per horsepower.

The following statement is also necessary for a full understanding of the above calculations: The energy absorbed in the reduction of banket-ore feed to the size of the final pulp as an average is estimated at 30 E.U. (26 E.U. being the mechanical value of the final pulp with reference to the initial unit, plus 4 E.U. representing the energy absorbed in the reduction of 4-in. pieces to the size of the initial unit or zero-grade.—EDITOR.]

Where Should the Primer Go?

With regard to the position of the primer, Mr. Semple's experiment, cited in the JOURNAL of Mar. 23, 1912, igniting a fuse "threaded through a series of dynamite cartridges," is not conclusive, because holes are never loaded in that way. The capped fuse is inserted in one stick to make the primer, and the fuse lies alongside, and outside of those sticks which are inserted in the hole after the primer, the paper wrapping of those sticks intervening between the fuse and the dynamite. This paper wrapping burns freely in the open air, but with difficulty in a tightly tamped hole. The custom of placing the primer near the bottom of the hole is practically universal among those miners engaged in machine drilling,

In one case of tunnel work (Gunnison tunnel, December, 1909), by an unusual combination of circumstances governing ventilation, I was enabled to witness from a safe distance the actual explosion of a series of rounds of holes, continuing through several weeks. The holes were uppers, 4 to 6 ft. deep, loaded with 8 to 12 sticks of 60% gelatin dynamite, 1⅛ in. diameter, and were fired in rounds of 50 to 60 holes. The loading and firing were carefully superintended by the shift boss, himself an experienced miner, and the primer was invariably inserted as the second or third stick in each hole. After spitting and during the period of explosion, the smoke was continually carried away by a strong air current, and it was easy to distinguish between the sudden flash of a detonated hole and the steady, long continued flare of a burning hole. Of some 600 holes, whose explosion I personally witnessed under these circumstances, only two burnt.

Mr. Semple criticizes my stipulation of a load of nine sticks in a hole in a 5-ft. round. I mentioned that quantity as covering the extreme of my own experience. The conditions which, in some few cases, have justified me in putting that much dynamite in one hole, while interesting in themselves, are not germane to this discussion.

HARVEY S. BROWN.

Victor, Colo., Mar. 26, 1912.

---

[1] Trans. I. M. M., Vol. XIX, 1909-1910.

Calumet & Arizona Smeltery

Much of the concrete work has been completed and a number of important contracts have been placed for equipment for the new smeltery that is being built at Douglas, Ariz., for the Calumet & Arizona Mining Co. Repath & McGregor, engineers, are designing the plant and supervising the construction.

The following is a brief description of the plant being constructed. It is proposed to equip the present ore-receiving bins with chutes suitable for feeding the ore into the hoppers of conveyor feeders. The ore bins will be equipped on both sides with a 30-in. conveyor which will convey the ore directly to the sampling and crushing plant. For the coke-receiving bins it is proposed to utilize the present storage trestle as an approach, and for the coke bins proper a new steel structure will be built.

Crushing and Sampling Plant

The crushing and sampling plant proposed is estimated to have a capacity of 100 tons per hour if all the material passing through it is crushed down fine for roasting, or it will have a capacity of approximately 200 tons per hour if the large pieces of ore are screened out for blast furnaces. The building is to be of steel and concrete throughout, and is to be 40x84 ft. five stories high. The mill is to be divided into sections, which may be run independently of one another. Each section will have a crushing and sampling department. In the sampling department the ore will be cut four times by Snyder or similar automatic samplers, so that for each ton of ore, a sample weighing 1.6 or 3.2 lb. as desired, may be obtained. All the ore from the bins will pass through the crushing or sampling plant. The plant will be flexible, and suitable arrangement will be made for sending the ore directly to the bins without sampling or crushing. The plant will be so arranged that sulphides may be crushed down to ⅜ in. for the roasters, or they may be screened and the coarse lumps sent directly to the blast-furnace beds.

Bedding and Conveyor System

From the sampling and crushing plant the materials will pass directly to either the coarse-ore beds or to the fine-ore beds by belt conveyors. The bedding scheme proposed will practically duplicate the Cananea system. Three beds for coarse ore will be provided, each having a capacity of 10,000 tons. Three beds will be provided for the fines, each having a capacity of 10,000 tons, and a bed will be provided for the coke which will have a capacity of 3500 tons. The coke will be dumped from the cars into the coke-receiving bins and from the bins it will be conveyed directly to the blast-furnace charge bins or to the coke-storage bed. The coarse and fine ore will be reclaimed as it is done at Cananea. The coke from the storage bed will be reclaimed by shoveling or wheeling it to a conveyor-belt feeder. The coarse ore and coke will be conveyed up an incline to the ore and coke charge bins directly over the blast-furnace charge floor. The fine ore will be conveyed up a similar incline to the roasting plant.

Roasting Plant

The roasting plant will contain twelve 21x6-ft. diameter Herreshoff roasters, each having a capacity of approximately 75 tons fine ore per day. The roasting plant will be equipped with a brick dust chamber of ample capacity for settling the fine dust carried with the fumes. For this dust chamber and also the blast-furnace dust chamber copper roofing will be used.

The main smeltery building will be 168x506 ft. in plan and in it will be two blast furnaces, four reverberatory furnaces, six converters, and the converter slag- and copper-casting department. The blast and reverberatory furnaces will be on one side of the main aisle, while the converters and casting machines will be on the other.

Blast Furnace Department

Two 48-in. by 40-ft. blast furnaces will be installed. Ore and coke will be discharged directly from the bins just over the charge floor into the charge cars, which will be resting upon the platform scales, so that the amount of coke and ore for each charge will be accurately determined. The charge car will be moved from the scales to the charge doors of the furnace by a small electric motor geared to it. A large steel dust chamber 60x140 x70 ft. high will be provided which will have ample capacity to settle the blast-furnace dust and converter dust. It is proposed to pass the converter gases through this chamber.

Reverberatory Department

In the reverberatory department four reverberatories will be installed, having hearths 19x100 ft. leaving a foundation space for a fifth furnace. Each of the furnaces will be equipped with two waste-heat boilers of 712 hp. capacity each. The furnaces will be charged directly from calcine cars running on tracks overhead. Matte will be tapped into large ladles and conveyed by cranes to the converters. The slag will be skimmed directly into large slag pots running on tracks underneath, and just in front of the furnaces.

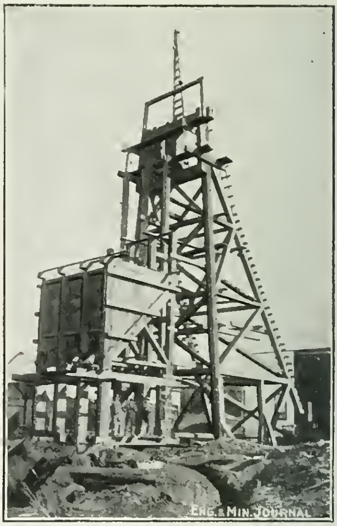
The main converter aisle will be 55 ft. wide and will be equipped with two 40-ton electric traveling cranes. Six vertical Great Falls type converters will be installed. Two straight-line casting machines will be installed. It is proposed to erect a steel chimney which will be brick lined, and will be 25 ft. in diameter by 350 ft. high.

Preparations for Reopening Plymouth Mines, California

San Francisco Correspondence

The new plant, composed of electric hoist, air compressor and pump, installed at the Pacific vertical shaft of the Plymouth Consolidated mines in Amador County, by the California Exploration Co., has been in operation since the middle of February. In the first 30 days the water was lowered to the 400-ft. point, and the timbering repaired to the same level.

The installation was begun on Oct. 15, 1911, and completed on Feb. 17, 1912. It is estimated that it will be necessary to lift about 60,000,000 gal. of water before practical exploration and development can be undertaken. This estimate is made from a study of the available history of the underground workings and the amount of ore extracted in the 36 years' life of the mines, in which period the production totaled nearly $7,000,000. A concise history of the mines was published in the Journal.[1]



Pacific Shaft, Plymouth Mines, California

The Pacific shaft is 1700 ft. deep; the lowest working level is at 1600-ft. depth. So far as I have been able to learn this was the first deep vertical shaft on the Mother lode in Amador County. It was opened in May, 1880, and in two years had reached a depth of 1400 ft. It is in three compartments, each 4x5 ft. in the clear, two of which were used for skips, the other for pump and manway. At the time of my visit to the mines in February the shaft had been sounded to a depth of 1265 ft. in the working compartments and found to be clear of débris. It is probable that from that depth to the 1350-ft. level the débris from the rotted timbers and rocks and earth from the caved formation have filled the space.

---

[1] Eng. and Min. Journ., Jan. 20, 1912, p. [illegible]

At the 1350-ft. level there is a bulkhead, put in at the time of the attempted reopening of the mines after the fire in 1888. The estimate of the quantity of water in the workings is based on the probability that one-half of the excavations is filled with rock and débris, the remainder with water. The water was running over the collar of the shaft, and when pumped out for a depth of the first 14 ft. the timbers were found to be badly rotted, though generally in place. The new timbers used in repairing the shaft are 12x12 in.; the shaft guides are 4x4 in. The water in two other (inclined) shafts on the property will be drained through the Pacific, which will be cleared to the full 1700-ft. depth, as it is expected that any extensive orebodies left in the mines will be found below the 1600-ft. level. The work of unwatering and timber repairs should be completed in August.

HOISTING AND PUMPING EQUIPMENT

The plant is operated by two General Electric motors, having a total of 325 hp., and supplied with electricity by the Western States Gas & Electric Co., of Stockton, brought in over a pole line at 60,000 volts and stepped down to 440 volts. The hoisting engine is 225-hp., direct driven, with capacity for lifting 300 tons per day, at the rate of 650 ft. per min. from a depth of 2000 ft. The pump is a No. 7 Knowles, capacity 100 gal. per min. and lifting through about 300 ft. It is operated by a Sullivan 500-cu.ft. compressor, belt-connected to a 100-hp. motor.

Two new Aldrich electrically driven plunger pumps have been ordered and will be installed immediately, one for a lift of 500 ft., the other for a lift of 1100 ft. The larger one will be stationed at the 1065-ft. level, the smaller one at the 1600-ft. level. At present two 550-gal. skips are employed in lifting water, but will be mostly used in repair work when the new pumps are installed. The cable hauling these skips is ⅞-in. plow steel The machinery of the plant was manufactured by the D. D. Demarest Co., of San Francisco, in the shops at Altaville, near Angels, Amador County.

The gallows frame is an "A" type, 58 ft. high, 22x32 ft. at base, resting on concrete foundation. The timbers are of Oregon pine, 12x12 in. square. The hoist building is 40 ft. 8 in. by 48 ft. 8 in.; blacksmith shop, 24x16 ft.; timber shed, 40x24 ft.; all of corrugated iron; the powder house is 16x12 ft., built of brick; cap house, 5x5 ft., of concrete; change house, 20x12 ft., of brick.

The elevation at the Pacific shaft is 1200 ft., about 300 ft. lower than the elevation at the Kennedy mine near Jackson. Measured in geographical sections the Plymouth Consolidated is 8 miles north and 2 miles west of the Kennedy. It is in the west or foot-wall side of the Mother lode; the Kennedy is situated in about the center of the Mother lode between the greenstone hanging wall and the slate foot wall, and in the proximate geographical center between the north and south ends of the Mother lode in Amador County.

The Pacific shaft was sunk east of the vein in slate and intersected the hanging wall of this vein at 1400 ft. where 40 ft. of $16 milling ore were mined. The dip of the veins along the entire length of the Mother lode in Amador County is approximately uniform at about 60° E. The strike of the formation is west of north and east of south. The greenstone croppings of the hanging wall of the lode in the Plymouth district are 1500 to 2000 ft. east of the Pacific shaft.

There are other mines in the Plymouth district to be described in a separate article respecting their development and, as in the present writing, with only a general reference to the geological formation. Plymouth represents the northerly end of the Mother lode mines in Amador County, but the lode extends into Eldorado County where there is present extensive development and mining in progress.

The preparation for development of the Plymouth Consolidated is attracting attention to the possibilities of reopening other old mines in the district, and will probably lead to prospecting for new veins and ledges. The work at the Pacific shaft is under the direction of Albert Burch, Crocker Building, San Francisco, representative of Bewick, Moreing & Co. of London, managers of the California Exploration Co. J. F. Parks is superintendent, at Plymouth.

Shell Transport & Trading Co.

The aggressive Shell Transport & Trading Co., not content with alliance with the Royal Dutch Co., has now bought 80% of the Société Caspienne et de la Mer Noir and the Société de Mazut, says the *Petroleum Review*, Feb. 24, 1912. A further issue of stock will be necessary to finance this purchase, and the directors will call for *pro rata* subscriptions from the present stockholders at 65s. per share for the unissued 510,000 shares of the 3,500,000 authorized. The new move is expected to strengthen the Royal Dutch Shell hold on Russian markets.

A New Iron Ore Deposit in Pennsylvania?

Under this head, mention was made in last week's JOURNAL of the reported discovery of a fabulous quantity of supposedly limonite and hematite iron ore, in Fulton County, Penn. At that time such information as was generally available was given. It now appears that the U. S. Geological Survey detailed a geologist to make an immediate examination, for which great credit is due; the result of Geologist George H. Ashley's investigation is interesting.

PRESENCE OF IRON ORE LONG KNOWN

According to Mr. Ashley, Dickey's Mountain, Laurie's Knob and the Meadow Ground Mountain, in Ayr Township, Fulton County, Penn., have been known as iron-bearing for about 100 years. The descriptions given in the earlier reports by Rogers in 1858 and Stevenson in 1886, as regards structure and iron content of these hills, are, in the main, confirmed by Mr. Ashley. It is stated that Dickey's Mountain contains a little sandy, Clinton hematite, a little limonite, containing 38% iron and abandoned after a short trial by the old Hanover furnace, and a little bog ore. Laurie's Knob has yielded between 60,000 and 80,000 tons of 46% limonite ore from a group of pits on the east side. The largest of these pits may not have been worked out and other pockets may be found, although this is considered not likely. A little ore also occurs on the west side of the knob, as on Dickey's Mountain. The Meadow Ground itself is a poorly drained flat in a shallow, canoe-shaped synclinal basin of red Mauch Chunk rocks, covering about 1000 acres in the center of a basin of Pocono sandstones, forming the mountains on either side, with all dips toward the center. This flat lies between Meadow Ground Mountain and Scrub Mountain.

A large fault runs through Laurie's Knob and Dickey's Mountain, throwing the rocks on edge and partially crushing them, but there is no evidence of "volcanic action." The old geological reports state that the Hanover furnace, near the gap between Dickey's Mountain and Laurie's Knob used iron from these hills 90 years ago. That furnace shut down in 1847, having found the ore of Dickey's Mountain too low in grade and too thin, and that in Laurie's Knob apparently having been exhausted except possibly in the deepest pit. No commercial mining has been done on the Meadow Ground, and the recent excitement appears to have been due to the drilling of three holes there. In the center of the basin is a thin group of red shales and some red sandstone, which show everywhere in the Meadow Ground. The bottom of the group outcrops around an area about 3½ miles long and ½ mile wide, including the maximum area of about 1000 acres mentioned above. The drilling has gone into these red rocks. At surface the latter show practically no iron except the coloring of the rocks, and therefore cannot in any way be considered as iron ore. Using the dips and known area at the surface, this group, it is stated, may have a volume of 300,000,000 cu.ft. Assuming 10 cu.ft. per ton, if the red rocks pierced by the drill were solid ore, the total tonnage would not exceed 30,000,000 tons.

DICKEY'S MOUNTAIN

Dickey's Mountain is about eight miles long and is in Ayr and Thompson Townships in Fulton County. The crest is hard, white Medina sandstone, and on the west side are Clinton rocks, such as contain the red Clinton iron ore at points between Lake Ontario and Birmingham, Ala. Fragments of red sandy ore or ferruginous sandstone are found scattered locally over the western slope of this mountain; when traced they appear to come from one or possibly two layers in the Clinton formation. The largest blocks seen are stated to indicate a thickness of these layers of at least 4 ft., in places. Similar iron-bearing sandstone or sandy iron ore is common elsewhere in the Clinton formation. It is stated that a bed of this iron ore, averaging 4 ft. thick for a distance of three miles, on the west side of Dickey's Mountain, will carry about 5000 tons of ore for every foot of depth. However, just west of the outcrop is the Great Cove fault, which is a break in the rocks and runs entirely across Fulton County; the Clinton rocks cut off against this fault. With a liberal allowance of 1000 ft. in depth before the bed strikes the fault, the bed will, so it is stated, contain 5,000,000 tons of ore. The average thickness of the bed may be less or greater than 4 ft.; a similar ore in Virginia has been found 20 ft. thick. At present this ore is not generally considered of commercial use, as most of it will not carry more than from 10 to 25% metallic iron. The best of it may possibly run to 35% and a few picked specimens might run as high as 40 per cent.

LAURIE'S KNOB

Laurie's Knob, less than one mile long, is a northern extension of Dickey's Mountain, and is separated from it by the gap of Big Spring Run. The rocks, fairly well exposed at each end of the knob, are hard Medina sandstone on the crest, Lower Silurian shales and limestones on the eastern slope, and a little Clinton formation on the west slope at the south end, the balance of the west slope being composed of Devonian shale, sandstone and limestone. The old Hanover furnace worked out two large and several small pockets of brown ore on the east side. Prospect pits sunk in the bottom of the largest pocket are said to show 18 ft. of ore still in sight. The presence of one pocket suggests, it is stated, the possibility of more, but as such pockets are usually formed only at the surface, it is said that if they exist, they should have been found before this. According to Rogers and Stevenson, the ore in this pocket gave 46% iron. During 27 years the furnace is said to have smelted a total of between 30,000 and 40,000 tons of iron ore. If the entire Laurie's Knob were all iron ore, it could hardly contain over 100,000,000 tons.

The Hanover furnace also did a little work on a cellular brown ore in soft, yellow-bluish shales on the west side of Dickey's Mountain; according to Rogers, the ore ran from 14 in. to 2 ft. thick and carried 38% iron. Drilling on the west side of Laurie's Knob is said to have passed through 30 ft. of iron ore, but as the rocks are nearly vertical, these 30 ft. may represent only a foot or two of actual thickness.

It is hardly necessary to comment on the analyses of the ores when it is recalled that brown ore, when chemically pure, has less than 60% of metallic iron and the carbonate of iron, when chemically pure, has less than 49% of iron, and ordinarily runs much below that. Hematite, when pure, has practically 70% and hematite ores are frequently found running over 60% of metallic iron. The only hematite found in this region, in the Clinton formation, has only to be tested by the hand to realize the difference in weight between it and a high-grade hematite ore.

This is merely a broad general statement of the case without going into the details, which would require maps and sections, but is sufficient to show why the geologist finds it difficult to substantiate the figures given in the press dispatches.

Rescue Car Wanted on Iron Ranges

The miners in the employ of the United States Steel Corporation on the Mesabi and other ranges have followed the lead of the underground workmen in the Marquette district, and have circulated petitions, which will later be presented to their Congressmen, asking that the government provide instruction cars in the use of safety apparatus, to be operated under direction of the Bureau of Mines, at the expense of the government. Such cars are maintained in the Eastern coal districts, and it is desired to obtain at least one car for the Lake Superior iron region.

The larger iron-mining companies have lately purchased rescue outfits, including Draeger apparatus and pulmotors, their attention having been directed to such a need by the fire in the Hartford mine, of the Republic Iron & Steel Co., at Negaunee, last spring, when seven men were killed.

The Oliver Iron Mining Co. has established rescue stations on the several ranges as follows: Ishpeming for the Marquette range; Hibbing and Eveleth on the Mesabi; Ely on the Vermillion; Ironwood on the Gogebic; Iron Mountain on the eastern Menominee, and Iron River on the western Menominee. An expert visited all these stations and instructed selected crews in the use of the apparatus, but a more detailed knowledge is desired by the miners as a whole. The officials of the mining companies are favorable to the demand for a government car.

February Operations at Goldfield Consolidated

During February, the total production of the Goldfield Consolidated Mines Co. was 27,641 tons, containing $740,793, an average of $26.80 per ton. This was milled with an average extraction of $25.08 per ton or 93.57%. The total net realization was $487,261, or $17.64 per ton. Development work totaling 2869 ft. was done during the month.

The total mining, development, milling, office and general expense was $7.47 per ton, distributed as follows:

OPERATING COSTS AT GOLDFIELD CONSOLIDATED FOR FEBRUARY

Mining:		
Development	$0.96	
Stoping	2.62	
		$3.58
Transportation		0.09
Milling		2.19
Marketing		0.33
General expenses		0.48
Bullion tax		0.26
Construction		0.54
Total cost of operation		$7.47
Miscellaneous earnings		0.03
Net cost per ton		$7.44

General Superintendent Thorn states that at the Clermont the sill of the 428 stope between the 600- and 750-ft. levels was extended and produced 561 tons of average $48.57 ore. The 604 raise from the 1000 ft. level produced 472 tons of average $93 ore. At the Mohawk the 3-E sill on the 150-ft. level, near the old Sheets-Ish workings, was extended and produced 59 tons of average $17.57 ore. The 3-D sill on the same level was also extended along the south end of the Sheets-Ish old workings and produced 70 tons of average $70.27 ore. The No. 29 drift, being cut around the 3-E stope in the foot wall, encountered the extension of the 3-E ore, and produced 30 tons of average $15.30 ore. The 111-M sill was extended and produced 854 tons of average $14.67 ore. The 415-X crosscut between the 450- and 600-ft. levels produced 198 tons of average $41.13 ore. The 491 sill produced 111 tons of $23.35 ore.

At the Red Top the 353 intermediate, between the second and third levels just north of the shaft, was extended and produced 90 tons of average $41.34 ore. Work through the Red Top shaft has been discontinued, the Laguna surface plant and shaft now serving both mines. At the Combination the 292-O sill, being cut from the 295-X crosscut on the fourth level south, and west of the Hampton stope, produced 138 tons of average $20.87 ore.

United States Smelting, Refining & Mining Co.

The United States Smelting, Refining & Mining Co. operates the Mammoth copper mines and smeltery and the Needles lead and copper smeltery in California; the Gold Road mine in Arizona; the Real del Monte y Pachuca mines and cyanide plant in Mexico; the United States Mining Co., in Utah; an electrolytic lead refinery at Grasselli, Ind., and a copper smeltery and electrolytic refinery at Chrome, N. J.

The net earnings of all companies, except for depreciation allowance, for 1911, were $3,961,103; depreciation allowed was $1,120,690; leaving a net profit of $2,840,413. Of this $1,702,120 was required for the 7% preferred-stock dividends, $702,210 for 4% common-stock dividends; $339 for dividends on minor stock of subsidiaries; leaving $435,744 to be carried to surplus, which amounted to $2,230,640 as at Jan. 1, 1912.

Metals produced during the year, including custom ores and Mexican production, and the percentage of the total production value, were: Copper, 22,199,141 lb., 21.48%; lead, 49,022,791 lb., 16.81%; silver, 10,285,150 oz., 42.72%; gold, 118,703 oz., 18.99%. The metals sold for: Copper, 12.459c. per lb., lead 4.428c.; silver, 53.815c. per oz. The total production of company ores was 1,037,685 tons of ore, in which the value of the metals was in the proportion: Copper, 38%; lead, 6%; silver, 35%; and gold, 21 per cent.

Charges to capital account for 1911 were: Mine properties, $1,806,585 (including purchase of Gold Road mine); addition at Mexican and Needles plant, $499,510; additions at Chrome and Grasselli, $69,987; miscellaneous, $115,996. The excess of current assets over liabilities is shown at $7,641,512.

Shipments of lead ore from the mines at Bingham amounted to 99,500 tons; of copper ore, 176,800 tons. More ore was developed than was extracted, as was also the case in the Centennial-Eureka, where the production was 108,275 tons. Some development work was done in the Bullion Beck & Champion mines, but no large orebodies were found. Development will be continued in what seems to be promising territory. The Richmond-Eureka company was idle during the year, as the railroad was not rebuilt. It is hoped that this company will resume operations in 1912. The Niagara Mining & Smelting Co., in which the U. S. company holds the majority interest, has been reorganized, and will resume operations.

The Midvale smeltery ran steadily, the bag-house taking care of all fumes. Both the Huff electrostatic plant and the concentrator ran on larger tonnages. The Mammoth plant operated three furnaces steadily without damage to the surrounding vegetation. Experiments are in progress on the utilization of the bag-house products, but although progress has been made, a satisfactory solution has not been found. The ore tonnage developed is almost equal to that extracted, and the indications for future orebodies are favorable. The Mammoth company holds the Original Quartz Hill mine under lease, which furnished the smeltery with 29,412 tons of siliceous low-grade ore, as flux.

The Gold Road mine in the Kingman district, Ariz., and a 40-stamp mill, were taken over in July, 1911, and efforts directed toward opening up the mine in depth and on the strike, and to lowering costs.

CONSOLIDATED BALANCE SHEET, U. S. S. R. & M. CO., at Dec. 31, 1911

Assets	
Costs of properties	$44,066,883
Shares held for exchange for stocks of other companies	2,287
Deferred charges	504,218
Metals on hand and in process	3,203,288
Ore, matte and byproducts	1,116,295
Supplies, fuel and timber	1,225,454
Accounts and notes receivable	1,490,117
Cash and call loans	2,787,955
	$54,396,497

Liabilities	
Common stock	$17,553,788
Preferred stock	24,313,725
Minority subsidiary stocks	1,032,899
Surplus applicable to same	174,199
Outstanding 5% notes	4,000,000
Current liabilities	2,181,597
Depreciation funds	2,829,352
Exploration fund	80,297
Profit and loss balance	2,230,640
	$54,396,497

The Grasselli refinery operated at a marked reduction in cost, and about the same output. The Chrome refinery worked on increased tonnage, with lower costs.

The Needles plant was run intermittently, as there was not the hoped-for increase in mining activity in the tributary country, and the company mines, which yielded the bulk of the ore, could not keep the concentrator and smeltery busy. The Tennessee mine is down to the 700-ft. level, with encouraging results. The zinc extraction from this ore is satisfactory.

At the Pachuca plant, power service was again good, and large tonnages of milling ore were opened up. The capacity of the mills was raised from 600 to 1200 tons per day.

Offices of the exploration department were opened in Seattle and the City of Mexico. In 1911, there were 921 properties considered. Of these only 141 were good enough to warrant field examination, 28 were subjected to a complete sampling and examination, and one was taken over.

Heated Areas in Culebra Cut

A peculiar phenomenon was observed recently in the Culebra cut on the line of the Panama Canal. Steam was seen coming from a bank of blasted ground, in which considerable heat had developed. Under date of Feb. 12, 1912, states *The Canal Record*, the division engineer of the central division reported as follows:

> A little less than three weeks ago I noticed that the material, which consisted of stratified, sedimentary rock, in which there appeared some lignite of low grade, was sending up in the early morning a thick cloud of white steam. I examined the spot a day or two afterward and found that for a width of about 20 ft., length of about 100 ft. and a depth of about 15 ft., the entire mass of material appeared to be heated to a considerable temperature. Steam was escaping from numerous small openings and from four principal vents, or openings; the smallest of the four being about 3 in. in diameter and the largest about 1 ft. The temperature was so high that the hand could not be held at the mouth of the larger openings for more than a second or two, and when withdrawn was quite moist, showing quite unmistakably the presence of steam or heated vapor. The sides of two of the vents were encrusted both with white and yellow powdered material, the yellow appearing to be sulphur.
>
> I have observed this place almost daily for over two weeks, and within the last four or five days there has been a change in two important characteristics. The temperature has increased and a pale blue smoke, instead of steam, is now emerging from the vents. The odor of sulphuric acid, which was marked when only steam was emerging, is fully as marked today. To give an idea of the temperature of the larger vent I took a 9-in. brown manila envelope and held it at the mouth of the largest vent for three seconds; it was totally destroyed although it did not ignite in flame. I then took a piece of the white pine covering of a dynamite box and held it for three minutes within the mouth of the largest vent and on withdrawing it, it was completely charred, so that another three or four minutes' exposure would probably have carbonized it completely.
>
> We have had premature explosions in the past on at least two occasions due to chemical heating of the rock, and I am convinced that the material which I have described was hot enough to have readily fired dynamite at any time within the last three weeks.

The commission geologist, D. F. MacDonald, made an investigation and stated that the marl shales, through which Culebra Cut extends, are dark, thin bedded, soft and easily crumbled, and some of the layers are largely fine tuff, or volcanic ash, loosely cemented by lime. Other beds contain more carbonaceous material, with some local partings of lignite, an inch to a foot or more thick. A large sample of the shale was crushed and panned, a concentrate of pyrite in very fine grains being obtained. This indicates that the oxidation of the finely disseminated pyrite is the cause of the phenomenon, and that it may develop enough heat to cause further rise of temperature by the oxidation of the carbonaceous matter in the shale.

The Situation in Mexico

Special Correspondence

The revival of mining throughout Mexico, which hesitatingly began in the autumn of 1911, after Madero's accession to the presidency, had gained full headway at the time of the beginning of the present disturbances, about February 1. There were, it is true, serious labor difficulties in many of the camps, but the operating mining companies were meeting these conditions by compromise and adjustment, and generally were preparing to carry on an increasing program of operation. The silver mines particularly were encouraged by the advance in silver and were planning to take advantage of it by larger output. Then "like a thunder clap out of a clear sky," as one mine manager expressed it, came the disturbances in the north and the increased activities of the rebels in the south. Along with this came a distrust and lack of confidence in the government among the Mexicans themselves that was not easy to explain. The Americans too became "frantic" in their state of mind, if this word may be used, with the prospect of more revolutionary conditions. They recalled too many individual cases of personal danger and humiliation to be philosophical under the prospect of a repetition of their experiences during the Madero revolt. The exodus of Americans and their families from Mexico began in February and has continued increasingly since. The uncertainty that preceded the troubles was soon followed by the closure of the railroad at Torreon and the quick crumpling of the regular government authority in all of the state of Chihuahua, and the spread of the "rebel" control over practically all of the northwestern states. Sporadic manifestations against the government on the Pacific coast, at Tampico and elsewhere were also frequent and the authority of the constitutional government was flaunted in nearly all of the region south of Mexico City.

These political and psychological conditions have had their direct effect upon the mining industry of the country. Since February the Americans and their families (the families in particular) have been fleeing from the country by the thousands. Many of them are remaining on the border in hopes of returning at an early date, while others are cutting loose and seeking other connections for their activities. In many cases the responsible managers feel it is necessary to remain at the properties as a matter of duty, and generally they are doing so, utilizing such native labor and skill as are available to continue operations in a limited way.

The hopes of the silver-mining camps to realize the advantage of the increase in silver have been largely frustrated, and the whole industry is in a state of uncertainty which will surely tell in the dollars and cents account of the annual reports.

In the Chihuahua country most of the mines have been cut off from direct communication nearly eight weeks, and in the absence of any definite data, it is impossible to tell just how much damage has been done to the industry.

In general there is no concern over the validity of titles, but most of the companies in the north have suffered considerable loss by way of "contributions" to the rebel army, and it is hard to tell whether any of these losses will be repaid.

Even if the actual financial losses are reimbursed ultimately, the loss in disorganization and cessation of continuous activity will be a matter of many million dollars to the mining industry of Mexico.

And what of the future? *Quien sabe!*

Report on the Landslide at Frank, Alberta

On April 29, 1903, a landslide occurred at Frank, Alberta, causing the loss of 70 lives in the town and the destruction of much property including 7000 ft. of the Crows Nest Ry. The slide occured on the north side of Turtle Mountain which is due south of the town. As it appeared quite possible for further sliding to take place, which might not only destroy the town, but shut off the coal mines west of Frank and perhaps permanently close the Crows Nest pass, a commission was appointed by the Department of Mines, of Canada, to make an investigation. The report[1] of the commission, which consisted of Reginald A. Daly, W. G. Miller and George S. Rice, has recently been published and recommends the abandonment of the Frank townsite.

The geological profile of Turtle Mountain shows that the foot on the northern side is made up of beds of sandstone interbedded in shale. The beds dip towards the west at a high angle. These beds are bounded on the north by a thrust plane dipping westward at an angle of about 50° and which is the plane of contact of the shale-sandstone beds with the limestone that forms the major portion of the upper part of the mountain. The limestone dips to the west at an angle of about 50° and lies unconformably on the shale. A short distance above the thrust plane the limestone beds are contorted in what are known as the contorted zones. The limestone is jointed, the joints running at right angles to the dip and continuing to the thrust plane.

Two coal mines are operated along the foot or east base of Turtle Mountain. The seam is nearly vertical and is in the shale series. Both mines are the property of the Canadian Coal Consolidated, Ltd., and formerly belonged to the Canadian-American Coal & Coke Co. The strike of the seam is north and nearly parallel to the long axis of Turtle Mountain. Mining was started in 1901 and prior to April 29, 1903, the walls of part of the worked out portion of the southern end of the seam had caved. The joints in the limestone appear from the profiles prepared by the commission, to dip directly towards, but not to continue as far as, the main coal seam. The slide seems to have taken place in a direction approximately parallel to these joints.

The commission regards the slide as having been caused by natural conditions and by the mining operations in the coal seam. Excepting at the places known as the North Peak block and South Peak block and the fissured ground between them the commission is not of the opinion that the danger of more heavy slides into the Frank valley is imminent, but states that it is impossible to deny the existence of danger in certain places. The course of future slides would probably be in the already mined and now uninhabited area covered by the 1903 slide. It has designated a certain area of the coal seam as lying within a zone of danger from further landslides and on account of the unstable condition from natural causes, has recommended the abandonment of the townsite of Frank whether the coal seam is worked in the danger zone or not.

Dispatches from Frank on Mar. 30 state that serious slides are taking place. Much alarm is being felt in the town and many people are reported to be moving out of the danger zone.

High Tension Cables Underground

To mines dependent on high-tension transmission lines for power, there seems hope of escape from interruption by storms, in the announcement that two underground cables for a pressure of 60,000 volts have been laid on the German railway between Muldenstein and Bitterfeld. As such high pressures have hitherto been exclusively used in connection with overhead lines, it is considered (*Engineer*, Feb. 16, 1912) that the present experiments will be of particular interest. One of the cables has aluminum for the conductor, while the other is a copper cable. The cables are laid in conduits filled with dry sand.

---

[1] Memoir No. 27, Canada Department of Mines.

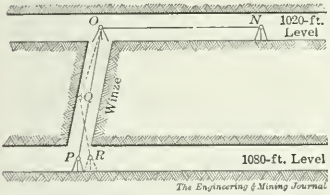
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Back Sighting in a Winze Survey

Many of the difficulties encountered in underground surveying are of an unexpected nature, and owe their origin to awkward workings or other conditions that have to be overcome by the ingenuity of the surveyor. For example, in surveying for a proposed raise between the 1020- and 1080-ft. levels in a large tin mine with an instrument known as the Henderson rapid traverser, a difficulty presented itself which was overcome in the manner to be described.

The start was made from two pegs placed in the "back" of the 1020-ft. level, and near the place where it was desired that the raise should hole through. The survey was then carried on by the aid of two stands to a point some 480 or 540 ft. west of the starting point on the top of a narrow winze.



The Light *O* Can Be Seen from *Q* and *R*, But Not from *P*

The difficulty which arose can best be appreciated by reference to the accompanying sketch. After placing the instrument on the stand set up over the winze at the point marked *O* and taking a back sight to the stand at *N*, this back stand was brought on and set up in the 1080-ft. level on the point marked *P*. It was then found, however, that while the direction *O* to *P* could be recorded on the disk of the traverser, it was impossible in consequence of the narrow winze, to make a back shot from *P* to *O*. As a matter of fact, while the candle on the stand at *P* could be quite easily seen from the instrument at *O*, it was quite impossible to see the candle at *O* when the instrument was fixed on the stand at *P*.

In consequence of this unforeseen difficulty the surveyor came to the conclusion that it was necessary to do the survey over again, but this course was strongly objected to by the underground manager, on account of the prolonged hindrance to the trammers that would be caused by this extended survey. It will easily be seen that had there been three stands in use instead of two there would have been no serious difficulty inasmuch as the head of the instrument could have been again fixed on the stand at *O* and the back sight taken to *N*. Under the conditions existing, therefore, it was decided, after some little consideration, to proceed in the following manner: The head of the instrument was brought up from *P* and fixed to the stand at *O* and, the alidade still remaining clamped, a sight was taken to *P*. This brought the alidade and the disk of the instrument into exactly the same position as they had after the original foresight to *P* had been taken. The alidade was then unclamped and its fiducial edge was brought into line with the line *N* to *O* which was already marked on the disk. It will be apparent that in this way the alidade was brought back into the position it had occupied before taking the shot down the winze to *P*. As shown above the line or course adopted to reach *P* proved a failure and it therefore became necessary to adopt a new route down the winze as shown by the dotted lines *OQ* and *QR*. With this alteration the survey was finished, and the subsequent successful carrying out of the raise showed that even with this complication in the survey, it was performed with the necessary degree of accuracy. In this particular case the advantage of the rapid traverser over the ordinary theodolite or dial is marked.

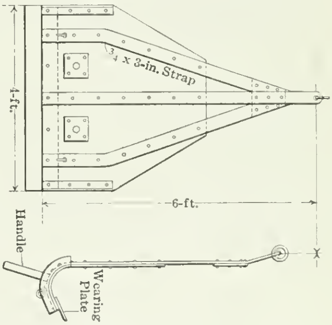
Facts About Explosives

According to a bulletin[1] of the U. S. Bureau of Mines, "high" explosives are those that usually act by detonation; "low" explosives, those that act more slowly. Detonation is practically instantaneous combustion. Compared to detonating explosives, "low" explosives take an appreciable period of time to develop maximum pressure.

Dynamites consisting of kieselguhr, chalk or other inert substances impregnated with a large proportion of nitroglycerin have been almost entirely replaced with an active base consisting usually of sodium or potassium nitrate, wood pulp, sawdust or charcoal, practically a low-grade gunpowder. About 1% of calcium carbonate is added to neutralize any acid that may be developed during storage. The nitroglycerin fires the gunpowder mixture which serves to still further expand the gases produced by the detonation of the nitroglycerin.

Scraper for Cleaning Stopes

The stopes of the Calumet & Hecla mine dip at about 38°. The empty stopes are not filled and after the stoping is finished, a considerable quantity of ore is left clinging to the floor, especially if the floor is at all rough as is the case in the amygdaloid mines, where the ore often makes off along the foot wall. In the conglomerate stopes less trouble is experienced from rough foot walls; most of the ore that piles up in the stopes is held by the rolls of the foot wall.



A Lake Superior Stope-floor Scraper

This ore, when there is not much to be handled, is worked down to the level by hand, it being shoveled and scraped along. When much ore has accumulated on the floor, it pays to use the scraper, the construction of which is shown in the accompanying drawing. A sprag is set in the top of the stope, and a small air hoist is installed at the bottom. The rope that goes from the hoist to the rear end of the scraper passes through a pulley carried by the sprag, while another rope from the hoist goes directly to the front ring of the scraper, so that the air hoist, besides pulling the scraper with its load of ore in front of it to the bottom of the stope, also pulls it back again. The scraper works well when the foot wall is not too rough and practically no hand shoveling of the ore is necessary, but if the ore lies in pot holes in the foot wall, it must be shoveled out to a smoother part of the foot wall, where the scraper can get at it. This scraper was designed by Mine Captain Samuel Richards, of the Calumet & Hecla company, and has now been in use for several years, both in the amygdaloid and in the conglomerate stopes.

---

[1] Bull. 15, U. S. Bureau of Mines.

The main plate of the scraper is $\frac{5}{16}$ in. thick, and is strengthened by means of three 3x¾-in. iron straps that come together near the front, so as to distribute the load to the haulage strap. A ring is provided for fastening the rope from the hoist to the front end, while at the rear is a chain that is fastened to two eyebolts that go through the two outside straps. To this the return rope is fastened. There are also riveted to the rear of the scraper two plates carrying two handles. By means of these handles the men are able to steer the scraper, and by pulling up or shoving down on them regulate the quantity of ore that the scraper takes on its trip down the stope. In case the scraper has a tendency to ride over the ore, owing to the compact way in which it lies on the foot, car wheels can be hung on these handles, and the scraper made heavy enough to dig into the pile of ore.

Maintenance of Generators and Motors*

By A. Kelly

Commutation is probably the weakest point of a direct-current machine. Bad commutation is brought about in a variety of ways, but the remedies are often simple. Imperfect commutation is often brought about through brushes being too wide, a very weak field in the case of a motor, eccentricity of the commutator, flats on commutator, dirt or oil, and high mica.

Two motors, one of 30 and the other of 60 hp., on their trial run, sparked so badly at the brushes that it was found impossible to keep them running. The trouble was in the brushes. This was remedied by reducing the cross-section of the brushes by cutting away a piece ⅛ in. thick the full width of the brush, and making up with a packing piece, in order to insure the brushes still fitting the holders.

High mica is often one of the most difficult faults to detect, and in this connection I will mention my experience with three 7-hp. motors, which were connected to pump gear. The motors were installed in a comparatively dust-free place and were comfortably loaded. Excessive brush consumption was the principal annoyance. When cold, a close examination of the commutators revealed nothing out of the ordinary, but after careful examination of the mica between the segments, before and after extended runs, it was found that the mica had been forced up, presumably through the varnish with which it was cemented together expanding when heated. The mica was cut out about [illegible] in. below the face of the segments, and the result was perfect commutation with a set of brushes lasting six months instead of a week. This trouble often occurs in very large commutators, in which "built-up" mica is used. It is easily cut down by a knife, file or small carborundum wheel on a flexible shaft, such as is used by dentists.

The hardness of brushes affects commutation, frequently making a big difference in the maintenance cost of a machine. Brushes which were operating on the rings of a turbo set, with a peripheral speed of 7000 ft. per min., required replacing after 32 hours' run. Harder brushes were used, with the result that 4000 hours' run did not terminate the useful life of the brushes.

Bearing on the question of the wrong grade of brush for any particular machine, some engineers are in the habit of varying this order of things by mixing indiscriminately a great variety of grades, makes and sizes, sometimes with good, but generally with bad results, due to brushes of low resistance taking excessive current, glowing and softening the brush springs. A ready method of increasing the resistance of a brush is by cutting a slot, with a hack saw, parallel to the commutator bars, and midway in the face of the brush, to a depth which will just reach the brush holder from the face of the commutator.

The way in which brushes are ground in is worthy of attention, for badly ground brushes will set up sparking on the best machines. Grinding in can be expeditiously carried out by lapping completely round the commutator and over itself again to the extent of two brush arms, a strip of emery cloth. The machine may then be barred or otherwise turned the few revolutions generally required for the grinding in. On large commutators it is customary to use a cloth wide enough to overhang the commutator sufficiently to allow a No. 18 copper wire to be passed several times around this overhang and then be fastened to one of the commutator bolts, in order to prevent slipping of the cloth.

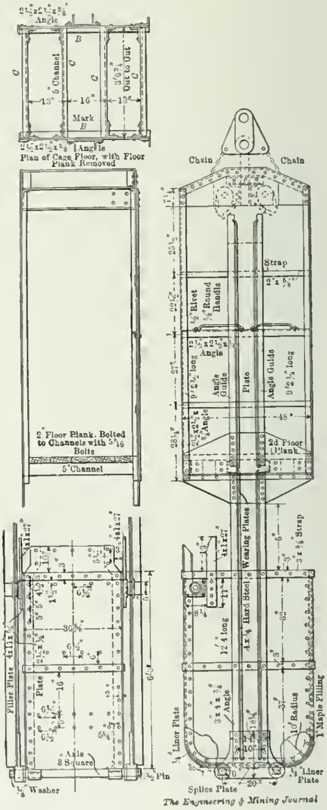
It sometimes happens that an armature coil will short-circuit and burn out in a machine, and, although machines are usually laid up on this account, it is not always necessary. In many instances the coil may be cut through, the ends well and carefully taped apart, and the coil segments bridged over. A temporary repair of this kind will run for weeks. Great care must be taken when next running the machine, after cutting the coil, to see that the machine does not overheat; otherwise further faults and extensive damage might be the result.

One of the most important points about the upkeep of electric equipment is cleanliness, and it is generally the least attended to. Of course, there are certain situations where it is impossible to keep clean the type of machine installed. For instance, it is not unusual to see open-type machines in use in dusty places instead of totally inclosed motors, the former often being unrecognizable under the deposits of dirt and dust.

Hiawatha Mine Cage

By H. L. Botsford*

In the accompanying illustrations are shown a type of cage and safety catch much used in the Lake Superior iron districts. The principle of operation of the safety catch is the same as that of a Lake Superior Copper-country safety catch described in these columns, P. 636 issue of March 30, 1912, although the arrangement of the springs is different.



Hiawatha Cage with Skip Attached

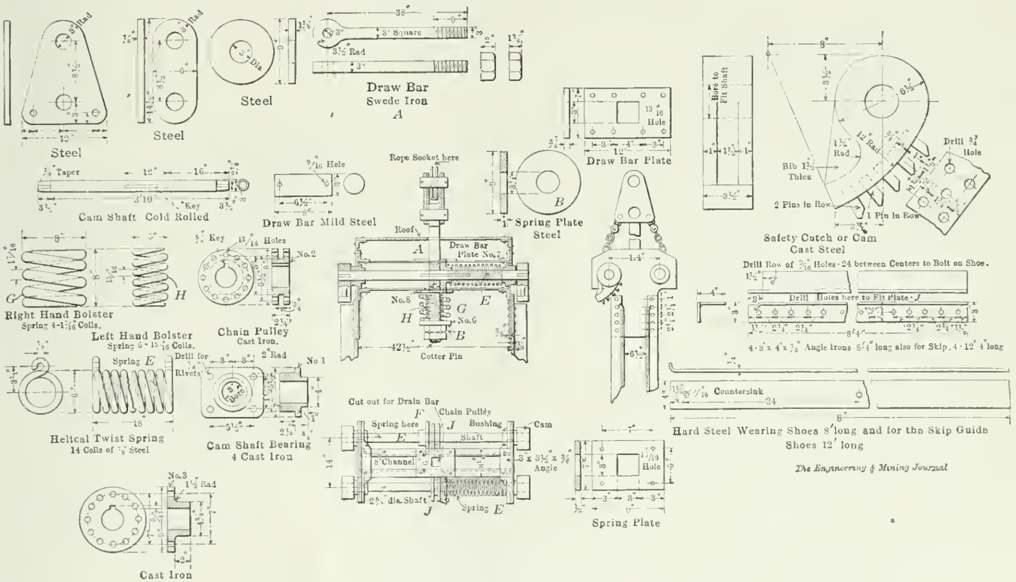
The draw bar *A* is free to slide through the crosshead or supporting frame, until the cage is carried by the plate and jamb nuts *B*. Chain connections between the draw bar and the cam shafts, cause the latter to rotate when the draw bar is raised. The springs *E* are of the helical type and are placed concentrically around the cam shafts, one to each shaft. The springs are fastened to the side of the cage and to collars *F* keyed to the shafts. Any rotation of the shafts produces a torsional stress in the springs. Should the hoisting rope break the cam shafts are turned into such a position that the cams are brought into contact with the guides and cut into them sufficiently to stop any downward motion.

---

*Abstract from a paper read before the Victorian Institute of Electrical Engineers.

*Mining engineer, Creighton Mine, Ont.

This cage is also provided with two bolster springs *G* and *H*, one within the other and both concentric around the draw bar. Their purpose is to lessen the strains in the hoisting cable due to a too sudden starting or stopping of the cage, and also to draw down the drawbar in case of the failure of the hoisting rope, thus permitting the full force of the cam-shaft springs *E* to be expended in forcing the cams into contact with the guides. There are several holes in the chain pulleys *J*, and the spring collars *F* for the fastening of the chains *K* and the springs *E*. This permits of careful adjustment to secure the proper tension in the springs *E*. The cage is substantially a type made by the Lake Shore Engine Works of Marquette, Mich., and is shown with a Kimberley skip attached below it, for hoisting ore.



SAFETY CATCH USED ON THE HIAWATHA MINE CAGE

Zinc dust for use in the precipitation of gold from cyanide solutions should be fine enough at least to pass a 200-mesh screen.

Rate of Burning of Fuse

After a thorough investigation of the rate of burning of fuse, W. O. Snelling and W. C. Cope of the U. S. Bureau of Mines have published[1] the following practical conclusions:

It is important that time fuse should have a uniform rate of burning, and in almost all blasting operations the fuse that is used is assumed to burn in a regular and uniform manner. When fuse has been subjected to such conditions as produce acceleration or retardation in its rate of burning it becomes dangerous. Acceleration of the rate of burning increases the liability of a shot going off before the miner has left the face; retardation increases the chance of the flame in the fuse progressing so slowly that the miner will be injured by a delayed shot when he returns to the working face. All conditions that bring about any marked change in the rate of burning of fuse are dangerous, and from a study of the list of accidents in mines and quarries each year injury and loss of life are seemingly often brought about by such conditions.

Under ordinary conditions nearly all types of fuse show great uniformity in their rate of burning. Practically all types of fuse examined in connection with the preparation of this report had a total variation in their rate of burning under normal conditions of less than 20% and all would have been passed under the allowance of "no variation greater than 10% above or 10% below the average rate of burning."

Under the influence of pressure practically all types of fuse are subject to wide variation in their rate of burning. Such pressure as can readily be produced by the confinement of the gases evolved by the burning fuse itself is sufficient to increase the normal rate of burning from 92½ sec. per m. (28.2 sec. per ft.) to 21 sec. per m. (6.4 sec. per ft.). Thus, even confinement will cause fuse to burn from three to four times as rapidly as its normal rate. In experiments made with fuse confined by stemming of various kinds wide variations in the rate of burning were noted, and whenever lengths of fuse are confined by stemming or other materials impervious to gas, a sufficient length of the fuse should be used to allow for the increased rate of burning due to the pressure produced by the evolved gases.

High temperature causes a marked retardation in the rate of burning of fuse, and storage for even a short period of time near boilers, or wherever the temperature may be high, is sufficient either to cause "misfires," or to retard the rate of burning of the fuse so much as to greatly increase the liability to "hold-backs," delayed shots, etc. It is probable that many of the difficulties that are sometimes encountered in regard to fuse burning too slowly and causing delayed shots are due, in part at least, to such fuse having been kept in too warm a place. Fuse that is not intended for use in wet places (cotton fuse, etc.), does not suffer marked change in its normal rate of burning by reason of the effect of high temperatures, whereas the more completely waterproofed types of fuse show increasingly great effects from heat. Even exposure to comparatively low temperatures for considerable lengths of time causes marked retardation in the rate of burning of such fuse, and exposure to a fairly high temperature for even a short length of time may cause certain types of fuse to burn from three to five times as slowly as their usual rate. To insure the best results, fuse should always be protected from extremes of temperature.

---

[1] Technical Paper 6, Bureau of Mines.

Climate conditions affect to a considerable extent the rate of burning of the less waterproof types of fuse. Damp fuse burns more slowly than normal fuse, and fuse that has been wet and then thoroughly dried tends to burn at a rather slow rate, and may even cause delayed shots by smoldering for a considerable time. Fuse containing several wrappings of tape saturated with tar or asphalt resists moisture to a considerable extent, and may be used for firing shots under water, provided the fuse is not allowed to remain too long a time in contact with water before the shot is fired.

It is, of course, evident that when these waterproof types of fuse do become wet, whether through storage for a long time in a damp place or through exposure to water after protecting layers of asphalt or gutta-percha are mechanically abraded or injured in any other way, they are more difficult to dry out than are other types of fuse, and are more liable to burn at a rate slower than the normal rate.

Fuse that has been subjected to actual mechanical injury, particularly to hammering or pounding or the blows of falling rock, etc., has a greatly increased rate of burning, and sometimes burns so rapidly as to be almost instantaneous in its action. The mere bending, coiling, and twisting of fuse, such as would be brought about by forcibly placing within a bore hole a length of fuse considerably greater than the depth of the bore hole, does not produce any marked change in the rate of burning, but pounding or direct abrasion of fuse greatly increases that rate. Fuse that has been injured by severe abrasion or by too great pressure from any cause should not be used in any work where adjustment of the rate of burning is desired.

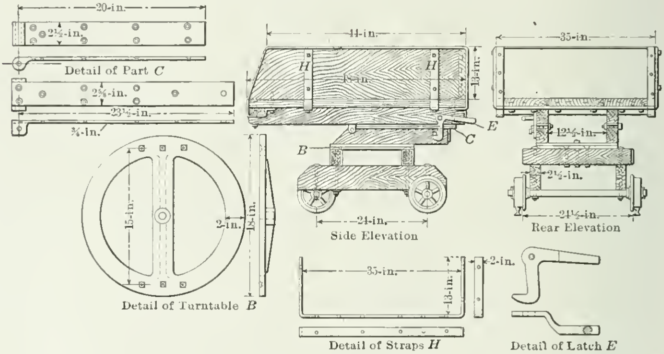
As a final summary it may be stated that ordinary fuse may under some conditions burn as fast as 3 sec. per m. (1 sec. per ft.), and under other conditions it may burn as slowly as 745 sec. per m. (227 sec. per ft). The former rate is more than 200 times as fast as the latter, and each is widely removed from the normal rate of burning of similar brands of fuse. Hence, the condition and past history of any roll of fuse is an important matter, and in mining and blasting operations the safety of the miner demands that only fuse that has been carefully stored and kept from unfavorable conditions shall be used.

A Joplin Car for Boulders

By Claude T. Rice

In the mines of the zinc and lead district of southwestern Missouri the ore is hoisted in buckets, then dumped on grizzlies spaced 4½ to 6 in. apart, and the barren portion of the oversize is sorted out and taken to the dump. The headframes used are of the derrick type in which the hoist is placed at a height of 50 ft. or more from the ground. Therefore, it is not desirable to use a large car for tramming boulders as it would require a more expensive trestle on which to run the boulders away from the derrick to the boulder pile. Moreover, because the life of most of the mines is short, a cheap construction is desirable. For those reasons the boulder car used universally throughout the Joplin district is the one shown in the accompanying drawing.

As will be seen, this is an end dump car having a turntable deck carried on a wooden truck. The wooden box of the car, which is open at the front end, is hinged to the turntable. The edges of the side boards are bound with strap iron and are reinforced by the bands *H*, passing under the body of the car and up the sides. The box is prevented from dumping by a simple hook on one side of the box. The car, as loaded in the district, holds about 1000 lb. of boulders.



Car for Tramming Boulders, as Made at Joplin

In cutting a plat in an inclined shaft, if the ground is good, the first holes may be drilled while the machine is rigged for shaft-sinking; with weak ground, however, it is safer to leave the plat-cutting until after the shaft has been sunk a few feet below the proposed level. In this way, the brow of the plat can be secured and the cutting-out performed with little danger to the shaft.

Anchoring New Bolts in Old Foundation

It is sometimes necessary to change an old foundation to accommodate a new arrangement of equipment, such as the compounding of low- and high-pressure steam cylinders, to increase the power of the engine. Whenever it is necessary to set an anchor bolt in an old foundation, the difficulty may be met in one of two ways, says R. B. Dale in *Power*. In the first method a hole is drilled in the concrete slightly larger in diameter than the bolt to be used and to the proper depth. A bolt is then prepared by cutting a slot in one end lengthwise of the bolt and about six or eight inches long. This slot is then fitted with a wedge of hardened steel held in place by a pin of soft copper or other soft metal. The bolt is lowered into the hole and struck several hard blows on the upper end with a heavy hammer. This shears the soft metal pin and drives the wedge into the slot, thus enlarging the diameter on the bolt at the lower end. The bolt is then grouted into the hole and the nut is tightened to complete the work.

In the second method a hole is drilled for the bolt as before. A second hole is then drilled laterally through the side of the masonry to meet the first hole and this is enlarged sufficiently to take the standard anchor plate. The work is completed in the customary manner, precautions being taken to grout the anchor plate to a firm bearing in the old concrete. The first method is cheap and simple, although there is no certainty as to what happens in the bottom of the hole. It also has the disadvantages of the grouted bolt previously noted. The second method, while it is more troublesome and expensive, is the more reliable and should be used in preference. It is similar to the method of anchoring the mortar bolts of a stamp battery in wooden stamp blocks are used in Australia and certain districts in this country.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Calculator for the Cyanide Plant

Several articles have from time to time been published in the JOURNAL describing report forms and similar devices to aid in the control of operations at cyanide plants, but no mention has been made of the adjustable table shown in the accompanying illustration. This table has been used at the Homestake plant in South Dakota, and has been found to be of great convenience when conducting experiments involving variations in the strength of cyanide carried by the ongoing solutions.

CALCULATING TABLE FOR BRINGING CYANIDE SOLUTIONS UP TO STRENGTH

Depth of Effluent Solution in Sump in Feet[1]	Desired Working Strength[2]	STRENGTH OF EFFLUENT SOLUTION IN SUMP TO WHICH CYANIDE IS TO BE ADDED UNTIL THE DESIRED WORKING STRENGTH IS OBTAINED								
(Cut with knife along dotted lines; then insert "sliding strip" shown below the table.)										
		POUNDS OF CYANIDE TO BE ADDED TO SOLUTION IN SUMP								
1		3	6	9	12	15	18	21	24	27
2		6	12	18	24	30	36	42	48	54
3		9	18	27	36	45	54	63	72	81
4		12	24	30	48	60	72	84	96	108
5		15	30	45	60	75	90	105	120	135

[1] Figures in this table are calculated for a sump holding 30 tons per foot depth.
[2] By strength is meant the percentage of free KCN in the solutions.

Sliding Strip

PERCENTAGE OF KCN IN SOLUTIONS										
0.120	0.115	0.110	0.105	0.100	0.095	0.090	0.085	0.080	0.075	0.075

The illustration is almost self explanatory. A simple table having been calculated, a single vertical column, equal in width to those following it, is ruled at the left of the columns containing the indicated weights of cyanide. The headings of the latter columns are entered on a detached strip of paper which is inserted in guides cut in the main sheet. By shifting this strip to left or right the headings of the various columns are shifted while the positions of the headings, relative to one another, are not changed. Provided that the columns are prepared for uniform variation of effluent strength, the column at the left may be headed "Working Strength Desired" and the table becomes adustable for any working strength within the range selected.

Crushing Frozen Concentrate

By N. L. STEWART*

I was called upon recently to investigate the merits of various kinds of crushing machinery for frozen ore and concentrate. The material to be crushed was frozen fine material containing hard lumps.

The most promising machine seemed to be a squirrel-cage type of disintegrator. However, there was some doubt as to whether it would stand the hard blows at high-speed and it was feared that the frozen material might build up on the runners. Therefore, a wagonload of frozen concentrate was put through as a test.

The test was made at the plant of the Salt Lake Pressed Brick Co., near Salt Lake City, Utah. The machine used was a 44-in. Stedman's disintegrator driven by a 75-hp., alternating-current, General Electric Co., form K motor. The motor was belted to a countershaft, from which, besides the disintegrator, a short belt-conveyor was driven. The machine runners were driven at about 400 to 500 r.p.m. No clutch was used, the motor being capable of starting the machine without such a device.

The machine handled the material easily and the product was as fine as the original material before freezing. When the machine was opened at the end of the test, the runners and casing were found to be clean and free from any accumulation of frozen ore. Meter readings, taken while the equipment was running empty, indicated about 26 hp., and while crushing about 44 hp. As the belt conveyor could not have taken more than 3 hp. in either case, the machine required about 23 and 41 hp. under the two conditions.

*Care East Butte Copper Mining Co., Butte, Mont.

Fuel Used in an Oil Engine

By EARL C. CLEAVELAND*

At the Deadwood mine and mill in the Mogollon district, New Mexico, a 125-hp. De La Vergne, type F. H. oil engine has been in continuous operation for 12 months. It is operated at an altitude of 7000 ft. A Prony brake test made when the engine first arrived showed a development of 125 hp. and an oil consumption of 0.48 lb. per brake-horse-power-hour.

At this place 110 hp. is used for 12 hr. and 50 hp. for the rest of the day making 1920 hp.-hr. per day. This requires, taken from a year's run, 860 lb. of fuel oil, or 0.45 lb. per hp.-hr. Fuel oil from Kansas fields is used which costs at the railroad $1.72 per bbl. of 42 gal., and at the mine, 90 miles from the railroad, $5.46 per bbl., 13c. per gal. or 1.7c. per lb. This figures out at a cost of 0.778c. per hp.-hr. or $68.14 per hp. per year, 24-hr. service for 365 days.

---

*Mining engineer, Mogollon, N. M.

The gravity of the oil is 27° Beaumé and its heating value is 19,000 B.t.u. The power cost has been reduced to less than a quarter of what it was with steam, figuring wood at $8 per cord. One engineer on each shift looks after the entire power plant.

Erecting a Steel Stack

The following method of erecting a steel boiler-stack was described by F. W. Fischer in *Power*. The stack was 127 ft. high including the masonry base, 66 in. diameter and was built to supply draft to two 300-hp. water-tube boilers. It could not be hoisted into place without being cut into sections because the boiler house was completed and hemmed in on three sides by buildings and on the other side by telephone and telegraph wires, and three lines of railroad.

The stack was shipped in three 30-ft. and one 15-ft. breeching section. The breeching was placed over the boilers; this was a comparatively easy matter. The first section was then cut into 5-ft. lengths which were set up one at a time by block, tackle and a gin pole, without much trouble. The limit of the gin pole was then reached and other means had to be provided.

It was decided to cut the other two 30-ft. sections into 5-ft. lengths and then cut those in half to enable the work to be carried on around the pole and tackle.

Starting inside the breeching, a scaffold was built; a length of 2x4-in. timber was placed vertically in the center of the stack and crosspieces of the same dimensions were cut to make a snug fit against the side of the stack. These were then spiked to the vertical timbers, making a strong scaffold. Cleats were then nailed to the vertical timber to aid the workmen in going up and down the stack.

A 12-ft. section of 2½-in. pipe was then bolted to the upper section of the stack by means of 3½-in. bolts, three rivets having been left out for the purpose. An eyebolt was placed at the upper end of the pipe, to which was fastened the block and tackle.

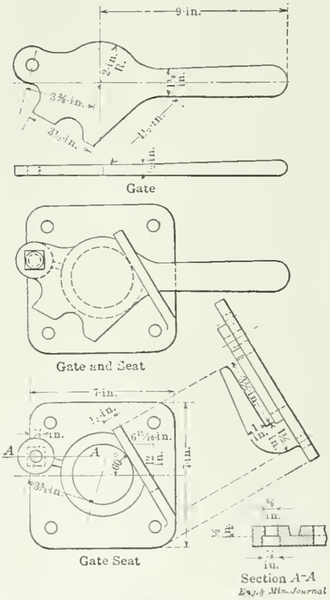
A half section of the stack was then hoisted and bolted temporarily in place until the next section was hoisted, then the two were riveted together. The pole was then raised to the section just erected and the same operation repeated, the scaffold, of course, being added to as the sections went up.

The riveter's stage was made of 1½-in. angle iron and 1x6-in. oak boards, the top of the stage being supplied with a grooved wheel which enabled the riveter to swing around the stack.

One would think, says Mr. Fischer, that this was a slow method of erecting a stack, but the whole operation took only seven working days, including the riveting, and half the time the men were nearly suffocated by the smoke coming from the other stacks at the same plant.

Tailing Gate for Jigs

In the Joplin district, jigs are fed an unclassified undersize from trommels, and a large portion of the slime goes off with the tail product from the last cell, although there is a large recovery of the finer sizes in the hutch product from the jigs. To free the tailings from this finer, richer portion, a settling compartment is provided at the tail end of the jig. This compartment is equipped with a baffle board to stop the rush of water. In some cases a hydraulic attachment of crude design is added, consisting of a 5-in. tee in which the sorting water comes in at the bottom while the underflow runs off through the branch. But whether a simple settling box or one fitted with a hydraulic attachment is used, these compartments are fitted with a gate of the general type shown in the accompanying drawing.



Eng. & Min. Journal

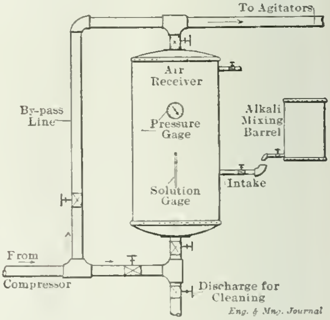
Tailing Gate Used on Joplin Jigs

The gate consists of a cast-iron plate that is bolted to the wooden frame of the jig. In it is a hole 3 in. in diameter, while projecting from its side is a brace to support the gate proper which is fastened to the seat casting by a bolt. The gate piece is cast with a handle to permit of easy adjustment, while in the bottom face is a small semicircular recess. This permits the opening to be contracted as much as desired, and it is possible, in case of stoppage, while using a small discharge opening, to start the flow again by simply opening the gate valve to its full extent. It is by the size of the draw-off opening that the grade of the overflow is regulated, and it is on that account that the valve must permit close adjustment, while, because of the fact that the bulk of the mill feed goes through it, it must be cheap and easily replaceable. The gate herein described seems to fill these requirements.

Purifying Air for Agitating Pulp

At a number of cyanide plants in the United States, the compressed air that is to be used for aërating the sand or slime, or in agitating the pulp, is purified by filtration before use. Several types of filters are used; at the Homestake plants the air is passed through a filter-press made up of several cells similar in all respects to the cells of the Merrill presses used in the treatment of slime. At the Alaska-Treadwell concentrate-cyanide plant, the apparatus described by W. P. Lass[1] and shown in the accompanying illustration, is used.

Cylinder oil or the products of its combustion or decomposition, which are introduced into the air in the cylinders of the compressors, are the impurities that should be removed as completely as possible before the air is used for agitating. The Homestake presses do this effectively by the filter cloths retaining the oil and other solid impurities contained in the air.



Eng. & Mng. Journal

Alaska-Treadwell Air Purifier

The apparatus herein illustrated has a further advantage in that carbonic acid is also removed by caustic soda or milk of lime. The removal of this acid is accompanied by a decrease in the consumption of cyanide, for it is a well-known fact that carbonic acid decomposes potassium and sodium cyanides, and even in the presence of an abundance of protective alkali some decomposition by this acid may take place.

---

[1] Bull. A. I. M. E., February, 1912

Construction of Argentine Tram

By C. A. Tupper*

The lack of reliable maps necessitated a preliminary topographical survey. The proposed route was indicated on continuous photographs of the country between the terminals, Chilecito and Upulungos. The structural-iron work was made and assembled in Germany, then knocked down and shipped. The construction work occupied 11 months, about 1200 men being employed.

The construction of the aerial tramway, now operated by the government of the Argentine Republic from Chilecito, in the province of Rioja, to the Famatina group of mines, 21½ miles distant, with an elevation of 11,570 ft. above the plain, was attended by features of unusual interest.

No Reliable Maps Available

There were no reliable maps of the region, which is studded with precipitous slopes and lofty peaks; it was therefore necessary to complete a thorough topographical survey before the route to be followed by the aerial line could be even approximately determined. This was accordingly undertaken by an engineering commission appointed by the Argentine government especially for the purpose. Then the route apparently most suitable was roughly sketched out.

In general it followed, at the beginning, the bed of a mountain stream, and ran for almost exactly half the distance, or over 10 miles, in a practically straight line. Beyond this point it was necessary to make four turns, only the last of which, however, was at anything like a sharp angle. The plan and profile are shown in the accompanying engraving.

Subsequently, cameras were set up at frequent intervals along the proposed route in such a manner as to secure, when the resulting photographs were placed end to end, a continuous bird's-eye view of the country at close range, with every physical feature clearly outlined. Then the line was drawn in on the photographic prints, as shown on greatly reduced scale in the accompanying halftones, one roll of which was sent to the engineers of the tramway designers and constructors, Adolf Bleichert & Co., Leipzig-Gohlis, Germany, another filed with the proper department of the government at Buenos Aires and a third retained for use in the field. The prints also showed the places suitable for stations, of which 10 were found to be desirable, inclusive of the two terminals.

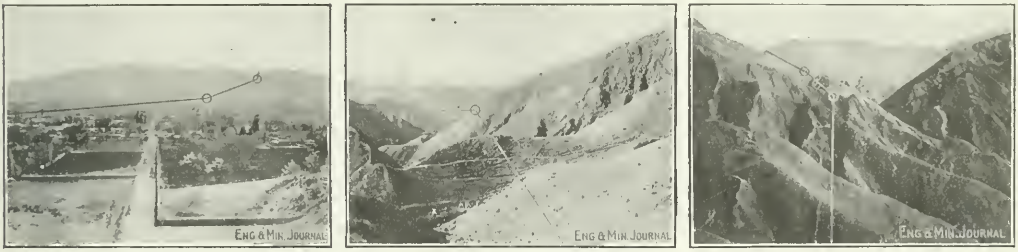
Following the preliminary survey, the government engineers made a general determination of altitudes and distances, employing for this purpose the instrument, used largely by European engineers, known as the "tachometer," literally "rapid measurer," a name which has also been appropriated by manufacturers of revolution indicators for high-speed machinery. This has on its telescope a level, a vertical arc or circle and stadia wires. It is adapted to the rapid determination of points in a survey, since with it the three coordinates of a point in space can be measured, viz: The angular coordinates of azimuth and altitude and the radius vector or distance.

For the actual construction work, this method was not considered sufficiently accurate; careful detailed measurements of altitudes, contours and air-line distances were accordingly made for the entire route, this work being carried out by a supervising engineer in the employ of the tramway builders, with the aid of government engineers. For aerial line construction accurate measurements are just as essential as in railroad surveys, or, in fact, more so; for discrepancies in ground contours, elevations, etc., and the consequent furnishing, for erection, of supports that are too high or too low are apt to cause serious difficulties in operation. In such a case, for example, when the line is heavily loaded, the carrying or track cable may tear itself loose from the shoe holding it down. Therefore the ground contours for the Chilecito tramway and all other measurements were accurately secured, the curves of the track cables plotted for safe working tension and the heights of the supports decided upon. In actual construction the cables were stretched to a somewhat lower tension, to reduce the lifting strains. Not content with the precautions above enumerated, the engineers of Bleichert & Co. made a final confirmatory survey, which began with the laying of the foundations for the lower terminal station and first supporting towers and preceded, from point to point, the placing of all foundations.

Cart and Mule Road Made first

Before any labor on the tramway itself was begun, a start was made towards opening up communication through the mountains from Chilecito to the proposed upper terminal, at Upulungos, by the cutting of a road traversable with carts for a part of the distance and by mules for the remainder. This followed as nearly as possible a course coinciding with that to be taken by the tramway, although subject to innumerable windings; side paths were cut to various construction points. In all there was over 30 miles of the main path and about 38 miles of side paths, much of which had to be built under the most difficult conditions.

As soon as the road-making was sufficiently advanced to permit work on the tramway itself, operations for this purpose were inaugurated. A great deal of cutting was necessary along mountain slopes to avoid deviation of the line and numerous levels were required for the foundations of the stations and towers. As much of the mountain-slope formation consisted of granite and quartz, considerable blasting was necessary. At the seventh station out from



The Proposed Route of the Argentine Tram Was Sketched on Continuous Photographs, As Shown

---

*Consulting engineer, 389 Thirty-first Ave., Milwaukee, Wis.

Chilecito it took 70 drillings and the simultaneous firing of as many dynamite charges to clear the space needed. In another part of the route a tunnel 492 ft. long had to be bored through one of the peaks to reduce the grade and overcome other construction difficulties at that point.

While the work proceeded provision had to be made for construction camps and everything pertaining to them, as well as for mechanical facilities with which to carry on the erection of the tramway without interruption. A large storage and assembling plant was constructed at Chilecito from which all supplies, structural iron, cables, tools, provisions, etc., were regularly forwarded as required.

When the line got beyond the point where carts could be used, all transportation had to be undertaken with mules and donkeys, of which nearly 900, including requisitions from the government artillery service, were in use at the last. The structural material was sent from Germany in sections small enough to be carried in this manner. The cables could not safely be divided into lengths of less than 200 to 300 m. (665-982 ft.) and some of the pieces exceeded 2 tons in weight; hence it was necessary to unroll them and have the cable carried on the shoulders of native porters, from about 60 to several hundred of whom were required, according to the extent of the burden and the grade and difficulties of the ascent.

In pushing forward an aerial line there are not, of course, the advantages of railway building, where the construction train advances rod by rod as the track is laid. As soon as cables have been stretched from one station to another, however, and the necessary sheaves installed, that section can be put in operation for the bringing up of material. Cables for the Chilecito tramway were transported over finished stretches, being hung in coils from carriages one behind another in close proximity, as shown in the accompanying halftone.

Screw Bolts Used Instead of Rivets

All of the structural shapes and columns were fabricated in Germany, the stations, towers, etc., being put together complete with screw bolts, each part carefully marked to indicate its position and then knocked down for shipment. For the most part the erection was also with screw bolts, little riveting being done.

The intermediate stations were at points where the division of the line could be made to the best advantage, with due allowance for stresses in the traction cables. These stations are all of low, simple construction, not more than 16 to 20 ft. above their foundations. The use of scaffolding could therefore be almost entirely dispensed with; an important consideration in a district where timber is scarce and expensive to procure.

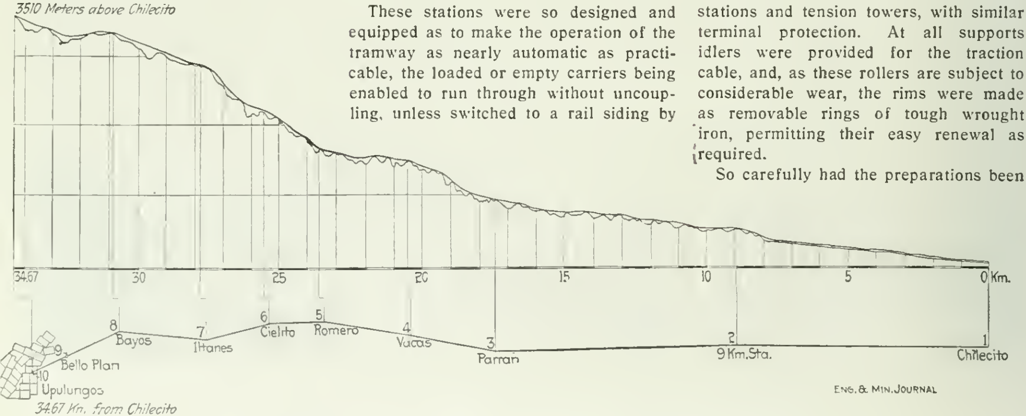
These stations were so designed and equipped as to make the operation of the tramway as nearly automatic as practicable, the loaded or empty carriers being enabled to run through without uncoupling, unless switched to a rail siding by the attendant. Through each station the traction cable was replaced by overhead rails. At the points of entry and departure these were made to terminate in special "shoes" or saddles so arranged that the transition of the carriages to and from the cables would be without jar. These shoes were provided with hinged steel hoods that cover the cable on both sides of the saddle and protect it from excessive wear.

Between stations special towers were erected wherever it was necessary to apply tension to the carrying cables which constitute the carriage track, such cables being rigidly anchored or counterweighted, according to conditions. Where the cables were parted at these towers the ends were joined by rail tracks, with connections similar to those at the stations, allowing the carriages with their suspended loads to pass through smoothly without interruption. All cable sections were joined with what is known as the Bleichert patent coupling. The tension apparatus installed included structural box frames with weights of concrete suspended over sheaves and rollers by flat-wire cables of tough steel.

The smaller line supports, up to 32 ft. in height, were bolted and riveted on the ground, then raised and secured to the masonry and concrete foundations. Higher supports, however, up to towers 135 ft. high, including the tension and anchoring structures above mentioned, were erected and riveted by stages, each section forming the base for the one above, until near the top, when the remaining sections were put together at ground level, raised and bolted to the substructure, as indicated in the accompanying illustration.

In one place along the route, where it was desired to clear a mountain peak at a vertical angle without increasing the elevation of the line, the track cables were overhung by rails carried on a series of bents and arranged like those at the stations and tension towers, with similar terminal protection. At all supports idlers were provided for the traction cable, and, as these rollers are subject to considerable wear, the rims were made as removable rings of tough wrought iron, permitting their easy renewal as required.

So carefully had the preparations been made that the various structures and pieces of operating mechanism all went together without any changes, beyond such minor details as the occasional redrilling of a hole. There were no parts missing and no accidents, except such mishaps as were due to blasting and other unavoidable occurrences of the kind known in contracts and insurance policies as "the acts of God." Among the last named were, of course, rain and snow storms and floods, including a cloudburst which carried material many miles down the mountain slopes; but, even in this case, it was nearly all recovered without material damage, the deficiency being supplied from the spares in store at Chilecito. So far as possible, all parts had been made interchangeable, thus greatly facilitating replacements and reducing the stock to be carried. Each section of a supporting tower, for ex-

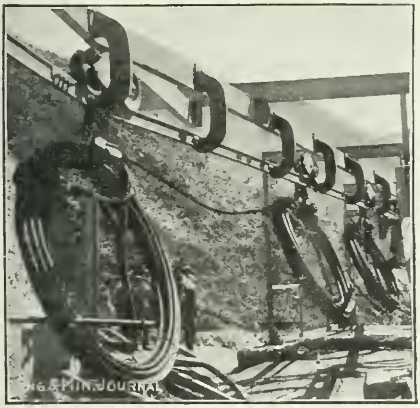


Plan and Profile of the Country Traversed by the Argentine Tram ample, was identical with that of any structure for the same purpose in the part having the same base area, regardless of the total height.

Built in Eleven Months

Seven months after the construction of the tramway itself was started, more than two-thirds of the line was in operation, and four months later it had been completed. During that period the working force reached at times nearly 1200 men. On the lower end a 10- or 12-hr. shift was employed daily, except as saints' or feast days interfered; but, as the line climbed the mountains, it was necessary to curtail the working day. In the upper reaches the temperature was only endurable for labor between about 8 a.m. and 4 p.m. With the going down of the sun in that region a cold, cutting wind ordinarily sets in, rendering it dangerous to remain outside of shelter.

Another fact to be taken into consideration was the rarity of the atmosphere at the high altitudes and its effect upon the vitality of the laborers; so that the progress made towards the end was remarkable under the circumstances. At the camps the best of provision for food, sanitation and sleeping quarters was made. In the lower region tents sufficed; but for the upper stone huts had to be built to secure the necessary shelter and warmth. The laborers were a motley crew of natives, including Indians, also Spanish, Portuguese and Italian immigrants. The Italians, particularly those from Piedmont, made the most efficient workmen. Skilled mechanics and structural workers had to be brought from Europe, with their foremen and a staff of superintendents and engineers.



Bringing Up Cable Over Finished Section.

Raising Top Section of Tower

The Miami Copper Co. has declared its first dividend of 50c. per share. This dividend is for the quarter ended Mar. 31, 1912, and is payable May 15, to stockholders of record on May 1, 1912.

Superficial Examination of Ore Deposits

In speaking of the superficial appearance of ore deposits, George J. Bancroft (*Proc.* Colo. Sci. Soc., vol. 10, p. 39) says that the examination of a prospect calls for more skill in all directions than the examination of a developed mine, as the engineer is often called upon to decide the future development, when there is nothing in sight but a 10-ft. hole with ore in the bottom.

When the immediate surroundings of an outcrop give no indication of its identity, it will often be found instructive to walk around a prospect at a radius of a mile or so. The walls of the cañons or gulches will often give a clue to the structure. A bold outcrop is often a remnant of an overlying stratum, and the local dip of the formation can sometimes be picked up at its base. Or the outcrop may be an intrusion, or a false scarp, but in any event it is worth knowing about. Of course neighboring mines, if they exist, should be visited and studied, if the owners will permit.

The most perplexing prospects are those which occur in a flat or gently rolling country. This class embraces a good many commercial mines. Where acid waters are prevalent, the rocks are softened, and the hills take on a soft rolling contour, while nearby mountains, which contain no ore deposits, may be sharp and rugged. In such cases it will often be found useful to climb a neighboring hill, and look down on, or over at, the hill of the prospect. At first no structural indications may be apparent, but it pays to go slowly in these cases. As the shadows change the structural details may appear. Sometimes a certain tree or bush will have a fondness for a certain formation, and a half hour spent in studying the verdure will often reveal more of the hidden rock structure, than days of digging would do. Thus a vein or porous stratum is apt to be a waterway, and its outcrop is often marked by water-loving shrubs, bushes, or by green grass. A slight shading in the soil may also become distinct under changing light or cloud shadows.

Deep-rooted trees are killed by acid waters, hence a hill barren of trees, or containing many stunted trees, in a forested country, should be an object of interest to a mining man. The outline of large sulphide deposits can sometimes be traced by the boundary of injured timber. As a rule orebodies do not make coarse pieces of float, so study the finer particles of the soil. A common gold pan will be found useful in doing this; while the local prospector will probably run down any clues to free gold, he will pay but little attention to the black sand, which should be carefully attended to. Having ascertained the dip of a fissure vein one should imagine how a plane surface having that dip would cut the contour of the particular locality. Many a prospector has lost valuable property by failing to realize the rudiments of conic sections. If a vein dips into a hill, and the outcrop crosses a gulch, the outcrop will extend up that gulch in a V shape, the angularity depending on the dip.

A simple plan is to take a book or a piece of board, and hold it parallel in dip and strike with the vein, and sight across it to the hill or gulch where the continuation is sought. In contact bodies between eruptive and noneruptive rock, it not infrequently happens that all the ore will make on the contact between the eruptive and a certain stratum of the surrounding rock. A close study of the local conditions should be made, as it will probably save much exploration work.

An impregnation deposit in a crystalline rock looks, as a rule, like a narrow vein with a reddish or brown discoloration of the rock on both sides. As most veins are accompanied by bands of discolored rock, there seems to be no way to be sure except to assay the discolored country rock alongside an orebody. Although the valuable portion of a vein is generally confined within its walls, nevertheless it is the duty of the examining engineer to keep his eyes open for impregnation deposits.

It usually requires but little work to prove that a deposit is not a vein or a contact, then of course, it is either a pocket, or a pipe, or a chimney. Unfortunately the true pipes, or chimneys are rare, while isolated pockets are many. There is no certain way to prove whether the prospect is one or the other, except to sink on it, but sometimes one can find sinter, or oynx, or other evidence of geyser action. Where such evidences are found it is fairly safe to sink in case the ore is of value.

Solution and Its Importance

By Harry C. Jones*

Solution incomparably the most important manifestation of matter; nine varieties of solution are considered. Optical activity, surface tension, capillarity and osmotic pressure some of the interesting functions of solutions.

We have frequently spoken of the term solution as used in the modern or broad sense. We had become accustomed to think of solution as chiefly, if not exclusively, the solution of a solid in water. This is a limited use of the term.

NINE KINDS OF SOLUTION

We know matter in three states of aggregation, and matter in every state dissolves in matter in the same and in every other state of aggregation. There are, therefore, nine kinds of solutions and we have well defined examples of them all. They are:

(1) Gas in gas; (2) liquid in gas; (3) solid in gas; (4) gas in liquid; (5) liquid in liquid; (6) solid in liquid; (7) gas in solid; (8) liquid in solid, (9) solid in solid.

A mixture of any two gases that do not act chemically upon one another is an example of the first type of solution. Such mixtures are as typical solutions as mixtures of liquids and liquids or solids and liquids; in terms of the definition of solution universally accepted, as a "homogeneous mixture, the constituents of which can not be separated mechanically."

An example of the second type of solution is water or any other liquid throwing vapor into the gas above it. It may be objected that this is not a solution of a liquid in a gas, since the liquid appears to pass first into vapor and this then dissolves in the gas. To offset this objection it is only necessary to remember that when cane sugar dissolves in water the cane sugar in the aqueous solution could scarcely be regarded as being in the solid state. Similarly, when a solid like iodine throws vapor into the superincumbent gas, we have a solution of a solid in a gas.

When we turn to solutions in liquids as solvents the number of examples is almost limitless. Practically all gases dissolve in all liquids, and when the gas does not act chemically upon the liquid we have a true solution of the former in the latter.

Examples of (5) and (6) are too well known even to mention. There are also abundant examples of solutions of gases in solids. Charcoal has long been known to take up large quantities of carbon dioxide; and many liquids are also taken up by solids. Case (9) or solutions of solids in solids, is especially interesting, not simply on account of the large number of examples known, but on account of their important properties. These will be discussed at some length in the proper place. If the meaning of this section is clearly grasped, the broad sense of the term solution will be understood.

SOLUBILITY

We have all degrees of solubility represented in these various different types of solutions. All gases dissolve in all other gases, upon which they do not act chemically, to an unlimited extent—we have unlimited solubility. Liquids and solids dissolve in gases to only a limited extent. When we come to solutions in liquids as the solvents we have all degrees of solubility represented. Some liquids are scarcely miscible at all with others, while other pairs of liquids mix in all proportions; and we have all intermediate degrees of solubility. There is one case in connection with liquid solutions that is very interesting, and that is where the liquids, at ordinary temperatures, mix to only a limited extent—where there is only limited solubility.

SOLUBILITY INFLUENCED BY TEMPERATURE

This case is interesting because of the change that it undergoes with change in temperature, and because of a misunderstanding of a simple matter, to which it has led. Given two liquids that at ordinary temperatures mix, or dissolve one another to only a limited extent. If such a pair of liquids is placed in a glass tube, sealed up and shaken, we will have two solutions—that of A in B and that of B in A. These two solutions will be separated by a well defined meniscus, and we will have in the tube two well defined systems.

Now place the tube in a furnace and raise the temperature. There is always a temperature where the meniscus between these two systems will disappear—where the two systems will become one. When this is the case this class of liquids which dissolved one another to only a limited extent, passes over into the class where there is unlimited solubility. Limited solubility among liquids is then but a special case of unlimited solubility—its being a function of temperature only.

This raises the question as to whether there is not a temperature at which liquids, which at ordinary temperatures mix in all proportions, would dissolve one another to only a limited extent? Theoretically, there is a temperature at which every pair of such liquids would dissolve one another to only a limited extent—where this class of liquids would pass over into the class with limited solubility. Whether this temperature can be realized experimentally for any pair of liquids, depends upon whether it lies above or below the freezing points of the liquids in question.

An interesting misinterpretation has sometimes been given to such systems of liquids which mix to only a limited extent. For example, it has been said that salicylic acid melts under boiling water, and yet dry salicylic acid does not melt until a temperature of 156° C. is reached.

This is a remarkable contradiction in statements, especially when we consider what a melting point is. It is simply the temperature of equilibrium between the liquid and solid phases of a substance. This definition, it will be noted, does not raise any question as to what the nature of the medium is which surrounds the substance; and yet it is stated that the nature of the medium—air in one case and water in the other—changes the melting-point of this substance more than fifty degrees.

This statement, of course, ignores the most elementary physical principles, and is absurd. The oily liquid which appears under the hot water when more salicylic acid is added to the water than will dissolve in it, is not molten salicylic acid at all, but is a solution of water in salicylic acid; the supernatant liquid being a solution of salicylic acid in water. The system salicylic acid and water fulfills the condition, near the boiling-point of water, of two liquids which, at that temperature, mix to only a limited extent—the salicylic acid solution of water being a liquid at that temperature.

VAPOR TENSION OF SOLUTIONS

It has already been stated that the vapor tension of a solution is, in general, less than that of the pure solvent. This is true when the dissolved substance does not have much vapor tension of its own. Ether dissolved in water gives a solution whose vapor tension is greater than that of pure water. When the dissolved substance boils about 130° higher than the solvent, then it always lowers the vapor tension of the solvent in which it is dissolved. This is, of course, the same thing as to say that the dissolved substance raises the boiling point of the solvent.

---

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

There is one case of the vapor tension of mixtures of liquids that is especially interesting, because its misunderstanding has led to a serious error. If we mix two liquids like ordinary alcohol and water, and raise the temperature of the mixture, the vapor tension will increase with the temperature. If we plot the curve whose ordinates are vapor tensions and whose abscissas are percentages of alcohol, we would find that for almost any temperature the curve was approximately a straight line. This means that if such a mixture were boiled, more of the alcohol would come over first and more of the water later as the temperature is raised.

This principle is utilized in the fractional separation of water and alcohol by boiling the mixture in a fractionating still. More of the alcohol comes over at first, and more of the water remains behind. By repeating this process a number of times it is possible to obtain fairly pure alcohol from its aqueous solution.

CONSTANT BOILING MIXTURES

If, on the other hand, the vapor-tension curve of a mixture of two solids instead of approaching a straight line has a well-defined maximum in it, then a very different result is obtained when such a mixture is boiled. The maximum in the vapor-tension curve for a certain definite mixture of the two liquids, means that this mixture will boil lower than any other mixture of these two liquids—maximum vapor tension being of course synonymous with minimum boiling point.

If we start with any mixture of these two liquids and boil the mixture, that constituent will come over first, which by so doing will leave behind the mixture with the maximum vapor tension. When this mixture with a maximum vapor tension is reached, it will come over and will have a constant composition, if the mixture is boiled under a constant superincumbent pressure.

Such mixtures have frequently been looked upon as definite chemical compounds, simply because they had, under given conditions of superincumbent pressure a definite composition. This is all an error. Constant composition is a necessary, but far from a sufficient condition to have chemical union, as we shall now see.

Take any mixture of hydrochloric acid and water and boil the mixture. Water or hydrochloric acid will predominate in the first part of the distillate, depending on the composition of the original mixture. That constituent will come over at first in the larger quantity which, by so doing will leave the residue of the composition $HCl.8H_2O$.

When this composition is reached the system $HCl.8H_2O$ will distil over, and of approximately constant composition. This was regarded for a long time as a definite compound of hydrochloric acid and water—a definite hydrate, and it was so stated in the text and reference books on chemistry.

It was, however, shown that if the superincumbent pressure was changed, the composition of the mixture that came over was likewise changed. If the pressure was lowered the mixture contained more hydrochloric acid than corresponded to the composition named above; yet for any definite superincumbent pressure, there always came over a mixture of perfectly definite composition.

The fact, however, that you change the composition of the mixture through comparatively wide ranges, simply by changing the pressure under which the boiling took place, showed that these mixtures of constant composition were *not* chemical compounds. They are simply those mixtures of the two liquids in question that have a greater vapor tension, under the conditions, than any other mixtures, and, therefore, a lower boiling point. There are comparatively large numbers of such systems with a maximum in the vapor-tension curve, and the error of supposing that there were chemical compounds was, consequently, wide-spread.

The vapor-tension curve of the mixture of two liquids may, instead of having a maximum, have a minimum. That mixture which has the minimum vapor tension would, of course, have the highest boiling point.

If any mixture of the pair of liquids with a minimum in the vapor tension curve were boiled, that constituent would predominate in the first part of the distillate whose absence from the original mixture was in part necessary to give that mixture with the lowest vapor tension or highest boiling point.

When such a mixture is boiled the residue that remains behind in the flask will tend more and more to the composition having the minimum vapor tension, and by repeating the distillation several times, it is possible to obtain a residue with approximately constant composition.

If, however, the pressure under which such a mixture is boiled, is changed, the composition of the residue will change. This shows that such residues are no more chemical compounds than the distillates of constant composition which came over when the vapor tension curve contained a maximum point.

EQUILIBRIUM OF VAPOR TENSION

One other point before leaving the subject of the vapor tensions of liquids and solutions. We are accustomed to say that at any given temperature, a liquid or solution has a definite vapor pressure. Just what does this mean? How does a liquid produce a vapor pressure above it. Obviously, by throwing molecules of itself into the superincumbent space. The liquid continues to do this until the vapor above the liquid acquires a certain concentration—until a certain vapor pressure is reached. Then what happens? Does the liquid then cease to throw off vapor? Certainly not. If the liquid ever throws off vapor at a given temperature it will always continue to do so. Then how is a certain definite vapor pressure reached at a given temperature? Why does not a liquid produce above itself an infinite vapor pressure? in a word, how is equilibrium established?

The liquid throws off molecules of vapor and always continues to do so. The vapor, on the other hand, is always condensing, reforming the liquid. The more concentrated the vapor—the greater the pressure of the vapor—the more rapidly is it condensing to the other liquid form.

When equilibrium is reached, i. e. when the vapor has acquired its normal pressure at the temperature in question, it means simply that the vapor is condensing just as rapidly as it is being formed. The equilibrium here, as in the case of a typical chemical reaction discussed in the first chapter, is not statical as was supposed for a long time, but is dynamical. The two opposite processes, here the passage of the liquid into the vapor state and the condensation of the vapor back again into liquid, have acquired equal velocities.

This is in keeping with the way in which today we look upon equilibrium in general. Hitherto it was regarded as a statical condition, but now it is known to be dynamical; and the difference is one not merely of words, but is fundamental to our real understanding of both physical and chemical processes, as a moment's thought will show.

We shall probably see other examples illustrating the dynamical nature of equilibrium.

OPTICAL ACTIVITY

It is well known that certain pure liquids, and solutions of certain solids have the property of rotating or twisting a beam of polarised light. In polarised light the vibrations in the ether are all in the same plane. These substances turn the plane of polarisation, as can readily be seen and measured by means of the polariscope. Such substances are termed optically active.

This property at first sight might seem to be no more important than any other property of liquids or solutions. Such is, however, far from being the case.

The first to throw any really scientific light on the meaning of this property was another of the greatest men of science who has ever lived—Pasteur. Racemic acid, which is an organic acid isomeric with ordinary tartaric acid, forms a beautiful crystalline double salt with sodium and ammonium. The sodium-ammonium racemate forms two kinds of crystals. On one of these kinds we have what are called right-handed planes, and on the other the left-handed planes. By means of these planes the crystals can be separated into two classes, the so-called right-handed crystals and the so-called left-handed crystals.

When the right-handed crystals were dissolved in water their solution rotated the plane of polarisation to the right, and the solution of the left-handed crystals rotated the plane of polarisation to the left. These crystals were obviously unsymmetrical, since some contained only right-handed and others only left-handed faces. Pasteur recognized this and pointed it out clearly.

He then obtained the acid from the right-handed crystals of the salt, and found that it was identical with the dextro-tartaric acid, and the acid from the left-handed crystals was laevo-racemic acid, rotating the plane of polarisation just as much to the left as dextro-tartaric acid rotated it to the right.

He then separated from ordinary racemic acid, which is optically neutral, two optically active constituents; but he went further than this. He brought these two optically active constituents together and reformed optically neutral racemic acid.

Asymmetry in Crystalline Structure Necessary for Optical Activity

From his work as a whole, Pasteur was able to see not only that asymmetry in crystalline structure was necessary for optical activity, but that to explain the phenomenon we must go much more deeply into the matter. Light is a vibration of the ether. If matter affects light it must do it by means of something which affects the ether and, consequently, vibrations in the ether. The smallest constituents of matter that were known in the time of Pasteur were the atoms. These were united and formed the molecules. Pasteur, with that insight and foresight which are characteristic of a great genius, saw that in order to explain optical activity, the molecule itself must be asymmetric. A symmetrical molecule could not twist a beam of polarized light, since what one side of a symmetrical molecule would do, the other side would just undo, and *vice versa*.

Said Pasteur "there must be an asymmetric grouping of the atoms in the molecule" in order that a substance should be optically active. He went a little farther than this and pointed out that the asymmetry in question "must be that of an object and its image in a mirror," but he was not able to give any conception of the geometrical configuration of the molecule.

Origin of Stereochemistry

When we reflect on what our conception of a molecule is, its size and other properties, it seems next to impossible to solve the problem of the geometry of even the simplest molecule; and yet this has been done, and done in such a way as to leave no reasonable doubt of the result. To bring this out, was the special object of taking up the property of optical activity in the present connection.

It has been the history of chemistry that whenever any fundamental problem was to be solved, resort had to be had to physical methods. There is not a single exception to this statement. Here we are dealing with the shape of molecules—a fundamental problem of chemistry, and we must resort to "optical activity," or the action of substances on light to solve it.

Further, when any fundamental problem comes up for solution, there are only a few men at any one time who are capable of coping with it. At this time Van't Hoff was only about 22 years old, and his first great contribution to science was the solution of the problem now under discussion.

The question then is, what is the cause of certain substances rotating the plane of polarized light? Pasteur showed that it was due to some kind of asymmetry. The question is what kind? And this involves the question of geometrical shapes of the molecules themselves.

Take the simplest compound of carbon and hydrogen, methane, which contains one atom of carbon and four atoms of hydrogen—CH_4. It had been shown that the four hydrogen atoms all bear exactly the same relation to the carbon atom in this molecule. This was done by purely chemical methods. One hydrogen atom was replaced by chlorine and the properties of the monochlormethane (CH_3Cl) thus formed, were studied. This chlorine was replaced by hydroxyl, another hydrogen replaced by chlorine, and the hydroxyl then replaced by hydrogen. This insured the production of a monochlormethane in which the replaced hydrogen atom was not the same as in the first compound, but the properties of this compound, when studied, were found identical with those of the first. In the same general way all four of the hydrogen atoms of methane were removed and replaced, one at a time, by chlorine, and the four monochlormethanes thus formed were all found to have identical properties, i. e., to be the same substance; showing that all four of the hydrogen atoms in methane bear exactly the same relation to the molecule.

Geometry of Methane

Given this fact, Van't Hoff saw clearly that the geometry of methane follows, of mathematical necessity. Given a central point, what is the necesary geometrical configuration of four things arranged symmetrically about it in three dimensions in space? Necessarily the regular tetrahedron. The shape of the molecule of methane is, then, the regular tetrahedron; and this was the first time (1874) that the geometrical configuration in space of any molecule had ever been worked out.

How does this solve the problem of optical activity?

If the carbon atom is combined with four atoms or groups of the same kind, then we have the arrangement of the regular tetrahedron. If, however, the carbon atom is combined with four different atoms or groups, then we have asymmetry; the center of gravity of such a system not being at the geometrical center of the tetrahedron. If this is the explanation of optical activity, then only those compounds could be optically active which contain a so called asymmetric carbon atom, i. e. a carbon atom in combination with four different atoms or groups. This was a crucial test, being a necessary consequence of the theory. When Landolt's comprehensive book "Optische Drehungsvermögen" was published in the last edition, there were about seven hundred optically active compounds of carbon known, and there was not a single discordant substance among them. Every one of them contained a carbon atom in combination with four different atoms or groups. Thus the theory was beautifully substantiated by the facts.

While discussing this work of Van't Hoff on the tetrahedral carbon atom, so called, in connection with the subject of optical activity, something should be said in reference to its bearing upon chemistry in general, and especially upon the chemistry of carbon.

Importance of Stereochemistry

This suggestion of Van't Hoff is connection with carbon compounds, was the beginning of chemistry in three dimensions, of stereochemistry as it is called. It is difficult to over estimate the influence of this suggestion, especially upon organic chemistry. So great, indeed, has this become that practically all of the best organic chemistry for the last 30 years has centered around it. The tetrahedral carbon atom "has been the philosophy or guiding thought in carbon chemistry for the last quarter of a century, almost to the exclusion of every other generalization."

And stereochemistry has by no means been limited to carbon and its compounds. We have already made a beginning in the stereochemistry of oxygen, nitrogen, sulphur, cobalt, and several other elements. The chemistry of the near future will largely be the chemistry in three dimensional space, and this was all opened up by a Dutch boy of twenty-two.

SURFACE TENSION

When a bit of mercury is thrown upon a smooth wooden surface, it does not spread out and cover the entire surface in the form of a layer of infinitesimal thickness, but collects in the form of droplets, which, except on their under surfaces, are approximately spherical. The question is why is this?

It is due to the presence of a force which exists at the surfaces of liquids, which acts so as to give the liquid the least free surface—so as to draw the liquid into that geometrical form which has the largest mass for the given surface, or the smallest surface for any given mass. Hence, the spherical form of the mercury in the case cited above. This force which exists at the surfaces of liquids is known as surface tension.

A large number of methods, and several good ones, have been devised for measuring the magnitude of this force. The best known is the capillary tube method. The liquid is allowed to rise in a glass capillary tube, and the height to which it rises determined. We must also know the diameter of the tube, the specific gravity of the liquid and the gravitational constant in order to calculate the surface tension. These values are all easily determinable, so that it is quite possible to measure surface tension with reasonable accuracy by this method.

The question is why is the surface tension of liquids even referred to in the present connection?

When we were discussing the laws of gases as applied to the osmotic pressure of solutions, it was pointed out that while we have a very plausible theory as to the cause of gas pressure, we do not know even today, what is the cause of osmatic pressure.

A large number of suggestions have been put forward to account for osmotic phenomena and none of these seem, on their face, to be plausible. Take this one. Given a semi-permeable membrance below which is pure water and above it a solution of cane sugar. The water molecules strike the membrane from below and pass through, the water molecules from above are, in part, prevented from striking the membrane, due to the increasing influence of the sugar molecules dissolved in the water. More water molecules strike the membrane from below than from above, consequently more water passes into the solution than passes out in a given time; and we have what we term osmotic pressure.

This plausible suggestion on careful analysis will be seen to explain nothing. The membrane is transparent to water. Therefore, with respect to water it is just as if it were not present. The sugar molecules above the membrane will, therefore, throw down through the membrane just as many molecules of water as it will screen off from striking the membrane from above. This explanation could, therefore, never account for a thousandth of a millimeter of osmotic pressure.

SURFACE TENSION AND OSMOTIC PRESSURE

And the same fate has befallen about every other explanation of osmotic pressure that has thus far been prepared. We are, however, today pretty certain of this—that osmotic pressure is fundamentally connected with surface tension, which manifests itself in the fine capillaries of the semi-permeable menbrane, and whenever the phenomenon of osmosis is really explained, we shall have to take into account capillarity and its cause—surface tension. This is one of the reasons for discussing surface tension in the present connection. Surface tension can, however, be discussed among the physical properties of liquids in general, without any apology, on account of its own inherent importance. We are coming more and more to realize that it plays a prominent part in living matter. It appears in many relations to be fundamentally connected with life, and what these relations are is just beginning to be discovered.

Further, surface tension is at the foundation of all precipitation in chemistry, as will come out when we discuss colloidal solutions and colloidal suspensions.

Again, by means of the surface tension of liquids we are enabled to determine their molecular weights in the pure, homogeneous condition. The importance of this method will be obvious if it is pointed out that it is the only reliable method even today of determining the molecular complexity of a single substance in the liquid condition. It is the only method which enables us to answer the question. What is water? At ordinary temperatures it is not H_2O, but $(H_2O)_4$.[1]

DIELECTRIC CONSTANTS

What is meant by the dielectric constant of a liquid? It is difficult to give a physical interpretation of it. Its meaning is most clearly understood to myself, from its place in Coulomb's law of electrostatic attraction. The force F with which any two quantities of electricity q_1 and q_2 attract one another, if they are at a distance r, apart is:

$$F = \frac{1}{C} \frac{q_1 q_2}{r^2}$$

in which C is the dielectric constant of the medium between the two charges.

The dielectric constant is then, for me, C, in Coulomb's equation. The same question arises here as in connection with the surface tension of liquids. Why should dielectric constants of liquids be discussed in these papers on the scientific and technical bearings of physical chemistry? Because it has been shown to be of great physical chemical importance.

It was first pointed out by J. J. Thomson, and a little later by W. Nernst, that there is a simple relation between the dielectric constants of media and their power to break molecules down into ions, and their dissociating power which is a fundamental physical chemical quantity.

Before going into this, a few words should be said in reference to a method of measuring the dielectric constants of media. A number of methods for this purpose have been proposed, but of these the simplest and probably the best is that devised by the German physicist Drude. It consists in passing long electrical waves—Hertz waves—down two parallel wires surrounded by the medium in question and measuring the lengths of the waves. The length of the waves is a simple function of the dielectric constant of the medium around the wires. The length of the electrical wave was shown by Drude to be inversely proportional to the square root of the dielectric constant of the medium in which the wires were immersed.

DIELECTRIC CONSTANTS AND DISSOCIATION POWER

The relation pointed out by Thomson between the dielectric constants of media and their dissociating power is this. The higher the dielectric constant of a liquid the greater its power to dissociate electrolytes dissolved in it. This conclusion is a consequence of the theory of electrolytic dissociation, and it was of interest and importance to see whether it held, and how closely and generally it was applicable to liquid solvents.

Of all the more common solvents water has the highest dielectric constant—about 78 at 18°—in terms of air as unity. Of all of the more common solvents water has the greatest dissociating power, as we shall see in a later chapter.

There are a few liquids with higher dielectric constants than water. Thus, liquid hydrocyanic acid has a dielectric constant of 95; formamide a dielectric constant of 84; sulphuric acid 84, while the dielectric constant of hydrogen dioxide is about 93.

All of these liquids have been shown to have greater dissociating power than water.

Of the more common solvents methyl alcohol has a dielectric constant of 33.7; ethyl alcohol of 25.9; liquid ammonia of, 22, chloroform of 5, ether of 4.4, carbon disulphide of 2.6 and benzene of 2.3; and these are just about their relative powers of breaking molecules down into ions—of disassociating electrolytes dissolved in them, as we shall see.

---

[1] For a discussion of this application of surface tension, see "Elements of Physical Chemistry," H. C. Jones, 4th ed., pp. 115-150.

So confident have we now become of this relation between the dielectric constants of solvents and their dissociating power that the following incident occurred. When the power of solutions of electrolytes in liquid ammonia to conduct the current was first studied, it was concluded that it had greater dissociating power than water. This conclusion was based upon the fact that solutions in liquid ammonia conducted more than corresponding solutions in water. The dielectric constant of liquid ammonia was then determined and it was found to be somewhat less than one-third that of water.

The question of the large conductivity of solutions of electrolytes in liquid ammonia was then examined again, and this was found to be due not to the great dissociating power of this solvent, but to its small viscosity. There were not such a large number of ions present, but these mixed through the liquid ammonia so rapidly that they gave great conductivity. When this factor was taken into account, it was found that the dissociating power of liquid ammonia bore just about the same relation to the dissociating power of water, that the dielectric constants of the two media bore to one another.

While discussing the relation between the dissociating power of liquids and their physical and chemical properties, there is one other matter which must be mentioned. A relation, which holds approximately, has been worked out between the dissociating power of solvents and their own association. When surface tension was just being discussed, it was pointed out that a method, based upon the surface tension of pure liquids, had been worked out by Sir William Ramsay and Doctor Shields for determining the molecular weights of pure liquids, i.e., for determining the number of the simplest chemical molecules which were aggregated to form the so-called physical molecules. This method has been fairly extensively applied, so that we now know the approximate states of aggregation of most of the common solvents at ordinary temperatures. Of the more common solvents, water is the most associated. Then come methyl alcohol, ethyl alcohol, acetone, and finally those liquids which are only slightly associated, such as chloroform, carbon disulphide, the hydrocarbons, etc.

It will be seen that the solvents, with respect to their dielectric constants, stand in just about the same order as they do with respect to their own association. The more associated a solvent, in general, the higher its dielectric constant. Since dielectric constants and dissociating power are roughly proportional to one another, so also are the association of solvents and their dissociating power approximately proportional.

The discoverers of this relation were Dutoit, of the University of Lausanne and Miss Aston, working with him. Dutoit has clearly pointed out that this relation is only an approximation, and in some cases only a rough approximation. The relation, if only an approximation, is, however, interesting and important.

Iron Silver Mining Co.

The report of the Iron Silver Mining Co., operating at Leadville, Colo., shows for the year 1911 total shipments of 42,673 tons, of a net value of $10.04 per ton. Although the output is somewhat less than in preceding years, the gross return was greater, owing to a larger value per ton. The Leadville mill of the American Zinc Extraction Co., which formerly treated a large portion of the Iron Silver tonnage, closed early in 1911, but favorable contracts with other reduction works were made, which also cover 1912 shipments. The Moyer mine ores go to the Cañon City plant of the Empire Zinc Co., and the Tucson ores to the Western Chemical Manufacturing Co., of Denver. The American Smelting & Refining Co. takes the smelting ores.

Production and Treatment Charges

The production of the Moyer mine was: Zinc sulphide, 10,527 tons, gross value, $287,075; zinc-lead sulphide, 7962 tons, $359,660; lead sulphide, 1173 tons, $28,633; iron sulphide, 5325 tons, $62,175; lead carbonate, 22.7 tons, $162. The treatment charges against these classes of ore are as follows: Zinc sulphide, $21.65 per ton; zinc-lead sulphide, $36.58; lead sulphide, $5.04; iron sulphide, $8.13; lead carbonate, $4.27.

In the Tucson mine the tonnages and gross values of the various grades of ore were: Copper sulphide, 8199 tons, $260,461; zinc-lead sulphide, 6797, $254,359; zinc carbonate, 2006, $51,482; lead carbonate, 662 tons. The treatment costs on these classes were respectively $8.62; $30.95; $19.73; and $2.47 per ton.

Total productions were: 1752 oz. gold; 571,736 oz. silver; 4,398,318 lb. lead; 13,025,891 lb. zinc; 4,125,661 lb. iron; and 350,487 lb. copper. There was also a production of 4143 tons of ore by lessees, which paid $3697 in royalties.

Results of Exploration

Development consisted of 9451 ft., the largest amount of work done on the property in any year: 7553 ft. of drifts; 1861 of raises, and 37 of winzes. The results obtained in this development were in the main satisfactory, and the present year opened with good ore reserves.

While the Moyer mine, as in previous years, contributed the bulk of the output, the remaining ore in the South Moyer is being rapidly exhausted, and the old ground can only be expected to yield a small future production. The workings from the South shaft were carried forward an additional 517 ft. into the lower horizons of Rock Hill, but the results obtained were not encouraging. The pay ore in the North Moyer has been completely mined, and vigorous prospecting has failed to find any new orebodies, and active mining operations were suspended there late in the year.

However, prospecting in the hitherto unexplored territory adjacent to the South Moyer, south of the Moyer fault, disclosed an orebody parallel to the main shoot of an average width of 25 ft., and of undetermined length, consisting of galena, blende and pyrite, with about 8 oz. silver to the ton. The ore already blocked out will keep up the contracted production for several months to come.

The upper levels of the Tucson mine were explored for oxidized zinc ores, but no appreciable amounts were disclosed of marketable ores, although a large body of 24% zinc ore was discovered on the first level. Some marketable oxidized lead ores were discovered in the search for zinc ores on the second level. Zinc-lead ore was discovered on the fifth level. The copper output for the year came from the levels below the fifth, but extensive prospecting showed that these deposits were limited and a maintenance of the copper-ore production cannot be expected during the coming year.

The Stevens mine, closed in 1902, on the exhaustion of oxidized lead ores, was reopened and zinc ore prospected for. However, the veins found on the first level were too small to be payable, but prospecting from a station 98 ft. below this level, and 12 ft. above standing water level is now being done.

An excess of income over expenditures of $187,640 was received, from which dividends of 1% or $100,000 were paid, the year closing with a surplus of $355,291, of which $355,272 was in cash.

Nisi Prius

The known orebodies on the property of the Nisi Prius Mining Co., controlled by the Iron Silver interests, have been practically exhausted, and the attraction to lessees has become very slight. However during 1911 there was a desire to explore the old workings for zinc, and a revival of mining was experienced. The Reindeer mine was worked throughout the year without developing anything of importance. In the Crown Point mine small deposits of zinc carbonate were found, but they were not payable. On the Estey lease a new shaft was sunk to 275 ft., and drifts are now being run to explore the ore-bearing contact.

Caving System at Ohio Copper Mine

By Clarence G. Bamberger*

Mining by the caving system as used by the Ohio Copper Co., in Bingham Canyon, Utah, compares favorably in regard to cost with steam-shovel mining. Upon driving a network of raises and sublevels the ore breaks and is drawn through chutes to the Mascotte haulage tunnel; the capping comes down upon the surface of the broken ore.

There are in general but two methods of mining deposits of this type in use; the stripping of the overburden and the mining of the ore by steam shovels, when the deposit lies near the surface; and some form of caving-system when the deposit is deeper.

In certain places, especially Butte, the square-set method of stoping has been in successful operation on comparatively large low-grade copper deposits, but owing to the excessive cost, this method, has narrow limitations. The system employed in most of the low-grade copper deposits, popularly called "the porphyries," is the first, or steam-shovel method, or a combination of the two.

On deposits where the average overburden is but a little over 100 ft., and where about three tons of ore are uncovered per ton of stripping, the steam-shovel method has been successful both as to large output and low cost. A notable example is the operation of the Utah Copper property. Quoting the annual report of this company for the year 1910: "Of the total ore mined 82% was mined by steam shovels and 18% by underground methods. The average cost of mining was 40.97c. per ton, of which 13.3c. was charged to development and stripping expense, leaving 27.67c. as the actual cost of shoveling the ore. The total cost of producing 20% of the underground ore was approximately the same as that of producing the other 80% by steam-shovel method."

Thus it appears that the actual cost of mining ore by the steam-shovel method was 17.25c. per ton against 69c. by underground mining, the relative cost of production per unit by the latter method being approximately four times that by the steam-shovel method.

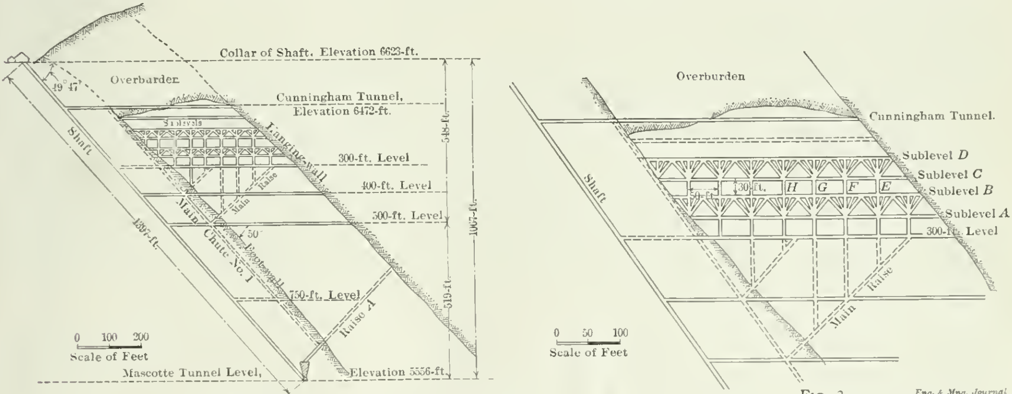


Fig. 1

Fig. 2

Cross-sections, Ohio Copper Mine, Showing Preparation for Caving

Conditions Favorable for a Caving System

The purpose of this article is to describe a system of underground mining wherein the costs per unit are made to approach more nearly those obtained by the steam-shovel method. It, however, in no way advocates such a method as being preferable to steam-shovel methods in all cases as undoubtedly each system has its particular adaptation due to existing conditions.

A striking example of low cost for underground mining is found in some data of operations at the Ohio Copper property in Bingham Cañon, Utah. The following description of existing conditions will enable a better understanding of the methods practiced there.

The country rock is in general quartzite. Merging into this formation is a large laccolithic mass of monzonite. Both the quartzite and the monzonite are mineralized, the latter usually containing more copper than the former. Two well defined parallel fissures about 450 ft. apart, with an easterly strike, dip into the mountain at an angle of 45°. The filling of these fissures forms what will be considered here as the vein. It will be assumed that these fissures are at the hanging- and foot-wall contacts of the vein and that they inclose a body of mineralized quartzite and monzonite about 400 ft. in width. This body of quartzite is much broken and shattered. Disseminated throughout this mass, with a certain concentration along cleavage planes, copper ore exists in the form of chalcopyrite, bornite and in places chalcocite. The entire mass is of about the same average copper tenor, however, where a secondary enrichment has taken place, chalcocite and native copper are found, and in the neighborhood of porphyry intrusions an enrichment has taken place. It will be assumed in this discussion that the copper tenor of the entire mass is approximately uniform.

In order to meet such conditions a system of underground mining was devised to handle a large tonnage at a minimum unit cost. By closely following the description of the methods employed as herein stated and the accompanying cost data, the work being accomplished at this property will be more fully appreciated.

In résumé the conditions are: An orebody opened 400 ft. in width, 450 ft. in length, 1300 ft. in depth, dipping from the horizontal at an angle of 50°. The entire mass being a broken shattered quartzite containing copper, chiefly in the form of chalcopyrite disseminated throughout, inclosed by foot and hanging wall of the same formation with boundaries not clearly defined.

---

*Salt Lake City, Utah.

MANY SUBLEVELS AND RAISES NECESSARY

The preparation of this ground for a caving system of mining has been carried out as shown in Fig. 1. An incline shaft was sunk in the foot wall on the dip of the vein connecting with the different levels for the transportation of men and supplies. Two main ore chutes No. 1 and No. 2 were driven in the foot wall on an angle slightly greater than the dip of the vein. These chutes were driven in the foot wall because the ground stands better than in the orebody itself. Driving the chutes in the orebody is the ideal method as in their preparation no dead work is required. These chutes connect by diagonal raises through the foot wall, with the different levels where extraction is taking place and deliver into bins of large capacity at the Mascotte tunnel or main haulage adit which in turn leads to the concentrator situated at the portal about three miles distant.

Lateral main levels were driven across the orebody at the 100-, 300-, 400-, 500-, 750- and 1000-ft. or haulage level. By a network of crosscuts and drifts these different levels have been cut up into blocks 200 ft. square which in mining will again be subdivided. Between the several levels the ground has been blocked out into sublevels 30 ft. apart and again subdivided by crosscuts, drifts and raises into blocks approximately 30x50x25 feet.

The actual procedure of extraction can be clearly understood by reference to Fig. 2 which shows in detail the sublevels above mentioned. Thus we have for example the four sublevels, *A*, *B*, *C* and *D*. Raises are driven from the crosscuts and drifts on the 300-ft. level through sublevels *A* and *B*. From these vertical raises at the various points *E*, *F*, *G* and *H* raises are run into sublevel *C*, radiating like fingers from the palm of the outstretched hand. At the breast of these several raises sublevel *D* is blasted down, the ore falling by these leads into the cross inclined chutes connecting with the main ore chute which delivers into bins at the loading-station on the haulage-tunnel level.

The same procedure is carried out on sublevel *B* which in turn is blasted down; at the same time sublevel *C*, which has already been cut up by this finger-like network of raises, comes with it as the solid ground below is blasted down. Thus each alternate sublevel is cut up by the numerous raises and the corresponding sublevel above and below is blasted down.

ORE RUN TO HAULAGE LEVEL WITHOUT HANDLING

The capping can either be previously removed by steam shovel or, as is the more general practice allowed to come down with the ore, care being taken that it always rests on the top portion of the ore as it is broken down and that the drawing of the ore is stopped when the capping appears. As a result there is continually being broken down and drawn a mass of ore with the capping resting on it, the surface contour changing and an immense depression not unlike a glory hole being formed.

In the actual operation of mining the ore is never handled, falling along inclined planes by gravity and delivering into cars at the haulage-tunnel level.

TYPICAL DAILY LABOR REPORT. OHIO COPPER CO.

Description of Labor	Number	Rate	Amount
Superintendent	1	11 66	11 66
Foremen	2	5.33	10.66
Shift bosses	3	4.00	12.00
Timekeeper	1	3 00	3.00
Sampler	1	3 00	3.00
Mine engineer	1	5 00	5.00
Hoist engineer	2	3 25	6.50
Stationary engineer	2	3.50	7.00
Chainman	1	3.50	3.50
Tool sharpener	2	3.50	7.00
Machine men	21	3.25	68.25
Machine men	8	3.00	24 00
Muckers	23	2.50	57.50
Muckers	10	2.75	27.50
Loaders	2	3.25	6 50
Loaders	3	3.00	9.00
Chute tappers	3	3.00	9.00
Nippers	2	2.50	5.00
Blacksmith	1	4.25	4.25
Blacksmith's helper	1	3.25	3.25
Carpenter	1	4 00	4.00
Carpenter's helper	1	3.25	3.25
Trackman	1	3.00	3.00
Trackman's helper	1	2.50	2.50
Pipeman	1	3.25	3.25
Pipeman's helper	1	2.75	2.75
Timbermen	7	3.25	22.75
Timbermen's helpers	7	2.75	19.25
Total	110	.....	$344.32

Total labor charge for Oct., 1911		$11,582.78
Total stores consumed for period		3,743.82
Total power consumed for period		476.00
Total operating expense for period		$15,802.60
Total development and equipment for period		3,429.00
Total actual operating expense for period		$12,373.60
Average number of feet driven per day		31
Average number of feet raised per day		42
Average tons mined per day	1,817	
Total number of feet driven for period	......	961
Total number of feet raised for period		1302
Total tonnage mined for period	56,311	

All calculations based on wet weight.

There trains are made up and trammed by electric locomotive to the concentrator at the tunnel mouth.

The actual cost per ton for the different phases of the operation is shown in the accompanying table which is an average covering a period of 31 days in October, 1911, during which period 56,311 tons were mined.

From the above data several interesting conclusions can be drawn. Considering the whole working force of 110 men as producing the ore, approximately 17 tons of ore are delivered to bins per day per man. Considering, however, only the men who are actually breaking the ore, approximately 63 tons of ore are delivered to bins per day per man. From the "total operating expense for period" and "total tonnage mined for period," the cost per ton delivered to bins is shown to be 28.06c. which figure includes development and equipment charges. From "total actual operating expense" and "total tonnage mined for period," the actual cost per ton for mining delivered to bins is shown to be 21.97 cents.

This cost per unit is at the present time the minimum cost for operating underground under like conditions. The application of this system of mining has permitted and will permit of the development and operation of copper deposits, which until recent times have been considered of no commercial value. In conclusion, I wish to thank Alfred Frank, the general manager, under whose personal direction this work is being carried out, for his kindness and the information given me for use in this article.

Electrolytic Detinning

The original electrolytic method of detinning was worked out by Hette in 1876, says *Bull. Technologique de Agriculture et Mines*, Nov., 1911, and consisted in electrolyzing the tin scrap in a 10 to 12% sodium-hydrate solution, heated to 60 to 70° C. The current density was 100 amp. per sq.m., and the resistance 1.5 to 2 volts. The scrap was placed in iron baskets, and served as anodes.

With 50 tanks three meters cube, and three baskets per tank, each basket held about 60 kg. of clippings, the electrolysis lasted five to seven hours and the original works treated about 9000 tons of clippings per year.

A more recent process, that of Meunicke and Steiner, uses a solution of sodium sulphide heated to 90° C. The current density is 50 amp. per sq.m., and the resistance under 0.2 volts. Tin is deposited on the cathode, and other metals are precipitated as sulphides. The following reactions take place:

$$2\ Na_2S + Sn = SnS_2 + 4\ Na$$
$$4\ Na + SnS_2 = 2\ Na_2S + Sn$$

If the resistance per cell exceeds 0.2 volts the sodium sulphide is not regenerated, because of:

$$Na_2 + 2\ H_2O = 2\ NaOH + H_2$$

The cathodes are pure tin, and the electrolyte ought not to contain iron, copper, or antimony. Each time the anodes are changed, 1% of sulphur ought to be dissolved in the bath.

Over a million and a half acres of public land now stand withdrawn by the Government as being valuable for the possible development of water power.

The Mathematics of Copper Sampling

By Edward Keller*

A discussion of the interior structure of copper bars, and a demonstration of a method of sampling by which each separate hole can be made to represent the average of the bar in which it is placed. The commercial method merely attempts to make the average of all the holes represent the average of all the bars.

In the issue of the JOURNAL for Dec. 16, 1911, Donald M. Liddell calls attention to possible errors in sampling argentiferous-auriferous copper bars by drilling, due to their shape and consequent incorrect size-weight ratio of the drillings, or of the drill-hole cylinder in relation to those stereometric units of the bars whose cross-sectional area is laid out on the surface by the template. As a remedy, Mr. Liddell advises thin slabs with little bevel. Since Mr. Liddell proceeds in his argument from an entirely mathematical, or theoretical viewpoint, let us follow on the same lines to their ultimate consequences. Although I do not pretend to be a mathematic critic, yet it would seem to me that in this case Mr. Liddell has fallen short of drawing the full logical conclusions in his argument. We shall presently see that the suggested remedy, as far as it concerns the bevel of a bar or slab, is not theoretically a remedy.

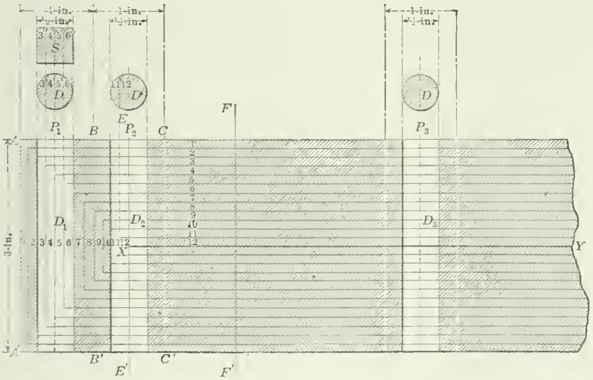
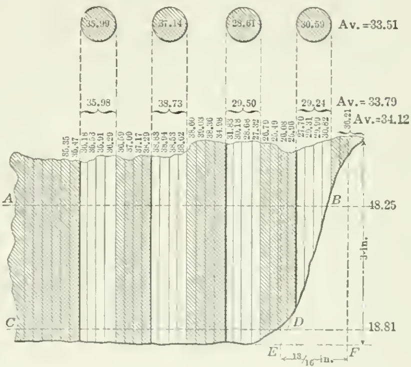


FIG. 1. VERTICAL SECTION OF IDEAL COPPER BAR



The Engineering & Mining Journal

FIG. 2. SILVER ASSAYS OF COMMERCIAL BULLION

ELIMINATION OF BEVEL DOES NOT ELIMINATE ERROR

Taking the thin slab[1] for our analysis, we would say: If a reduced bevel reduces the error, an eliminated bevel will eliminate the error of sampling. This conclusion would be true if the geometrical form of the slab were the sole factor in making up a correct sample, for as will readily be seen from Fig. 1, a vertical section through an ideal copper slab, where drillhole D_1 through parallelepiped P_1, of which $A\ B\ A'\ B'$ is the vertical section, has the correct size-weight ratio. However, apart from the external geometrical form there exists an internal structure quite dissimilar to the former and composed by numerous invisible geometrical units which, in a theoretically correct sample, should each be represented by its proper size-weight ratio. This internal structure is caused by the rearrangement of the silver and gold contents in the copper when the latter passes from the molten to the solid state.

We may assume the molten metal (alloy, bullion) to be homogeneous, but as soon as solidification begins there takes place a differentiation of the contents in silver and gold, due to changes in osmotic pressure and consequent diffusion.

We may now assume that the solidification proceeds so as to form even layers from all the surface planes of the slab (in reality there is, of course, irregularity) and that each successive layer differs in composition from its predecessor, the silver and gold tenor increasing from the surface to the center. (In certain cases the reverse takes place.) These imaginary layers are shown in the figure as ⅛ in. thick, by continuous lines and as meeting at right angles (in the actual freezing of the copper the corners are rounded). We now have in the slab two sets of horizontal layers; one set formed from the top, the other from the bottom and meeting along the line XY. Then we have vertical layers around the four sides; a section of one being shown in Fig. 1. The zone of vertical layers will herein be called the edge zone, as we have no bevel.

SIZE-WEIGHT RATIO FOR SEGREGATION LAYERS INCORRECT

If we now examine drill-hole cylinder D_1, we note that is passes a part of the horizontal layers and then includes four vertical layers in their full length; all of them, however, being of different composition. In the parallelepiped P_1, these layers are represented by rectangular prisms of equal cross section, but of unequal altitude; their size-weight, therefore, being proportional to their altitude. It follows, that to obtain their proper ratio in the sample, we must cut them in their full cross section, which could be accomplished with a square or rectangular hole, as shown in horizontal section S. The round drill-hole through the vertical layers can never give a theoretically correct sample; the ratio of the layers being as incorrect as the segments 3', 4', 5' and 6' in horizontal section D differ from each other in area. But, in the edge zone the round drillhole does not even properly sample the horizontal layers; in parallelepiped P_1, layer 1 covers its full horizontal cross section; all the others but decreasing portions of it. Layers 1, 2 and 3 receive the full cross section of the drillhole, therefore, 2 and 3 more than their proper ratio. Quite similar are the errors in P_2.

It must, from the foregoing, appear clear that D_1 and D_2 do not properly sample the edge zone and that to obtain the theoretically correct ratios of all the internal geometrical elements of this zone nothing but a continuous section will answer; we must take a sample with saw or planer. The theoretical definition of this edge zone is given in Fig. 1, comprising the area from the edge *A A'*, to the line *EE'*, which passes through the point *X*, at which diffusion in the horizontal direction theoretically stops.

---

[1] The thin slabs of practical metallurgy are of 2 or 3 in. thickness and from 15 to 20 by 24 to 30 in. horizontal dimensions.

*Perth Amboy, N. J.

By the continuous section through the edge zone we not only obtain a correct sample of it but, as the zone contains all the elements of diffusion derived from the original, homogeneous, molten metal, it is also a correct sample of the whole slab. Naturally, therefore, that remaining portion of the slab within the edge zone, beyond the line *EE'*, will also contain the average contents of the whole slab and, as this portion is composed entirely of horizontal layers, each of uniform thickness and extent, it is but necessary to drill a single hole at any one point (D_3) to obtain the theoretically correct size-weight ratios of all the layers and a correct sample of the whole slab. This appears as the simplest mathematical solution of theoretically correct sampling of metallic slabs; it eliminates the complicated edge zone, or bevel, from consideration and makes the inconvenient and expensive procedure of sawing, or planing, unnecessary.

PRACTICE PROVES ONE-HOLE SAMPLING CORRECT

A correct theory will, indubitably, give correct practical results. I have repeatedly demonstrated that the one-hole scheme and the full-template scheme yield results well within the usually accepted commercial limits, an example of which has but recently been published.[2] As a modification of the one-hole scheme, a template with a much restricted number of holes might be laid out for the inner field of the slab.

In making suggestions on the foregoing lines to a colleague, he said: But, suppose you were dealing with a concern which would place iron bars around the edge of the slab? Such ethics would be unfortunate, yet some of us are still professionally somewhat unsophisticated, for the reason that no other demands, from responsible side, have been made, than the delivery of anything but bare facts, or the demonstration of anything than the naked truth.

A discussion of this kind without due consideration of the practical side of the subject in a journal devoted to practical work would be useless. To reassure those interested in these problems, in a practical and financial way and who may be afraid of iron bars, or who think, for other reasons of their own, that the whole slab should be sampled, it must be acknowledged that the magnitudes in contention between Mr. Liddell and me are of a small order and that they seem to become totally lost in the much larger ones of the irregularities which make up the composition of the actual slab.

QUARTER SECTION TEMPLATES PREFERABLE

Besides, the templates for the drillholes are generally laid out in approximate inch squares, insuring the drilling of many holes, and the law of averages plays an important rôle. It is, without doubt, preferable to cover only one-half or one-fourth of a slab with a template of small squares than the whole slab with a template of larger squares. This statement will be substantiated in the concrete figures that will follow.

It is not the object here to produce many figures, but one extreme example may serve a useful purpose: If it can be demonstrated that fairly uniform results are produced by various modes of sampling a highly heterogeneous copper slab, we are then justified in the conclusion, that a sample from a hundred, or several hundred, slabs of similar composition will be still more reliable. Such a slab was sampled in eight lateral zones: (1) a cut ½in. wide by planer, near the center line, horizontally through the whole width of the slab; (2) adjoining the first, a cut 3 in. wide through one-half the width of slab; (3) and (4), to either side of (1) and (2), drilling three holes, in line, in center of every inch of the width of slab, the latter top surface up; (5) and (6), adjoining (3) and (4), in the same manner as these, but bottom surface of slab up; (7), *X* end of slab, bottom up, drilling by regular, 1-in. template, 72 holes; (8), *Y* end of slab, top up, in the same manner as (7), 91 holes. In each of the last two zones the drillings from all the holes were united. With the other zones, the drillings from each template section, 1 in. square, were weighed and assayed separately. Cut (1) was taken in ⅛-in. layers, horizontally, each weighed and assayed separately, thus giving the distribution of the metals in the vertical direction. Cut (2) was taken in layers as the former, but vertically, thus showing the distribution of the metals in the horizontal direction. All samples were used up, except the last fractional assay ton, in assaying. All average assays are figured according to weights of individual samples. The results are incorporated in the table.

SILVER CONTENTS OF ZONES OF SLAB

Sample	Oz. per Ton
Horizontal cut	34.23
Vertical cut	34.53
Drillings, top, *X*	34.22
Drillings, bottom, *X*	34.32
Drillings, top, *Y*	33.28
Drillings, bottom, *Y*	33.67
Drillings, end, bottom, *X*	34.65
Drillings, end, top, *Y*	34.06

Fig. 2, a vertical section of a portion of the slab under examination illustrates the great heterogeneity of the material. The extremes in silver tenor in the vertical direction are given as along the lines *AB*, 48.25 oz., and *CD*, 18.81 oz. This figure, however, is chiefly designed to show the constitution of the edge zone, the correct ascertainment of its composition by a continuous cut, the composition of the drill-hole cylinders and the composition of the corresponding sections of the vertical cut in an adjoining zone.

GOLD IS CORRECT WHEN SILVER IS

It is not probable that anyone will dispute the close concordance of all the foregoing comparative results and averages of the silver contents in this slab; they were a surprise to me in view of the much reputed heterogeneity of the material. The gold has not been given consideration here, because in my experience there is no case in which the heterogeneity of the gold approaches in degree that of the silver; therefore, whenever the correct silver tenor is ascertained that of the gold is assured with it. Generalizing on practical sampling on a large scale, it may be stated, that the results at two different copper works now not only agree within 1 oz., but generally within 0.5 oz. or 0.25 oz., and not infrequently within 0.1 oz. of silver; one of the methods of sampling being by shotting the homogeneous furnace charge, the other by drilling the slabs, bevel or no bevel and crude or refined, according to such templates as have already been mentioned. Recent observations have brought me to the conclusion, that it is not yet self evident to everyone connected with this practice, that drill-holes must extend through the entire thickness of a slab or bar.

Having described, somewhat, theory and practice, each by a figure, the question, "what is the difference between the two?" naturally suggests itself. The only modification to be introduced into Fig. 1 to make it the section of a reality, would be to move the point *X* considerably inward, about to the line *FF'*. In ordinary converter copper the diffusion towards *X* causes a depression of the freezing point of the copper and a consequent retardation of solidification, as also a horizontal extension of the diffusion zone. The line *XY* in reality is much removed towards the upper surface, because the mold at the bottom absorbs more heat than does the air on top, therefore a much more rapid freezing from the bottom. The indicated (imaginary) layers below the line *XY* would as a consequence be thicker than those above that line.

In Fig. 1 we may see that a copper bar with a square cross section, or one approaching it, is composed of two edge zones of a slab, symmetrically joined together; the most irrational form for the purpose of sampling by drilling.

---

[2] E. Keller, Bull. A. I. M. E., June, 1911.

Concrete figures may here be given: The point X is now in the center of the bar; each layer extends around the four sides; the drill-hole D_2 passes vertically through point X, including in its section the entirety of layers 11 and 12, in an argentiferous bar the richest (or poorest) in silver, while layers 10 to 1 are represented in the same section in decreasing ratios. Ignoring the overlappings of the layers at the corners, an error which but reduces the evident impropriety of the drill-hole sample at this point, we have the simple relations as expressed in the following table, which apply to the edge zone as well:

INCORRECT RATIOS OF DRILLHOLE IN SQUARE BAR OR EDGE ZONE

Layer No ..	1	2	3	4	5	6	7	8	9	10	11	12
Ratio in D_2 ..	$\frac{1}{12}$	$\frac{1}{11}$	$\frac{1}{10}$	$\frac{1}{9}$	$\frac{1}{8}$	$\frac{1}{7}$	$\frac{1}{6}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{3}$	1	1

PROPER WIRE BAR SAMPLING

For argentiferous copper, the thin slab has been advocated and largely adopted for at least 15 years; for such copper the thick bar should be discontinued entirely. However, there are other copper castings which, with their approximately square cross sections, will remain. These are the marketable forms of refined copper, such as wire-bars, etc. Of these the exact copper contents are frequently required. This copper contains approximately 0.1% of oxygen, or 0.9% of cuprous oxide. From E. Heyn[3] we have learned that the copper-cuprous-oxide eutectic contains about 3.5% of the oxide. The wire bar is, therefore, a sub-saturated solution of the oxide in copper and for that reason, the former probably concentrates strongly towards the freezing center of the bar. A sample drilled through the center of the bar would yield low results; one from the cleaned surface high ones. The latter, however, would approximate the true content more closely than the former, because along the contact with the mold the freezing is so rapid that there is little time for diffusion. Only a full cross-section of such material would yield a correct sample.

Whatever has here been demonstrated, theoretically or practically in relation to argentiferous copper, would equally well apply to any other bullion or alloy.

The following minerals are given by the U. S. Geological Survey as the American minerals used in the paint trade without change in their chemical composition: Asbestos, asphalt, barytes, brown slate and shale, clay, graphite, gypsum, hematite, limonite, magnesite, ocher, pyrite, shells, siderite, silica, sienna, talc, umber and whiting.

The Dwight-Lloyd Process in Iron Metallurgy

The general description of the Dwight-Lloyd straight-line sintering machine is well known to the JOURNAL readers[1] as is also the fact that it has been used in sintering iron-blast-furnace flue dust[2]. Further details of this operation were presented by J. G. Klugh at the February meeting of the Institute of Mining Engineers. Since Oct. 1, 1911, the process has been used at Birdsboro, Penn., at the blast furnace of the E. & G. Brooke Iron Co. The material treated was the current flue dust and material from an accumulated stock pile which was high, but not uniform, in carbon, so that desirable control or regularity of the amount of fuel in the mixture treated could not be maintained.

Nevertheless, the sinter produced was in all cases of excellent quality. It has been found that an amount of carbon equivalent to 8% of the weight of the ore to be sintered furnishes ample heat for the production of the sinter. Carbon in excess of 8% consumes too long for its combustion, raises the temperature of the sinter to its fusing point thus enveloping unconsumed carbon and raises the temperature of the grate bars and other parts of the machine. For economic reasons, too, it is desirable to have a minimum consumption of carbon and a maximum production with the most desirable quality of product. From a given material with the correct percentage of fuel, the character of the sinter depends wholly upon the material itself, being unaffected by the speed of sintering or the velocity of air supply. Consequently, the rate at which the machine can be run depends upon the permeability of the bed of material and the pressure drop between the atmosphere outside and that in the wind box.

WATER ADDED BEFORE SINTERING

Water is always added to these flue dusts before sintering, which largely influences the permeability, although the complete function of the water is not understood. Primarily, it causes a temporary agglomeration of the particles of the material, thus preventing them from passing through the grate. The interstices in the bed are then larger, offering less resistance to the gas current. The percentage of moisture added is not a given percentage by weight, but the quantity required to produce a certain degree of plasticity. For instance, to a fine hematite ore there should be added 15% by weight of water, but with magnetite 4% would produce the same result. The regulation of this phase of the process is very important, but has as yet been done by rule of thumb only.

When high-carbon material follows low-carbon material, the only adjustment necessary for the machine is to slow down the speed of the pallets, allowing greater time for burning out the excess of carbon. Residual carbon is only left in the sinter when the temperature in the upper part of the bed is raised so as to render it incipiently fluid and permit it to envelope small amounts of carbon. This will only occur when the carbon is high, say above 20%. Desulphurization is usually good, but seems independent of form or quality of the ore. Pyrite cinder was brought down from 4.41 to 0.07%, while magnetite was lowered in sulphur from 3.50 to 0.15 per cent.

There is no analogy in the working of this Dwight-Lloyd sinter and mill cinder. One is a mere agglomeration of highly porous material, the other is a completely fused glass, that is, a satisfied chemical compound giving up its oxygen only at high temperature and affording a minimum area of contact for reducing gases.

Several times, as much as 10% of easily reducible Lake ores have been replaced by sinter. The management of the Birdsboro furnaces believes that taking off the ore and putting on the sinter has the same influence on the fuel consumption as would result from taking off entirely the given amount of ore burden. When mill cinder is used with a burden of a high percentage of magnetic ores, a scouring action is often noticed, especially when the mill cinder is used to the amount of 12 per cent., no such action being observable with Dwight-Lloyd sinter. The wider use of the Dwight-Lloyd process for the preparation of the blast-furnace charge is strongly recommended by the author.

Age Distribution of North German Miners

In view of the agitation for workmen's compensation laws and pension systems, the accompanying table which has been sent us by Frederick L. Hoffman, statistician of the Prudential Insurance Co. of America, will be of interest. This table is taken from the German Occupation Census for 1907, and shows the age distribution of miners in the North German Miners' Pension Fund.

AGE DISTRIBUTION OF MINERS

Age attained	Males	%	Females	%
16-18	6,182	5.3	150	9.5
18-20	7,547	6.5	219	13.9
20-25	16,309	14.1	281	17.8
25-30	18,570	16.1	316	20.1
30-40	31,489	27.3	298	18.9
40-50	22,083	19.1	200	12.7
50-60	11,023	9.5	87	5.5
60-70	2,226	1.9	21	1.3
70 and over..	132	0.1	4	0.3
Total	115,561	100.0	1,576	100.0

---

[3] Mitth. Kgl. Tech. Versuchsanstalten, Jahrg. 18, 315, 1900.

[1] Eng. and Min. Journ., Aug. 13, 1910.

[2] Eng. and Min. Journ., July 15, 1911.

The Mining Index

A Classified Bibliography of the Current Literature of Mining and Metallurgy

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print), in the original language, for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COAL AND COKE

18,279—ACCIDENTS—Coal Mine Fatalities in Canada. F. W. Gray. (Can. Min. Journ., Feb. 15, 1912; 1½ pp.) 20c.

18,280—ALASKA—Geology and Coal Fields of the Lower Matanuska Valley, Alaska. G. C. Martin and F. J. Katz. (U. S. Geol. Surv., Bull. No. 500, 1912; 98 pp., illus.)

18,281—ALBERTA—Extracts from Report on the Brule Lake Coal Claims, Belonging to the North Alberta Coal Syndicate. James McEvoy. (Can. Min. Journ., Mar. 1, 1912; 4½ pp., illus.) 20c.

18,282—ANALYSIS—Methods of Analyzing Coal and Coke. Frederic M. Stanton and Arno C. Fieldner. (Tech. Paper 8, Bureau of Mines, 1912; 21 pp.)

18,283 — COKE — Electrically Operated Coke Plant of the Indiana Steel Co., Gary, Ind. J. M. Matthews. (Gen. Elec. Rev., Jan., 1912; 6 pp., illus.) 40c.

18,284—COKE BYPRODUCT—Losses of Combined Nitrogen. John D. Pennock. (Journ. Ind. and Eng. Chem., Mar., 1912; 5¼ pp., illus.) A list of byproduct and retort coke-oven plants in United States is given. 60c.

18,285—COLORADO—The Trinidad District in Colorado. F. W. Whiteside. (Coal Age, Mar. 2, 1912; 3¾ pp., illus.) 20c.

18,286—COMBUSTION OF COAL. Kenneth Austin. (Journ. South African Inst. of Engrs., Feb., 1912; 9¾ pp., illus.) 60c.

18,287—DUST — Automatic Sprinkling Apparatus for the Prevention of Dust in Mines. T. Campbell Futers. (Colliery Guardian, Jan. 5, 1912; ¾ p., illus.) 40c.

18,288—DUST—Experiments on Liquid Mixtures for Laying Coal Dust. W. M. Thornton. (Trans. N. Eng. Inst. Min. and Mech. Eng., Dec., 1911; 21 pp.)

18,289 — ELECTRICAL MACHINERY for Coal Mines. Sydney F. Walker. (Coal Age, Mar. 16, 1912; 2 pp., illus.) 20c.

18,290—EXPLOSION—Cross Mountain Mine Explosion, Bruceville, Tenn. (Mines and Minerals, Feb., 1912; 5 pp., illus.) 20c.

18,291 — EXPLOSIONS — Methane in Coal-Dust Explosions. F. I. Wilbur. (Coal Age, Feb. 17, 1912; 2½ pp.) 20c.

18,292—FIRES—Notes on Underground Fires. James Ashworth. (Coal Age, Mar. 2, 1912; 2¾ pp., illus.) 20c.

18,293—GAS—Release Gas Accumulations. W. H. Cunningham and C. R. Conner. (Coal Age, Dec. 30, 1911; 2 pp., illus.) 20c.

18,294—GERMANY—Kohlengewinnung und -aussenhandel Deutschlands im Jahre 1911. (Glückauf, Feb. 10, 1912; 5 pp.) Germany's coal production and export trade in 1911.

18,295—HAULAGE — A Self-Dumping Car Haul System. (Coal Age, Feb. 17, 1912; 3 pp., illus.) 20c.

18,296—ILLINOIS—Mining Methods in Illinois. M. F. Peltier. (Coal Age, Mar. 16, 1912; 3¼ pp., illus.) 20c.

18,297—JAPANESE COAL INDUSTRY. H. F. Bain. (Coal Age, Mar. 16, 1912; 1¼ pp., illus.) From Bull. A. I. M. E., Jan., 1912. 20c.

18,298 — KENTUCKY — Coal Developments at Stearns, Ky. J. E. Butler. (Mines and Minerals, Mar., 1912; 1½ pp., illus.) Use of an aerial tramway to transport coal across a river; description of equipment and surface arrangements. 40c.

18,299—LONGWALL MINING in Mines of Spring Valley Coal Co., Illinois. (Mines and Minerals, Mar., 1912; 3½ pp., illus.) 40c.

18,300 — MANAGEMENT — Scientific Coal Mine Management. Sim and W. H. Reynolds. (Mines and Minerals, Mar., 1912; 1½ pp., illus.) Three devices by which accurate knowledge of working conditions can be had daily. 40c.

18,301—POWER—Central Station Power in Coal Mines. W. A. Thomas. (Proc. A. I. E. E., Mar., 1912; 14 pp.)

18,302—POWER ECONOMIES—Possible Power Economies. Henry D. Jackson. (Coal Age, Mar. 9, 1912; 1 p.) 20c.

18,303 — POWER-PLANT DESIGN — Faulty Power Plant Design. E. L. Cole. (Coal Age, Mar. 9, 1912; 1½ pp., illus.) 20c.

18,304—RESCUE WORK—Mine-Rescue Work in Illinois. H. H. Stoek. (Coal Age, Feb. 17, 1912; 3 pp., illus.) 20c.

18,305—TIMBERING—The Problem of Mine Timbering. R. B. Woodworth. (Coal Age, Mar. 9, 1912; 2½ pp., illus.) Paper before Kentucky Min. Inst., Dec. 11, 1911. 20c.

18,306—TIPPLE at Delagua Mine, Colorado. (Mines and Minerals, Mar., 1912; 2¼ pp., illus.) Novel haulage of new tipple at the mines of the Victor-American Fuel Co. 40c.

18,307—UNLOADING COAL—Notes on the Use of Alternating Current in Unloading Coal at Duluth-Superior Harbor. W. N. Ryerson and J. B. Crane. (Proc. A. I. E. E., Mar., 1912; 21 pp., illus.)

18,308 — VENTILATION — Coal-Mine Ventilating Equipment. W. M. Weigel. (Coal Age, Jan. 13, 20, 27, Feb. 3, 17, and Mar. 2, 1912; 14¾ pp.) 80c.

18,309—WASHERY—Consolidated Coal Washery at Saginaw. (Mines and Minerals, Mar., 1912; 1¼ pp., illus.) 20c.

18,310—WASHING—Standardization in Coal Washing. Geo. R. Delamater. (Mines and Minerals, Mar., 1912; 4¼ pp.) A plea for uniformity in tests and reports—formulas for accurate comparison of washery work. 40c.

18,311—WEST VIRGINIA—The Smokeless Coal Field of West Virginia. Edwin Ludlow. (Mines and Minerals, Mar., 1912; 1¾ pp., illus.) 40c.

COPPER

18,312—ANALYSIS—Limits of Accuracy in Copper and Brass Analysis. Ernest A. Lewis. (Journ. Soc. Chem. Ind., Feb. 15, 1912; 1 p.)

18,313—LEACHING Applied to Copper Ore. W. L. Austin. (Mines and Methods, Feb., 1912; 3⅓ pp.) Fifteenth article, reviewing results accomplished, with special reference to lixiviation with solutions formed by passing electric current through liquors containing chlorides. 20c.

18,314—MICHIGAN—The Copper Mining Industry of Michigan. Reginald E. Hore. (Min. and Eng. Wld., Mar. 16 and 23, 1912; 5 pp., illus.) 40c.

18,315—MINE WATER—Treatment of Mine Water from the Ashio Copper Mine. Joseph W. Richards. (Advance proof, A. I. M. E., Feb., 1912; 4 pp., illus.)

18,316—MONTANA—Some Observations in Butte, Mont. W. R. Ingalls. (Eng. and Min. Journ., Mar. 16, 1912; 1½ pp.) 20c.

18,317—OXYGEN IN COPPER—The Influence of Oxygen on Copper Containing Arsenic or Antimony. R. H. Greaves. (Engineering, Feb. 9, 1912; 3⅓ pp., illus.) 40c.

18,318—SLAGS—Untersuchungen über die beim Steinschmelzen den Eintritt des Kupfers in die Schlachen beeinflussenden Umstände, über die verbindungsform des Kupfers innerhalb der Schlacken, und über die Verminderung der Kupferverluste durch Verschlackung. W. Wanjukoff. (Metallurgie, Jan. 8 and 22, 1912; 40¼ pp., illus.) 80c.

18,319—SMELTERY—Recent Improvements and Additions to the Smelting Plant of the Canadian Copper Co. David H. Browne. (Quart. Bull., Can. Min. Inst., Feb., 1912; 8 pp.)

18,320—SMELTING — Copper Smelting at the Kennett Plant, California. C. A. Tupper. (Min. and Eng. Wld., Feb. 10, 1912; 3 pp., illus.) 20c.

18,321 — WASTE — Die Verhüttung kupferhaltiger Industrieabfälle. W. Siepke. (Metallurgie, Feb. 22, 1912; 12 pp., illus.) Working industrial wastes and furnace refuse carrying copper.

GOLD DREDGING

18,322—AUSTRALIA—Methods of Restoring Soil on Dredged Areas and Costs of Gold Dredging in Australia. (Eng. and Contracting, Mar. 13, 1912; 1 p.) 20c.

18,323—CALIFORNIA—Northern California Gold Dredging. Lewis H. Eddy. (Eng. and Min. Journ., Mar. 23, 1912; 3½ pp., illus.) 20c.

18,324—CALIFORNIA—The First Steel Dredge in California. A. H. Martin. (Min. Sci., Feb. 8, 1912; 1 p.) Describes armored dredge to go into cimmission in the Folsom field in April. 20c.

18,325—GOLD DREDGE INSTALLATIONS during 1911. John Tyossowski. (Eng. and Min. Journ., Mar. 16, 1912; ¾ p.) 20c.

18,326 — GOLD-SAVING TABLES — Cross-System Gold-Saving Tables. Lewis H. Eddy. (Eng. and Min. Journ., Feb. 24, 1912; ¾ p., illus.) 20c.

18,327—WORLD—Status of the World's Gold Dredging Industry. A. H. Martin. (Mines and Methods, Feb., 1912; 1 p.) 20c.

GOLD AND SILVER—CYANIDATION

18,328—AGITATION—Piping for Continuous Agitation. H. R. Conklin. (Eng. and Min. Journ., Mar. 23, 1912; ⅝ p., illus.) 20c.

18,329 — ASSAY OF GOLD-BEARING CYANIDE SOLUTIONS by Electrolysis. C. Crichton. (Journ. Chem., Met. and Min. Soc. of South Africa, Dec., 1911; 1¾ pp.) Discussion on paper previously indexed. 60c.

18,330 — FILTRATION — Recent Improvements in Filtration Methods. Ernst J. Sweetland. (Journ. Ind. and Eng. Chem., Feb., 1912; also Met. and Chem. Eng., Feb., 1912; 3 pp., illus.)

18,331—MATTE TREATMENT—Treatment of Matte from Mill Clean-up. M. W. von Bernewitz. (Min. and Sci. Press, Mar. 2, 1912; ¾ p.) 20c.

18,332—PROGRESS of Cyano Metallurgy in 1911. R. Stuart Browne. (Min. and Eng. Wld., Feb. 3 and 10, 1912; 6 pp.) 40c.

18,333—TAILING — Cyaniding Weathered Pyritic Tailing at the Plant of Lady Gladys Co., Mulline, Western Australia. Herbert R. Edmands. (Eng. and Min. Journ., Mar. 23, 1912; 2 pp.) 20c.

18,334—TAILINGS—Cyaniding Tailings in Colombia. Ralph W. Perry. (Eng. and Min. Journ., Mar. 9, 1912; 2⅓ pp., illus.) 20c.

18,335—TESTING OF ORES in the Cyanide Treatment. George J. Bancroft. (Min. Sci., Mar. 7, 1912; 1½ pp.) Brief review of latest progress in the methods.

18,336—ZINC-BOX PRECIPITATE—Method for Assaying Zinc-Box Precipitate. Haral R Layng. (Min. and Eng. Wld., Mar 23, 1912; 1½ pp., illus.) 20c.

GOLD AND SILVER—GENERAL

18,337—ALASKA—The Valdez Gold Mining District, Alaska. L. W. Storm. (Min. and Eng. Wld., Mar. 23, 1912; 3 pp., illus.) 20c.

18,338 — AMALGAMATION PLATES—Notes on Absorption of Gold by Amalgamated Copper Plates, Cast-Iron Retorts and Amalgam Trays. H. G. Stanley and M. Thornton Murray. (Journ. Chem., Met. and Min. Soc. of South Africa, Dec., 1911; 4¼ pp., illus.) 60c.

18,339 — ANALYSIS — Die quantitative Bestimmung der Edelmetalle Gold, Silber, Platin. Trenkner. (Metallurgie, Feb. 8, 1912; 2¾ pp.) Quantitative determination of the precious metals, gold, silver and platinum. 40c.

18,340—ARGENTINA—The Gold-Mining District of Milla-Michi-Co and Malal Caballo, Territory of Neuquén, Argentine Republic. Julio Vatin and Gaston Barrie. (Min. Journ., Feb. 17, 1912; 1½ pp.) 40c.

18,341 — CALIFORNIA — Gold Production in California. Charles G. Yale. (Bull. A. I. M. E., Mar., 1912; 5 pp.) 40c.

18,342—CALIFORNIA—The Headlight, a Notable California Gold Mine. A. H. Martin. (Min. and Eng. Wld., Feb. 3, 1912; ⅔ p.) 20c.

18,343—COBALT—Recent Underground Development Work at Cobalt. Cyril W. Knight. (Quart. Bull. Can. Min. Inst., Feb., 1912; 12 pp.)

18,344—COLORADO — Development of the Rico-Wellington Mine. (Salt Lake Min. Rev., Mar. 15, 1912; 2½ pp., illus.) 20c.

18,345—COLORADO—Present Status of Drainage at Cripple Creek. T. R. Countryman. (Min. Sci., Jan. 25, 1912; 1¾ pp., illus.) 20c.

18,346—COSTS and Cost Conditions at Bluebell Mine, British Columbia. S. S. Fowler. (Quart. Bull., Can. Min. Inst., Feb., 1912; 9 pp.)

18,347—CRUSHING—The Slow Speed Chilean Mill. E. H. Webster. (Eng. and Min. Journ., Feb. 24, 1912; 1¼ pp.) 20c.

18,348—DURANGO—Algunos Criaderos Argentiferos de Cerca de Reyes, Durango. P. B. Lord and Y. S. Bonillas. (Bol. Sociedad Geologica, Mexicana, T. VII, Part 2, 1911; 7 pp., illus.)

18,349—DUTCH GUIANA—Prospecting for Gold in the Jungles of Surinam. G. B. Percival. (Min. and Eng. Wld., Mar. 9, 1912; 1⅓ pp., illus.) 20c.

18,350—ECUADOR—Notes on the Geology of the Zaruma Mines, Ecuador. J. G. Baragwanath. (School of Mines Quart., Jan., 1912; 5 pp., illus.) 60c.

18,351—HYDRAULIC MINING—L'Eau fait l'Or. Comment on doit laver les alluvions aurifères. J. Laur. (Metaux et Alliages, Jan., 1912; 4 pp., illus.) 40c.

18,352 — JALISCO — Deposito de Antiguos Aluviones Argentiferous en el Rio de Santiago, Jalisco. Alberto Capilla. (Bol. Sociedad Geologica Mexicana, T. VII, Part 2, 1911; 9 pp., illus.)

18,353—MILLING the Tam O'Shanter Ore, Ashcroft, Colo. James M. McClave. (Mines and Minerals, Mar., 1912; 2 pp., illus.) Transporting ore with an aërial tramway; water power for electric drive; milling methods. 40c.

18,354 — MILLING COSTS — Operating Costs at the Pittsburg-Silver Peak Mill. (Min. and Sci. Press, Feb. 10, 1912; 4 pp., illus.) 20c.

18,355—NEVADA — Notes on Pioche, Nev. Edward R. Zalinski. (Eng. and Min. Journ., Mar. 23, 1912; 1 p.) 20c.

18,356—NEVADA—Present Status of the Manhattan District, Nevada. A. H. Martin. (Min. Sci., Mar. 14, 1912; 1¾ pp., illus.) 20c.

18,357—NEVADA—The Geology of the Tonopah Mining District. Augustus Locke. (Bull. A. I. M. E., Feb., 1912; 10 pp.) 40c.

18,358 — NEW MEXICO — The Oro Grande Mine in Grant County, New Mexico. Byron O. Pickard. (Min. Sci., Feb. 15, 1912; 2¾ pp., illus.) 20c.

18,359—NEW YORK—Adirondack Gold Schemes. D. H. Newland. (Eng. and Min. Journ., Feb. 24, 1912; ½ p.) 20c.

18,360—NICARAGUA—Geology of the Pis Pis Mining District in Nicaragua. Oscar H. Hershey. (Min. and Sci. Press, Feb. 17, 1912; 2½ pp., illus.) 20c.

18,361 — ONTARIO — The Consolidated Ophir Mines, Ltd., Lake of the Woods. (Can. Min. Journ., Feb. 15, 1912; 2 pp.) 20c.

18,362—ORE TREATMENT at the Associated Mine, Kalgoorlie. M. W. Von Bernewitz. (Min. Mag., Feb., 1912; 5 pp., illus.) 60c.

18,363—OREGON—Mining Activities in Baker County, Oregon, in 1911. Dennis H. Stovall. (Min. and Eng. Wld., Feb. 17, 1912; 2 pp., illus.) 20c.

18,364—PLACER MINES of Summit County, Colorado, and Geological Structure Thereof. Thomas A. Brown. (Min. Sci., Feb. 15, 1912; 1 p., illus.) 20c.

18,365—PLACER MINING—Dry-Placer Mining Methods. W. G. Burroughs. (Mines and Minerals, Mar., 1912; 2 pp., illus.) 40c.

18,366 — PLACERS — Geology of the Breckenridge Placers. Arthur Lakes. (Mines and Minerals, Feb., 1912; 3½ pp., illus.) 20c.

18,367—PORCUPINE—Notes on Porcupine. H. Y. Russell. (Eng. and Min. Journ., Mar. 23, 1912; ⅔ p.) 20c.

18,368—PORCUPINE GOLD AREA of Northern Ontario. A. G. Burrows. (Bull. Can. Min. Inst., Oct., 1911; 4 pp.)

18,369—QUEBEC—The McKenzie Gold Mine. Extract from Report of Chibougamau Mining Commission. (Can. Min. Journ., Feb. 15, 1912; 2½ pp., illus.) 20c.

18,370—SILVER BULLION—A Modification of the "Gay Lussac" Method for Silver Bullion Containing Tin. Luis E. Salas. (Bull. A. I. M. E., Mar., 1912; 12 pp., illus.) 40c.

18,371 — SILVER DEPOSITS — Genesis of Silver Deposits. W. G. Matteson. (Mines and Minerals, Mar., 1912; 2 pp.) Comparisons of geological features and conclusions in regard to the origin of various American deposits. 40c.

18,371a—SLIME SETTLING—The Settling of Mill Slimes. D. L. H. Forbes. (Eng. and Min. Journ., Feb. 24, 1912; 4⅓ pp., illus.) 20c.

18,372—SONORA—Algunos Datos Geologicos Sobre el Mineral La Campana. Y. S. Bonillas. (Bol. Sociedad Geologica, Mexicana, T. VII, Part 2, 1911; 17 pp., illus.)

18,373—STAMP MILLS—Notes on High Duty Gravity Stamp Mills. Peter N. Nissen. (Journ. Chem., Met. and Min. Soc. of South Africa, Dec. and Jan., 1912; 8¼ pp., illus.) Discussion on paper previously indexed. $1.

18,374—TONNAGE—The Estimation of Battery Tonnage. A. W. Allen. (Min. and Sci. Press, Feb. 24, 1912; 1½ pp.) 20c.

18,375—TRANSVAAL—Some Observations on Ancient Mine Workings in the Transvaal. T. G. Trevor. (Journ. Chem., Met. and Min. Soc. of South Africa, Jan., 1912; 7¾ pp., illus.) 60c.

18,376 — WASHINGTON — Geology and Ore Deposits of the Myers Creek Mining District. Joseph B. Umpleby. (Wash. Geol. Survey, Bull. 5, 1911; 41 pp., illus.)

IRON MINING

18,377—AUSTRIA—Der steirische Erzberg. (Stahl u. Eisen, Feb. 22, 1912; 6 pp., illus.) The Styrian ore mountain in its present-day aspect. 40c.

18,378—CHINA—Notes on the Han-Yeh-Ping Iron & Coal Co., China. Cho-Yang and Cheng-fu Wang. (School of Mines Quart., Jan., 1912; 7 pp., illus.) 60c.

18,379—LABOR—The Iron-Ore Miner of Northern Michigan. W. J. Lauck. (Min. and Eng. Wld., Mar. 9, 1912; 2 pp.) 20c.

18,380—MICHIGAN—The Chapin Mine of the Oliver Mining Co. George E. Edwards. (Min. and Eng. Wld., Mar. 2, 1912; 3 pp., illus.) 20c.

18,381 — NORWAY — The Sydvaranger Iron Mines in Norway. (Elec. Rev., London, Mar. 1, 1912; 3 pp., illus.) 40c.

18,382—VIRGINIA—Limonite Prospecting and Mining. Charlton Dixon. (Mines and Minerals, Mar., 1912; 2¼ pp., illus.) Large deposits of ore in Virginia mined by open cut with steam shovels and also by underground work. 20c.

IRON AND STEEL—METALLURGY

18,383—BLAST DESICCATION by Calcium Chloride. J. B. Van Brussel. (Eng. and Min. Journ., Mar. 23, 1912; 1½ pp., illus.) 20c.

18,384 — BLAST-FURNACE GAS — Les Asphyxies par les gaz des hauts-fourneaux. Revue Analytique et Critique des Accidents Survenus en Belgique de 1906 a 1911. Ad. Breyre. (Annales des Mines de Belgique, T. XVII, Part 1, 1912; 89 pp., illus.)

18,385—BLAST-FURNACE PRACTICE — Commercial Application of the Turbine Turbo-Compressor. Richard H. Rice. (Journ. A. S. M. E., Feb., 1912; 34 pp.)

18,386—BLAST FURNACE PRACTICE —Regenerative Stoves: Their Relation to Blast-Furnace Practice. N. Diehl. (Proc. Eng. Soc. W. Penn., Jan., 1912; 43 pp.) 60c.

18,387—BLAST-FURNACE PRACTICE —Ueber Kohlenstoffabscheidung in Hochofensteinen. H. Kinder. (Stahl u. Eisen, Feb. 8, 1912; 1 p.) On the segregation of carbon in the lining of blast furnaces. 40c.

18,388 — BLAST-FURNACE SLAG — Ueber die Versertung der Hochofenschlacken. H. Fleissner. (Stahl u. Eisen, Feb. 8, 1912; 7½ pp., illus.) On the utilization of blast-furnace cinder. 40c.

18,389 — BRIQUETTING — The Schumacher Briquetting Process. Joseph W. Richards. (Advance proof, A. I. M. E., Feb., 1912; 3 pp., illus.)

18,390—CANADA—Opportunities in the Iron Industry in Canada. (Can. Min. Journ., Mar. 1, 1912; 1½ pp.) 20c.

18,391—CORROSION—Ueber das Rosten von Gusseisen und Flusseisen. K. Arndt. (Metallurgie, Feb. 8, 1912; 3½ pp.) On the rusting of cast iron and steel. 40c.

18,392 — ELECTRIC SMELTING — Experiments with a Three-Ton Girod Steel Furnace in the Gute Hoffnungshütte, Oberhausen, Germany. (Engineering, Feb. 23, 1912; 1¼ pp., illus.) 40c.

18,393—FOUNDRY—Die Eisen- und Stahlgiesserei der Société Francaise de Constructions Mécaniques in Denain. J. Leber and E. Leber. (Stahl u. Eisen, Dec. 28, 1911; 5¼ pp., illus.) 40c.

18,394—GERMANY—Der Aussenhandel der deutschen Eisenindustrie. (Stahl u. Eisen, Feb. 8, 1912; 3 pp., illus.) The export trade of the German iron industry. 40c.

18,395—LOW-GRADE ORE TREATMENT—The Metallization of Low-Grade Iron Ores by the Jones Process. George E. Edwards. (Min. and Eng. Wld., Mar. 9, 1912; 1¾ pp.) 20c.

18,396—MANGANESE — Determination of Manganese in Steel. James J. Boyle. (Journ. Ind. and Eng. Chem., Mar., 1912; ½ p.) 60c.

18,397—ROLLING MILLS—Testing in Steel Mills, with Particular Reference to the Power Requirements of Rolling Mills. B. N. Westcott. (General Electric Rev., Feb., 1912; 9 pp., illus.) 40c.

18,398—SINTERING of Fine Iron-Bearing Materials by the Dwight-Lloyd Process. J. G. Klugh. (Advance Proof, A. I. M. E., Feb., 1912; 12 pp., illus.)

18,399—SLAG — Eisenhochofenschlacken, ihre Eigenschaften und ihre Verwendung. Hans Fleissner. (Oest. Zeit. f. B. u. H., Jan. 20 and 27, 1912; 9½ pp., illus.) Abstract from the author's larger work on the same subject, published by W. Knapp, Halle.

18,400—SOUTHERN STATES—The Future of the South in the Manufacture of Iron and Steel. John J. Porter. (Mfrs. Rec., Feb. 22, 1912; 2¼ pp., illus.) 60c.

18,401 — TETRA-BASIC CALCIUM PHOSPHATE—Die Konstitution des vierbasischen Kalkphosphates und seine Reduzierbarkeit durch kohlenstoffhaltiges und reines Eisen. E. Steinweg. (Metallurgie, Jan. 8, 1912; 13 pp.) Constitution of the four-basic lime phosphate and its reducibility by carburetted and by pure iron. 40c.

18,402—THERMITE—Ueber die Verwendung von Lunkerthermit bei Flusseisen-Blöcken. C. Canaris. (Stahl u. Eisen, Feb. 22, 1912; 8 pp., illus.) On the application of thermite to cast-steel ingots for the removal of cavities and air holes. 40c.

18,403—TOOL STEEL—Structure and Heat Treatment of Tool Steel. J. V. Emmons. (Iron Tr. Rev., Feb. 22, 1912; 3¾ pp., illus.) A study of the microscopic constituents of tool steel, the effects of annealing and quenching. 20c.

18,404 — VALUATION — The Rational Valuation and Quality Efficiency of Furnace Stock. John J. Porter. (Bull. A. I. M. E., Mar., 1912; 13 pp.) 40c.

LEAD AND ZINC

18,405 — BLAST ROASTING — On the Theory of Blast Roasting of Galena. C. O. Bannister. (I. M. M., Bull. 89, 1912; 56 pp., illus.)

18,406 — BLENDE ROASTING — The Practice in Blende Roasting. E. Schütz. (Eng. and Min. Journ., Mar. 16, 1912; 3½ pp., illus.) Abstracted from "Metallurgie," Oct. 22, 1911. 20c.

18,407 — JOPLIN DISTRICT — Mining and Milling in the Joplin District. J. J. McClellan. (Can. Min. Journ., Mar. 1, 1912; 5¼ pp., illus.) 20c.

18,408—ORE DRESSING in the Joplin District. James L. Bruce. (Eng. and Min. Journ., Feb. 24, Mar. 2, 9 and 16, 1912; 13¼ pp., illus.) 80c.

18,409 — SOUTHERN STATES — The Copper, Lead and Zinc Industries of the Southern States. C. E. Siebenthal. (Mfrs. Rec., Feb. 22, 1912; 2¼ pp.) 60c.

18,410—SUBLIMED WHITE LEAD—Process of Manufacturing Sublimed White Lead. Evans W. Buskett. (Min. and Eng. Wld., Feb. 17, 1912; 3⅓ pp., illus.) 20c.

18,411—WISCONSIN ZINC DISTRICT. P. K. Kelley. (Min. and Sci. Press, Feb. 17, 1912; 2 pp., illus.) 20c.

18,412—ZINC LOSSES in Brass Manufacture. W. H. Bassett. (Journ. Ind. and Eng. Chem., Mar., 1912; 3¼ pp.)

OTHER METALS

18,413—ALUMINUM AND BAUXITE MINING in Tennessee. George H. Ashley. (Min. and Eng. Wld., Mar. 9, 1912; 1¼ pp., illus.) 20c.

18,414—COBALT—The Electro-Deposition of Cobalt, with a Short Account of Its History, Properties and Uses. Emmanuel Blassett, Jr. (Met. Ind., Mar., 1912; 1½ pp.) 20c.

18,415 — MANGANESE — Beitrage zur Kenntniss der Manganerzlagerstätten in der spanischen Provinz Huelva. Hoyer. (Zeit. f. prakt. Geol., Dec., 1911; 23½ pp., illus.) 40c.

18,416—NICKEL—Ontario Nickel Industry in 1911. Alex. Gray. (Min. Journ., Jan. 27, 1912; 1¼ pp.) 40c.

18,417—NICKEL DEPOSIT in the San Poil Mining District, Wash. Howland Bancroft. (Min. and Sci. Press, Jan. 20, 1912; 1¼ pp.) 20c.

18,418—PLATINUM—The Direct Determination of Small Amounts of Platinum in Ores and Bullion. Frederic P. Dewey. (Advance proof, A. I. M. E., Feb., 1912; 4 pp.)

18,419—QUICKSILVER—Der Quecksilberbergbau in Toscana. H. E. Miller. (Glückauf, Feb. 10, 1912; 11 pp., illus.) 40c.

18,420—RARE MINERALS of the South. Frank L. Hess. (Mfrs. Rec., Feb. 22, 1912; 1½ pp.) 60c.

18,421—THORIUM—A New Method for the Separation of Thorium. T. O. Smith and C. James. (Journ. Am. Chem. Soc., Mar., 1912; 2 pp.) 60c.

18,422—TIN MINING in Bolivia. O. Gore Adams. (Aust. Min. Stand., Feb. 8, 1912; 1¼ pp.) To be continued. 40c.

18,423 — VANADIUM — New Vanadium Fields. John R. Wood. (Min. and Sci., Jan. 25, 1912; ½ p., illus.) 20c.

NONMETALLIC MINERALS

18,424—ASBESTOS—Serpentine Asbestos Deposits in the Berezowa Kamenskaja and Manetnaja Estates Ural, Russia. W. F. Kryshanofsky. (Quart. Bull. Can. Min. Inst., Feb., 1912; 3 pp.)

18,425—BUILDING STONES — Granite, Marbles and Other Building Stones of the South. Ernest F. Burchard. (Mfrs. Rec., Feb. 22, 1912; 1½ pp.) 60c.

18,426—CLAY PRODUCTS and Clay in the South. Jefferson Middleton. (Mfrs. Rec., Feb. 22, 1912; 2 pp.) 60c.

18,427—CORUNDUM. Walter C. Gold. (Met. Ind., Mar., 1912; 1 p., illus.) 20c.

18,428 — DIAMONDS — History of the Diamond Fields of India and Brazil. C. Roe Gardiner. (Min. and Eng. Wld., Feb. 17, 1912; 2 pp.) 20c.

18,429 — FLUORSPAR — Valuation of Fluorspar. E. Bidtel. (Journ. Ind. and Eng. Chem., Mar., 1912; 1¾ pp.) 60c.

18,430—FULLER'S EARTH in the South. F. B. Van Horn. (Mfrs. Rec., Feb. 22, 1912; 1½ pp.) 60c.

18,431—KAURI GUM MINING in New Zealand. R. A. F Penrose, Jr. (Journ. Geol., Jan.-Feb., 1912; 7 pp., illus.) 60c.

18,432 — MAGNESITE — Der Magnesit und seine technische Verwertung. Kern. (Glückauf, Feb. 17, 1912; 4½ pp.) Magnesite and its uses. 40c.

18,433—NITRATE OF SODA and Sulphate of Ammonia. (Am. Fertilizer, Feb. 10, 1912; 9 pp.) Abstract from the annual review of the nitrate of soda and sulphate of ammonia market for the year 1911, as prepared by Bradbury & Hirsch, Liverpool, Eng. Shipments and average monthly prices. 20c.

18,434—PHOSPHATE—Equipment of a Modern Phosphate Plant in Florida. C. A. Tupper. (Min. and Eng. Wld., Mar. 9, 1912; 3 pp., illus.) 20c.

18,435—PHOSPHATE DEPOSITS and Mining Methods in U. S. S. R. Stone. (Min. and Eng. Wld., Mar. 2, 1912; 1 p.) 20c.

18,436—PHOSPHATE MINING in Relation to the Fertilizer Industry. C. G. Memminger. (Mfrs. Rec., Feb. 22, 1912; 2 pp.) 60c.

18,437—SALT—Das Verfahren von Kayser zur Erzeugung von Kochsalz und Einengung oder Verdampfung sonstiger Lösungen. J. Schrempf. (Glückauf, Feb. 3, 1912; 4½ pp., illus.) Kayser's method for the preparation of table salt and concentration or evaporation of other solutions. 40c.

18,438—SALT—Louisiana Salt Mines; Their Operation and Output. Paul Wooton. (Min. and Eng. Wld., Feb. 17, 1912; 1¼ pp., illus.) 20c.

PETROLEUM AND NATURAL GAS

18,439—BURMA—Labor on the Burmese Oilfields. A. M. Finlayson. (Min. Mag., Feb., 1912; 3½ pp., illus.) 40c.

18,440—CALIFORNIA—Notes of Tertiary Deposits near Coalinga Oil Field and their Stratigraphic Relations with the Upper Cretaceous. E. T. Dumble. (Journ. Geol., Jan.-Feb., 1912; 10 pp.) 60c.

18,441—ILLINOIS—Developments in the Illinois Oil Fields. H. A. Wheeler. (Journ. Assn. of Eng. Socs., Feb., 1912; 10 pp.) 40c.

18,442—KENTUCKY—Oil and Gas Development in Knox County, Ky. M. J. Munn. (U. S. Geol. Surv., Bull. 471-A, 1912; 14 pp., illus.)

18,443—NATURAL GAS—Liquefied Products from Natural Gas, Their Properties and Uses. Irving C. Allen and George A. Burrell. (Bureau of Mines, Tech. Paper No. 10; 23 pp., 1912.)

18,444—OIL WELL—Some Mechanical Features of an Oil Well. Dorsey Hager. (Min. and Eng. Wld., Mar. 23, 1912; 1 p., illus.) 20c.

18,445—ORIGIN—Fallacies in the Theory of the Organic Origin of Petroleums. Eugene Coste. (I. M. M., Bull. 89, 1912; 4 pp.) Contributed remarks on paper previously indexed.

18,446—PENNSYLVANIA—Geologic Atlas of the United States, Claysville Folio, Penn. M. J. Munn. (U. S. Geol. Surv., 1912; 19 pp.)

18,447 — SOUTHERN STATES — Vast Storehouse of Fuel in Southern Petroleum and Natural Gas. David T. Day. (Mfrs. Rec., Feb. 22, 1912; 1½ pp.) 60c.

18,448—UTAH—Geology of the San Juan Oil Field, Utah. E. G. Woodruff. (U. S. Geol. Surv., Bull. 471-A, 1912; 35 pp., illus.)

18,449—WYOMING—The Powder River Oil Field, Wyoming. Carroll H. Wegemann. (U. S. Geol. Surv., Bull. 471-A, 1912; 22 pp., illus.)

ECONOMIC GEOLOGY—GENERAL

18,450—DURANGO—Estudio Geologico y Minero de la Sierra de el Oro, Durango. Villar Roldan. (Bol. Sociedad Geologica Mexicana, 1911; 20 pp., illus.)

18,451—ORE DEPOSITS—The Superficial Appearance and Alteration of Ore Deposits. George J. Bancroft. (Proc. Colo. Sci. Soc., June, 1911; 54 pp.)

18,452—OXIDATION OF SULPHIDES. Second Paper. V. H. Gottschalk and H A. Buehler. (Econ. Geol., Jan., 1912; 20 pp.) 60c.

18,453—QUEBEC—Géologie du Canton de Fabre, Comté de Pontiac. Robert Harvie. (Ministère de la Colonisation des Mines et des Pecheries, Bureau des Mines, Quebec, 1911; 36 pp., illus.)

18,454—VOLCANISM—Brun's New Data on Volcanism. A. N. Winchell. (Econ. Geol., Jan., 1912; 14 pp.) 60c.

MINING—GENERAL

18,455—ACCIDENTS—Die Unfälle im Bergbau. Hanauer. (Oest. Zeit. f. B. u. H., Dec. 23, 1911; 1¼ pp.) 40c.

18,456 — ACCIDENTS in Transvaal Mines, with Special Reference to Falls of Ground. James Chilton. (Journ. Chem., Met. and Min. Soc. of South Africa, Dec. and Jan., 1911; 12 pp.) Discussion on paper previously indexed.

18,457—BLASTING—Investigations of Fuse and Miners' Squibs. Clarence Hall and Spencer P Howell. (U. S. Bureau of Mines, Tech. Paper No. 7, 1912; 19 pp.)

18,458—BOLIVIA—Mineral Resources of Bolivia. Carlos Sanjines. (Min. and Sci. Press, Mar. 9, 1912; 2¼ pp., illus.) 20c.

18,459—CANADA—Preliminary Report on the Mineral Production of Canada, 1911. John McLeish. (Canada Dept. of Mines, Mines Branch, 1912; 23 pp.)

18,460—CAVING of the Bunker Hill Shaft, California. L. H. Eddy. (Eng. and Min. Journ., Feb. 24, 1912; ¾ p.) 20c.

18,461—CHINA—The Mineral Production and Resources of China. Thomas T. Read. (Bull. A. I. M. E., Mar., 1912; 51 pp., illus.)

18,462—DIAMOND DRILL HOLES—Determining the Angle of Diamond-Drill Holes. G. C. Bateman. (Can. Min. Journ., Mar. 1, 1912; 3½ pp., illus.) 20c.

18,463—DRILLING—The Prevention of Dust in Development Drives in Mines during Drilling Operations. C. J. N. Jourdan. (Journ. South African Inst. of Engrs., Feb., 1912; 4½ pp.) Discussion on paper previously indexed. 60c.

18,464 — ESTIMATING IRREGULAR AREAS. R. H. Rowland. (Eng. and Min. Journ., Mar. 23, 1912; 1 p., illus.) 20c.

18,465—EXCAVATION — Electricity in Excavation Work. W. C. Lancaster. (Gen. Elec. Rev., Mar., 1912; 7 pp., illus.) 40c.

18,466 — EXPLOSIONS — Earthquakes and Mine Explosions. (Coal Age, Mar. 9, 1912; 1¼ pp.) 20c.

18,467—GERMAN PROTECTORATES—Der Bergbau in den deutschen Schutzgebieten im Jahre 1910-11. (Glückauf, Feb. 14, 1912; 2 pp.) Mining in the German Protectorates in 1910-11. 40c.

18,468—HOISTING—Notes on the Operation of Two Winding Engines as Registered by a Karlik Tachograph. Humphrey M. Morgans. (I. M. M., Bull. 88, 1912; 5 pp., illus.)

18,469—HOISTING AND HAULING—Electric Power for Underground Winding and Hauling Engines. (Can. Min. Journ., Mar. 1, 1912; 1½ pp., illus.) 20c.

18,470 — HONDURAS — Transportation Development and Projects in Honduras. Edward Perry. (Eng. Mag., Mar., 1912; 13½ pp., illus.) 40c.

18,471 — HYGIENE — Die Einwirkung des Klimas in Bergwerken auf die Bergarbeiter. Hanauer. (Oest. Zeit. f. B. u. H., Jan. 6, 1912; 1¼ pp.) Influence of the climate in mines on mine workers. 40c.

18,472—LANDING CHAIR—An Automatic Landing Chair for Mine Cages and Skips. (Min. Sci., Feb. 22, 1912; 1 p., illus.) Invention of F. C. Wright. 20c.

18,473—LAW—A Discussion of Mining Law. H. V. Winchell. (Eng. and Min. Journ., Mar. 9, 1912; 4⅔ pp.) A paper before Can. Min. Inst., Mar. 6, 1912. 20c.

18,474—MALAY STATES—Mining in the Malay States. W. F. A. Thomae. (Min. Mag., Feb., 1912; 4 pp., illus.) 40c.

18,475—MANAGEMENT—The Application of Business Principles to Mining. G. W. Schneider. (Colo. School of Mines Mag., Mar., 1912; 4¾ pp.)

18,476—MANAGEMENT — The Science of Management in Practice—II and III. Frederic A. Parkhurst. (Ind. Eng., Feb. and Mar., 1912; 8 pp.) The selection and training of all classes of labor. 80c.

18,477—MEXICO—Mining in Mexico. T. Lane Carter. (Eng. Mag., Mar., 1912; 20 pp., illus.) 40c.

18,478—ONTARIO—Northern Ontario. Ben Hughes. (Can. Min. Journ., Mar. 1, 1912; 2 pp.) 20c.

18,479—ORE DOCK—A Concrete and Steel Ore Dock Having New Features in Its Design. W. E. King. (Eng. Rec., Mar. 9, 1912; 2⅓ pp., illus.) Describes in detail the dock of the Great Northern Ry., at Allouez Bay. 20c.

18,480—ORE DOCK at Cleveland, Ohio. (Eng. News, Feb. 22, 1912; 5 pp., illus.) 20c.

18,481—ORE RESERVES—A Method of Showing Ore Reserves. N. H. Emmons, 2d. (Eng. and Min. Journ., Mar. 9, 1912; 2 pp., illus.) From paper before A. I. M. E., Feb., 1912. 20c.

18,482—SHAFT SINKING—A Difficult Piece of Shaft Sinking in Connection with the Catskill Aqueduct. (Coal Age, Mar. 2, 1912; 1¾ pp., illus.) 20c.

18,483—SHAFT SINKING—Sealing Off Water in Catskill Aqueduct Shafts. J. F. Springer. (Eng. and Min. Journ., Mar. 9, 1912; ¾ p.) 20c.

18,484—SNOWSLIDES in Mining Districts of British Columbia. Arthur Lakes, Sr. (Min. and Eng. Wld., Mar. 2, 1912; 2¾ pp., illus.) 20c.

18,485 — STOPE MEASUREMENTS. (Journ. Chem., Met. and Min. Soc. of South Africa, Dec., 1911; 5 pp., illus.) 60c.

18,486—SURVEYING—Notes on Direct Solar Observation. Leroy A. Palmer. (Min. Sci., Feb. 22, 1912; 2 pp.) 20c.

18,487—TIMBERING—The Problem of Mine Timbering. R. B. Woodworth. (Coal Age, Feb. 10, 1912; 3 pp., illus.) Paper before Ky. Min. Inst., Dec. 11, 1911. 20c.

18,488 — TRANSVAAL — Dividends of Transvaal Mining Companies in 1911. (Min. and Eng. Wld., Mar. 23, 1912; 1½ pp.) 20c.

18,489 — UNWATERING TRESAVEAN MINE. Cyril Brackenbury. (I. M. M., Bull. 89, 1912; 12 pp.) Discussion on paper previously indexed.

18,490—VENTILATION in Metal Mines. Frank C. Loring. (Quart. Bull. Can. Min. Inst., Feb., 1912; 5 pp.)

ORE DRESSING—GENERAL

18,491—CONCENTRATING SANDS AND SLIMES—Das Filter bei der Aufbereitung feiner sulphidischer Sande und Schlämme. M. Moldenhauer. (Metallurgie, Feb. 8, 1912; 3½ pp., illus.) The filter in concentrating fine sulphide sands and slimes. 40c.

18,492—CRUSHING—A Large Rock Crushing Plant, near the Kensico Dam Site in Westchester County, N. Y. (Eng. and Min. Journ., Mar. 2, 1912; 2 pp., illus.) 20c.

18,493—CRUSHING — Rock-Crushing Plant, Kensico Dam. Samuel W. Traylor. (Eng. News, Feb. 22, 1912; 3 pp., illus.) 20c.

18,494—CRUSHING—The Large Ore Crusher at the Biwabik Mine. (Iron Tr. Rev., Feb. 15, 1912; 3 pp., illus.) 20c.

18,495 — ELECTROSTATIC CONCENTRATION or Separation of Ores. Henry A. Wentworth. (Advance proof, A. I. M. E., Feb., 1912; 16 pp., illus.)

18,496—FLOTATION PROCESS—Concentration by Flotation of Dry Ore Pulp. H. C. Parmelee. (Met. and Chem. Eng., Mar., 1912; 2¾ pp., illus.) Describes process invented by Henry E. Wood. 40c.

18,497—FLOTATION PROCESSES—Die Methoden der Schwimmverfahren in der Erzaufbereitung. M. Moldenhauer. (Metallurgie, Jan. 22, 1912; 9 pp., illus.) Methods of the flotation processes in ore dressing. The author reviews the old and the new Elmore processes, the McQuisten, Potter-Delprat and the Minerals Separation, Ltd., processes and gives the preference to the last. 40c.

18,498 — MILL DESIGN — Progress in Mill Design. Frank E. Shepard. (Eng. and Min. Journ., Mar. 16, 1912; 4⅗ pp.) 20c.

METALLURGY—GENERAL

18,500 — AGGLOMERATION of Fine Materials. Walter S. Landis. (Advance proof, A. I. M. E., Feb., 1912; 6 pp.)

18,501—ALLOYS—A Study of the Properties of Alloys at High Temperatures. G. D. Benough. (Engineering, Jan. 19 and Feb. 2, 1912; 10 pp., illus.) 60c.

18,502—ALLOYS—On the Behavior of Certain Alloys when Heated in Vacuo. Thomas Turner. (Engineering, Mar. 1, 1912; 1 p.) Paper before Brit. Institute of Metals, Jan. 16, 1912. 40c.

18,503 — ALLOYS — Studien über die Einwirkung der wichtigeren metallischen und nichtmetallischen Zusätze auf normale Kupfer-Zinn-Bronze. H. Miller. (Metallurgie, Jan. 22, 1912; 9 pp., illus.) Studies on the action of the more metallic and nonmetallic admixtures of copper-tin-bronze. 40c.

18,504—ASSAYS — Quick Combination Methods in Smelter Assays. A. T. French. (I. M. M. Bull. 89, 1912; 18 pp.)

18,505—BRITISH COLUMBIA—Metallurgy in British Columbia in 1911. E. Jacobs. (Can. Min. Journ., Feb. 1, 1912; 8½ pp.) 20c.

18,506—CHIMNEYS—The Design of Tall Chimneys. Henry Adams. (Ind. Eng., Mar., 1912; 7¼ pp., illus.) Paper before British Society of Engineers, Dec. 4, 1911. 40c.

18,507 — COPPER-ZINC ALLOYS — Further Experiments on the Critical Point at 470 Deg. Cent. in Copper-Zinc Alloys. H. C. H Carpenter. (Engineering, Feb. 23, 1912; 3½ pp., illus.) Paper before Institute of Metals, Jan. 17, 1912.

18,508 — EXTRACTION TESTS — A Graphic Method of Illustrating the Results of Extraction Tests. H. K. Picard. (I. M. M., Bull. 89, 1912; 3 pp.)

18,509—FURNACE CHARGES—Calculation of Furnace Charges—III. Regis Chauvenet. (Met. and Chem. Eng., Mar., 1912; 4 pp.) 40c.

18,510—FURNACE WALLS—The Flare of Furnace Walls. Carl Hering. (Met. and Chem. Eng., Mar., 1912; 1 p.) 40c.

18,511—JUNK SMELTING—The Treatment of Metallic Junk. Donald M. Liddell. (Eng. and Min. Journ., Mar. 2, 1912; 3 pp., illus.) 20c.

18,512—LABORATORY — Das Metallhüttenmännische Institut der Königlichen Technischen Hochschule zu Breslau. K. Friedrich. (Metallurgie, Jan. 22 and Feb. 8, 1912; 18 pp., illus.) 60c.

18,513—METALLOGRAPHY—Ueber die Darstellung Umwandlung von Atom-bzw. Molekularprozenten und Gewichtsprozenten in multiplen Systemen. F. Hoffmann. (Metallurgie, Feb. 22, 1912; 9 pp., illus.) 40c.

18,514—ORE DRYING—Abrasion and Dust Losses in Ore Drying. Carl F. Dietz and Dyke V. Keedy. (Advance proof, A. I. M. E., Feb., 1912; 22 pp., illus.)

18,515—PHYSICAL CHEMISTRY—The Beginnings of Physical Chemistry. Harry C. Jones. (Eng. and Min. Journ., Mar. 23, 1912; 3¾ pp.) First of a series of articles. 20c.

18,516—SMELTER FUMES — Mineral Losses in Gases and Fumes. F. G. Cottrell. (Journ. Ind. and Eng. Chem., Mar., 1912; 2¼ pp.) 60c.

18,517—SURFACE COMBUSTION. Raymond C. Benner. (Min. and Sci. Press, Mar. 2, 1912; 1½ pp., illus.) 20c.

18,518—WASTES—Miscellaneous Mineral Wastes. Charles L. Parsons. (Journ. Ind. and Eng. Chem., Mar., 1912; 4 pp.) Brief notes on losses in mining and treating the important minerals and metals. 60c.

18,519—WELDING—Das Rohrschweisswerk der British Welding Co. (Stahl u. Eisen, Feb. 8, 1912; 4 pp., illus.) The tube-welding plant of the British Welding Co. 40c.

MINING AND METALLURGICAL MACHINERY

18,520—AERIAL ROPEWAY—A Remarkable Aërial Ropeway in Bolivia. (Engineer, Mar. 1, 1912; ⅓ p., illus.) 40c.

18,521 — AERIAL TRAM — Argentine Government Aërial Tram. C. A. Tupper. (Eng. and Min. Journ., Mar. 23, 1912; 3 pp., illus.) 20c.

18,522—BELT CONVEYORS—Notes on the Use of Belt Conveyors. John J. Ridgway. (Power, Mar. 19, 1912; 1⅗ pp.) 20c.

18,523 — BENDING MACHINE — Hydraulische Biegmaschine für eiserne Kappen. Schulze Höing. (Glückauf, Jan. 20, 1912; 2 pp., illus.) Hydraulic bending machine for iron caps. 40c.

18,524—BUCKET ELEVATOR CHART to Determine Speed and Capacity. (Eng. and Min. Journ., Mar. 23, 1912; 1 p., illus.) 20c.

18,525—CONVEYING AND ELEVATING MACHINERY—V and VI. Reginald Trautschold. (Ind. Eng., Feb. and Mar., 1912; 11 pp.) Suction conveyors, their capacities, economic speeds, horsepower requirements and operating costs. 80c.

18,526—CONVEYORS—A Study of Mechanical Conveyors — I. Lincoln D. Moss. (School of Mines Quart., Jan., 1912; 19 pp., illus.) Extracts from lectures before the Dept. of Mech. Engineering, Columbia University. 60c.

18,527—DUMP—Successful Type of Rotary Dump. A. E. Lindrooth. (Coal Age, Mar. 16, 1912; ¾ p., illus.) 20c.

18,528 — ELECTRICAL EQUIPMENT. D. L. & W. Mine. (Coal Age, Mar. 16, 1912; 2⅗ pp., illus.) 20c.

18,529—GAS ENGINE at Sons of Gwalia Mine. W. R. Degenhart. (Journ. Chamber of Mines, Western Aust., Dec. 30, 1911; 5 pp., illus.) 60c.

18,530—GAS PRODUCER—Hochdruck Gaserzeuger "Kerpely" für Vargasung feinkörniger Brennstoffe. (Stahl u. Eisen, Dec. 7, 1911; 2¼ pp., illus.) The Kerpely high-pressure gas producer utilizing fine-grained fuels. 40c.

18,531—GAS PRODUCERS—Die Gewinnung der Nebenerzeugnisse beim Gaserzeugerbetrieb. Anton Gwiggner. (Stahl u. Eisen, Dec. 21, 1911, and Feb. 1, 1912; 1 p.) The saving of byproducts in operating gas producers. 60c.

18,532—GAS PRODUCERS—The Gasification of Fuel—II and III. Typical Forms of Producer Construction. Charles E. Lucke. (Eng. Mag., Feb. and Mar., 1912; 13 pp., illus.) 80c.

18,533—HOIST—Electric Hoist at Negaunee Mine. P. B. McDonald. (Eng. and Min. Journ., Feb. 24, 1912; ½ p., illus.) 20c.

18,534—HOIST—Electrical Control of a Large Hoist. H. W. Cheney. (Proc. A. I. E. E., Mar., 1912; 16 pp., illus.)

18,535—HOISTING—Electric Winding on the Rand. (Elec. Rev., London, Mar. 8, 1912; 2 pp., illus.) 40c.

18,536—HOISTING—Safety Devices for Hoisting through Inclines. L. E. Ives. (Eng. and Min. Journ., Mar. 9, 1912; 1 p.) 20c.

18,537—HOISTING ENGINE—Abnahmerversuch an einer Dampffördermaschine. (Glückauf, Feb. 17, 1912; 2 pp., illus.) Communicated by the boiler inspectors of Dortmund district. 40c.

18,538—HOISTING ENGINES—Selbsttätige Geschwindigkeitsregelung an Dampffördermaschinen. Schönfeld. (Glückauf, Feb. 24, 1912; 3½ pp., illus.) Automatic speed regulation at steam hoisting engines. 40c.

18,539—HYDRO-ELECTRIC PLANT—New Hydro-electric Plant of Northern California Power Co. Rudolph W. Van Norden. (Elec. Wld., Feb. 3, 1912; 4¼ pp., illus.) 20c.

18,540—HYDRO-ELECTRIC POWER for Minnesota Ranges. C. A. Tupper. (Min. and Eng. Wld., Mar. 23. 1912; 4¾ pp., illus.) 20c.

18,541—LOCOMOTIVES—Storage Battery Locomotives. (Coal Age, Feb. 3, 1912; 1 p., illus.) 20c.

18,542—POWER — The Comparative Values of Water Power and Steam Power. A. C. Dunham. (Elec. Wld., Jan. 6, 1912; 2½ pp.) 20c.

18,543—POWER PLANTS — Modern Power Plants in Florida Phosphate District. C. A. Tupper. (Min. and Eng. Wld., Feb. 3, 1912; 3¼ pp., illus.) 20c.

18,544—PUMPING PLANT at Sloss Iron Mines, Alabama. C. A. Tupper. (Eng. and Min. Journ., Mar. 16, 1912; 1⅓ pp., illus.) 20c.

18,545—PUMPS—High-Speed Turbine Pumps. J. W. Rogers. (Cassier's Mag., Mar., 1912; 9 pp., illus.) 40c.

18,546—STEAM ECONOMY—Economy in the Use of Steam. R. H. Rowland. (Mines and Minerals, Mar., 1912; 1½ pp., illus.) 40c.

18,547—STEAM POWER PLANTS. O. S. Lyford, Jr., and R. W. Stovel. (Proc. Eng. Soc., W. Penn., Jan., 1912; 54 pp., illus.) 60c.

18,548 — STEAM-SHOVEL DIPPER TRIPS Used on the Panama Canal. (Eng. News, Jan. 25, 1912; ¾ p., illus.) 20c.

SAMPLING AND ASSAYING

18,550—PLATINUM—The Direct Determination of Small Amounts of Platinum in Ores and Bullion. Frederic P. Dewey. (Advance proof, A. I. M. E., Feb., 1912; 4 pp.)

18,551—RAPID METHODS of Technical Analysis. Frank D. Aller. (Colo. School of Mines Mag., Mar., 1912; 1¼ pp.) Continuation of articles previously indexed.

18,552 — SMELTER ASSAYS — Quick Combination Methods in Smelter Assays. A. T. French. (I. M. M. Bull. 89, 1912; 18 pp.)

INDUSTRIAL CHEMISTRY

18,553—ATMOSPHERIC NITROGEN—Ausnutzung der Koksofengase zur Gewinnung von Salpetersäure aus dem Stickstoff der Luft. Dobbelstein. (Glückauf, Feb. 24, 1912; 10½ pp., illus.) Utilization of coke-oven gases for the extraction of nitric acid from the nitrogen of air. 40c.

18,554—NITROGLYCERINE — Fabrication de la Nitroglycérine. P. Lambert. (Rev. de Chimie Industrielle, Jan., 1912; 4¾ pp.) 40c.

18,555 — SULPHATE OF AMMONIA. Nitrate of Soda and Sulphate of Ammonia. (Am. Fertilizer, Feb. 10, 1912; 9 pp.) Abstract from the annual review of the nitrate of soda and sulphate of ammonia market for the year 1911, as prepared by Bradbury & Hirsch, Liverpool, Eng. Shipments and average monthly prices. 20c.

18,556 — SULPHATE OF AMMONIA. Plants for Making. C. G. Atwater. (Progressive Age, Jan. 1, 1912; 6¼ pp., illus.) 40c.

PERSONAL

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Alexander Gray, of Porcupine, Ont., is in New York.

J. E. McAllister has gone to England on a business trip.

M. K. Rodgers, of Seattle, Wash., was in New York last week.

Wallace Broad is now on his way to the province of Hunan, China.

Henry Krumb is examining the property of the Ohio Copper Co. in Utah.

Price McKinney, of Cleveland, O., has gone to Terrazas, Chihuahua, Mexico.

Thomas R. Stevens, recently at Batum, Russia, has just returned to the United States.

Charles M. MacNeill, president of the Utah Copper Co., has been visiting the mines.

George H. Garrey, who recently returned from Mexico, has been in New York the past week.

George J. Hough has sold his business as assayer at Salida, Colo., and has gone to Zacatecas, Mexico.

Stanley C. Sears has returned from Mexico, and will be for the present at Room 104, State House, Boston.

Grant B. Schley has been visiting the Britannia, on Howe Sound, B. C., in which mine he is largely interested.

H. Parks, superintendent of the Nipissing mine, Cobalt, was in New York last week, on his way to England on a short visit.

William Hanson, of Montreal, has been elected president of the Maritime Coal, Railway & Power Co. of Nova Scotia.

Francis Drake has taken an appointment as consulting mining engineer in Rhodesia for Lewis & Marks, of London.

C. C. Forester has been appointed general manager of the Evans Consolidated Mining Co. in the Black Hills, South Dakota.

Heinrich Koppers, of Essen, Germany, inventor and builder of the Koppers by-product coke oven, is visiting the United States.

John W. Miller, at one time heavily interested in the Porcupine camp, has returned to Canada from a visit to South America.

P. Justice Grugan recently made an investigation of the iron ore deposits in Fulton County, Penn., for a steel company of Pennsylvania.

Henry Cribb, recently at Peak Hill, Western Australia, is now manager of the Tominil mine, near Guadalupe de los Reyes, Sinaloa, Mexico.

W. L. Saunders, president of the Ingersoll-Rand Co., will make the commencement address at the Colorado School of Mines, Golden, Colo.

S. F. Shaw has been appointed superintendent of the Tiro General mine of the American Smelting & Refining Co. at Charcas, San Luis Potosi, Mexico.

J. M. Callow, consulting mill engineer, for the Inspiration Copper Co., has returned to Salt Lake after four months' absence on professional work in connection with the new mill.

H. L. Brinker has been appointed assistant superintendent of blast furnaces at the Ohio works of the Carnegie Steel Co. He has been chief chemist of the plant for some time.

George O. Argall, general manager of the Iron Silver Mining Co., of Leadville, Colo., has returned from a trip to Panama. After attending the annual meeting of his company in New York he proceeded to Leadville.

Kenneth Duncan, recently connected with the Pioneer mine, has been appointed general manager of the North American Iron Co. and the Consolidated Vermillion Iron Co. operating on the Vermillion iron range in Minnesota.

O. B. McKay, of Arizona, who has been employed as superintendent of construction of the power plant installed at the Fruitvale mine, in Nevada County, California, will make an extended trip north, including Victoria, B. C., and Juneau, Alaska.

C. H. McMillan, who recently severed his connection with the Dominion Steel Corporation, will shortly accept a leading position with the Canada Cement Co. and devote his attention to the fuel question with a view of lessening the cost of production.

E. C. Hutchinson, of San Francisco, president of the Kennedy Mining Co., operating the deepest gold mine in California, in Amador County, has been appointed, by Governor Johnson, trustee of the State Mining Bureau, to occupy the place vacated by the death of Dr. Deane last year.

N. P. Turner has resigned his position as chief engineer of the Cuba R.R. In association with L. D. Moore, of New York, he will take up mining and general engineering and exploration work in the West Indies, Central and South America, with headquarters for the present at Hotel Camagüey, Camagüey, Cuba.

George Burnham, Sr., formerly head of the Baldwin Locomotive Works, Philadelphia, celebrated his 95th birthday anniversary, last week. His connection with the Baldwin Locomotive Works began as a clerk when he was 17 years of age, and he filled various capacities until he became the head of the firm at the death of Matthias Baldwin, in 1886. He retired two years ago, after having served with the company for 76 years.

Gen. Pascual Orosco, now at the head of the insurrectionary movement in northern Mexico, was at one time in charge of a burro train at Florence, Arizona. It was then believed that he was American born but this he denies. He later moved to western Chihuahua and before the Madero revolt was engaged in the transport of supplies for the American mining companies operating in that region. He was considered very energetic and responsible in this business and had very good relations with American mining men.

OBITUARY

George Hardie, one of the pioneer mining men on the Upper Peninsula of Michigan, died at Chicago, March 24. He was 88 years old, having been born in Edinburg, Scotland, in 1824. His chief interests were in Michigan copper properties, which he developed in the early fifties.

Simeon F. Sullivan died at Brooklyn, N. Y., March 29. He was for many years the confidential agent of the late Senator Calvin S. Brice of Ohio. After Senator Brice's death Mr. Sullivan became secretary and treasurer of the Chihuahua (Mexico) Mining Co. Later he established an investment company in New York.

Henry O'Sullivan, formerly provincial geologist of the province of Quebec, died at Quebec on March 27. He was a native of Ste. Catherine, Que., and graduated at Laval University in 1869. He was a fellow of the Royal Geographical Society and a recognized authority on the geology and geography of Quebec, his work including surveys of the James Bay region, the Labrador coast, Gaspé, Ungava and the Abitibi district.

Societies and Technical Schools

University of Idaho—Prof. R. S. McCaffery, head of the mining department, addressed the Associated Miners of the University at their last bi-weekly meeting Mar. 19. He gave an interesting talk on aërial tramways and illustrated with lantern slides. At this meeting the association discussed plans for its spring mining trip will probably be taken to British Columbia.

International Congress of Applied Chemistry—Announcement No. 3, containing information on the program, excursions and factory visits which have been arranged for the members of the Eighth International Congress of Applied Chemistry, to be held Sept. 4 to 13, has been sent out by the secretary, Bernhard C. Hesse, 25 Broad Street, New York. Members who desire to take part in the various tours which have been arranged are especially requested to notify the American committee as soon as possible since some of the reservations will have to be disposed of entirely before May 15. The present announcement is the last to be issued before the holding of the congress.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Mar. 27—The farmers of Shasta County are again complaining that crops are being damaged by the fumes from the Mammoth smeltery at Kennett; the farmers of Calaveras, Amador and San Joaquin Counties are still grumbling about the Campo Seco smeltery; and the state conservation commission is reported to be preparing for a campaign against the quartz mills, that will require the impounding of tailings as required of hydraulic miners. It is not believed by disinterested investigators that there is any actual damage being done to the crops or to the streams that will not be cured by the smeltery and mill operators without a shutdown. It is doubtful if the present damage is in any measure caused by smeltery smoke. The complaints come from farmers 30 miles southeast of Kennett, and the blight on the alfalfa and the alleged damage to the olive orchards extends into Glenn and Tehama Counties, entirely out of the limit of the smoke area. It is more likely to have been caused by the long, dry winter and the cold north winds, as is admitted by farmers who are not complaining. In the Campo Seco vicinity the same cause may be safely set down for much of the damage. The Mammoth company has been operating the baghouse successfully, and it is believed that there is no further actual cause for serious complaint. The Campo Seco smelter has been industriously experimenting for the last year, and the damage in that vicinity has been greatly reduced.

The reported complaint of the conservationists is a new wrinkle, and it is as surprising as it is new. The damage done to streams by the tailings from the mills, if there really is any, is so small that it is hardly worth the attention of a dignified body of men. Men of broad acquaintance with the quartz-mine operations are of this opinion. In many districts there is room for improvement and such improvement would add to the value of the land, though without direct relation to the near-by streams. In one instance in Amador County, advantage was taken of the tailings pile by a farmer, and a productive plot resulted. The leveled area was first occupied as a feeding corral; after the stock had been wintered there the ground was plowed and cultivated and produced good crops of alfalfa. A law that would require the construction of impounding dams by all quartz-mine operators that have mills in the vicinity of live streams, or a law similar to that regulating hydraulic mining would work a hardship and demand needless expenditure of large sums of money.

Butte

Mar. 27—If ore shipments to the Washoe and Great Falls smelteries continue without interruption during the remainder of March at the present rate, the production will not only exceed that of February when 27,450,000 lb. of copper were produced, but will exceed considerably the figures of any month for the last two years. In March, 1909, the smelteries of the Anaconda company turned out 27,028,728 lb. of copper, and the Clark mines, which did not then belong to the Anaconda company, produced about 1,500,000 lb., a total of 28,528,728 lb. It is estimated that this month's production of the two plants of the Anaconda company will be about 29,000,000 lb., and allowing for about 1,250,000 pounds from the East Butte and some other small companies, that the amount for the Butte district will exceed 30,000,000 lb. The Mountain View, High Ore and Badger State mines of the Anaconda, have been selected to bear the heaviest burden of this increase, although none of them are being run at their full capacity.

Preparations are being made for the electrification of the Butte, Anaconda & Pacific R.R., between Butte and Anaconda, and actual work will commence soon. Twenty-five cars of steel rails, bored for electric connections, have been placed along the right-of-way between Anaconda and Durant, and 20 cars of ties have also been unloaded. Anaconda will be headquarters for the working crew, and the work will proceed from that city toward Butte.

Denver

Mar. 29—Judge W. A. Colburn, president of the company owning the Ajax mine, on Battle Mountain, in the Cripple Creek district, is credited with the statement that the mill, recently built, is a complete success, and that a cleanup after three months' operation resulted in a retort of $14,000, from ore worth $16,000. The local paper naïvely remarks: "This demonstrates that the process is dissolving the gold." The president further states that the ore treated runs from $1.60 to $3 per ton, and that the tailings assay 80c. per ton. A statement of costs is not given.

Fifteen cement plants in Kansas and Oklahoma are parties to a merger, which was effected for the purpose of maintaining a steady price and eliminating competition, and which has closed a war of three years' duration. The result is that cement prices have advanced 20c. per bbl. in Denver, and another advance of 30c. is predicted. It is now selling in Denver at $1.37 per bbl., based on a Kansas mill price of 70 cents.

In view of the fact that the deep drainage tunnel has rendered available for working without the cost of pumping, ground about 700 ft. deep over the entire Cripple Creek district, and that rich ore has been found at the lowest levels attained by the deepest shafts, it is interesting to note from a statement compiled by the Victor *News*, that there are only 38 shafts in the entire recognized producing area, that have been sunk to a depth of 1000 feet.

Salt Lake City

Mar. 28—It is reported that the Utah Copper Co. will, during the next few months, complete the removal of a piece of overburden that has heretofore interfered with the maximum extraction of ore and that soon after midsummer it will become possible to supply the mills with 20,000 tons per day, which will mean a copper production at the rate of about 140,000,000 lb. per annum.

During February the Ohio Copper Co. treated 51,924 tons of ore, producing 1870 tons of concentrates, averaging 20.4% copper. Profits from the 757,207 lb. of copper produced were $37,117, as compared to $26,413 for November from 711,914 lb. The average daily ore treated was 1790 tons, as against 1741 tons for November. The ratio of concentration was 27.76:1, and that for November was 39.02:1. Comparing costs for the two months, in general, milling costs were lower in November, and mining and transportation charges higher. Milling costs for February, including general expenses, were 37.97c. per ton as against 34.20c. for November. February mining costs were 22.40c. per ton, and those for November, 24.03c. Transportation charges in February were 15.97c. per ton, as compared to 16.3c. in November.

A fact not generally known is that the branch office of the U. S. Geological Survey here, is open to the public, and any information regarding the survey publications or maps on the local or surrounding mining districts may always be obtained. The office is in the Kearns Building and is in charge of Victor C. Heikes.

Deadwood, S. D.

Mar. 28—The order allowing the U. S. Assay Office here to make ore assays for $1 each, has been enlarged so that the office is authorized to make not only an ore assay for gold and silver for this price, but the following metals also are determined: Copper, lead, zinc, iron and tin. This is the only government assay office in the country at which this charge has gone into effect, and marks the first step of the federal government in doing assay work at a commercial price. Previously the price has been $3 for a gold-silver assay.

A decision, handed down at Detroit, Mich., in a suit brought by one of the stockholders of the Golden Crest company for an accounting of about $750,000, gives a verdict for the defendant, Pres. R. L. Bailie. The decision also goes farther and orders the cancellation of certain stock and notes given by the company. This clears up the company's affairs so that work will be begun this summer.

Houghton, Mich.

Mar. 29—The advance in the price of copper is particularly interesting to the mines of the Lake Superior district, for at the present price practically all the mines can make a fair profit and some will return large dividends. The Ahmeek will earn large returns at the present rate of production, and when the two new shafts are sending out their share of rock, the mine's present production will be about doubled. Calumet & Hecla will be materially affected by the rise, both through its own production and its holdings in other companies. During the last month this company produced rock from the Osceola amygdaloid lode, on its property, at a cost of $1.27 per ton, and it will, in all probability, do as well, if not a little better, in March.

Osceola Consolidated will benefit, for the North Kearsarge branch can return a good profit with copper at 15½c., while at about 12½c. per lb. it could scarcely meet expenses; the old Osceola workings can also be operated profitably, and the shafts at that mine will likely be reopened early in the summer. Tamarack should also make money, considering the present conditions at the mine.

Isle Royale is planning to increase production materially during the coming summer, although it is rumored that the proposed plan for affording additional stamp facilities for this and other companies associated with the Calumet & Hecla, is to be blocked. This would not affect the production of Isle Royale, as the management has control of other milling facilities that could handle this production.

Negaunee, Mich.

Mar. 30—The prospect for an unusually late opening of navigation on the Great Lakes is occasioning some apprehension by railway, steamship and mining interests. Usually navigation opens in April; this year due to the abnormally severe winter, it may be delayed until the middle of May. Reports differ as to the statements that in the last winter Lake Superior was frozen over for the first time in many years; it is agreed, however, that the ice for a considerable distance from shore is unusually thick and that it will be some time before the ice has left the vicinity of the Soo ship canal. The question of how much ore will be shipped is, of course, an open one; the initial feeling was that several million tons more than last year's output of 32,000,000 tons would be needed, but recent rumors of a cut in ore prices have caused some pessimism. Following the report of the cut in the price of ore have come rumors that the price of transportation from docks to lower Lake ports would be cut.

Surveyors are at work on the proposed extension of the Chicago, Milwaukee & St. Paul R.R., from Crystal Falls to Iron River. The new route will take in the Chicagon, Erickson and Rogers mines, and the Blair exploration, and it will enter Iron River near the Tully mine. No official statement has as yet been given out by the railway company that the extension will actually be built, but it is believed that an announcement will be made soon.

Chihuahua, Mexico

Mar. 25—The Liberal revolution is seriously affecting the mining industry in this and adjoining states, in fact more so than did the Madero revolution of last year. Immediate and subsequent results will be more detrimental, because lack of confidence on the part of foreign investors will be greater than during or since the previous revolution, and there is, perhaps, good ground for such an attitude.

No property destruction or personal interference with foreigners has been reported, except in isolated cases, but there is difficulty in securing supplies and in marketing products because of irregular, and, in some instances, entire absence of railroad transportation. The immediate difficulty is the shortage of dynamite, and unless this commodity is permitted to come in immediately, the majority of the mines throughout this and adjoining states will be forced to suspend operations. The supply in the Santa Eulalia camp will be exhausted in about two weeks, after which time all the mines will probably shut down indefinitely, throwing over 3000 peon laborers out of employment, the majority of whom will presumably take up arms in the Liberal or Orozco cause. The few mines operating in the western part of the state, as well as in the vicinity of Parral, Santa Barbara and Naica, are in the same dilemma, with the additional difficulty of running low on cyanide and other mine supplies.

The Sierra Mining Co., operating at Ocampo, closed down about Mar. 15, as did several smaller mines in the same camp. The Yoquivo Development Co. is still in operation, as are the Dolores, Batopilas and Republica companies, but it is likely that the last two, as well as the Yoquivo, will be forced to suspend soon. The Dolores company has sufficient supplies to continue for at least two months. The El Rayo, at Santa Barbara, as well as the Creston-Colorado and La Dura mines, in Sonora, report sufficient supplies for at least two months.

The American Smelting & Refining Co.'s smeltery, at Chihuahua, continues in uninterrupted commission, and has had its entire five furnaces in blast since Mar. 15, smelting a larger tonnage than ever before. Sufficient coke and coal have been secured for three months, and if the Santa Eulalia ore supply can be maintained, the plant can continue for a long time. The Asarco plant has practically suspended operations, but the Aguascalientes works are operating steadily, and will continue to do so as long as communication over the San Luis Potosi division of the National Railways of Mexico is kept open. The Torreon smeltery is operating at small capacity, but with the exhaustion of its accumulated ore and fuel supplies, will have to close down, as railroad communication to the coal fields and ore-supply centers has been cut off for several weeks. The ore-buying agencies at both Parral and Chihuahua have discontinued ore receipts, and this has caused the shutting down of many smaller mines. Operations have continued almost uninterruptedly in the Guanacevi camp, but the Inde camp is shut down for an indefinite period. At Guadalupe y Calvo, operations are under way on a small scale.

Another perplexing problem for the mining men in this state just now is the payment of mine taxes, falling due not later than Apr. 1. A large portion of the mining area is now under the control of the rebel factions. In many districts there are officials representing the constitutional government and in others the officials appointed by the rebel leader are collecting taxes. In some cases the companies have sent their taxes direct to the Department of Hacienda, at Mexico City, which is permissable, and others have deposited the money with the American Consuls or the American Ambassador, and notified the officials. It is certain that serious complications will arise under the extraordinary conditions of political affairs which now prevail in Mexico.

The Mining News

The Current History of Mining

Alaska

Horner & Co. are installing a large hydraulic plant on Eva Creek, where the ground, it is said, will average $5 per foot.

Isabella—Some rich gravel has been found on these claims on Vault Creek, in the Fairbanks district. Conta & Co. have charge.

Ramsey-Rutherford — This property, near Valdez, is being developed by Col. B. F. Millard and associates, and is showing some good ore.

Arizona

GILA COUNTY

Live Oak—The work of enlarging No. 2 shaft has been completed. The third compartment was added by raising from three different points and the total distance of 925 ft. was accomplished in 40 days. Sinking will be resumed soon, and it is intended to sink to 1250 ft. Meanwhile, the new steel headframe will be erected and the new hoisting equipment installed. The new Ingersoll-Rand 1300-cu.ft. compressor is being erected.

Barney—Hole No. 1 has been discontinued at 1450 ft. depth, being the deepest hole ever drilled in the district. It is bottomed in schist and is a flowing well, the strong flow of water encountered in the dacite formation at 960 ft., continuing undiminished and sufficient for both churn-drilling and domestic use. Hole No. 3 will be started at once. Hole No. 2 is 370 ft. deep.

Miami—Development work totals about 6000 ft. per month. All mining is being done above the 420-ft. level, but the 570-ft. level is being opened up. Near the mill, pits are being made for foundations for a tailing tower. It will be equipped with four bucket elevators, having 24-in. belts and designed to elevate the tailings 60 ft., so that the gulch into which they are now being run, may be entirely filled. This elevation will also be sufficient to run the tailings by gravity into the next gulch to the east.

South Live Oak—Harry Millard, who will have charge of churn-drilling, has returned from St. Louis, where he purchased a large machine, especially designed for deep drilling. It is expected to arrive in about six weeks.

Arizona Commercial—A syndicate, composed of banking interests closely connected with the reorganization committee, has purchased $113,000 bonds from Hayden, Stone & Co., and Paine, Webber & Co., and will deposit them. This assures the success of the reorganization plan. The new company will be named the Arizona Commercial Mining Co., and will be formed under Maine laws, with 300,000 shares and $5 par value.

Southwestern Miami—Drilling has been resumed in hole No. 2. It is reported that both this hole and more recently No. 3 hole, have found ore, but we have been unable to confirm this.

MARICOPA COUNTY

Development is underway on some silver-lead prospects of the well known Bronco vein belt, in the Seven Springs district.

Maricopa—A tunnel is being driven at this mine to cut the old workings at about 150 ft. in depth.

Magazine—Some rich copper ore, with native gold, has been found in this prospect, about 40 miles north of Phoenix, beyond the Cave Creek district.

Grande Traverse—Operations on this and the Oriental copper properties, near Gold Hill, have entirely closed.

Mormon Girl—Work will be resumed soon on this property near Cave Creek station. The openings are 400 ft. deep.

Nicholson—In the Gold Hill camp, 35 miles north of Phœnix, leasers are treating the surface ore from this property in the Dravo mill.

Dugas — This mine adjoining the Nicholson has been recently examined for eastern interests.

Bondurant—This mine in the Cave Creek district, north of Phœnix, has been equipped with a 10-stamp mill and will operate.

Phoenix—An investigation of the old mine has been made recently for the eastern owners. The mine at one time had a 60-stamp mill, now partly removed. W. H. Channel has recently made some tests of the vanadium ore in the mine.

PIMA COUNTY

Oceanic—This gold mine at Arivaca, owned by H. R. Bacon, is under bond to Marion E. Ish, Walter E. Jelsky and S. J. Shoemaker, of Los Angeles. A cyanide plant has been installed and is being operated on a small scale. Development is being done.

California

CALAVERAS COUNTY

Melones—The rich ore reported to have been found recently is melonite, the same as was taken from the old workings several years ago. The oreshoot is about 11 ft. wide, averages about $20 per ton, and is in the south drift of the 1350-ft. level, the latter being 250 ft. below the main tunnel.

INYO COUNTY

Skidoo—During February, 1350 tons of ore were milled, yielding $11,602 gross and net $3078. Operating expenses were $7860 and $863 were expended on development.

PLACER COUNTY

Eldorado & Placer Mining & Power Co.—Lumber for hull construction is being hauled to Butcher Ranch for the new dredge to be installed on the middle fork of American River, 20 miles east of Auburn. Alfred Tregidgo, Foxcroft Building, San Francisco, is president, and George L. Holmes is engineer.

SANTA BARBARA COUNTY

Palmer Union Oil Co.—Announcement has been made of the sale of this company's properties to the Imperial Foreign Corporation, of London. This marks the termination of negotiations extending over a period of two years.

SACRAMENTO COUNTY

Natomas Consolidated — No. 10, the new steel-hull dredge, designed for installation at Rebel Hill in the American River district near Natoma, is in course of construction. The steel hull, built by Johnston Bros., Ferrysburg, Mich., for the Yuba Construction Co., is *en route*. The hull was put together at the Michigan works, and knocked down for shipment. The buckets will be of 15-cu.ft. capacity; the latter with other machinery is from the Yuba Construction Co. shops, at Marysville. The rebuilding of No. 8, the dredge that was burned last October, will begin as soon as the new steel hull is completed. These boats will be in commission this year.

SIERRA COUNTY

Mountain—This property, at Sierra City, is reported to have been bonded to Denver men.

Rosasco—The tunnel being driven to cut the vein on the serpentine contact, is nearing the intersection point. This property is being worked under bond to C. A. Austin and associates of Sunnyvale, Cal. H. F. Whirlow, of Berkeley, is superintendent.

Telegraph—Rich gravel is being taken out and the quartz mill will be rebuilt this season and used in crushing the high-grade ore recently found. The quartz lies along the Mountain House-Goodyear Bar serpentine belt, which reaches the Kate Hardy mine on the south. Hon. J. W. Finney is manager.

Colorado

Boulder County

Tungsten Mountain Mines Co.—The mill, near Nederland, has been enlarged to a capacity of 30 tons per day of crude ore, and is now in operation and producing high-grade concentrates. It is stated that the company's tunnel is being pushed ahead rapidly with machine drills, and that a year's supply of ore is in sight.

Clear Creek County

It is reported from Idaho Springs that H. B. Clifford and associates, of New York, who are credited with purchasing the Waldorf mines in the Argentine district, and other properties on Seaton Mountain, will construct a large mill. It is also stated that last summer they sent two cars of ore to Thomas A. Edison for test purposes.

West Griffith—W. O. Robinson, of Georgetown, has taken a five years' bond and lease on this mine, and has started work.

Josephine—This mine, in West Argentine, has been sold for $7500 by the referee in bankruptcy, Fermor J. Spencer, to J. C. Bell.

Capital—This mine, under the Hummer lease, is shipping $60 ore, and also a good tonnage of ore to the company mill. The ore carries galena and copper.

Cripple Creek District

El Paso—A good orebody has been opened for 40 ft. in the first level. Assayed samples of the first car of screenings indicate 3 oz. gold per ton. The shaft from the deep drainage tunnel level will be completed soon.

Dante—Two cars of 1-oz. gold ore from the Gaylord lease will be shipped this month. About 500 ft., in depth, of stoping ground have been opened in this orebody.

Golden Cycle—It has been officially announced that the capacity of the mill is to be increased to 1200 tons, following the blowing in of the ninth Edwards roaster.

Stratton's Independence—During February, production amounted to 2766 tons, averaging $19.13 per ton. Low-grade mine and dump ore milled totaled 8700 tons. Net working profit at mine and mill was $17,800, and $1500 were expended on special development.

Wild Horse—The cyanide mill is treating 40 tons per day of low-grade ore, from the development underway by the United Gold Mines Company.

Lake County—Leadville

Little Pittsburgh—Fred Hoffer, lessee, is reported to have discovered a streak of zinc-carbonate ore, assaying about 40% zinc, 90 ft. north of the old shaft. High-grade lead carbonate was formerly taken from this mine.

Dinero—About 200 tons of ore per month are going to the smeltery from this tunnel in Sugar Loaf Mountain.

American Extraction Co.—About 500 tons per month, from the dump of this company, are being shipped to the Arkansas Valley plant, and 300 tons to Pueblo.

Mt. Champion—The machinery for the new 75-ton mill for this mine is on the ground and will be installed soon. The equipment consists of crushers, rolls, tube mill and tables.

Ouray County

Revenue—This mine, in the Sneffles district, has been operated for over 30 years, and produced about $12,000,000 gross, under the general management of A. E. Reynolds, of Denver. Lessee Platt is now operating it. Superintendent Camp has charge of 12 men, who are cleaning up the workings preparatory to the summer's work.

Idaho

Boise County

Gold Hill & Iowa—This mine, at Quartzburg, continues to stope ore from the 500 level, and the mill is running at full capacity. E. E. Carter is manager.

Elkhorn—F. Fitzhugh, manager, states that good ore has been found and that milling will start as soon as the weather permits.

Coeur d'Alene District

Lucky Calumet—The new compressor is now in operation and is giving good results. Progress now is more rapid than formerly, when hand work was necessary. Air is also being supplied from the new compressor to the Snowshoe mine.

Stewart—An electric-haulage system has been installed in the new lower tunnel and the gravity tram, connecting the lower tunnel with the railroad, is about completed.

Tamarack—The litigation which has been holding up operations at this property for several years has been settled, and the mine will be worked soon. The work already done has developed an orebody which can be mined and milled without delay. The orebody is in the same fault as the Hercules orebody, and is a high-grade, lead-silver deposit.

Lemhi County

A crew is prospecting Girtson Creek, with shafts, to determine if dredging is warranted. The dredge on Kirtley Creek has had no trouble working this winter, and reports a successful season.

The Gilmore district has been active all winter, and has been shipping from three to five cars of ore per day to Salt Lake smelteries.

Kittie Burton—This mine, at Ulysses, has employed a good-sized force of men all winter, and has maintained steady shipments of concentrates.

Carmen Creek—This company has completed a 20-ton mill on its property, at Carmen Creek. Equipment includes a Lane, slow-feed, chilean mill and a Ludwic concentrating table. Power is supplied by a 36-in. Pelton water wheel under a 100-ft. head. Operations will start as soon as the snow goes. J. W. F. Halcombe is manager.

Kansas

Ozark Smelting & Mining Co.—This company will add another block of oxide furnaces to its works at Coffeyville.

Michigan

Copper

Godfrey M. Hyams, of Boston, connected with the former Bigelow Syndicate mines, has secured in the Federal Court, at Grand Rapids, Mich., a temporary order, restraining the carrying out of the milling plans proposed recently by the Calumet & Hecla company. Isle Royale is restrained from contracting with the Lake Milling, Smelting & Refining Co., or with the Superior company for hauling Superior rock. Calumet & Hecla is restrained from voting Isle Royale and Tamarack shares at the annual meetings, as regards the proposed milling scheme. The Tamarack company is also restrained from taking any action at its annual meeting, in this connection.

Hancock—Streaks of copper have again appeared in the vertical shaft and results are being awaited with interest.

Superior—This company has tapped the West lode at various levels, by drilling, and at all points has found it to be well mineralized; it will probably soon be opened by crosscuts and drifts.

Michigan—It is likely that this property will resume operations during the early summer, owing to the price of the metal. Considerable work has been done on the Calico and Branch lodes, but the ground is low grade. An exploratory campaign will probably be carried on in the Evergreen group of lodes.

Lake—The return from the second week of the mill run has shown about 25.90 lb. of mineral per ton of rock stamped, which is a material improvement over the run for the first week. Rock shipments are being made to the Trimountain mill of the Copper Range Consolidated Company.

Indiana—The total expense for 1911 was $82,083, of which drilling constituted $11,946, shaft sinking, $24,840, and construction, $24,855. Accounts payable were $41,966. On Jan. 1, 1912, the shaft was 533 ft. deep and advancing 75 ft. per month. Plats will be cut at the 600- and 1000-ft. levels, and some drifting done. T. H. Bennett is in charge.

Contact—The report for 1911 shows balance on hand, Jan. 1, 1912, $20,462. Since that time, $24,370 have been received from subscription under the plan of exchange with the Elm River Copper Co. A horizontal width of 4900 ft. has been disclosed by drilling, and No. 10 hole showed copper in places.

Iron

The Stephenson lumbering interests, controlled by Senator Stephenson, have joined with Marquette men to erect a charcoal-iron blast furnace, at Wells, Mich. John R. Van Evera, Austin Farrel, head of the Cleveland-Cliffs Iron Co. furnace department, and Charles Schaffer, all of Marquette, are interested; the last named is managing director. Charcoal will be furnished from the Stephenson plants.

Rolling Mill—Work at the new No. 2 shaft is progressing rapidly. The 8x8-ft. raise, which was holed through to surface from the 620-ft. level, is being enlarged to 12x14-ft. size, and timbered with Washington fir. This work of enlarging the shaft is progressing from the top down, and more than 110 ft. have been finished. The same "stoper," air-feed, hammer drills, which were used in the raise, are being used in the slicing work now being done, by putting in 45° holes from below for a 5-ft. cut. A temporary headframe and puffer are installed on surface for lowering tools, men and timber, but the rock is hoisted through No. 1 shaft.

Hoose Mining Co.—This new corporation, composed of Iron Mountain men, is to operate in the Iron River district. An option has been taken on the Boyington farm, north of Iron River, near the Bates mine. This tract was partially diamond-drilled several years ago; more holes will be drilled on other portions of the property.

Winter-Vermillion Iron Co.—Work has been discontinued on this company's holdings, two miles east of Negaunee, which were being diamond-drilled by W. T. McCarthy.

Norman Iron Co.—On this 320-acre tract, northwest of Republic, the Jones & Laughlin Co., which is diamond-drilling under option, has put down several deep angle holes, pointing east. The two drills have been moved to the west and vertical holes will be sunk.

Minnesota

Mesabi Range

Morton—This mine, operated by the Todd-Stamhaugh company, will make its initial shipment this year. It is an underground mine, one of the deepest in the district, the shaft having been sunk by the New York Foundation Co., last year.

Longyear—This Jones & Laughlin mine will become a shipper this season. Butler Brothers, who have the contract for the stripping, will load the ore for the mining company this season.

Buffalo & Susquehanna—The Winston-Dear company, that has the stripping contract, will mine the ore for the company this year; the Rogers-Brown Ore Co. will not put in its own mining equipment until next season.

Stevenson—This mine, which was closed down on account of a strike recently, will ship ore from the pit and the stockpile. The shaft will remain boarded up until a settlement has been reached. The property is operated by the Corrigan-McKinney Co. It is generally understood that the strike was caused by a disagreement on the rate of pay for 8-hour shifts.

Missouri

Katy Lou—This Chitwood Hollow property, in the Joplin district, has been sold to the Cripple River Hydraulic Mining Co., of New York, J. B. Shale, president. It comprises about nine acres, and has a mill. It will be operated as heretofore.

Montana

Butte District

Anaconda—The station on the 1600-ft. level of the Badger State mine is being enlarged to 20x50 ft., to handle increased production. This station is being timbered with 14x14-in. posts and caps, the sets being 12 ft. high. The 1800-ft. level station is also being enlarged. All ore in the Badger State mine is trammed to the shaft by the miners, as the workings as yet are not far from the shaft. All of the levels have been laid with heavy steel, however, and it is the intention to equip the mine with electric motors soon. The Emily shaft, 500 ft. northeast of the main shaft, is to be used as an air shaft. Sinking is approaching the 600-ft. level. The first station cut was the 340-ft., and from here one crosscut has been driven south over 100 ft., and another north about 300 ft. A pump station has been cut on the 540-ft. level, and a pump, operated by compressed air, has been installed.

Rex—George Carter and James Ducy, who have been operating this group of claims in Tramway Gulch, four miles east of Butte, have opened a 10-ft. vein, carrying copper, silver and gold.

Jefferson County

Corbin Copper—The Bonanza tunnel recently encountered the north vein, and 40 ft. of drifting have been done. The vein that was developed on the Dewey claim has been cut 50 ft. west of the Bonanza tunnel, and drifted on for 65 ft., showing silver-bearing quartz. Stoping and sinking are in progress in the Rosalie claim; the shaft has been sunk 22 ft. on the foot wall, and shows copper and silver ore in the bottom. About 10 tons of ore per day are being sent to the East Helena smeltery. The Dow tunnel is being driven south about 5 ft. per day to intersect the Minah vein.

Lincoln County

Libby Mining Co.—This and the Comet Mining Co. operating placer mines on Libby Creek, have been closed down during the winter, as it is impossible to work there at this season. They were operated steadily last summer and the work will probably be continued soon. P. J. Brophy, of Butte, is president and manager of both companies, which control about 1000 acres of placer ground.

Madison County

Preparations are being made to resume placer mining in Alder Gulch; if the present warm weather continues, work will commence soon, as there is plenty of water and the frost is leaving the ground.

Missoula County

King & Queen—A complaint has been filed with the state board of railroad commissioners, at Helena, by this Pittsburg company, operating claims near Ashmore, attacking the rate on ore from the mines to the East Helena smeltery. It is stated that the total distance is 333 miles, and the rate $2.95 per ton. The complaint asks that the transfer point be changed, thus reducing the distance, and that an equitable rate be made.

Nevada

Clark County

Operations in the copper-gold area, about four miles northeast of Searchlight, have ceased entirely for the present. Several shallow shafts have been sunk on the Philadelphia-Searchlight and the adjoining Jupiter property. Another adjacent property, now closed, is the Gold Beam Consolidated. Work was commenced on the group in 1906 and more than $250,000 have been spent in exploration. The Lenape has recently been examined by an engineer for its eastern owners.

Duplex Extension—This property, adjoining the Duplex at Searchlight, has been acquired by Carlson & Lund and development by a shaft has been commenced.

Pompeii—Sinking has been resumed at this mine, north of Searchlight, on a newly discovered orebody. It is proposed soon to install a cyanide annex to the mill. W. B. Rulon is president and John R. Mendenhall is superintendent.

COMSTOCK LODE

Ward—The advance of the north drainage drift on the 2450-ft. level continues to open an extensive hot-water belt, from which a large flow of water is being obtained, the temperature of which is 170° F. It has been necessary to "snow-shed" the drift to protect the men from the scalding water. It is claimed that since this water was first tapped, it has had the effect of lowering the water 3 ft. at the Combination shaft, about 1000 ft. to the east.

C. & C.—Three of the new centrifugal pumps have been lowered to the new 2310 station. They are being set on their foundations and the electrical and discharge connections made.

ESMERALDA COUNTY

Goldfield Consolidated—The estimated March production was 30,132 tons; gross recovery, $685,000; operating expenses, $200,000, and $485,000 net realization.

NYE COUNTY

Shipments from Tonopah mines to date and for the week ended Mar. 21, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,350	39,619
Tonopah-Belmont	2,250	26,626
Montana-Tonopah	1,029	11,857
Tonopah Extension	1,085	10,902
West End	713	8,299
Midway	.....	180
MacNamara	440	3,307
North Star	.....	40
Totals	8,867	100,830
Estimated value	$221,675	....

Tonopah-Halifax—The most important development in the district recently has been the cutting of a vein at a depth of 1010 ft. on this property. The mine adjoins the Tonopah-Belmont on the east and the shaft has been sunk to cut the eastern extension of the Belmont vein. The vein cut this week is 8 ft. wide, assaying from $8 to $90 per ton, but is another parallel vein, the Belmont vein being probably 100 ft. deeper. Half of the property is owned by Thomas Kearns, of Salt Lake City, and the other half by the West End Consolidated Mining Co., of Tonopah.

Tonopah-Belmont—During the quarter ended Feb. 29, total receipts were $897,814; expenses, $437,669; net earnings, $460,145; miscellaneous income, $15,031; total net income, $475,176. Available resources on Feb. 29 were $1,293,493, and there were $926,548 cash in banks.

West End—A 10-in. streak of high-grade ore has been opened in an orebody 10 ft. wide, averaging $40 per ton, in the west drift on No. 5 level.

New Mexico

GRANT COUNTY

Monte Rico—This company is developing a copper property at Lee's Peak, near Lordsburg. Lawrence R. Boyd, of Washington, Penn., is in charge. An adjoining property, is also under development.

SIERRA COUNTY

Vanadium Mines Co.—This Pittsburg company, A. B. Bement, receiver, is planning to resume operations at its vanadinite property, at Cutter. The mine is down 400 ft. and is extensively developed. A mill is erected, the treatment scheme of which will be radically modified to meet the results of recent metallurgical tests on the ore.

SOCORRO COUNTY

Socorro—The new De La Vergne oil engines are effecting a saving of $7000 per month. The 3-compartment, vertical shaft is 750 ft. deep and has been cutting through the vein from 730 ft. Drifting has advanced a total of 950 ft. on the seventh level, and 700 ft. have been in ore. One-half of the ore for the mill is mined in the lower levels.

South Dakota

BLACK HILLS DISTRICT

Black Hills Smelting Co.—At the annual meeting the following directors were elected: H. C. Osterman, president; Frank Czerwenka, vice-president; W. E. Tagney, secretary and treasurer; Charles Greve and R. N. Ogden. A superintendent has been engaged to succeed Paul Danckwardt, and he is expected to arrive soon.

Utah

JUAB COUNTY

Tintic shipments for the week ended Mar. 22 were 173 cars.

Beck Tunnel—The ore recently discovered in a raise from the 175-ft. level of No. 2 shaft is being followed south, and 4 ft. of shipping ore have been opened in a drift. Shipments for the month to Mar. 14 are 10 cars, a part coming from the new discovery.

Swansea—Drifting north is being continued on the 940-ft. level, and ore is still in the face. A crosscut west has been started from the north drift, and work to the east is planned.

Scranton—Lead ore, running 25% lead and 3 oz. silver, was opened six months ago in this mine, hitherto known as a producer of zinc ores. The monthly output of lead and silver ore has been 1000 tons until recently, when the output was reduced on account of the lower price for lead. The ore, from 1 to 6 ft. thick, occurs as a replacement of limestone along a strong north and south fissure, which has been followed for 1000 feet.

Chief Consolidated—Net earnings for February were $56,000; one car of ore brought smeltery returns of $10,776. The north extension of the Eagle vein has been developed from the 100-ft. level.

SALT LAKE COUNTY

Utah Consolidated—The February production is given as 16,000 tons, exceeding the monthly average of 1911 by 2000 tons; 1500 tons of lead ore were also shipped. The shaft has been sunk to the 1100-ft. level.

Utah Copper—The February production was 8,612,729 lb., being about the same as that for January.

Utah Apex—Gross receipts from ore for the six months ended Feb. 29 were $302,220; mining, smelting, freight and development expenses were $186,524. The mining profit was $115,696, and $100,000 net profit.

Thompson-Quincy—The new ore opened above the main working level is being followed toward the limestone-quartzite contact. A station is being cut at the 280-ft. level, and when this is completed, raising will be continued. The fissure carries high-grade silver-lead ore, and about 10 tons have been mined in doing this work.

SUMMIT COUNTY

Ontario—This property is being worked by the Crowther Leasing Co. It is reported that the old mill will be remodeled and put into commission June 1.

Daly West—First-class ore from and below the 1200 is being shipped. The mill has closed down temporarily, and milling ore is being developed on the lower levels.

TOOELE COUNTY

Construction has begun on the St. John & Ophir R.R., the new branch line between the Salt Lake Route and Ophir.

Ophir Hill—A considerable tonnage of concentrates is awaiting the completion of the St. John & Ophir R.R. The capacity of the mill is being increased, and the 3000-ft. tunnel has been completed. The ore carries copper, lead and silver, yielding concentrates with copper in excess of lead.

Cliff—Ore has been opened in a winze below the lower tunnel level. The present daily output of 50 tons will probably be increased when the new railroad is in operation.

Washington

White Elephant—A car of machinery has been received at this gold mine near Orient, and will be installed.

Yankee Girl—The tunnel at this mine in Ferry County is now in 245 ft. in good ore. An air compressor is to be installed.

Republic—The Rathbon Reduction Co., of Republic, has renewed a lease for two years on this property in Ferry County, and will install crushing machinery.

Wisconsin

Zinc-Lead District

Stark—A drilling company has been organized at Platteville to prospect this land adjoining the Kohinoor Blende lease.

Dugdale—Joseph Piquett and associates are assembling a hoist and pumping equipment to develop this land, three miles east of Platteville.

Gardner—Chicago men have leased this land one mile south of Platteville and will prospect by drilling.

Wyoming

Wyoming-Ervay Oil Co.—This company has been organized to operate in the Rattlesnake and Dutton Basins, Fremont and Natrona Counties. It is proposed to build a pipe line to the railroad, a distance of 12 miles. W. W. Hurt is president and J. M. Foote, Newark, N. J., is secretary.

Canada

British Columbia

Hedley—During three months, ended Mar. 31, this company milled between 15,000 and 16,000 tons of ore. Average assay value in March was $12.18, as compared with $10.70 per ton for January. Net profit for January and February was $43,311. Profits for March are estimated at about $26,000.

Ontario

A syndicate of Rochester, N. Y., men, has taken an option on six claims, owned by Lindsay and McCluskey, near Night Hawk Lake.

Gold Moose—A depth of 85 ft. has been reached at this property, in the Manitou gold district area. The vein, which carries gold ore, has widened to over 4 ft. A. R. Hutchinson is in charge.

Good Luck—Two shafts are being put down on this property, in the Manitou gold district, the combined depth being 125 ft. A good showing of ore has been found.

Connely—J. H. Curley reports that he has opened a large body of white talc in a 7x14-ft. shaft, 38 ft. deep. This property is at Madoc and adjoins the Henderson mine, the latter being about 250 ft. from the shaft mentioned above.

Ontario—Cobalt

McKinley-Darragh—The annual report shows net profits of $916,865, while the amount paid to shareholders was $1,011,461. The cash balance on hand was $198,633. The production of silver was 2,634,006 oz., a reduction of about 20,000 oz., compared with 1910. The cost of production was 19c. per oz. The ore reserves were estimated at 5,561,780 ounces.

Cobalt Lake—Production is estimated at 40,000 oz. per month, all from mill concentrates. Most of the ore supplying the mill comes from an extension of No. 4 vein, about 15 ft. above the 280-ft. level. The vein here runs 2 to 3 in. wide of 2000-oz. ore.

Nipissing—Deep exploration work is being undertaken. At No. 64 shaft an exploration shaft is being put down to 450 ft. It has already been sunk 275 ft., which is 75 ft. below the contact with the Keewatin. When it has reached a depth of 200 ft. in the Keewatin, crosscuts will be run.

Ontario—Porcupine

Moneta—The main shaft is being sunk to 175 ft., from which point considerable diamond drilling will be done.

Rea—Diamond-drill holes are being bored from the 400-ft. level, in an effort to find the oreshoot. The mine has not been closed down, as reported. It is stated that at the 400-ft. level, the crosscut has been pushed 80 ft. without definite results.

McIntyre—The mill, which was closed temporarily on account of power shortage, has been able to resume operations with a supply from the Porcupine Power Co. Pres. Albert Freeman has deposited in the bank a gold brick of 160 oz., worth approximately $3000, the result of the first cleanup after a run of 174 hours. He states that the company is making a recovery of 75% on the plates, and the tailings, which are assayed every two hours, show an average of 58c. The mill is now treating 60 tons per day.

Hollinger—The mill is expected to be ready for operation about May 1. The stamps are placed and the heavy machinery is ready for power. Two hundred men are working day and night on construction. The orebody being opened in the winze from the drift at the 200-ft. level is showing up well.

Dome—The mill has been operating under difficulties, though at one time all the batteries were in motion for a 6-hour run.

Jupiter—The final payment on the property has been made by the company. The total purchase money was $300,000 and $125,000 have been spent on plant and development. The 11-ft. vein, which showed good gold content on the upper levels, has been picked up in a crosscut on the 200-ft. level.

Dobie—This property has been closed down. D. Lorne McGibbon and his associates, who are heavily interested in the property, have placed in the treasury the title to 17 patented claims owned by them. There are $50,000 cash in the treasury. The claims will be developed.

Porcupine Kendall—Work is to be started on this property. Considerable diamond-drilling will be done.

Mexico

Chihuahua

Northern Mexico Power Co.—This company owning concessions on the Conchos River, under which it is proposed to build a dam for hydro-electric power, to supply the mining camps of Chihuahua, Parral and vicinity, has just held an important meeting in Montreal, at which matters looking to a change in the company's plans were considered. Owing to the necessity of securing a market for its power the company decided in December to secure some mining property in the Parral and adjacent camps and extensive options were taken through Paul Ginther, on which about $250,000 were advanced. This program has been criticised by some of the stockholders and it is understood that an investigation of the plan will be undertaken.

Durango

National Mines & Smelters Co.—This Pittsburg company, successor to the Lustre company, is carrying on extensive development at the properties at Magistral, under the direction of Clawson & Gillingham, mining engineers of Los Angeles, Calif. Recent work has opened a body of sulphide ore running about $10 in gold and copper. Work is now being done on the sixth level and it is intended to continue to the 1000-ft. level before making any output. The property is extensively equipped and has a smeltery on the ground; at one time this was operated as a pyritic plant. William L. Curry, vice-president, and a party of the officials recently made a trip to the mine. Present work at the mine is reported to be hampered seriously by interference with the supplies by the insurrectionists. S. H. McKee, of Pittsburg, is president.

Guerrero

Las Truchas—This iron-ore deposit at the mouth of the River Balsas has recently been examined for New York interests having an option on it. The ore is hematite and the tonnage has been estimated as high as 400,000,000 tons. There has been no development but the ore is exposed over a large area, capping a group of hills flanking the river valley near the Pacific Coast. The deposit is owned by Mexico City and Pittsburg men.

Sonora

A new copper district near Bacanora, district of Sahuaripa, is attracting notice. It was discovered about a year ago but has only recently received general attention. Extensive locations have been made by W. M. Asher and by others supposed to represent some of the large southwestern copper interests. The deposit is a sort of blanket formation and runs from 3 to 5% copper, according to report. The deposit is about five miles from the Yaqui River, in Los Moros Cañon.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, April 3—Everything at present rests on the strike situation, which can only be summed up very briefly.

In the anthracite region work is entirely suspended, the collieries being closed almost without exception. Negotiations are not closed, however, and another conference between operators and miners is to be held April 10. Whatever proposition is then made will be submitted to a district convention of the union, so that there will be a suspension for some time, even if a compromise is effected at the conference.

In the bituminous field the joint committee last week agreed upon a compromise, by which the miners will receive an advance of 5c. a ton on lump coal, or 3c. on run-of-mine, and an advance of 5.26% will be made on day wages. This is now being voted on by the miners. If they vote to accept, the district scales will have to be adjusted. Meantime there is no strike, but most of the mines are closed, and will probably remain so for about 20 days. The probabilities are that the settlement will be accepted.

The H. C. Frick Coke Co., in the Connellsville coke region, has made an advance of 7.5% in mining wages. This will probably be followed by the smaller companies in the district.

In Great Britain the strike is still on. The question of accepting the minimum wage act passed by parliament has been submitted to a referendum vote of the miners, and the result is still in doubt.

Imports of coal into the United States, two months ended Feb. 29, long tons: Anthracite, 25; bituminous, 243,709; total, 243,734 tons, against 277,498 in 1911, showing a decrease of 33,764 tons, or 12.2%. Imports of coke were 23,503 tons in 1911, and 14,103 in 1912; a decrease of 9400 tons.

Exports of coal from the United States, two months ended Feb. 29, in long tons: Anthracite, 453,538; bituminous, 1,362,918; bituminous furnished to steamships in foreign trade, 1,080,866; total, 2,897,322 tons. The total in 1911 was 2,912,984 tons, showing a decrease of 15,662 tons, or 0.5% this year. Exports of coke for the two months were 181,027 tons in 1911, and 112,650 in 1912; a decrease of 68,377 tons, chiefly in shipments to Canada.

Coal and coke tonnage of Pennsylvania R.R. line east of Pittsburg and Erie, two months ended Feb. 29, short tons:

	1911	1912	Changes
Anthracite	1,938,093	2,147,761	I. 209,668
Bituminous	6,594,138	7,668,282	I. 1,074,144
Coke	1,683,771	1,964,184	I. 280,413
Total	10,216,002	11,780,227	I. 1,564,225

French Coal Trade—Imports of fuel in France for the year 1911 were, in metric tons: Coal. 16,230,703; coke, 2,319,591; briquettes, 1,189,326; total, 19,739,620 tons, an increase of 1,593,748 tons over 1910. Exports for 1911 were: Coal, 1,335,195; coke, 184,416; briquettes, 114,495; total. 1,634,106 tons, an increase of 54,972 tons.

IRON TRADE REVIEW

New York, Apr. 3—The iron and steel markets have generally maintained a good degree of activity. A gradual but slow bringing up of prices is reported.

In finished material, structural steel is again becoming a prominent feature, though it is the slowest to show any betterment in prices. The large fabricating companies are still taking contracts at low prices. Other lines report good business and a disposition to extend contracts further than has been the case.

Pig iron has been active, with large sales of foundry iron in Eastern territory; while basic pig is selling well also, both in the East and West. Contracts for second half are being discussed, but buyers are unwilling to pay more, in view of the reduction in Lake ore prices; while sellers are disposed to ask advances. These differences of opinion may not be adjusted without a good deal of discussion and delay. Southern iron is again being pushed, especially in seaboard territory.

The total tonnage of rails rolled in 1911 was 2,822,790 tons; a decrease of 813,241 tons, or 22.3%, from 1910. There was a very large increase in the proportion of openhearth-steel rails.

Reports from Philadelphia are that the Pennsylvania R. R. and the Reading companies have decided to sell their large interests in the Pennsylvania and the Cambria steel companies, as they consider it no longer advantageous to hold control of manufacturing companies.

The United States Steel Corporation has found it expedient to raise some $30,000,000 for new work and for working capital. The official statement says: "As authorized by unanimous vote of directors, not including any member of the firm hereafter mentioned, the Steel Corporation has sold to J. P. Morgan & Co. $30,500,000 bonds on a basis of 5.1% rate of interest. The amount will include $15,000,000, secured on Indiana Steel Co.'s plant, at Gary, Ind., $10,000,000 on Lorain Steel plant, at Lorain, Ohio, and $5,500,000 debentures of Illinois Steel Co., being part of an issue heretofore authorized. As there must be expended during 1912 about $20,000,000 for extensions of properties generally heretofore authorized. and as about $17,000,000 additional working capital is needed in consequence of increased business of companies, particularly in ore department, it has been thought advisable to secure the sum named by sale of bonds in order to keep amount of cash on hand up to the sum shown at beginning of calendar year. In view of the fact that very large sums have heretofore been appropriated from net earnings, for capital expenditures it has been decided to finance some of the capital expenditures as above stated."

Baltimore

April 1—Exports for the week included 113,280 lb. steel plates and 114,780 lb. steel billets to Glasgow, Scotland. Imports included 6400 tons iron from Cuba.

Birmingham

April 1—The present month promises to be an interesting one with the Southern pig-iron manufacturers for during April it is expected the price will be set for the last half of the year. There is inquiry for a large tonnage of iron and one consumer is said to be in the market for a quantity that will be felt. The quotations up to this time have been firm around $10.25@10.50 for No. 2 foundry, and the inquiries are along the line of getting the product at the first-named price. The manufacturers have not been willing to sell, expressing the belief that the price to be fixed for the last half of the year will be on stronger lines. The inventory to be taken this week will show a most satisfactory reduction of the stocks of iron in foundry and warrant yards in this section. The make can be materially increased with but short notice. The big consumption in the home territory is by the cast-iron pipe makers. These plants are running on full time.

Charcoal iron shows no change, either in price or in quantity of production, $22@22.50 being asked.

Chicago

Apr. 2—Sales of pig iron continue encouraging, but there is yet no advance in prices. The average founder, on whom this market chiefly depends, is buying more freely; a number of inquiries are out for large lots, but the disposition is to hold off from signing actual contracts and to watch closely the market. Orders now are for lots up to 1000 tons, with some inquiries over that amount, for second-quarter delivery mainly, and a few inquiries running into the last half.

For second-quarter delivery prices remain $10.50, Birmingham, on No. 2 Southern ($14.85, Chicago), and $14.50, furnace delivery, on Northern No. 2. On some sales this price probably is cut by at least 25c. The tone of the market, however, is stronger, and there is a disposition to ask the higher prices. The demand for local iron is lessening, in comparison with the demand for Southern, yet on small lots for quick delivery both Northern coke and Lake Superior charcoal have an advantage. The latter continues at $16.50 average price.

The market for iron and steel products is more active. The demand for railroad supplies has largely increased, rail orders being more numerous and for larger tonnage; track supplies are active. A stiffening of prices on supplies entering into railroad needs largely is being attempted, with the result of no noticeable diminution of sales.

Soft steel bars sell for 1.25@1.30c. and iron bars for 1.15@1.20c., with the demand active. For building material the tendency also is upward, but strike conditions in Chicago may lessen sharply the demand. Material up to 15 in. is now quoted at 1.30@1.35c. There is good business in sheets at slightly higher prices. Billets are steady at unchanged quotations. In wire goods there is activity due to the opening of spring trade. Plates are slightly higher, quotations running 1.30@1.35c., with the higher price asked on most business. General business conditions are stronger. There is a notable difficulty in obtaining coke supplies, which has advanced prices 25 or 50c., but this condition is looked upon as temporary and due to fear of labor troubles which have been quieted.

Cleveland

Apr. 1—Only a few additional sales of ore are reported. Some buyers seem to think that still lower prices may be male.

Pig Iron—Sales have been quite free, and some contracts for third quarter have been placed. Prices are a little firmer. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.25@13.50 for No. 2 foundry, $12.50@12.75 for forge and $16.50 for Lake Superior charcoal.

Finished Material—New business is coming in well. Prices are firmer, especially on sheets, plates and structural.

Philadelphia

Apr. 3—The determined attitude of most pig-iron makers accounts for the rather light volume of business for the past week considering the amount of iron asked for by near-by buyers and consumers in New York and New England. Makers believe their terms will be acceded to. Inquiries are more numerous. The drop in coke will not affect the present situation as supplies have been contracted for at high prices. There are pending inquiries for large quantities of iron for export and this fact helps to encourage makers. There is no certainty that the export demand will remain, as conditions in England may relieve European buyers from dependence on this side. Consumers of No. 2 X foundry have no occasion to purchase at present. Buyers of gray forge are purchasing in their usual hand-to-mouth way. Basic pig is strong but sales are limited. Several sales of Southern iron have been made within a week at full quotations. An adjustment of the anthracite strike will relieve the situation a good deal. The actual consumption of pig iron outside of gray forge is certainly increasing, but consumers generally are less anxious to anticipate requirements than they were two or three weeks ago. With the clearing up of the coal-strike situation, much will have been done to harmonize the views of buyers and makers. Quotations are $15@15.50 for No. 2 X; $14 for most grades of gray forge and $14.25 for basic, with $14.50 asked.

Steel Billets—Billets are strong at recent quotations and active mostly for early delivery and generally in small lots, though offers have been submitted for unusually large lots for late delivery at figures considerably below the latest mill quotations.

Bars—A general increase in mill orders for large lots is noted during the week. Steel bars are especially active. New car work has brought in quite a number of inquiries. Common iron is now under inquiry at several Eastern mills and the quantities wanted are large.

Pipes and Tubes—The pipe mills are crowded. Additional inquiries are reported today and inquiries for low-grade iron confirm the reports of the placing of new business for pipes. Tubes are also active, and two or three large concerns are about arranging for deliveries for three or four months ahead.

Plates—Plate mills are working almost to full capacity and with the placing of pending orders the plate output of this territory will represent full capacity.

Structural Material—Several held-up orders for shapes have been placed for material to be delivered within the next two months at an average of $1 or $2 per ton above recent quotations. The market is decidedly stronger, owing to the inauguration of the building season.

Scrap—After a long period of dullness, scrap is now moving briskly, especially heavy melting, railroad scrap, yard scrap and old steel axles. All kinds are in better demand and late buyers are paying higher prices than were asked a month ago.

Pittsburg

Apr. 2—At the Duquesne Club, Pittsburg, a little luncheon and meeting was held today, most of the important independent steel producers being present. The Steel Corporation was not represented. No official information is available as to what occurred, since the manufacturers refuse officially to admit that there was a meeting. The conference follows a similar one held recently in New York. The object, presumably, is to interchange information so that the manufacturers may show each other how well sold up they are and thus encourage the asking of higher prices.

The flow of specifications has been fairly good, and shows an improvement over conditions a fortnight ago. New buying is light. The generally quoted prices are 1.15c. on bars and 1.20c. on plates and shapes, these prices being adhered to by the Steel Corporation and by many of the independents. Locally the basis really prevails, but in several districts removed from Pittsburg there are lower figures, made by local producers. The Chicago district is endeavoring to maintain a 15c. arbitrary above Pittsburg, in place of the 18c. freight differential.

Production of steel in March made a new record for a month in the case of the Carnegie Steel Co. and the Republic Iron & Steel Co. The latter interest was assisted by its new openhearth plant, which made its first steel last June but did not operate in full until this month. The company's approximate output, of steel in the form in which it is shipped, was 52,000 tons of bessemer and 26,000 tons of openhearth.

Next Monday the Carnegie Steel Company will start making openhearth rails at the Ohio works, Youngstown, to the extent of 500 to 1000 tons daily, decreasing the output of sheet bars at the plant to that extent. It has been making openhearth rails at the Edgar Thomson plant, but as Edgar Thomson makes bessemer steel only the openhearth ingots must be brought from Homestead, and Homestead cannot spare sufficient to enable the company to make all the openhearth rails required. The total rail production of the Edgar Thomson plant last year was about 575,000 tons, and present prospects are that the output this year will be considerably larger. The light rail mill, No. 3, is operating at practically full capacity, making 10,000 to 12,000 tons monthly.

Pig Iron—The bessemer average for last month, compiled from actual sales, was $14.0536, Valley, or $14.9536, Pittsburg, an increase of 5.36c. over February, when the average was $14, Valley. The basic average for March was $12.76, Valley, against $12.25 for February. The market has been rather quiet in the past week, but has lost none of its recently acquired strength. The furnaces are well sold up. Clinton furnace, Pittsburg, is banked on account of lack of coke and the report is that it neglected to purchase April coke at the proper time. Quotations are: Bessemer, $14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; forge, $12.75, Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—There has been a decided scarcity of ferromanganese for prompt shipment, and fancy prices have occasionally been paid for very small lots. Ordinarily prompt metal can be had at $41@42, while the forward market remains at $41, Baltimore, freight to Pittsburg being $1.95. Imports have been light for a couple of weeks, on account of the English coal strike.

Steel—The market is very irregular. The leading interest has been out of the market since January, but two or three of the independants have continued making low prices, although demand is excellent. The market is practically on a Youngstown basis, at $19.25@19.50 for billets and $19.50@20 for sheet bars, f.o.b. maker's mill, Youngstown, freight to Pittsburg district being $1. Rods are about $25, Pittsburg, and occasionally small lots are sold at this figure.

Sheets—The market has been showing a slight stiffening tendency, particularly on galvanized. The leading interest adheres to its minimum of 2.90c. on galvanized, and books a little business at this figure, being already practically sold up to July 1. On black sheets it is also firmer. The lowest prices are being made exclusively by a few independents. We quote: Black sheets, 28 gage, 1.80@1.85c.; galvanized, 2.80@2.90c.; blue annealed, 10 gage, 1.35@1.40c.; painted corrugated, $1.33@135; galvanized, $2.47@2.50 per square.

St. Louis

April 1—The pig-iron market is more active, and there are numerous inquiries, some for good quantities. Prices are firmly held at $10.50 Birmingham, or $14.25 St. Louis, for No. 2 Southern. Northern No. 2 foundry is in good demand at $14.25@14.50, St. Louis. There is a call for lower grade irons, but they are scarce.

The coke market is strong and supplies are rather scarce. Standard foundry coke commands $5.20@5.25 per ton, St. Louis. The coal mining suspension does not affect trade, as it is not expected to last long.

Iron Ore Trade

In the dock rebate cases in Cleveland the court has decided against some of the defendants, holding that the allowances made on dock charges were in the nature of a rebate. Moreover the Court approves the holding of the Interstate Commerce Commission that the high unloading charge unduly favors those companies which own or lease ore docks, the excessive charge giving them an advantage over competitors who have been obliged to pay the higher rates. It is insisted that the ownership or control should not be invested in companies shipping their own ore.

The sales reported last week seem to have fixed the prices of Lake Superior ore as follows: Old Range nonbessemers, base 55% iron and under 0.45 phosphorus, $3.75; Mesabi bessemers, $3.50; Old Range nonbessemers, base 51.5% iron, $3.05; Mesabi nonbessemers, $2.85; all f.o.b. Lake Erie ports. Some buyers, however, think that prices may go still lower.

At current prices Lake Old Range Bessemer would cost about 9.4c. per unit delivered in Eastern Pennsylvania, and Mesabi nonbessemer, same delivery, 8.35c. per unit.

METAL MARKETS

New York, Apr. 3—The copper market has continued in a highly excited condition. There have also been some active movements in lead. Spelter has been quieter, and there is little new in tin.

New York Metal Exchange—At the annual meeting, Apr. 1, the following officers were chosen: President, James E. Pope; vice-president, A. B. Hall; treasurer, James L. Crooke; board of managers, B. Hochschild, H. W. Hendricks, G. E. Behr, A. Baerwald, Edwin Groves, W. Parsons Todd, Erich Benjamin, and J. H. Lang. Arbitration committee: C. J. Marsh, J. Langeloth, E. J. Keane, P. R. Jennings, and Humphrey D. Bond.

In the table of prices given last week, the quotation for lead in St. Louis, on Mar. 23, 25, 26 and 27, was given at 4.17½@4.20c. through a clerical error. The correct St. Louis quotation was 4.20c. per lb. for each of those days.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Feb. 1912..	$ 10,589,295	$ 2,937,271	Exp.	$7,652,021
" 1911..	424,733	5,805,844	Imp.	5,381,111
Year 1912..	12,504,497	8,078,517	Exp.	4,425,980
" 1911..	1,348,409	15,346,674	Imp.	13,998,265
Silver				
Feb. 1912..	5,121,776	3,780,477	Exp.	1,341,329
" 1911..	4,453,171	3,897,946	Exp.	555,225
Year 1912..	11,149,681	8,138,486	Exp.	3,011,195
" 1911..	10,104,247	7,449,372	Exp.	2,654,875

Exports from the port of New York, week ended Mar. 30: Gold, $20,100; silver, $827,068, chiefly to London. Imports: Gold, $366,897; silver, $259,750, from the West Indies, Mexico and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was again some demand for India, but little for the Continent. In New York there is some talk of gold exports to Europe, but none have been actually made.

Iridium—Prices are steady at $64 per oz. for pure metal.

Platinum—The market is reported a little stronger in demand. Dealers quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Mar. 19, the market is dull and inactive and prices are largely nominal. It would be difficult to sell any large lot of metal at these rates just now. The quotations are 9.90 rubles per zolotnik for crude metal, 83 per cent. platinum, at Ekaterinburg, and 38,200 rubles per pood for the same grade at St. Petersburg; equivalent to $37.22 and $37.44 per oz., respectively. The future of the market depends on the foreign demand, as stocks are rather large.

Silver—The market has continued steady with a downward tendency until today, when, under an Indian speculative influence, it advanced ¼d. in London.

SILVER AND STERLING EXCHANGE

Mar.-Apr.	28	29	30	1	2	3
New York....	58¼	58⅛	58	58⅛	58¼	58¾
London......	26 13/16	26¾	26 11/16	26¾	26 11/16	27 1/16
Sterling Ex..	4.8695	4.8690	4.8690	4.8670	4.8685	4.8695

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Mar. 21, reported by Messrs. Pixley & Abell:

	1911	1912	Changes	
India........	£2,280,100	£1,545,300	D.	£734,800
China........	692,800	400,000	D.	292,800
Total......	£2,972,900	£1,945,300	D.	£1,027,600

A shipment of £551,500 to India, made in the week ended Mar. 21, was temporarily lost by the wreck of the steamer "Oceana," and it is not included above. It will probably be recovered.

India Council bills in London averaged 16.07d. per rupee for the week.

Foreign commerce of the United States, two months ended Feb. 29, as valued by the Bureau of Statistics, Department of Commerce and Labor:

Merchandise	1911	1912
Exports....................	$373,040,696	$401,322,701
Imports....................	252,255,974	277,838,498
Excess, exports......	$120,784,722	$123,484,203
Add excess of exports, silver..........		3,011,195
Add excess of exports, gold..........		4,425,980
Total export balance..................		$130,921,378

Gold and silver movement in detail will be found in the table above.

Copper, Tin, Lead and Zinc

NEW YORK

Mar.-Apr.	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
28	15½ @15⅝	15.32½ 15.35	42¼	4.20	@4.17½ 4 20	6.40 @6 55	6.25 @6.40
29	15⅜ @15⅝	15.35 @15.40	42¾	4 20	4.17½ @4.20	6 40 @6.55	6.25 @6.40
30	15½ @15⅝	15.40 @15.45	42¾	4.20	4.15 @4.17½	6.40 @6 55	6.25 @6.40
1	15¾ @16	15.60 @15.80	43¼	4.20	4 12½ @4.17½	6.40 @6 55	6.25 @6 40
2	15¾ @16	15.60 @15.80	43	4.20	4.12½ @4.17½	6.40 @6.55	6.25 @6.40
3	15¾ @16	15 60 @15 70	43⅛	4.20	4 12½ @4.17½	6 40 @6 55	6 25 @6.40

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Mar.-Apr.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
28	68 3/16	69 1/16	72¾	193	189¼	16⅛	25½
29	69½	70⅜	74	195	191	16⅛	25¼
30	......	......	......	......	......	......	......
1	70⅝	71½	75	196¾	192¼	16⅛	25¼
2	70⅝	71½	75	196½	192¼	16 3/16	25¼
3	69¾	70⅝	75	197	192¾	16 3/16	25⅜

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market crept upward on March 29-30 under the influence of relatively small business. On April 1 a crazy demand set in from Hamburg and London, causing a jump of ¼c. and more in the price. American agencies made sales of electrolytic copper at prices ranging from 15.80 to 16c., delivered in Europe, higher prices being asked from the speculative interests than for copper known to be destined directly to consumers, but premiums were willingly paid. At the same time prices as high as 15⅞, delivered, usual terms, were realized from domestic manufacturers. The market on this day was very erratic, sales being made at a wide range of price. The aggregate of the business was some millions of pounds, chiefly to Europe. On Tuesday the market became quieter but held the advance, though with indications of softening in the latter part of the day after the receipt of the second cable from London showing a decline in the standard market. The opening cable on Apr. 3, showing a decline of 32s. 6d., half of which was regained at the closing, created an uncertainty in this market and a disposition to await further events. As was the case in the previous week the demand for Lake copper was moderate this week and the sales reported by several agencies were of but small volume. The market closes quiet at 15¾@16c. for Lake copper and 15.60@15.70 for electrolytic in cakes, ingots and wirebars. Casting copper is quoted nominally at 15¼@15½c. as the average for the week.

The London standard market, which on Mar. 28, was £68 3s. 9d. for spot and £69 1s. 3d. for three months, advanced about £1 on Mar. 29, and a further £1 on Apr. 1. On Apr. 3, under realization of speculative holdings, the market declined to £69 for spot and £69 18s. 9d. for three months, but it closes at £69 15s. for spot, and £70 12s. 6d. for three months.

Copper sheets have been advanced and are now 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire has again been advanced to 17c. base, carload lots at mill.

Copper exports from New York for the week were 6286 long tons. Our special correspondent gives the exports from Baltimore at 2061 tons.

There has recently been a steep advance in the freight rates to the European ports, which has had an important effect upon shipments of copper. The rate on copper from New York to Liverpool has gone from 7s. 6d. to 15s. (16.2c. per 100 lb.); the rate from New York to Hamburg has gone from 10c. to 16c. per lb., and the rates to other ports about the same way.

Visible stocks of copper in Europe Mar. 31 are reported as follows: Great Britain, 35,730; France, 6420; Rotterdam, 3300; Hamburg, 7600; afloat from Chile, 2330; afloat from Australia, 5700; total, 61,080 long tons, a decrease of 950 tons from the Mar. 15 report.

Imports of copper in Germany, two months ended Feb. 29, are reported by L. Vogelstein & Co. at 33,787 tons; exports were 1717 tons, leaving the apparent consumption of foreign copper 32,074 tons, against 28,138 tons last year. Of the imports this year, 29,293 tons were from the United States.

Brass Prices—The American Brass Co. on Apr. 1 advanced brass prices as follows: Sheets, high brass, 16¾c. net per lb.; low brass, 18¼c. Wire, high brass, 16½c.; low brass, 18¼c. Rods, high brass, 16½c.; low brass, 19c. Tubing, brazed, 21½c.; open-seam, 20⅛c. Brass angles and channels, 20½c. Scrap allowances, 11¼c. net per lb. for high brass and 12¼c. for low brass scrap.

Tin—With the exception of Mar. 28, on which day the London market took a sudden slump, which was attributed to the liquidation of a speculator's holdings, the metal ruled firm throughout the week. There was also more interest shown than heretofore, which was evidenced by the increased transactions.

The market here was dull. Spot tin is again scarce and commanding a slight premium. The market closes very firm at £197 for spot, and £192 15s. for three months, and about 43⅛c. for April tin here.

Visible stocks of tin on Mar. 31 are reported as follows: London, 7694; Holland, 1944; United States, excluding Pacific ports, 6056; total, 15,694 long tons, an increase of 698 tons in March.

Exports of tin from the Straits in March are reported at 2410 long tons.

Lead—The conditions in this market that we have recently reported led to the concentration of speculative business in St. Louis and brought the price at that point to a parity with New York. This led to the transaction of some business for delivery at interior points at the St. Louis price, plus freight, as, for example, 4.32½c., Buffalo, a higher price than those realized at either St. Louis or New York. Since Mar. 21 the market at St. Louis has eased off under offerings both from second hand and first hand, there having evidently grown a fuller appreciation of the probability that recent operations of the leading interests were designed for the purpose of marketing lead rather than for any peculiar and merely temporary purpose. Consequently, there has developed more of a willingness by independent producers to enter the market again and an indication of cutting of prices, sales having been made at as low as 4.12½c., St. Louis. We quote at the close 4.20, New York, and 4.12½@4.17½, St. Louis.

Lead at London continues firm, and Spanish lead is quoted at £16 3s. 9d., and English lead 2s. 6d. higher.

Spelter—There has been almost complete stagnation, nobody having apparently wanted to buy. We quote the market nominally at 6.25@6.40c., St. Louis, and 6.40@6.55c., New York, although somewhat higher prices are asked for prompt deliveries and lower terms are offered for the later dates.

The London market for good ordinaries is quoted at £25 7s. 6d. and £25 12s. 6d. for specials.

Zinc dust is quoted at 7⅛c. per lb. New York.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Silesian Market—Paul Speier writes from Breslau, Germany, that the coal strikes in England and Germany have adversely affected the market. Syndicate price for ordinary brands of spelter for April is 54.65 marks per 100 kg.—5.90c. per lb.—f.o.b. works in Silesia. Special brands are 1 mark higher. Zinc sheets are 65.75@68.75 marks per 100 kg.—average 7.26c. per lb. Zinc dust in 10-ton lots is 51.75 marks per 100 kg.—5.51c. per lb.—delivered at Stettin.

Imports and Exports of Metals

Exports and imports of metals in the United States, two months ended Feb. 29, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	65,785	33,506	Exp. 32,279
Copper, 1911....	61,077	23,990	Exp. 27,087
Tin, long tons....	57	8,458	Imp. 8,401
Tin, 1911........	58	8,063	Imp. 8,005
Lead, short tons.	10,074	19,471	Imp. 9,397
Lead, 1911......	11,471	17,453	Imp. 5,982
Zinc, short tons..	3,861	2,196	Exp. 1,665
Zinc, 1911......	815	477	Exp. 338
Nickel, lb........	3,961,172	5,484,354	Imp. 1,523,182
Nickel, 1911....	4,570,605	4,627,157	Imp. 56,552
Antimony, lb.....	....	1,789,986	Imp. 1,789,986
Antimony, 1911.	139,524	1,205,249	Imp. 1,065,725
Platinum, oz.....	....	13,987	Imp. 13,987
Platinum, 1911.	47	11,504	Imp. 11,457
Aluminum, lb....	8,425	3,231,455	Imp. 3,223,030
Aluminum, 1911	....	....	....
Ores, etc.			
Zinc in ore, lb...	7,162,587	5,491,794	Exp. 1,670,793
In ore, 1911....	2,211,938	7,793,970	Imp. 5,582,032
Zinc oxide, lb. ..	4,452,007	....	Exp. 4,452,007
Zinc oxide, '11..	4,117,695	....	Exp. 4,117,695
Zinc dross, lb....	299,424	....	Exp. 299,424
Zinc dross, '11..	985,490	....	Exp. 985,490
Chrome ore, l.t..	....	9,251	Imp. 9,252
Chrome ore, '11	....	7,979	Imp. 7,979

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 8125 tons; exported, 4587. Imports of aluminum were not reported previous to July 1, 1911. The metal exports given above include reexports of foreign materials.

Other Metals

Aluminum—Business has been good; demand is increasing and prices are again firmer. Quotations are 20@20½c. per lb. for No. 1 ingots, New York. The foreign market is also reported to be firm with a tendency to advance.

Antimony—Business is fair and the market is steady. The quotation for Cookson's is 8c. per lb., and for Hallett's and U. S. 7¾c.; while 6⅞@7c. is named for Hungarian, Chinese and other outside brands.

Quicksilver—The demand is still fair but prices are rather unsettled and there is some range. New York quotations are $42@44 per flask of 75 lb., with the usual advances for small quantities. San Francisco is $42.50 for domestic orders and $40 for export. The London price is £8 12s. 6d. per flask, with £8 7s. 6d.@£8 10s. quoted from second hands.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 30—The base price paid this week for 60 per cent. zinc ore was $50@51 per ton. The base price paid for 80 per cent. lead ore was $52@53 per ton.

SHIPMENTS, WEEK ENDED MAR. 30

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point.........	967,610	....	....
Benton................	829,100	....	344,900
Galena................	766,200	....	....
Shullsburg............	618,700	....	....
Highland..............	537,700	....	....
Platteville...........	406,950	....	....
Hazel Green...........	382,000	....	....
Harker................	211,420	....	....
Cuba City.............	142,000	84,560	84,340
Livingston............	80,000	....	....
Linden................	....	87,560	59,190
Total.................	4,941,580	172,260	488,430
Year to date..........	50,087,170	1,381,610	4,710,890

Shipped during week to separating plants, 2,191,800 lb. zinc ore.

Joplin, Mo., Mar. 30—The high price of zinc sulphide ore is $55, the base price per ton of 60% zinc, $48@52. Zinc silicate sold for $25@29 per ton of 40% zinc. The average price, all grades of zinc, is $48.50. Purchases were made at the week-end, for next week's delivery, on a base of $53 per ton. Lead sold as high as $57.50 per ton, with competition active between the local smelters and the St. Louis Smelting & Refining Co. The average price, all grades of lead, was $55.94 per ton. Heavy rain during the week has precipitated a fight against water encroachment. It is six years since so wet a season was known.

SHIPMENTS, WEEK ENDED MAR. 30

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,695,760	......	984,260	$144,948
Joplin........	2,189,210	......	300,590	65,335
Duenweg.....	759,060	325,510	66,590	24,682
Alba-Neck...	941,050	......	......	23,867
Galena.......	689,260	......	117,690	19,835
Miami......	311,940	......	250,330	13,680
Jackson......	476,910	......	16,570	12,356
Carl Junction	289,610	......	......	7,965
Carthage ...	286,860	......	......	7,171
Spurgeon ..	79,730	171,890	26,850	5,160
Cave Springs.	190,160	......	......	4,750
Granby	69,090	174,220	9,450	3,970
Oronogo.....	154,090	......	......	3,685
Aurora......	74,960	130,000	......	3,670
Wentworth...	101,000	......	......	2,424
Stott City	60,580	......	......	1,515
Lawton	57,190	......	......	1,425
Quapaw......	58,190	......	......	1,280
Sarcoxie......	......	61,000	......	896
Totals......	11,473,640	865,620	1,762,330	$348,613
3 months..	127,917,010	7,369,810	20,765,560	$3,653,348

Blende val., the week, $286,442; 3 months, $2,974,096
Calamine, the week, 12,858; 3 months, 104,185
Lead value, the week, 49,313; 3 months, 575,067

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January....	$41 85	$44 90	$40 55	$43.64	$55 68	$58.92
February..	40 21	45.75	39 16	43 31	54 46	52 39
March.....	39 85	51.56	38.45	49.25	54.57	54.64
April.......	38 88	....	37 47	......	56 37	....
May.........	38.25	....	36 79	......	55 21	.
June........	40.50	......	38.18	......	66 49	......
July.........	40 75	......	38 36	......	58 81	....
August......	42 50	......	41 28	......	60 74	......
September	42 63	......	41 29	......	69 33	......
October.....	42 38	......	40.89	......	54.72	......
November...	45.40	......	43.26	......	57 19	....
December	44 13	......	40.76	......	62 03	......
Year......	$41.45	.....	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Other Ore Markets

Zinc Ores—For Rocky Mountain blende of good quality, especially as to iron and lead contents, the current price is for the zinc contents, less eight units at the St. Louis price for spelter; with a deduction of $16 to $18 per 2000 lb. of ore; sellers to deliver ore at smeltery. Penalties may be charged for detrimental impurities. Blende is readily obtainable at Joplin on the basis of 87 per cent. of the zinc content at St. Louis quotation, less $16 for treatment, and less penalties for iron and lime.

Chemicals

New York, Apr. 3—The general market is rather quiet and shows little change.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, two months ended Feb. 29:

	Imports	Exports	Excess
Copper sulph. lb.	....	4,130,329	E. 4,130,329
Copper sul., '11	....	3,066,338	E. 3,066,338
Bleach, lb.......	16,812,467	....	I. 16,812,467
Bleach, 1911....	18,901,600	....	I. 18,901,600
Potash salts, lb..	141,819,348	78,008	I. 141,741,340
Potash salts, '11	166,398,195	104,032	I. 166,294,163
Soda salts, lb....	2,018,415	95,747	I. 1,922,668
Soda salts, 1911	7,802,112	125,643	I. 7,676,469
Acetate lime, lb.	....	8,923,891	E. 8,923,891
Acetate, 1911...	....	10,397,676	E. 10,397,576
Nit. of soda, tons	80,062	1,277	I. 78,785
Nitrate, 1911...	139,521	1,330	I. 138,191
Phosphates, tons	....	134,906	E. 134,906
Phosphates, '11	....	126,471	E. 126,471
Sulphur, tons....	3,484	2,188	I. 1,296
Sulphur, 1911..	6,079	407	I. 5,672
Pyrites, tons.....	126,516	....	I. 126,516
Pyrites, 1911...	141,552	....	I. 141,552
Magnesite, lb....	16,708,344	149,440	I. 16,558,904
Magnesite, 1911	36,427,258	443,940	I. 35,983,313
Sul. ammonia, lb.	33,314,839	....	I. 33,314,839
Sul. am'nia, '11	67,996,826	....	I. 67,996,826
Arsenic, lb.......	768,666	....	I. 768,866
Arsenic, 1911...	848,302	....	I. 848,302

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 123,291 tons.

Copper Sulphate—Business is good. Prices have again been advanced and are now $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Spot supplies are extremely scarce and sales of white arsenic have been made as high as $4 per 100 lb., while $3.75 per 100 lb. is quoted for futures.

Nitrate of Soda—Current demand is good and spot nitrate is firm at 2.35c. per lb. Futures are a shade higher, 2.35c. per lb. being asked to June 30, and 2.30c. for later dates.

Chemicals and Minerals

CURRENT WHOLESALE PRICES

Ammonium sulphate.......cwt.	3.35
Arsenic, white...............lb.	0.03¾@0.04
Barytes, ground..........sh. ton	12.50@14.00
" floated..........sh. ton	16.00@17.00
Calcium acetate, gray.......cwt.	2.25@2.30
carbide, ton lots f.o.b. Niagara Falls..sh. ton	70 00
Carbons, good drill quality, carat	50 00@75 00
Cement, Port., Am. 400-lb. bbl.	1.33
Chrome brick, f.o.b., Pittsburg M.	175.00
ore, 50%, ex-ship, N. Y., lg. ton	14.00@16.00
Copperas, bulk.............cwt.	0.55
bbl..............cwt.	0.60@0.85
Copper sulphate........... cwt.	5.25@5.50
Fluorspar, lump, f.o.b. Pittsburg, ton	8.00@9.00
Magnesite, crude, 95%....lg. ton	7.50@8.50
calcined, powdered...	26.00@35.00
brick, dom., f.o.b. Pittsburg.........M.	160@180
Paints, litharge, Am. powd...lb.	0.05½@0.06
red lead, American...lb.	0.06¼@0.07
white lead, Am., dry..lb.	0.05¼@0.05¾
zinc white, Am., dry...lb.	0.05⅜@0.06¼
Phosphates, acid:	
*Fla., hard rock 77%........	5 75@6.00
land pebble 68%......	3.70@3.80
†Tenn., 78@80%.............	5.00@5.50
75%................	4.75@5.00
68@72%............	4.25@4.50
‡So. Car. land rock 60%......	3.50@3.75
Potassium cyanide, 98@99%..lb.	0.18@0.20
Pyrite:	
Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit	0.12@0.12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines.......	0.11½@0.12
Imported, non-arsenical, furnace size, ex-ship, per unit..	0.13½
Imported, arsenical, furnace size, ex-ship, per unit.......	0.12¾@0.13
Imported, fines, arsenical, ex-ship	0.11@0.12
Imported, fines non-arsenical, ex-ship, per unit...........	0.12½

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

Sodium cyanide, 120 to 130% KCN..............lb.	0.18@0.20
nitrate 95% spot....cwt.	2.35
95% future..cwt.	2.35
Sulphur, Louisiana prime, N. Y., lg. ton	22.00@22.50
roll...............cwt.	1.85@2.15
flour..............cwt.	2.00@2.40
flowers, sublimed...cwt.	2.20@2.60
pow. com., bags....cwt.	1.50
Sicilian, crude brimstone.........lg. ton	22.50
Zinc chloride, granular.......lb.	0.04¼@0.04½

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.

Petroleum

Oil production in California in February is reported at 6,893,482 bbl.; deliveries, 6,301,985 bbl.; stocks on Feb. 29 were 42,236,635 bbl. The number of new wells completed in February was 65, and 8 wells were abandoned.

MINING STOCKS

New York, Apr. 3—Mar. 28 the market opened somewhat irregular, but toward the close prices generally advanced. Amalgamated Copper closed at 80¼. On the Curb there was a good business, well distributed, but a little irregular. Some coppers advanced and others declined, changes being only fractional. Cobalts were a little weak, but other mining stocks firm. There was much excitement in the Standard Oil stocks; Standard of Kentucky advanced from 425 to over 950, on small sales.

Mar. 29 the Exchange was again irregular, but with a tendency to firmer prices in general. Dealings on the Curb in mining stocks were less active. The Standard Oil stocks showed some sensational declines from the very high points of the previous day.

Mar. 30 the Exchange remained strong and prices were, for the most part, well supported. The Curb was again irregular, so far as mining stocks were concerned; but fluctuations were small.

April 1 the Exchange was active and strong. Amalgamated Copper again advanced and Steel common sold up. On the Curb there was good trading in mining stocks, the coppers being especially strong.

Apr. 2 the Exchange fell off a little under the pressure of realizing sales, but recovered toward the close. Mining stocks on the Curb were active, the coppers being especially strong. Apr. 3 both Exchange and Curb were active, with prices generally well maintained.

At auction in New York, Feb. 28, a block of 50,000 shares Santo Domingo Mining Company, $1 par, brought $30 for for the lot.

Boston, Apr. 2—The copper-share market has gained great momentum by the continued strength of the metal and is almost laboring under an old-time bull movement. This state of affairs is entirely welcome and brokers and holders of copper shares alike are happy. Trading has been on a large scale and while special stocks have shown material advances certain specialties have recorded almost phenomenal gains. Calumet & Hecla, for instance, is up $35 in the week's time, touching an even $500 per share. This compares with a low record price of $360 last year.

Lake Copper has been the most conspicuous feature outside of Calumet, having risen over $10 per share to $48.75. Another instance is a $3 advance in North Butte to $34.50 ex-dividend. A factor in the advance of this stock is the raising of the dividend rate from 30c. to 40c. quarterly.

Mayflower made a new high record at $13.50, an advance of over $3, while Old Colony, its running mate, rose $1.75 to $8.50. Calumet & Arizona has shown a clean slate with a $5 advance to $75. Amalgamated Copper, with its high price of the year, has been a strong incentive for trading on the long side.

On the Curb Ahmeek has risen to a record price of $300 per share, an ad-

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Jan.	Feb.	March
Alaska shipments.	3,701,010	....	....
Anaconda	26,350,000	27,450,000	....
Arizona, Ltd........	3,200,000	3,020,000	... .
Copper Queen......	6,748,264	6,046,860	7,197,121
Calumet & Ariz....	4,541,000	4,152,004	4,652,000
Detroit...	1,941,970	2,068,370	....
East Butte..........	1,520,000	....	....
Mammoth..........	1,665,319	1,722,954	....
Mason Valley......	600,000	1,100,000	....
Nevada Con........	6,309,228	....	....
Old Dominion......	2,044,000	2,039,000	....
Ray................	2,475,945	2,140,000	....
Shannon............	1,550,000	1,300,000	1,388,000
South Utah.........	189,678	283,838	....
United Verde*	2,000,000	2,250,000	....
Utah Copper Co....	8,156,612	....	....
Lake Superior*....	17,500,000	19,100,000	....
Non-rep. mines*.	8,400,000	8,000,000	....
Total production.	98,896,026	....	....
Imports, bars, etc..	31,790,590	18,976,513	....
Total blister.....	130,686,616	....	....
Imp. in ore & matte	8,340,740	10,432,438	....
Total...	139,027,356	....	....
Miami.............	2,235,647	2,475,996	....
Brit. Col. Cos.:			
British Col. Copper	538,190	860,003	....
Granby	1,607,558	1,773,496	....
Mexican Cos.:			
Boleo..............	2,315,040	2,204,720	....
Cananea	3,552,000	....	....
Moctezuma	2,732,867	2,687,712	2,446,731
Other Foreign:			
Cape Cop., S. Africa	784,000	786,440	....
Kyshtim, Russia...	....	....	....
Spassky, Russia....	795,200	649,600	....
Famatina, Argen..	172,480	....	....
Tilt Cove, Newf'd..	153,257	109,059	....
Exports from:			
Chile...............	8,064,000	6,720,000	....
Australia	7,056,000	7,164,000	....
Arrivals in Europe†	13,144,320	10,868,680	....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
III, 1911........	130,532,080	66,080,789	59,081,127
IV........	118,085,223	52,407,650	62,129,599
V.............	126,962,544	64,543,963	61,978,557
VI............	124,554,312	61,655,561	71,460,519
VII...........	112,167,934	56,982,582	74,880,658
VIII.........	125,493,667	59,935,364	69,855,660
IX............	115,588,950	57,311,584	50,824,011
X.............	118,255,442	64,068,307	60,084,349
XI......	111,876,601	68,039,776	67,049,279
XII...........	122,896,697	65,988,474	79,238,716
Year, 1911...	1,431,938,338	709,611,605	754,902,233
I, 1912...........	119,337,753	62,343,901	80,167,904
II.............	116,035,809	56,228,368	63,148,096
III............	....	....	....

	VISIBLE STOCKS		
	United States	Europe	Total
IV, 1911........	162,007,934	223,014,400	385,022,434
V...............	165,555,908	212,284,800	377,840,708
VI..............	165,995,932	202,540,800	368,536,732
VII..	157,434,164	195,932,800	353,366,964
VIII...........	137,738,858	191,891,840	329,630,698
IX....	133,441,501	191,228,800	324,670,301
X...............	140,894,856	191,945,600	332,840,456
XI..............	134,997,642	176,825,600	311,823,242
XII............	111,785,188	164,281,600	276,066,788
I, 1912.........	89,454,695	158,323,200	247,777,895
II..............	66,280,643	154,851,200	221,131,843
III........ ..	62,939,988	141,142,400	204,082,388
IV	....	136,819,200	... .

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

vance of $25 during the week. Southwestern Miami, on the declaration of an initial dividend, is up almost $2 to $9.43¾. Curb stocks are following the trend of the regular market with increased animation.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1	....	$0.005
Algomah, Mich	Jan. 22	....	1.00
Belcher, Nev	Apr. 8	Apr. 30	0.10
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.50
Cedar-Talisman, Utah	Apr. 20	....	0.005
Con. Virginia, Nev	Apr. 24	May 15	0.20
Crown Point, Nev	Mar. 28	Apr. 19	0.05
Ely Con., Nev	....	....	0.05
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0.05
Hancock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
Lehi Tintic, Utah	Feb. 29	....	0.01½
Leonora, Utah	Apr. 15	Apr. 30	0.0125
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	....	1 005
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz.	Jan. 15	....	1.00
Tintic Central, Utah	Mar. 9	Mar. 27	0.005
Union Con., Nev	Feb. 20	Mar. 12	0.15
Wabash, Utah	Mar. 19	Apr. 10	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52 222	59 043	23.794	24.081	27.190
March	51 454	52 745	58.375	23,690	24.324	26.875
April	53 221	53.325	......	24 483	24.595	......
May	53.870	53.308	......	24 797	24.583	......
June	53.462	53.043	......	24 651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24 428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55 490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53.486	53.304	......	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	14.094	12.680	14 337	55.600	62.760
February	12 256	14 084	12.611	14 329	54 974	62 893
March	12 139	14.698	12.447	14.868	54 704	65.884
April	12 019	......	12 275	..	54 034	....
May	11 989	....	12.214	....	54.313	....
June	12 385	......	12.611	.	56.365	....
July	12 463	.....	12.720	....	56 673	...
August	12 405	.....	12 634		56 266	...
September	12 201	.....	12.508		55 253	....
October	12 189	.....	12 370	.	55 170	..
November	12 616	....	12.769	..	57 253	...
December	13 552	..	13 768	..	62 068	....
Year	12 376		12.634	.	55 973	..

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	...
February	41 614	42 962	August	43 319	.....
March	40 157	42 577	September	39 755	.....
April	42 185		October	41 185	...
May	43 115		November	43 125	...
June	44 606		December	44 655	..
			Av. Year	42 281	...

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4.435	4 334	4.327	13 009	15.619
February	4 440	4 026	4 266	3 946	13 043	15 738
March	4.394	4.073	4 238	4.046	13.122	15.997
April	4 412	......	4 262	......	12.889	.....
May	4 373	.....	4.223	......	12.984	.....
June	4 435	......	4 292	......	13.260	.....
July	4 499	......	4 397	......	13 530	.....
August	4 500	......	4 406	......	14.260	......
September	4 485	.....	4 356	......	14 744	......
October	4 265	......	4.139	......	15.332	......
November	4 298	......	4.181	......	15.821	......
December	4 450	......	4.332	......	15.648	.....
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	6.499	5 368	6.349	23 276	26 661
March	5 563	6.626	5.413	6.476	23 016	26.048
April	5 399	......	5.249	......	23.743	......
May	5.348	......	5.198	......	24.375	......
June	5 520	......	5 370	.....	24.612	......
July	5 695	......	5 545	......	25.006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	......	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14 40	$13.32	$14 75	$14.00
February	15 90	15.03	14 50	13.28	14 81	14.01
March	15.90	14.95	14 65	13.66	14.96	14.10
April	15 90	......	14 65	......	15 00	.....
May	15.90	......	14 30	......	14.72	.....
June	15 90	......	14 06	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	.....	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Apr. 2

Name of Comp.	Bid.
Acacia	.05¼
Cripple Cr'k Con.	02
C. K. & N.	.19½
Doctor Jack Pot	.06¾
Elkton Con	.63
El Paso	.76½
Findlay	.04½
Gold Dollar	.14
Gold Sovereign	.02¼
Isabella	.12½
Jack Pot	.06
Jennie Sample	.05½
Lexington	01
Moon Anchor	‡ 01
Old Gold	03¾
Mary McKinney	.59
Pharmacist	.02½
Portland	.90½
Vindicator	.73½
Work	.01

SALT LAKE Apr. 2

Name of Comp.	Bid.
Beck Tunnel	15
Black Jack	15
Carisa	‡ 15
Cedar Talisman	02
Colorado Mining	.30
Columbus Con	20
Daly-Judge	‡5.50
Grand Central	66
Iron Blossom	1.30
Little Bell	.39
Lower Mammoth	04½
Mason Valley	13.00
May Day	15
Nevada Hills	2.40
New York	‡ 05¾
Prince Con	1 15
Silver King Coal'n	1.67½
Sioux Con	.04
Uncle Sam	.23
Yankee	‡.15

TORONTO Apr. 2

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7 50	Hollinger	11 90
Hudson Bay	‡70 00	Imperial	.06½
Temiskaming	41	Pearl Lake	19
Wettlaufer-Lor.	68	Porcu. Gold	42
Apex	01	Porcu. Tisdale	03
Central	5 00	Preston E. D.	10
Crown Chartered	‡ 28	West Dome	40
Doble	45	Standard	13
Dome Exten	57	Rea	55
Foley O'Brien	30	Swastika	25

SAN FRANCISCO Apr. 2

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.10	Belmont	10.12½
Belcher	.79	Jim Butler	.71
Best & Belcher	.21	MacNamara	.25
Caledonia	3 90	Midway	.38
Challenge Con	.32	Mont.-Tonopah	2.90
Chollar	.14	North Star	.31
Confidence	1.00	West End Con	2.32½
Con. Virginia	.77	Atlanta	.26
Crown Point	.80	Booth	.10
Gould & Curry	08	C.O.D. Con	.11
Hale & Norcross	34	Comb. Frac	.19
Mexican	3 45	Jumbo Extension	.44
Occidental	65	Pitts.-Silver Peak	1.40
Ophir	1.45	Silver Pick	.10
Overman	2 05	St. Ives	.35
Potosi	.13	Tramp Con	.01
Savage	29	Argonaut	2.00
Sierra Nevada	.37	Bunker Hill	‡5 50
Union Con	.99	Cent. Eureka	‡.22
Yellow Jacket	1 00	So. Eureka	‡5.00

N. Y. EXCH. Apr. 2

Name of Comp.	Clg.
Amalgamated	82⅝
Am. Agri. Chem	61¾
Am.Sm.&Ref.,com	87
Am. Sm. & Ref., pf.	107¼
Am. Sm. Sec., pf. B	87¾
Anaconda	44⅛
Batopilas Min	1⅞
BethlehemSteelpf	63
Chino	29⅜
Federal M. & S., pf.	43
Goldfield Con	4⅛
GreatNor.,ore.,ctf.	42⅝
Homestake	91
Miami Copper	26½
Nat'nalLead,com.	57
National Lead, pf.	109
Nev. Consol	20¼
Pittsburg Coal, pf.	82⅜
Ray Con	20½
Republic I&S,com.	21⅝
Republic I & S, pf.	73
SlossSheffi'd,com.	46¾
Sloss Sheffield, pf.	100
Tennessee Copper	41¼
Utah Copper	63½
U. S. Steel, com	68¾
U. S. Steel, pf.	112⅜
Va. Car. Chem	53½

N. Y. CURB Apr. 2

Name of Comp.	Clg.
Barnes King	.20
Beaver Con	.43
Braden Copper	5⅜
B. C. Copper	5⅞
Buffalo Mines	‡1¼
Butte & Vipond	‡ 53
Caledonia	‡ 50
Con. Ariz. Sm	$\frac{9}{16}$
Davis-Daly	1⅜
Diam'field-Daisy	15
Ely Con	⅜
Florence	.78
Giroux	5⅞
Gold Hill Con	$\frac{1}{16}$
Greene Cananea	9⅜
Greenwater	08
Guggen. Exp	221
Inspiration Con	20⅛
Internat. S. & R	‡128
LaGrange Placer	2⅞
Kerr Lake	$2\frac{11}{16}$
La Rose	$3\frac{13}{16}$
McKinley-Dar-Sa.	$1\frac{11}{16}$
Min. Co. of A. new	3¾
Nev. Utah M. & S.	$\frac{1}{16}$
Nipissing Mines	8⅛
Ohio Copper	2
Pacific Sm. & M	$\frac{9}{16}$
Precious Metals	‡1⅜
Ray Central	$2\frac{9}{16}$
Red Warrior	‡1½
South Utah M. & S.	$1\frac{3}{16}$
Standard Oil (Old)	842
Stand'd Oil of N.J.	362
Stand'd Oil Subs.	500
Stewart	$1\frac{3}{16}$
Tonopah	7⅛
Tonopah Ex	1⅞
Tri-Bullion	¾
Tularosa	1⅛
United Cop., pfd.	15
Yukon Gold	$3\frac{9}{16}$

LONDON Apr. 3

Name of Com.	Clg.
Camp Bird	£1 10s 9d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 13 1½
Mexico Mines	6 15 0
Oroville	0 4 9
Stratton'sInd.	0 3 1½
Tomboy	1 1 3

BOSTON EXCH. Apr. 2

Name of Comp.	Clg.
Adventure	5⅝
Algomah	7
Allouez	47
Am. Zinc	27½
Ariz. Com., ctfs.	6½
Bonanza	.45
Boston & Corbin	7⅝
Butte & Balak	5⅛
Calumet & Ariz	74½
Calumet & Hecla	490
Centennial	23
Con. Mercur	.04
Copper Range	63¼
Daly West	6¾
East Butte	15⅜
Franklin	15½
Granby	42⅞
Hancock	33¼
Hedley Gold	18
Helvetia	1⅞
Indiana	17
Island Cr'k, com.	43
Island Cr'k, pfd.	86
Isle Royale	28⅛
Keweenaw	2
Lake	46⅞
La Salle	6⅛
Mass	8¾
Michigan	3½
Mohawk	64
New Arcadian	4½
New Idria Quick.	6⅞
North Butte	33¼
North Lake	7¾
Ojibway	5¾
Old Dominion	51⅛
Osceola	117
Quincy	85¼
Shannon	15½
Shattuck-Ariz	22½
Superior	34⅛
Superior & Bost.	3⅜
Tamarack	31
Trinity	6½
Tuolumne	4
Union Mines	2¼
U. S. Smelting	39½
U. S. Smelt'g. pf.	48½
Utah Apex	3
Utah Con	20
Victoria	4⅞
Winona	7⅜
Wolverine	114
Wyandot	2½

BOSTON CURB Apr. 2

Name of Comp.	Last
Ahmeek	285
Bingham Mines	3½
Boston Ely	2¼
Boswyocolo	.08
Butte Central	7½
Cactus	16
Calaveras	3 00
Chief Cons	$2\frac{1}{16}$
Corbin	$2\frac{5}{16}$
Cortez	1
Crown Reserve	3⅛
First Nat. Cop	$2\frac{11}{16}$
Majestic	76
Mazatan	75
Moneta Porc	15
Nevada-Douglas	4
New Baltic	3½
Oneco	2½
Raven Copper	.45
Rhode IslandCoal	15
San Antonio	3
S. W. Miami	9¼
South Lake	8
Trethewey	.65
United Verde Ext.	53
Vulture	‡5 00

‡Last quotation.

The Engineering and Mining Journal

Vol. 93. APRIL 13, 1912. No. 15

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $6.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page
Editorials:
Lake Ore—East and West........ 725
The Guggenheims in Alaska...... 726
United States Smelting Co........ 726
A New Type of Gravity Plane.... 726
By the Way.......................... 727
Copper Production of the World.... 728
Amendment to Abolish Law of the Apex 728
Guggenheims Offer to Sell Alaska Railroad 728
Marketing of California Oil......... 728
Correspondence and Discussion:
Coöperation in Research Work.... The Mathematics of Copper Sampling....Secondary Sulphide Enrichment .... The Canon Diabolo Crater....Where Should the Primer Go? .... Research Work in Technical Schools 729
*The Dome Mine, Porcupine........ 731
Shannon Copper Company.......... 731
Cadmium and Nickel in Cyanide Bullion ....Frederic P. Dewey 733
Details of Practical Mining:
*Gate for Ore Bin Chutes....*A Method of Hanging Air Pipes.... *A Light Mine Cage....*The Walker Overwind Prevention Gear ....Separating Rock from Clay.... *Method of Driving in Heavy Ground .... *Homestake Amalgamation Tables....Clarifying Cyanide Solutions....Bucket Elevator Catch Boxes....*Safety Device for Traveling Cranes....Gold Absorption by Mills..................... 735
The Cost of Doing Things.......... 741
Notes from Current Literature...... 742
*A New Type of Gravity Plane. J. J. Smith 743
*The Blast Roasting of Galena...... 750
The Situation in Mexico............ 751
Daly-Judge Mining Company....... 752
Prussian 1910 Mineral Production... 752
*Colburn-Ajax Mill, Victor, Colorado..............S. A. Worcester 753
Petroleum Deposits in Chile Cesar Zelaya 756
New Publications 757
Personal, Obituaries and Societies.. 758
Editorial Correspondence.. 759
Mining News......................... 761
Markets 767
*Illustrated.

Lake Ores East and West

The rates charged for Lake Superior iron ore, while not fixed by general agreement as in previous seasons, seem to have been determined by some large sales made at figures which will probably be adopted by general consent. These are, f.o.b. Lake Erie docks, $3.75 per ton for Old Range bessemer and $3.50 for Mesabi bessemer ores; $3.05 for Old Range and $2.85 for Mesabi nonbessemers. The base for bessemer ores remains, as for several years past, 55% iron and not over 0.45 phosphorus; for nonbessemers, 51.5% iron. This is a reduction of 75c. per ton on bessemer and 65c. on nonbessemer ore. The actual reduction on the ore to the mining company is not so great as would appear, since there will be this season a decrease of 20c. in the freight from the Mesabi mines to the shipping docks. Moreover, the charters already made indicate a Lake carrying rate of 50c. from Duluth to Lake Erie ports, against 60c., which was the general contract rate last year. This means a difference of about 3c. only to the carrier, since the unloading charge—which is paid by the carrier—was 15c. last year, while it has now been cut to 8c. by the recent order of the Interstate Commerce commission. This does not, however, affect directly the seller of the ore; but taking the actual total difference in the freights, there is a reduction of 30c. The amount received for the ore at the Mesabi mine is less by 45c. on bessemer and 35c. on nonbessemer ores.

The season prices are no longer as important as they once were, since they affect not over 15 per cent. of the Lake ores. The rest are shipped to steel companies which own their own mines, and the ultimate price to them is the cost of mining and transportation, plus the royalty or other charge which represents the value of the ore in the ground. Several of the larger companies own their Lake carriers also; and the largest interest owns the rail carriers from the mines to the Lake, which has been one of the chief causes of complaint over the high freight rates heretofore charged. The same complaint is now being urged against the rates from Lake Erie to the chief furnace districts around Pittsburg and in the Mahoning and Shenango valleys. It is altogether probable that these rates will be reduced by the commission. The rates for carriage from the Lake Erie ports must be added to the price of the ore on dock to get its cost at the furnace.

Last year little Lake ore went to furnaces east of the Alleghenies, the needs of which were supplied by local ores and by imported ores, the latter being mainly from Newfoundland, Sweden and Spain. This year imports from Spain and Sweden are affected by the remarkable rise in ocean freights, which are now nearly double those charged early in 1911. Shipments from Newfoundland are not much affected as they are generally carried on long charters, or on boats controlled by the ore company. No great increase in Newfoundland shipments is possible at short notice, however. In view of these facts some sellers of Lake ore are making strong efforts to push their ores in the East. To that end they are said to have offered reductions of at least 25c. from the prices given above on Mesabi nonbessemers, which are the ores most in demand at the Eastern merchant furnaces. At the present time good local ores can be obtained at most stacks in the East at about 7¼@7¾c. per unit of iron, while imported ores are laid down, even with the higher freights at 7½c. at Philadelphia or Baltimore. Mesabi ores could hardly be delivered in Eastern Pennsylvania for less than 8.25c. per unit. even when the price is cut as stated above. We do not look, therefore, for much Lake ore to come East, unless business should be very active and an unexpected demand arise.

Production of pig iron has gone up again and is now at the rate of about 29, 500,000 tons a year. It may increase still more, but there is no probability of any shortage of iron ore. Eastern furnaces have their choice and can readily fill with Lake ore at a reasonable figure, if they find it necessary or advisable to do so later in the year.

The Guggenheims in Alaska

We have several times prophesied that a project to have the Government take over the Copper River railway would eventually materialize. The newspapers reported that Messrs D. and S. Guggenheim conferred with the President on this matter last Friday. We have no doubt, as we have also mentioned previously, that they would like to be relieved of their railway investment. The business has both serious and humorous aspects.

The Guggenheims and Morgans built a railway into Alaska, primarily to bring out the copper ore of the Bonanza mine, incidentally to develop the country, including the Bering coal field. The railway cost far more than was anticipated, the conservationists locked up the coal field, the railway has been operated under difficulties and now its builders would like to get their money back, with no prospective purchaser in sight except Uncle Sam.

This is different from the idea of the Guggenheims gobbling Alaska that has been worrying some of our lay contemporaries and some of the hayseeds in Congress. We wonder if the Guggenheims stirred up the whole business, making Mr. Pinchot an innocent catspaw, in order to lead up to the consummation now proposed?

If the Government should buy the Copper River railway for $20,000,000 and should saddle the charge upon Alaska, it would be a staggering blow to the mining industry of that territory. Yet we are not sure that the Guggenheims and Morgans are not entitled to some consideration at Washington. They invested their money in the development of Alaska, or a part of it, supposing that the Government was going to let it be developed in the old way. The Government, deferring to some foolish visionaries, stepped in and withdrew an important coal field, ousting some claimants thereto (who also appear to be entitled to redress).

The coal fields were heralded by the muck-raking magazines as being the locus of billions of treasure, but they turn out to be of but relatively small value, in fact of rather doubtful profit to any exploiter, although their coal would have been useful in the development of the territory if any one had been allowed to get any of it. The management of the whole business by the government has been a colossal bungle.

United States Smelting Co.

The report of the United States Smelting, Refining & Mining Co. allows some interesting deductions to be drawn concerning earnings of its properties. The ore produced from the company's own mines was 1,037,685 tons. The earnings of all companies without allowing depreciation, were $3,961,103, and after allowing for depreciation were $2,840,413. If the tonnage of company ore had yielded this profit, it would mean $2.74 per ton of ore.

Considering that the profits on the company's ore are those which ordinarily go to the miner, the smelter and the refiner, the margin of profit on either the company's or the custom ore must be rather small. That the amount of custom ore smelted is by no means inconsiderable, is shown by the fact that whereas the company ore (1,037,685 tons) carried the value of the metal contents in the proportion of 38% copper, 6% lead, 35% silver and 21% gold, the final figures of total production were: Copper, 21.48%; lead, 16.81%; silver, 42.72%, and gold, 18.99%. Of course, the smelting and refining profits on these custom ores must come out of the figures of profits, which, as said, points to one class of earnings being small indeed, and pointing again the moral that big corporations look to small profits on big tonnages.

The position of the minority stockholders in the subsidiaries has evidently been very interesting for the last three years. The outstanding minority stock and dividends are shown in the report. For the last three years these dividends have been respectively 0.66%, 0.08% and 0.03%, although in the last two years the growth of the portion of the surplus applicable to the subsidiaries' dividends has mounted to almost 9.8%. This points to an earning capacity of the subsidiaries on which minority stock is outstanding of about 5% per annum. This is, of course, an average figure, and some of the outstanding subsidiaries' stock has probably paid well. On the other hand, some must have paid nothing whatever.

A New Type of Gravity Plane

In this issue of the JOURNAL an interesting description of a self-acting gravity plane is published in which a device is used for throwing the short end of the haulage cable from one track of the incline up which an empty car has been hauled to the other track down which a loaded car is to descend. The brake drums and this device, a reversible guide sheave, are situated at the top of the incline, and the action of the last must be as fascinating to watch as its design is novel.

To those who are operating where the conditions are such as to permit a descending loaded car to haul up an empty one, this description will be of more than ordinary interest. It would seem that this device could easily be designed for use underground in stopes the floors of which are at too low a gradient for the ore to pass readily down to the haulage level.

It is worthy of more than passing notice that the author of the article presented in this issue, mentions a fault that developed in carrying out the original design of the first plane of this type that was installed; the fault arising from using a conical track-ring for the carrier of the guide sheave. Descriptions of the developments of faults in practice that could not be anticipated in plotting the designs are always instructive, but rarely are they described in print.

The fact that most large steel producers are running their mills up to 90 per cent. of capacity—which means practically full—shows that the trade is good, though it is not booming. The fact also that price advances from the lowest point have been small, and that no effort is being made to push them up further, shows that the situation is appreciated by the large producers as one that depends largely upon the incentive of cheapness.

By The Way

Sir Moreton Frewen, who is an expert on the silver question, anticipates that the drain of gold to India at the present time threatens the most serious consequences in the money markets of the western world. This ought, however, to be comforting to those economists who have seen in the increased supply of gold, the cause of high prices during the last decade. At the same time, the report that the Chinese Ministry of Finance contemplates the immediate issue of 30,000,000 silver dollars ought to gladden the hearts of the friends of silver.

Original, or "makeshift," methods of doing things can be seen and heard almost every day in the copper mines of upper Michigan. William was up in the stope at a freshly broken face, from which place he called to Tom, standing on the level, "Tom, ist there?"—"Ase, ase wat do 'ee want?"—"Go up to and fe'ch down bit stull"—"'Ow long of a stull do 'ee want?"—"A midlin' long un"—"Can't 'ee measure 'im?"—William measured in his own fashion and called back, "Tom, the bit stull I want 'ee dha measure is long as a pick an' a pick 'andle, a gad an' a gad 'andle, taw bluddy wedges an' a big flat rock."

A brisk advance in Quicksilver shares, on Apr. 9, interested antiquarians, says the *Sun*. The company is one of the oldest, if not the oldest, mining company with stock listed on the Stock Exchange. It was incorporated in 1866 and for several years paid handsome dividends. The par value is $100 and in the old days the stock sold at or above par. Daniel Drew is said to have made enough money out of it to found the Drew Theological Seminary. No dividend has been paid on the common since 1882 and none on the preferred since 1903. Latterly the quotations have ranged around 5 for both the common and the preferred. The advance on Apr. 9 carried the common to 6⅞ and the preferred to 6⅛.

Many things in mining and metallurgy look easier to do than they really are; the same is true in publishing. About six months ago, the coal-mining department of the Journal was discontinued, and the publication of a technical paper, devoted to the field of coal mining, was undertaken, under the direction of F. W. Parsons, who formerly had charge of the Journal's coal department. *Coal Age* has achieved a rapid and enviable success, and already has over 6000 paid subscribers, and we don't know how many readers—as the enterprising advertising solicitor would say. It might have more readers, as the accompanying letter indicates: "I am subscriber for your magazine and asking for some information. I want to know if you can print *Coal Age* in the Hungearing language. If so, it means an nother subscriber for you, as I have a Hungearn friend who wishes to read it." We fear, however, that Mohammed will have to be moved to the mountain.

There are exceptions to the endings of the stories of the "sucker" and his "investments" in mining stocks as such tales are generally related. Here is one that a correspondent has forwarded: Back in the late '90's the postmaster at Cripple Creek received a "squawk" letter from a crossroad hamlet in Iowa in which the writer berated his own folly in parting with $2000 of his good money for a mining stock and after exhausting all the proper expletives which the subject warranted asked to know if there was any such company as that, the name of which was engraved on his green certificates and if there was any chance of getting his money back or any part of it. He had paid 10c. per share and knew he was a fool to do so. The company inquired of was the great Portland, which in the interval of the "victim's" investment and the writing of the letter had paid three dividends and the stock of which was then selling at $2.60 per share. By error in the address on the company's records the stockholder had not been officially informed of the affairs of the company and his state of mind on receiving the reply with the facts can be well imagined.

In investigating an *antigua* in South America, Alexander P. Rogers, of New York, last year made a long journey into the interior, going up the Amazon to its sources, through the Riberao rapids, across the stretch of jungle from the Guapore River to the Paraguay, thence to Buenos Aires. In *World's Work* for April, he has described this interesting trip of 5500 miles, all but 180 of which were traveled in boats. In investigating the gold fields near Matto Grosso, he found proof that the same regions had been explored 150 years ago by a band of adventurous gold seekers. They were remarkably successful in their search for gold, too, and found every mine which is known today in that region. At a mine near Matto Grosso they brought in a small army of slaves and cleared off the jungle for a mile around, while others were set to work constructing a long ditch to bring water to the flat below. It was a clever piece of work for men without surveyor's instruments. They cut the ditch through a cement formation, that in places was 20 ft. in depth, and near the lower end they constructed a great chamber in which they ground the ore between huge rocks. Whether they used mercury to amalgamate the gold could not be determined, but several stone tanks and sluices indicated that possibly they did. They built a town around these works with a brick kiln and a distillery as the most important adjuncts. It must have been a busy and exciting place to live in, ruled over by an iron hand, the master's word law in everything, and a cruel law it was. They took out a large amount of gold. And then to enjoy it, they had to get out to the civilized world with it, through 3000 miles of hostile country, where free-booters lay in wait.

It's hard to keep a good fake down. Out of Darkest Arkansas comes an inquiry for a good, reliable "Spanish needle" for locating gold and silver. It's no use spoiling a thing in the telling, so we offer it in the original orthography and typographical style of the Arkansas hinterland: "April 3+4, 12—To the Engineering and Mining Journal: I Will Drop you a few lines to see Wheather or not you all handle eny Spanash Needles en your line of Goods iff you Doe Please Send me your Price list on them and your Best Turms and I Want one that a man Can Depend on. I Want one that will loe cate Silver or Gold and iff your house Don't handle the Goods Would you Bee able to Give me the name of some furm that Does. Well I Will Remain as ever yours truly ——— ——— By By hoping to here from Soone and a Good Reply." We chronicled, in the Journal of Feb. 4, 1911, the interference of the postal authorities with the Stauffers' thriving mail-order business in "goldometers," "electrometers," and "Spanish needles." We have not since heard of any new school giving "short courses" in gold finding, though it is quite possible that the former vendors have paid their fines and resumed business.

If we consider the current prices for chemical analyses, one is prone to think that in one field, at least, competition has had full play, says H. P. Talbot, in *Science*. It were, of course, rank heresy in this good city to suggest restraint, and yet it seems full time that something should be done, lest the day might come when the chemist would have to pay the manufacturer for the privilege of making analyses for him. How can an analytical chemist hope to maintain his professional standing when his charges for individual analysis—even when done in quantity—are such that, unless he is to count his own time as without value (and sometimes even under such an assumption), he can not possibly do reliable work without an actual financial loss? I do not wish to draw any unpleasant or unfair inferences as to which horn of such a dilemma the commercial analytical chemists choose; for the most of them are, no doubt, trying to make the best of a difficult situation. Unfortunately, I have no specific remedy to propose, but it is all too evident that these conditions tend to belittle this branch of our science, to result in a large output of inferior work, and to create a distrust which spreads unduly.

Copper Production of the World

Messrs. Henry R. Merton & Co., of London, have completed and issued their estimate of the copper production of the world; the figures being given in the table herewith in long tons:

COPPER PRODUCTION OF THE WORLD

In Long Tons

	1910	1911	Changes
United States	484,935	492,650	I. 7,715
Mexico	61,515	54,030	D. 7,485
Canada	25,715	24,930	D. 785
Newfoundland	1,080	1,155	I. 75
Cuba	3,475	4,455	I. 980
Total North Amer-	576,720	577,220	I. 500
Argentina	300	1,020	I. 720
Bolivia	2,500	1,800	D. 700
Chile	35,235	29,595	D. 5,640
Peru	18,305	25,445	I. 7,140
Total S. America	56,340	57,860	I. 1,520
Austria	2,130	2,440	I. 310
England	500	500	......
Germany	24,710	22,010	D. 2,700
Hungary	110	85	D. 25
Italy	3,220	2,600	D. 620
Norway	10,425	9,425	D. 1,000
Russia	22,310	25,570	I. 3,260
Servia	4,845	6,885	I. 2,040
Spain and Portugal	50,255	52,045	I. 1,790
Sweden	2,000	2,000	.....
Turkey	600	1,000	I. 400
Total Europe	121,105	124,560	I. 3,455
Africa	15,205	16,980	I. 1,775
Australia	40,315	41,840	I. 1,525
Japan	46,000	55,000	I. 9,000
Total	855.685	873.460	I. 17,775

According to this estimate the gain in the world's copper production has been very slow during the past two years. The production in 1909 showed an increase of 11.3%; but the gain in 1910 was only 1.9%; and in 1911 it was 2.1% as compared with 1910. In North America the increases in the United States and Cuba were nearly offset by the losses in Mexico and Canada. In South America the gain was almost entirely from Peru. In Europe most of the changes were small, the larger proportional increases being in Russia and Servia, while there was a decrease of 10.9% in Germany. In the other countries the only noteworthy change was the large increase in the Japanese production.

Amendment to Abolish Law of the Apex

WASHINGTON CORRESPONDENCE

Senator Smoot, of Utah, has introduced a bill to amend Sec. 2322 R. S., which, if passed, will put an end to the "law of the apex," over the interpretation of which there has probably been more litigation than any other law controlling the acquisition of mining claims on the public domain.

The amendment is to the effect that the locators of claims heretofore made on any mineral vein on the public domain, shall have the exclusive right to the lands so located and the veins apexing therein, as permitted by the customs, regulations, and laws in force at the date of their locations, but after the passage of the amendment the locators shall, subject to such other rights as pertain to claims located prior to the passage of the amendment, have the exclusive right to all the surface included within the lines of the locations and of such veins in place as lie within the block of ground bounded by vertical planes passing through the surface lines, and no locator shall have the right to follow any veins outside of the limits of such claim.

Section 2 of the amendment is to the effect that notice of location of all mining claims, lode or placer, made after the date of the passage of the amendment, must be filed for record with the register and receiver of the land district within which the lands are situated within one year from the date of each location.

Guggenheims Offer to Sell Alaska Railroad

According to the *Sun*, the Guggenheims have offered to sell the Copper River & Northwestern R.R., in Alaska, to the United States Government. A conference was held at the White House, on Apr. 5. The Guggenheims were represented by two of the brothers, Daniel and Simon. Secretary of the Interior Fisher and President Taft participated in the conference and Vice-President Sherman called to present Daniel Guggenheim to the President.

While the meeting did not bring out a flat offer from the Guggenheims, they made it apparent that they would be glad to have the Government take over the railroad at the actual cost to them. It is estimated that the Guggenheims have put about $20,000,000 into the railroad. The original purpose in building the road was to open up the Bonanza copper mine, but the Guggenheims counted on much additional tonnage from the opening up of the Alaska coal fields.

Practically the entire traffic over the Guggenheim's $20,000,000 road has been the ore from the Bonanza mine. With a great coal bed within 50 miles of the railroad they have been obliged to pay $14 a ton for coal to use in their locomotives. The Copper River railroad has consequently been a losing venture, and now that the Taft administration is seriously urging the building of a trunk line by the government the Guggenheim interests apparently will be glad to have the Government take their railroad holdings in Alaska off their hands.

There is a good deal of doubt now, however, whether the Government would consider acquiring the Copper River line. The route that Secretary Fisher has recommended for the Government line lies 200 or 300 miles west of Cordova and starts from Seward as a seaport. The Federal railroad as proposed by Secretary Fisher would open up the Matanuska coal field instead of the Bering field.

With a Government road constructed into the Matanuska fields there would be no likelihood of the Bering coal fields being opened for many years, inasmuch as the Matanuska fields are supposed to have a superior quality of coal and would easily be able to supply the market demand. This would mean ı at the Bering field would fail to yield any tonnage to the Guggenheim railroad and that the Copper River & Northwestern would be obliged to continue to depend for its income chiefly on the ore haul from the Bonanza mine.

Marketing of California Oil

Under this head it was stated in the JOURNAL of Mar. 30, that the proposal of the Union Oil Co. to issue certificates for the accredited oil in storage at a guaranteed price of 35c. per bbl., had been accepted by the Independent Agency. Further details of this transaction are now available.

The agency agrees that in the event of the price returned being less than 35c. per bbl., the difference will be borne by the current production. The agency further agrees that no agency oil will be sold to any marketing concern during the life of the certificates without the approval of the Union, and that no new members will be accepted into the agency during the life of the certificates without the approval of the Union. The agreement which fixes the life of the certificates is four years from and after Mar. 31, 1912. By this plan, the agency members may retain their storage in the form of certificates and participate in possible advance in price, or they may sell and have the present use of the money.

At present, the agency is able to dispose of only about 10% of the current production, while under the Union proposal with the storage oil practically removed from participation, the current sales will amount to approximately 90% of production. The Union is carrying about 65% of the stored oil, while its proportion of production is about 23,000 out of a total agency production of about 51,000 bbl. per day. The agency sales amount to 1,520,000 bbl. per month; of this amount, 240,000 bbl. go to the refinery. In 1911, the average monthly sales were 1,133,333 bbl.; the monthly average in 1910 was 693,630 bbl. The difference is partially accounted for by the admitting of the Union Oil Co. into the agency. The average price for the 12 months of 1911 was 31.8c. per bbl., and for 1910 the average price for 11 months was 38.08c. per bbl. The total agency sales in 12 months of 1911 were 13,600,000 bbl.; the total sales in 11 months of 1910 were 7,630,000 barrels.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Co-operation in Research Work

I would that "Consulting Chemist" had been possessed of sufficient courage of his convictions to have affixed his signature to his recent reply to a note of mine; which appeared in the columns of the JOURNAL,[1] and thus obviated the necessity of imposing our discussion upon uninterested readers. However, I cannot allow him to rest under such misapprehensions concerning the scope of the work of the Industrial Research Department of the University of Pittsburgh.

His line of distinction, so tightly drawn that every scientist connected with an institution of learning should work purely and simply along scientific or semi-scientific lines, his sole remuneration being the "consciousness of benefiting the race," would, if put into practice, keep many of the better men out of our engineering schools. On the other hand, apart from material considerations, if the consulting chemists would, more often, publish results giving others the same benefit of their work as they obtain from the scientists' publications, it would be a great aid to the advance of science.

From "Consulting Chemist's" note I take it that he feels that coöperation must signify a gratuitous unravelling of problems impossible to him but to all of which we know the solution by instinct, as it were—or the ultimate doing away of the consulting chemist himself by the absorption of his entire work by the industrial research worker.

It is not necessary to say anything concerning the absurdity of such a conception. With us coöperation consists in throwing open to the industrialist, who has a problem for solution, the research facilities of the university. We cannot do it gratuitously, for much of the success of our work lies in the fact, that for each industrial problem we obtain the services of a specialist in that particular line. That he is furthermore aided and abetted by favorable conditions of environment and equipment, for the obtaining of results in a short time, assures a larger return for the money invested than ordinary conditions could possibly produce.

"Can he not cut prices because he is protected by a steady college salary?" This idea is altogether wrong. Our salaries are paid entirely by the industrialist for whom we are working. We pay for our laboratories, offices, etc., by the instruction which we give in the university. That salaries are perhaps better than those given either by colleges or industries alone is not indicative of a "cut in price" and, still further, the system of industrial fellowships takes care of its Fellows, by giving, in many cases, a substantial bonus for the successful solution of the problem.

In conclusion, I would merely ask that our "Consulting Chemist" who has been so interested, continue his interest to the point of investigating our work in detail. I can furnish no more conclusive evidence that the engineering school and industrialist are being drawn closely together with advantages to both, that we are not, as he would have it "at the parting of the ways."

R. C. BENNER.

Pittsburgh, Penn., Apr. 1, 1912.

---

[1] Cf. Eng. and Min. Journ., Dec. 16, 1911; Feb. 10, 1912.

The Mathematics of Copper Sampling

In discussing Edward Keller's paper on copper sampling, in the JOURNAL of Apr. 6, 1912, one labors under the disadvantage that Doctor Keller is the master of us all in this particular field. However, on the practical basis, I think Doctor Keller has himself stated the objection to his theoretically correct one-hole sampling method, in that sampling must be done in such manner as to guard against intentional dishonesty.

Concerning Doctor Keller's criticism of my own article, I had considered his point, that a drill hole cuts several vertical layers of varying tenor, but I had considered that if the average assay of these layers was A, that the layers on each side would have values $A + \Delta_1 A$ and $A \quad \Delta_2 A$, etc., where $\Delta_1 A$ and $\Delta_2 A$ were very small quantities, and that what one might term the integration over the entire area of the drill-hole circle would be correct. (Passing to three dimensions, I believe that this argument applies to the drill-hole volume also.)

While Doctor Keller's practice has proved, with honest shippers, that the one-hole and full-template methods give concordant results, my own experience has certainly led to the belief that the thin slab with small bevel is much easier to sample correctly than the thick bar, with large bevel, while it is also my belief that in actual work on unknown bullion, the differences between Doctor Keller's and my ideas would be infinitesimals of the second order.

Doctor Keller's point about quarter or half templates being superior to whole, is good. I think it might well have been further emphasized.

DONALD M. LIDDELL.

Elizabeth, N. J., Apr. 8, 1912.

Secondary Sulphide Enrichment

A paper on secondary sulphide enrichment by H. V. Winchell appears in the JOURNAL of Feb. 17, 1912, in which he refers to a description of the Katanga copper deposits by a German geologist in the *Zeitschrift für praktische Geologie*. I do not know to what paper he refers, but an article by O. Stutzer, in the July number,[1] describing the Star of the Congo mine, takes a different view.

The latter states that the malachite ore is derived from primary sulphides, probably in quartzite, which have been oxidized, dissolved, and redeposited as oxides and carbonates in the adjacent clayey and sandy rocks; that the present richness of the oxidized ores is naturally no criterion as to the content of the primary ore, but probably due to a concentration of the copper from rock already eroded; and that the depth of the present oxidized zone, and the length of life of mine, can only be determined by boreholes, thus indicating that he does not expect any zone of secondary sulphide enrichment will be encountered.

It is difficult, however, to understand why Winchell considers the fact that these deposits are in a sandstone as discouraging the possibility of a zone of glance and bornite. Lindgren[2] has reviewed as a type a large number of deposits occuring in sandstones or shales where chalcocite and bornite are the predominant minerals, and which on the surface show malachite ore. A deposit of this kind occurs at Atbasar in Siberia[3], where it is estimated 389,000 tons of approximately 11% ore are developed.

The heading "Secondary Enrichment Can Only Occur Under An Iron-Oxide

---

[1] O. Stutzer: Die Kupfererzlagerstätte Etoile du Congo im Lande Katanga, Belgisch-Kongo, Z. f. p. G., July, 1911, 240 243.

[2] W. Lindgren: Copper (silver), lead, vanadium and uranium ores in sandstone and shale, Economic Geology, September, 1911.

[3] Min. Mag., January, 1912; Report of Atbasar Copper Fields, Ltd.

Hat" is presumably the work of the paragrapher and not the author. It might be well to emphasize that the Germans do not always use the term "Iron Hat" in its literal sense, but often apply it generally to the oxidized zone of an orebody.

C. T. Brodrick.

Kyshtim, Russia, Mar. 12, 1912.

[We have communicated with Mr. Winchell, who has sent the following comment.—Editor.]

My volumes of the *Zeitschrift für praktische Geologie* seem to be at the binders, and I am unable at this moment to refer to the number containing the article upon the Katanga copper deposits, mentioned in my paper on secondary enrichment. I do not think the article to which I referred was by Stutzer, and I am quite certain that I did not misunderstand the author. He stated very positively, and as it seemed to me, without any sufficient evidence, that the ores are the oxidized upper portions of enormous sulphide bodies.

Horace V. Winchell.

Minneapolis, Minn., Apr. 3, 1912.

The Canon Diabolo Crater

Is not the idea that the Cañon Diabolo "crater" is the result of the impact of a meteorite more than a mere "popular idea," as implied in the "By the Way" column of the Journal of Apr. 6, 1912. Although I have never visited it, from my reading I had gathered that there was no evidence whatever for volcanic action there. That craters formed by meteors are no new idea is shown by the writings of some of the recent selenographers, who attribute many of the moon's craters to that cause.

The idea of prospecting for the meteorite was no haphazard idea, as careful calculation had shown that a mass large enough to produce the effect noted would, if of a composition like that of the ordinary meteorite, yield an output of iron and nickel well worth trying for. Diamonds may have been thought of as a side issue, they are not unknown in meteorites, but if looked for in a meteoric-iron matrix, this should not be called searching for a diamond "pipe."

I was under the impression, too, that drilling was not unsuccessful, except that the drills hit nothing of value, but that drilling was abandoned because of the small chance of hitting anything. That is, it was impossible to tell at just what angle the meteor had entered the earth, or how far down to drill, and that it was believed that the only feasible thing was to follow the "crater" down.

As an interesting side light, it is said the Indians have a tradition concerning the fall of a great meteor in this region.

A. A. Nason.

New York, Apr. 8, 1912.

Where Should the Primer Go?

With regard to the discussion in the Journal of the question, "Where should the primer go?" it seems to me that any attempt to make a flat uncompromising statement that the primer should *always be,* the first, the last, or in any other definite position, in every case, is simply an exhibition of hidebound, slavish following of local customs, without any regard to the conditions that may exist.

F. H. Gunsolus, in the Journal of Mar. 30, 1912, in the last part of his letter makes two statements of fact which seem generally to have been lost sight of by the other correspondents.

Mr. Gunsolus says, "From results obtained, no difference in execution of the explosive was noted (by various positions of the primer in experiments carried on by the Du Pont Company), etc. . . . From an economical standpoint and also to eliminate the liability of igniting the explosive in the bore hole, it is best to place the primer in the bore hole last or next to last."

The question therefore as to which position of the primer will give the best results in actual execution of work may be dismissed as not being of sufficient practical importance to be considered.

It would seem that the governing rule to be followed is the rule of economy as expressed in Mr. Gunsolus' last statement. This rule, like all rules, is subject to modification or suspension in special cases.

It will be admitted, I believe, by every one, that if three feet of fuse is required to light a charge safely, say for example in a hole three feet deep, when placing the primer at the top, six feet of fuse will be required if the primer is placed at the bottom of the hole! He is a brave man indeed, or a foolish one, who in lighting a round of holes will permit the fire from any fuse to disappear in the hole without dropping everything and making for cover.

It has been demonstrated by experiments carried out by the U. S. Bureau of Mines that the rate of burning of a fuse compressed in a bore hole is apt to be much more rapid, depending on the nature of the tamping, than the same fuse burning free. It is therefore unsafe to rely in any way on the length of fuse that may be tamped in a hole, as affecting the time of explosion.

In a large mine managed several years ago by me there were fired on an average about 17,000 holes per week. Of this number fully 16,000 were in stopes and tunnels in the ore, the remaining 1000 being in tunnels and shafts in the rock.

In all holes blasted in the ore the primer was placed last in the hole. A careful record was always kept of misfires and the cause of same where ascertainable. I recall but few cases where the cause of misfire was due to breaking off the neck of the hole and throwing out the primer. In fact the percentage of misfires from any cause was low.

To illustrate the rule of economy in this case, suppose we have blindly decided that the primer should have been placed in every case at the bottom of the hole. Assuming that the holes averaged three feet in depth we would have used approximately three extra feet of fuse to each hole or about 48,000 ft. extra per week, which at the current price of fuse in that locality would have meant an additional expense of approximately $300 per week and no practical advantage gained.

On the other hand in shafts and tunnels in the country rock the general rule was to place the primer first in the hole, using the best quality fuse that could be bought.

This rule was followed not because of any theory as to extra execution or as to what might happen if the primer was placed anywhere else but because we found by experience that this rock shattered so badly in breaking that the blowing off of the neck of an adjacent hole was a frequent cause of misfires. Here then it was economy to be extravagant. In no case did we consider the fuse buried in the hole in calculating the time allowance of explosion.

While I have confined myself to fuse blasting the same reasoning applies to electric blasting.

It is absolutely essential for economical work to experiment in each kind of rock or ore to be blasted until the right combination is struck.

John F. Fuller.

Honesdale, Penn., Apr. 8, 1912.

Research Work in Technical Schools

I note with interest L. W. Bahney's remarks in the Journal of Mar. 23, 1912, under the above title, which in all except one point agree with my own views. There are exceptions to his statements that "when an experienced assayer is engaged by a mining company he is given about a week in which to get his bearings and adapt himself to new conditions, and that the beginner in an assay office will be given a week in which to learn the routine."

The first position I had after leaving college was in a small smeltery laboratory, where the only assistance was a day laborer to buck samples. The former chemist had apparently left "between two days," and the first day I had to clean up the laboratory and run about 70 determinations, both wet and fire. I think that in small plants such things are not unusual, and that "An Assayer's" article (Feb. 27, 1912) is founded on good common sense.

Another Assayer

Denver, Colo., Mar. 28, 1912.

The Dome Mine, Porcupine

Special Correspondence

On March 30 the Dome mill was officially started and the entire property opened for public inspection. Three of the eight development shafts are in operation; the others are being used as ore passes. No. 2 shaft will eventually be the main opening. Underground work is now confined to the 45-ft. level, the ore being mined at the surface and sent down mill holes; it is then hauled up an incline to the crushing plant.

The Porcupine mining district has been coming in for a good deal of attention lately on account of the official opening of the Dome mill on March 30, when, for the first time in its history, the Dome mine was thrown open to inspection, and was visited by many people from all over the country, approximately 1000 visitors being entertained on the property.

The construction of the mill has been under the supervision of the Merrill Metallurgical Co. and the results of the trial run have fully justified the confidence of the owners. Mr. Merrill has stated that the Porcupine ores lend themselves readily to treatment, and that an extraction of at least 95% can be obtained at the Dome.

To date the greatest part of the underground work has been confined to the 45-ft. level, the lack of power interfering with development on the 100- and 200-ft. levels. A new electric-driven compressor with a capacity of 1200 cu.ft. of free air per minute is being installed, and when this is in operation there will be plenty of power for all the projected work.

The Dome Mill and Haulage Incline, Porcupine, Ont.

Eight Development Shafts

Originally the property was opened by means of eight shafts, seven of which were sunk on the first discovery, commonly known as the "dome," on account of large rounded masses of quartz, which are at a greater elevation than the surrounding country. The other shaft was sunk to a depth of 100 ft., to develop a later discovery, known as the "Golden Stairway" vein, which is probably a continuation of the main orebody.

Of the seven shafts, two were sunk to the 100-ft. level while another was carried to 200 ft. The remainder were sunk only to the 45-ft. level. Three of these eight shafts are now in operation, the others having been converted into ore passes. No. 1 is a three-compartment shaft which was sunk to the 100-ft. level and will take care of all the development work for the present. No. 7 was sunk to the 200-ft. level and is used for prospecting purposes only. A crosscut was started to intersect a point underneath another shaft and from which a raise will be carried up to the 100-ft. level. When this is completed, the No. 7 shaft will be abandoned and used as an ore chute. The No. 2 shaft was sunk to a depth of 100 ft. at a point about 100 ft. south of the Golden Stairway vein. No work is being done on this at present on account of the shortage of air. The intention is, however, to start sinking this shaft as soon as possible and continue it to the 400- or 500-ft. level. On account of its central situation this shaft will eventually become the main opening on the property and the work of attacking the orebody will be carried on solely from this point, the ore being transferred to the crusher station by means of a rope haulage. A 60-ft. headframe is now being erected over this shaft.

At present, however, the main opening of the mine is the incline from the crusher station to the 45-ft. level. This incline, which is 350 ft. long, has a gradient of 13.55%, the ore being hauled up the incline in side-tipping, V-shaped cars, by means of a single-drum hoist. Six cars are hauled at a trip. The incline, while serving as a means of development for this end of the property, provides a most convenient and economical method of handling the ore, and leaves the main shaft free for carrying on the development work. At the bottom of the incline is a drift 140 ft. long and 8 ft. wide, which is connected with the workings on the 45-ft. level. This drift is double tracked and provides plenty of storage room for both empty and loaded cars.

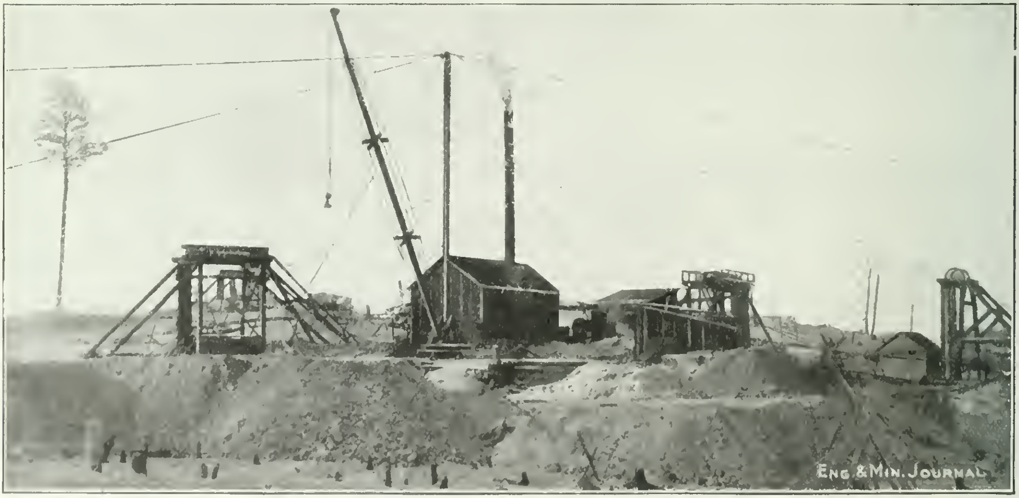
Developed on 45-Foot Level Only

The development on the 45-ft. level is laid out on the rectangular system, and embraces an area roughly 400x450 ft. Two main drifts were run parallel and 175 ft. apart, and these are intersected by four crosscuts 100 ft. distant from each other. The main shaft is situated 80 ft. to the north of the No. 1 drift and is connected with it by the main crosscut and two bypasses, one on each side of the crosscut, and at an angle of 45° with it. This provides easy access to the shaft and gives plenty of station room.

The main drift has a grade of 0.66% toward the incline and all the crosscuts have a grade toward the main drift. The No. 2 drift is practically level. This provides a complete circuit of the mine with only a slight grade against the empty cars, the loaded cars always having a down grade. At present the tramming is done by men, but later mules will be introduced.

Starting Mining at the Surface Near the Domes

The Incline Tunnel and Main Shaft, Dome Mine



Four Shafts on the Dome Mine, Porcupine, Ont.

Seven raises were put up to the surface and these combined with the old shafts give 11 working places. Two of these raises are indicated by arrows in the upper left-hand halftone. Specially designed chutes or boxes were built at the bottom of the raises, the ore being shot into the raises from the surface and loaded directly into the cars from the chutes. These raises are kept full of ore so that large blocks from heavy blasts may be "bulldozed" at the surface. The chutes are so constructed that blasting may be done in them at any time. The mine is worked on two 8-hour shifts and all the mining and tramming is done in the day time. The ore above the 45-ft. level will all be mined from the surface, thus giving low working costs. This system of mining will also be carried down to the 100-ft. level.

The cars from the loaded chutes are run to the bottom of the incline and hauled up to the No. 7½ gyratory crusher. The crushed ore is transported to the No. 3 crusher house by means of an inclined conveyor belt, the undersize passing through a grizzly, which is just below the discharge from the head of the belt. The undersize and the crushed ore from the No. 3 crushers passes directly to the mill conveyor belt, set at an angle of 20°, which carries the ore to the mill bins.

The development plans call for a somewhat different system of underground workings than were run on the 45-ft. level. In addition the raises will be spaced further apart, as working in toward each other from that depth they will not need to be as close as those above the 45-ft. level. From the bottom of the incline a drift will be run to connect with the workings from the bottom of No. 2 shaft. Crosscuts will be run at intervals from this drift to determine the extent of the orebody. Development work will also be carried on to the east of No. 2 shaft where diamond drilling has indicated the extension of the mineralized zone and at the same time this shaft will be sunk as rapidly as possible and new levels done at greater depth.

Shannon Copper Company

During the fiscal year ended Aug. 31, 1911, the Shannon Copper Co. extracted 263,975 tons of ore, against 311,456 tons during the previous year. From this 14,944,933 lb. of copper was produced, at a cost of 9.92c. per lb. at Clifton, and 11.5c. at New York. The price received was 12.352c. per lb. Shannon costs, per pound of copper, have shown a constant decrease since 1905, the costs at New York being: 1905-6, 14.6c.; 1906-7, 14.5c.; 1907-8, 12.6c.; 1908-9, 12.2c.; 1909-10, 12.1c.; 1910-1, 11.5c. per pound.

During the year the company has been

experimenting with its low-grade ores, of which is possesses from 1,000,000 to 1,500,000 tons, assaying 2 to 2½% copper. Although this ore is easily mined, in the past it has not been considered as pay ore, but recent experiments lead to the belief that it may be treated at a profit. The company's outside mining properties are showing up well, two of them having shipped sufficient ore to leave a profit over their development expenses.

DEVELOPMENT

Development during the year amounted to 7645 ft. of drifts and crosscuts. Much new smelting and concentrating ore was opened, but owing to irregularities in shape and composition of orebodies it is impossible to give accurate estimates of ore reserves. The outlook for the low-grade ores has already been spoken of. Mining is still being done by the square-set system, and so long as circumstances force this to be done, no material reduction may be anticipated in present mining costs.

There were no changes made in the blast-furnace department during the year. There were 56,000 tons less of burden handled, and operating costs were slightly lower. The output from custom ores was 223,169 lb. making a total production of 15,168,102 lb. Concentrator costs remained the same, the tonnage handled being considerably less.

The last of the Shannon Copper Co. bonds has been retired, although there are still $600,000 in bonds outstanding on the Shattuck-Arizona Railway Co., guaranteed by the Shannon Copper Co. The railroad carried its fixed charges during the year, and a small balance on its stock.

Cadmium and Nickel in Cyanide Bullion

By FREDERIC P. DEWEY*

In common with many others, the United States Mint service experiences much difficulty from the erratic results obtained at times in assaying bullion produced by cyanide mills. The bullion produced by the celebrated Mercur mine in Utah is deposited in the United States Assay Office at Salt Lake City, Utah, and is thence transferred to the mint at Denver. Occasionally serious differences occur in the settlements between the two offices which are referred to the Bureau of the Mint for adjustment. The Salt Lake samples from one group of three bars were subjected to an extensive investigation. The Salt Lake office took four samples from each bar, two dips and two drills, and assayed each sample in duplicate. These samples were then sent to four other laboratories in the service for assay. The accompanying table details the results reported, giving the fineness in gold shown by the eight Salt Lake assays, and the test assays made in the independent laboratories.

ASSAY EXPERIMENTS ON GOLD BULLION FINENESS

FIRST BAR			SECOND BAR			THIRD BAR		
Fineness	Salt Lake Assays	Test Assays	Fineness	Salt Lake Assays	Test Assays	Fineness	Salt Lake Assays	Test Assays
827.2		2	816 9	1		830 5	1	
3	1		817 2	1		831.5	1	
4	1		3		3	832 1		1
7		3	5		1	3		3
8		1	818 3		1	4		1
828 3	1		4		1	5		1
4		2	5		1	8		3
5	2	1	6		2	9		2
6		3	7		1	833 0		4
7	1	4	8	1		1	1	3
8		4	9	1	2	3		3
829 0		4	819 0	1	1	4	2	2
1		4	1		3	5	1	8
2	1	5	2		1	6	1	1
3		6	3		1	7		2
4		3	4		1	8		3
5	1	5	5		3	9	1	
6		4	6	1	6	834 0		4
7		1	7	1	2	1		2
8		3	8		2	4		3
9		3	9		4	5		1
830 0		4	820 0	1	7	7		1
1		1	1		1	835 0		1
3		1	2		4	4		1
4		1	3		2	6		1
5		1	5		1	9		1
			6		3			
			7		2			
			8		1			
			9		2			
			821 0		2			
			2		1			
			4		1			
			5		1			
			8		1			
	8	66		8	65		8	52

A part of the differences shown in these assays is undoubtedly due to the samples, but the chemical composition of the bullion affects the sampling as well as the assaying. It was, therefore, desirable to know the composition of the bullion. Some preliminary tests had already been made on a previous shipment of Mercur bullion. Therefore 18.5 grams of the third bar above were subjected to a most careful qualitative examination.

This analysis showed trifling amounts of silver and lead, and considerable copper. It also showed the presence of cadmium in an amount which was large as compared with the zinc present. An unusual amount of iron was shown. The most surprising point, however, was the presence of a notable amount of nickel and this nickel was so free from cobalt that it gave the characteristic nickel bead with borax. There were also some indications of tellurium but the reactions were obscure and there was not enough material to obtain decisive tests.

Undoubtedly the cadmium in the bullion was derived from the zinc used to precipitate the cyanide solutions and the large amount shown may have been due to the use of blue powder unusually rich in cadmium, although a concentration of the cadmium by the cyanide operations is possible.

Four other samples of cyanide bullion from mills in Montana have also been examined qualitatively. The Kendall bullion showed much cadmium and only a moderate amount of zinc. It showed a large amount of nickel, comparatively speaking, but only trifling amounts of iron. The Gold Reef bullion showed a moderate amount of cadmium, but a large amount of zinc. It also showed a large amount of iron and a notable amount of nickel. The Ruby Gulch bullion showed a moderate amount of cadmium, but a comparatively small amount of zinc. It also showed a little iron and gave a good test for nickel. The Cumberland bullion showed only a small amount of cadmium, and also a small amount of zinc. There were only traces of iron, but there was a good test for nickel. In no case was there sufficient cobalt to obscure the nickel in the borax bead. All the samples showed silver, lead and copper.

Undoubtedly the nickel in these cyanide bullions was derived from the ores. Aside from showing a wide distribution of nickel in small amounts, they are interesting as being practically free from cobalt. It is fair to assume from our general previous knowledge of the intimate association of these two metals in nature that the ores carried slight amounts of cobalt as well as nickel, but that the cyanide operations effected a separation of them. Other samples of Mercur bullion have been examined for cadmium and it has always been found A sample from the Goldfield Consolidated company, which was supposed to be a cyanide bar, did not show cadmium, but also it did not show zinc. It did, however, show bismuth.

---

*Assayer, Bureau of the Mint.

Note—Published by permission of the Director of the Mint.

These qualitative analyses open up a wide variety of possibilities as to the cause of the discordant assays so often obtained in cyanide bullion, and a systematic series of assays is now being made on synthetic cadmium alloys, for the purpose of elucidating the problem.

Smelting in Mexico

Stockholders of the American Smelting & Refining Company in annual meeting on Apr. 13, heard Vice-President Edward Brush discuss the effect on the company's operations in Mexico of the renewal of revolutionary activity. He said that what was giving the company most concern was the refusal of the United States Government to allow the shipment of dynamite to Chihuahua, where there is only one month's supply.

Three out of five furnaces at the Chihuahua plant are in operation, and while shipments to El Paso are blocked over the Mexican Central, ore is being sent over the Northwest route, and it is expected that the full battery of furnaces will be put in operation before long. Velardeña plant was closed down for about a week, but is now in full operation. Last year the Chihuahua mines and smeltery closed down on account of strikes, and transportation was interrupted by the revolution, but total loss to the company was no more than $200,000.

Having been through one revolution without disastrous results, he said, the directors feel that there is every probability that the new situation will not prove more serious than the old. Both the rebels and the government are interested in keeping the mines and plants running, recognizing that they are the life of the country and the chief factors in the support of the government-owned roads.

Shortage of Dynamite in Mexico

One of the most critical matters at the present time is the rapidly lessening supply of dynamite in Mexico for the continuance of mining work. Within a very short time, days not weeks, many mines will be compelled to shut down, says a correspondent of the *Evening Post,* turning loose on the land thousands of laborers of the wholly ignorant class who may be expected to join the revolutionary forces. There are at the present time 15 cars of dynamite at El Paso, each containing 800 or 900 cases of dynamite, but the United States Government will not release them to Juarez without the consent of Madero, and this he refuses to give, fearing, with reason, that they will be confiscated by the revolutionists to be converted to their own uses, and not forwarded to the mines.

Large orders have been placed in Europe, to come by way of Vera Cruz, but the explosive cannot possibly arrive for several weeks, and therefore not in time to save the mines from closing. The government plant in Durango was seized by the rebels two or three weeks ago, stopping the supply from that source.

Utah Consolidated Mining Co.

The Utah Consolidated Mining Co., during 1911, shipped to the International Smelting & Refining Co., 162,522 dry tons of copper ore, carrying: Cu, 2.891%; Ag, 0.9815 oz. per ton; Au, 0.0936 oz. per ton; 7793 dry tons of lead ore, averaging: Pb, 22.164%; Cu, 0.655%; Ag, 5.413 oz.; Au, 0.0854 oz.; and 512 dry tons of lead concentrates, carrying: Pb, 21.984%; Cu, 0.609%; Ag, 5.038 oz.; and Au, 0.0795 oz. The product from the tonnage shipped was: 9,162,023 lb. Cu; 3,311,939 lb. Pb; 160,367 oz. Ag; and 16,730 oz. Au. Profits amounted to $438,430 for the year.

In addition to the above ores there were 3238 tons of furnace bottoms shipped to the American Smelting & Refining Co. The lead concentrates were produced at the Winnamuck mill, at Bingham, from 2524 tons of second-class ore, and are, like the lead ores, covered by a five-year contract with the International company.

During the year, 18,799 ft. of exploratory work was done. A three-compartment, inclined working shaft was sunk 641 ft. from the seventh to the twelfth level. The eleventh level was opened, but although the orebodies encountered are large, they are too low-grade to be profitable at present. The territory west of the upper mine workings, in the limestone overlying the Highland Boy lime was also opened and first- and second-class lead ore found, but no copper. The porphyry dike which cuts the Highland Boy limestone is found to approach the footwall with depth, and the ore-bearing limestone lying between it and the footwall is decreasing. Five crosscuts were driven through the porphyry and five orebodies found, which present development indicates are small and of low grade.

The development of copper ore during the last year has not been satisfactory. All new ore found has been on the levels below the eighth, and the bodies, although large, were low grade.

Important lead orebodies were opened, and the work is still progressing in good ore. The principal body is on the California level, 150 ft. below the top level, at the contact of the upper limestone and quartzite. The ore extends along the contact for 300 ft., and is of 3 ft. average width. At depth the ore has been cut by a raise from the lower level, at a point 140 ft. on the dip below the California level.

The ore reserves are: 239,650 tons of copper ore, averaging 2.24% Cu; 0.603 oz. Ag.; 0.603 oz. Au; 23,785 tons of first-class lead ore, averaging 15.44% Pb; 1.04% Cu; 3.01 oz. Ag; 0.032 oz. Au; and 12,000 tons of second-class lead ore, averaging 6.8% Pb; 1.10% Cu; 0.350 oz. Ag; and 0.035 oz. of gold. Dividends of $150,000 were paid.

Rio Tinto Co., Ltd.,

The report of this company for the year ended Dec. 31, 1911, shows that the great mines continue to be operated as usual and with some increase in production. There was no material change in capital account during the year, the capital remaining at £1,625,000 preference and £1,875,000 ordinary stock.

The production for two years past was as follows, figures being in long tons:

	1910	1911	Changes
Pyrites for shipment.	637,020	649,215	I. 12,195
Pyrites for treatment	1,509,745	1,536,390	I. 26,645
Tatal................	2,146,765	2,185,605	I. 38,840
Av. copper contents..	2.097%	2.144%	I. 0.047%
Pyrites sold..........	578,443	662,359	I. 83,916
Washed and sulphur ore..................	683,605	841,964	I. 158,359
Copper prod. at mines	22,790	21,880	D. 910
Copper in pyrites sold	10,633	11 505	I. 872
Total copper........	33,423	33,385	D. 38

There was a continual strong demand both for pyrites and for sulphur ore for shipment. Deliveries of sulphur ore, both washed and crude, were much larger than in 1910. The preparation of the lode for future mining was continued as usual. Machine drilling, both in open-cut and underground workings, has given satisfaction and its use was increased. There was no scarcity of water during the year; the winter rainfall was excessive, operations in February suffering from floods.

The income account for the year was as follows:

Profit on sale of produce	£1,349,506
Interest, etc.	4,095
Total receipts..............	£1,353,601
Taxes in Spain and elsewhere.	£94,027
General expenses, interest, etc	109,079
Depreciation account ...	80,535
Staff provident fund	3,000
Total charges ...	£286,641
Surplus for the year .	£1,066,960
Surplus from 1910 ..	26,980
Total surplus.	£1,093,940
Dividends paid...	1,065,625
Balance forward.	£28,315

Dividends paid were 5% on preference and 52.5% on ordinary shares. The report says: "The market price of cash standard copper was again lower in 1911 than in the previous year, the average price in 1911 being only £56 1s. 9d. a ton. This price is lower than the average market value of the metal for many years past, and compares with £57 3s. 2d. in 1910. For months past, however, the consumption of copper has increased and has been in excess of the production. The world's stocks are therefore very considerably reduced, and, if good trade should prevail in the consuming centers, there is every reason to expect the continuance of improved prices."

Details of Practical Mining

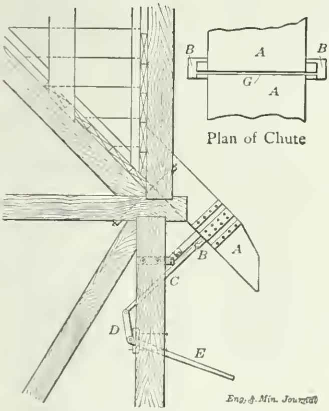
Accounts of Useful Ways of Doing Many Things in the Day's Work

Gate for Ore Bin Chutes

By Algernon Del Mar*

The accompanying illustrations show what in my estimation is one of the best gates for ore-bin chutes. It does not choke readily and can be used for coarse or wet as well as fine or dry ore. A gate of this type was furnished by the A. Leschen & Sons Rope Co. for the automatic loading station of their aerial tramway that I erected in Modoc County, California.

The sliding gate acts from below by a lever and slides up and down on wheels in a recess on the side of the ore chamber, but in such a way that the ore cannot get into these recesses. A boy can operate it and can load cars as fast as they can be run under the lip of the chute. When loading must be done expeditiously, for example where a train of cars must be loaded, I believe they could be loaded by the use of this gate while in motion. The amount of ore going through the chute is that sliding over the top when the gate is let down and nothing can choke the return of the gate to the position where it cuts off the stream of ore.



Gate for Ore Bin Chutes

Referring to the elevation, *A* is a steel chute, *B* a sliding gate actuated by the levers *C*, *D* and *E*. By lifting the lever *E* the gate is lowered allowing the ore to run over the top of the gate. As the top of the gate can be lowered until it is flush with the bottom of the chute there is a clear passage. When it is desired to shut off the stream of ore the lever *E* is depressed throwing the gate up.

Referring to the plan, *AA* is the ore chute, *G* is the slot in the bottom thereof through which the gate moves in a vertical direction, *B*, *B* are the recesses or chambers in which the wheels which are attached to the sides of the gate slide up and down, so that the movement of the gate takes little effort.

---

*Mining engineer, South Pasadena, Calif.

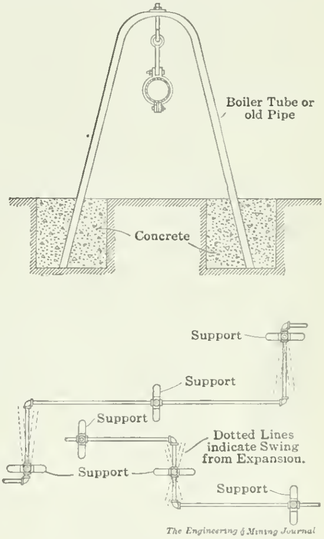
A Method of Hanging Air Pipes

By Claude T. Rice

The Copper Range company intends to connect its different properties in Michigan so that in case a compressor breaks down at one mine air can be delivered to it from another. Already the Trimountain and the Baltic mines are connected in this manner. The air pipe is carried above ground so that any leaks can be readily detected.

Supports of the type shown in the accompanying drawing are used. Timber legs have been used, but the support shown was found to be a good way of using old pipe. Any old piece of 2- 2¼- or 3-in. pipe or old boiler tube 8 ft. or more in length was used for the legs. This pipe was bent to a radius of 12 in. at the middle and the legs given a flare of one in four inches. Each piece of pipe was flattened at the top and a 1-in. hole punched through it to receive the ¾-in. hanger bolt that holds the air pipe. These pipe supports are footed in concrete pedestals about 24 in. on an edge and buried in the ground. The under surface of the top of the pipe is set to grade so that a constant and standard length of hanger can be used in suspending the pipes from the supports.

These supports are placed along the line at a maximum interval of 25 ft. No expansion joints are used in the entire line which is about 1½ miles long. Instead the expansion that would occur in the line with a change in temperature of 100° F. is figured for each straight stretch of pipe. This stretch of pipe is anchored at the middle, and the expansion is taken care of by the side swing of the pipes at the turns, or changes in direction. In case this would be too much to be taken care of in that way with the ordinary course of the pipe a double-angle turn or reverse bend is put in long enough to allow the expansion to be taken up by the swing of the pipe at this turn without danger of loosening of the joints. Often this turn is anchored in the middle so as to take care of the expansion of two stretches of pipe, but generally each turn is made to serve only one. In case that the stretch of pipe that must take up the expansion is short, the pipes are occasionally put in hot so that the end pipe of the expansion leg is pulled in the beginning in the opposite direction to that in which most of the expansion will occur. Owing to the pipes being suspended in swings at the supports, little resistance is offered to the movement of the pipes, and the expansion can be taken care of quite easily in this manner. It is a much better system than putting in expansion joints, even when the pipe has to be made somewhat longer to make room for the expansion turns.


Boiler Tube or old Pipe
Concrete
Support
Support
Support
Dotted Lines indicate Swing from Expansion.
Support
Support
The Engineering & Mining Journal

Old-Pipe Supports for Air Mains

A 70-ton Bucyrus steam shovel, used on the Panama Canal excavation work, recently loaded 2900 cu.yd. of material in a working day of eight hours, states the *Canal Record*. During this time a delay of 1 hr. 50 min. was incurred by waiting for cars. This is the best record yet made by a 70-ton shovel since the work was begun by the United States.

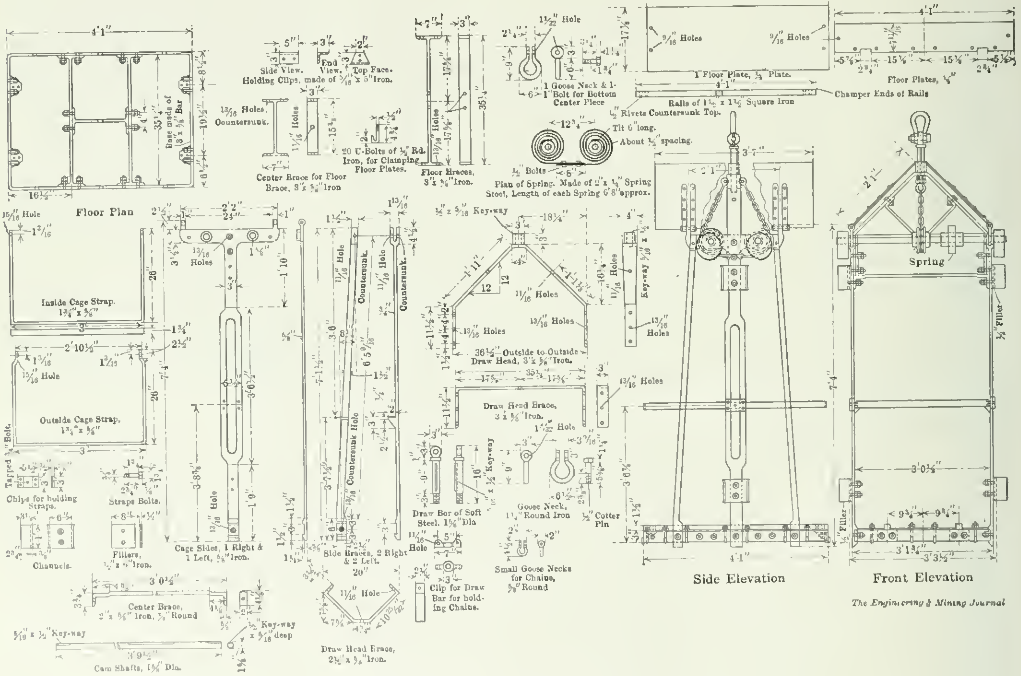
A Light Mine Cage

By H. L. Botsford*

The accompanying illustration shows a type of cage used in the West. This cage is of light construction, and is used for hoisting small loads.

The springs are of the spiral type, two in number. The inner end of the spirals are fastened to collars keyed to the cam shafts, and the outer ends are bolted together. Unlike the cages recently described in these columns, p. 636, issue of March 30, 1912, and p. 688, issue of April 6, 1912, the springs are not attached to the frame of the cage. The cams are circular in outline, with grooved surfaces. They are mounted eccentrically on the cam shafts, which gives them their gripping effect upon the guides.

The bonnets of these cages are usually attached by hinges so that they may conveniently be swung up out of the way when long timbers are being lowered. It will be noted that the guide shoes are short, whereas in the cages recently described the guide shoes were nearly as long as the cage. For a cage of this type which is intended especially for raising small loads it is not necessary that the guide shoes be long. The two sets of light short shoes should be set as far apart vertically as can be conveniently done as the greater the distance between them, the more will they tend to steady the cage during hoisting.


Floor Plan
Base made of 3" x 5/8" Bar
Side View. End View. Top Face.
Holding Clips, made of 5/16" x 5" Iron.
13/16 Holes, Countersunk.
Center Brace for Floor Brace, 3" x 5/8" Iron
20 U-Bolts of 1/2" Rd. Iron, for Clamping Floor Plates.
Floor Braces, 3" x 5/8" Iron.
1 Goose Neck & 1-1" Bolt for Bottom Center Piece
1 Floor Plate, 1/4" Plate.
Floor Plates, 1/4"
Champer Ends of Rails
Rails of 1 1/2" x 1 1/2" Square Iron
1/2" Rivets Countersunk Top.
Tit 6" long.
About 1/2" spacing.
1/2" Bolts
Plan of Spring. Made of 2" x 1/4" Spring Steel, Length of each Spring 6'8" approx.
Inside Cage Strap. 1 3/4" x 5/8"
Outside Cage Strap, 1 3/4" x 5/8"
Tapped 3/4" Bolt.
Clips for holding Straps.
Straps Bolts.
Channels.
Fillers, 1/2" x 6" Iron.
Cage Sides, 1 Right & 1 Left, 5/8" Iron.
Countersunk.
Countersunk Hole
Side Braces, 2 Right & 2 Left.
Center Brace, 2" x 5/8" Iron, 1/2" Round
1/2" Key-way x 5/16" deep
5/16" x 1/2" Key-way
Cam Shafts, 1 5/8" Dia.
Draw Head Brace, 2 1/2" x 5/8" Iron.
1/2" x 5/16" Key-way
36 1/2" Outside to Outside Draw Head, 3" x 5/8" Iron.
Draw Head Brace, 3" x 5/8" Iron.
Draw Bar of Soft Steel, 1 5/8" Dia
Goose Neck, 1 1/4" Round Iron
1/2" Cotter Pin
Clip for Draw Bar for holding Chains.
Small Goose Necks for Chains, 5/8" Round
Key-way 5/16" x 1/2"
Spring
Filler
Side Elevation
Front Elevation

The Engineering & Mining Journal

Structural Details of a Light Mine Cage

The Walker Overwind Prevention Gear*

By John Paul

In designing the overwinding prevention gear, for the Mary pit of the Lochgelly Iron and Coal Co., Ltd., the object was to provide a simple, reliable, and inexpensive device, as it was felt that while there were many excellent appliances on the market, their excessive cost and complications were inimical to their general adoption. Moreover, as there is in the near future a prospect of the provision of overwinding appliances becoming compulsory, an effort was made to solve the problem in as simple and economical a manner as possible.

The first idea which was carried out was based on steam control, that is, it was argued that if the steam were shut off at a predetermined point during the wind, there would be a guarantee that the engineman had his engines under control. If some means, therefore, of insuring this were found, then the problem of preventing an overwind from the bottom was solved.

To prevent the cages from being started in the wrong direction, a simple trip-out, actuated by the cage itself, was considered to be the better method, as, where there is limited height between the landing-plates and the headframe pulleys, a trip-out actuated by the engine shaft was considered too slow.

After the gear was inspected by a number of mining officials; the objection was raised that, in the event of steam being shut off, and owing to the possibility of the engineman being overcome by sickness or other cause at the particular moment when he should check his engine by means of the brake or reversing lever, there was a danger of the cage being dumped into the pit bottom.

To eliminate this possible defect, it was decided to add a speed controlling device, and thereby cover all contingencies, the object being to insure that, whether steam was shut off or not, the speed of the engines would be reduced gradually towards the end of the wind.

The Walker overwinding prevention gear shown in the accompanying illustration, consists of a clutch plate, fitted with roller contact spring-pin mounted on the depth-indicator shaft, and connected to the steam-control valve by adjustable rods and levers. The bracket for carrying the indicator shaft and dial is mounted with two vertical sliding bars, fitted at the top with clearing contact heads and at the bottom with adjustable hook plates. The bars work in suitable guide slots, and an electric alarm bell is connected to the sliding bars. At the bottom of the indicator there is a horizontal cross trigger shaft mounted with two levers *B* for engaging the hook plates, and with two levers *A*, Figs. 1 and 2, for engaging with the clearing catch fitted to the cage indicator, and through the action of either of them to operate the trigger lever. The trigger lever is connected to a compound-lever arrangement which throws into action the emergency-brake lever, thus shutting off steam, and centering the reversing gear.

---

*Mining engineer, Creighton Mine, Ont.

*A paper read at the December, 1911, meeting of the Mining Institute of Scotland.

Fig. 1. Side Elevation.

Fig. 2. End Elevation.

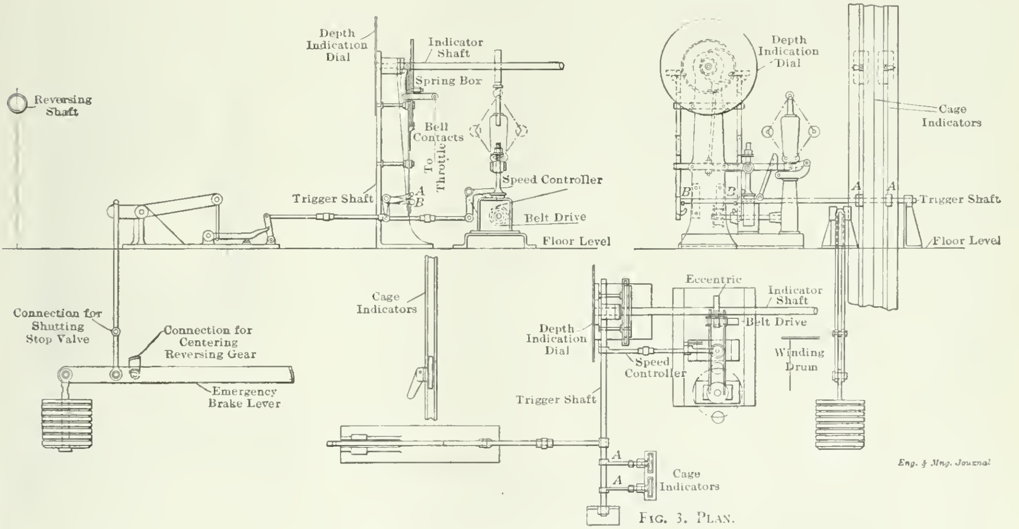


Fig. 3. Plan.

Diagram of an Overwind Prevention Gear

The apparatus comes into action as follows:—When steam is applied to the engines, the clutch plate is put into action automatically, and should the engineman fail to shut off steam at the proper moment, the contact pin in the clutch plate engages with the contact head of the sliding bar on one side or the other, according to the rotation of the engine, and thereby raises the sliding bar. The movement of the sliding bars causes an electric bell to ring, but if the engineman neglects the warning given, the hook plate, which is adjusted to the desired point of cutoff, engages with its lever on the trigger shaft, and through its action releases the trigger thus applying the brake, shutting off steam, and centering the reversing gear. Then, again, should the engines be started in the wrong direction, the catch on the cage-decking indicator comes into contact with its lever *A* on the trigger shaft when the cage has been raised two feet, or any predetermined distance above its mark, and the trigger is released, with the result already described. The spring on the pin in the clutch plate removes the only possible hindrance to the working of the engines while shaft work is being carried on, as in the position where the pin is immediately behind the contact head, steam can be applied. The act of putting on steam at that particular point causes the pin to be compressed into the box, and thus gives the necessary freedom for the clutch plate to move on the shaft.

The compound-lever arrangement gives a leverage of 72: 1, so that the strain on the indicator shaft is slight. The trigger is arranged in such a way that there is no chance of the emergency gear being thrown into action through vibration.

The apparatus in no way interferes with the ordinary working of the engines, and as steam must be completely shut off so as to allow of the contacts being kept clear, a guarantee is insured that the engineman has the engines under control, which is the object aimed at.

The variable speed-controller, Figs. 1 and 3, is designed to work, if so desired, in conjunction with the overwinding prevention gear already described, as a further safeguard, or it may be used as an independent prevention gear. It consists of an eccentric pulley and strap, fitted to the depth-indicator shaft, the eccentric rod being connected to one end of a double link, with the other end of the link connected to a governor worked with suitable gearing from the engine crank-shaft. The center of the double link works on a combined guide and trip-rod, which has a connection to the trigger shaft. The double link is fitted with a catch-pin on the governor end, and the catch is so arranged that the governor is prevented from rising at the beginning of the wind, so as to allow of acceleration of speed. The gear is mounted on a base plate, and the general arrangement is shown in the drawings.

The action of the speed controller is as follows:—Should the speed not be reduced towards the end of the wind, one end of the double link will be held up by the governor, and the other end, being raised by the eccentric, will lift the trip-rod, with the result that the trigger will be released. The emergency gear, which applies the brake, shuts off steam, and centers the reversing gear, is thus brought into operation. The controller can be adjusted by a screw on the eccentric rod, and by a screw on the trip-rod, so as to come into action at any predetermined point, after which it controls the speed for the remainder of the wind. It also acts as a preventive to the engine running in the wrong direction, as the action of the eccentric would actuate the trip-gear, and bring the emergency gear into action, in the event of the engine being started in the wrong direction.

The winding engines at the Mary pit, of the Lochgelly Iron & Coal Co., to which this overwinding prevention gear and speed controller have been fitted, consist of a pair of coupled engines with cylinders 24 in. in diameter by 60 in. stroke, working at a pressure of 100 lb. per sq.in., the diameter of the drums being 12 ft. and the depth of the shaft 864 ft. The engines make 23 revolutions per wind, steam is usually shut off at eight revolutions from the pit top, and the alarm bell rings at seven revolutions from the top.

The engineman can easily shut off steam after he hears the bell ring, and so avoid a trip-out. At five revolutions from the top, the gear comes into operation, in case the engineman should have failed to shut off steam, and the engines are thus brought to a standstill in two and one-half revolutions, leaving two and one-half revolutions still to go. The gear can be arranged to cut off or trip-out at any predetermined point. The total time occupied in winding is 26 sec.; the speed at maximum velocity is 52½ ft. per sec., and the average rope-speed is 33.23 ft. per sec. When the gear was tested, the rope had attained a speed of 56 ft. per sec. at the moment when the engines ran into the trip-out, and they were brought to rest in two and one-half revolutions, or a distance of 93 feet.

After a trip-out the gear can be readjusted in a short time. During a test the time occupied was 20 sec. The trip-out is so arranged that it can be readjusted quite readily by the engineman himself, but naturally with assistance the operation can be more quickly performed. There will be sufficient delay, should the engineman readjust the gear himself, to call attention to his carelessness.

The ordinary brake is the one employed for emergency purposes, and the brake levers are so arranged that the engineman can use his lever, or the emergency lever can be applied without one interfering with the other, or both may be applied at once.

In shutting off steam the throttle valve is used, although an independent stop valve could more easily be adopted in this case. By using the throttle, the man can keep control of the steam by opening the valve after a trip-out, by exerting a little extra force on the steam lever so as to overcome the weight employed to shut it.

The reversing gear is centered by a 15-lb. weight, so that there is no obstacle to the engineman's handling his gear after a trip-out, and he can, in the event of his brake failing, reverse the gear, put on steam, and thus bring the engines to rest.

The brakes on the winding-engine drum are of the double-post type. The posts are rolled-steel beams, fitted with brake-blocks, the posts being set at an angle to insure easy release from braking. The total bearing area of the combined brake blocks is 729.76 sq.in. on a drum 12 ft. in diameter

Separating Rock from Clay*

By A. G. Charleton†

In 1904, I was called upon to advise upon the treatment of a tin ore in the East, which, like the ore described by F. A. Killik[1], contained an excessive proportion of stiff wet clay and kaolin, and after looking up all the published information upon the subject, I came to the conclusion that none of the methods then in use was suited to the conditions which had to be dealt with. These methods might be divided into: (1) Puddling machines; (2) log-washers (mechanically stirred); (3) trough-washers (hand stirred), and (4) "Crickboom" washing trommels.

On account of their limited capacity or expense, I was satisfied that none of these alternatives would prove satisfactory, and we eventually devised and recommended a method which closely corresponds with that described by Mr. Killik. The distribution of the tin in the ore did not admit of hand sorting, as the cassiterite was not in sufficiently coarse crystals to make hand picking practicable; nor was there sufficient "waste" mixed with it to pay for sorting out, but this clay and kaolin were more or less rich in finely disseminated tin mineral.

It was obvious that the clay was bound to entail difficulty in several ways; making the ore sticky and difficult to crush in the rock breaker, rendering it impossible to use automatic feeders advantageously, reducing the duty of the stamps and tending to make the discharge of the batteries irregular by choking the screens.

I therefore suggested that the remedy for this state of things would be to eliminate the clay from the quartzose matrix of the ore before delivering it to the battery, by dumping the ore, after hoisting, on a grizzly, and washing it with a jet of water.

This freed the larger lumps remaining on the grating from clay, and they could be discharged direct from the grizzly into a rock breaker, where they were crushed to nut size (1 to 2 in.), the product of the breaker falling into a bin whence it was trammed direct to the battery.

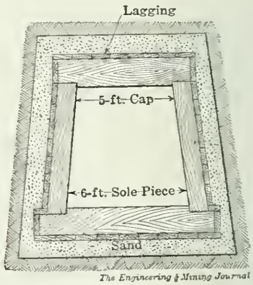
The material passing through the grizzly, consisting of mine fines and clay, was washed down an inclined plane into a revolving sieve, furnished with knives on the interior, to disintegrate the clay and separate the ore from it; and the oversize of the trommel, consisting of hard gangue too large to pass through the screen on the drum, fell into a small bin, and was trammed to the stamps.

The material passing through the revolving sieve consisted mostly of clay mixed with fine ore, which did not exceed in size the ore discharged from the battery, a matter regulated by using a sieve of corresponding mesh, and flowed down the launder to the elevator in front of the stamp battery, whence it was lifted with the battery pulp to the classifiers to undergo dressing.

This scheme, it will be seen, was practically the same in main outlines as that described by Mr. Killik; and I am glad to learn that it has proved so successful in his case.

Method of Driving in Heavy Ground

In driving in the new Langi Logan mine, in Australia, trouble was experienced from the pressure exerted by the swelling of the ground when exposed to the air. About 350 ft. of this ground was driven through in the following manner. The first object was to exclude the air. This was accomplished by cutting the drift larger than usual. A layer of finely crushed rock was then laid in the bottom of the drift on which 12-in. sole pieces were bedded. When the sets were put in fine sand was continued up the sides, as shown in the accompanying illustration from the *Australian Mining Standard*, to form a packing 12 in. thick between the lagging and the walls of the drift. The whole was then double lined with 12-in. timber.



SEALED DRIFT TO PREVENT SLACKING OF WALLS

The next step, and probably the most important of all, was to open out from the side of the main drift and then turn and drive two small relieving drifts parallel to the main drift, and about seven or eight feet away. These drifts were afterward shored up with firewood. The drift at this point and throughout has been standing for over three months without showing the slightest sign of crushing.

---

*Discussion of a paper by F. A. Killik entitled "Notes on a Simple Method of Separating Rock from Stiff Clays," Bull. 88, I. M. M.

†Mining engineer, 11 Queen Victoria St., London, England.

[1] Eng. and Min. Journ., Feb. 10, 1912.

Details of Metallurgical Practice

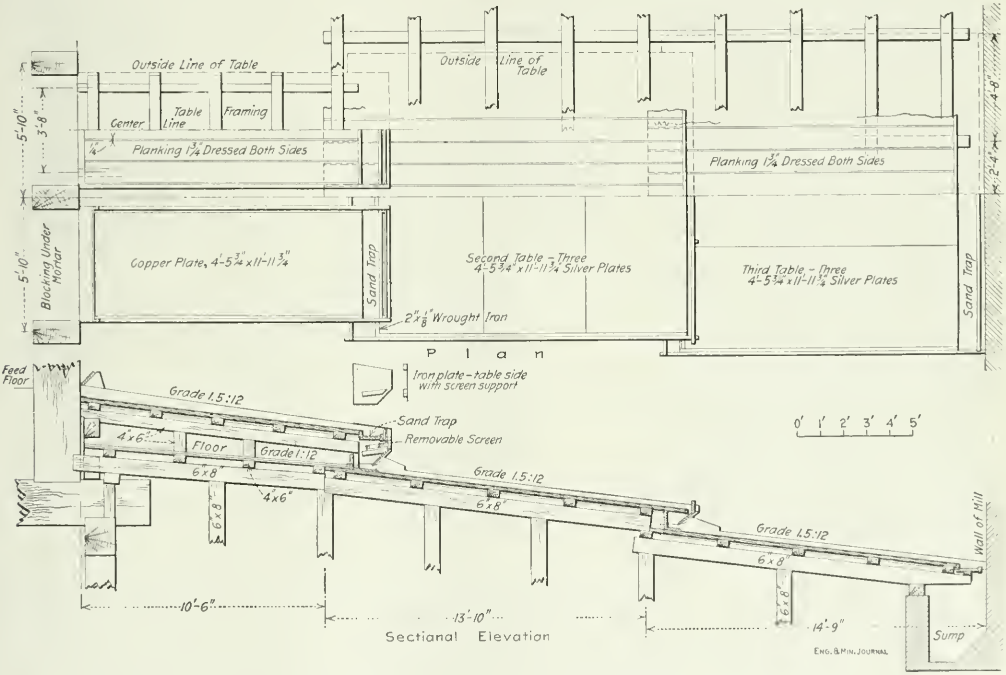
Records of Experience in Ore Dressing, Cyaniding and Smelting

Homestake Amalgamation Tables

The most notable characteristic of the stamp mills of the Homestake Mining Co. in South Dakota is the enormous total area of the amalgamation plates. The company is operating six mills in which there is a total of 1000 stamps. The arrangement of the plates is not the same in all the mills, but the most approved installation is that at the Amicus mill at Lead, which is shown in the accompanying illustration. The three sets of tables shown in the drawing are situated in front of the batteries and are within the mill building proper. After flowing over these tables the pulp passes to the "plate house" where it flows over a fourth set of tables. It is especially to be noted that no narrow sluice- or tail-plates are used; the plates of all the lower tables are wider than the first or battery plates.

The pulp from each battery of five stamps is thrown out upon a splash board whence it runs over the plain-copper plates of the first table which is 4 ft. 5¾ in. wide by 11 ft. 11¾ in. long. A sand trap and removable screen are built in the lower end of the first table. The streams from two of the first tables or from 10 stamps unite at the head of the second table. There is one of these tables for each group of 10 stamps, and are 11 ft. 11¾ in. wide by 13 ft. 5¼ in. long. From the second set the pulp passes over the third set of tables of the same dimensions as the second set thence to a sand trap and through the launder leading to the fourth set of tables in the "plate house." All plates except the first set in front of the battery are electroplated with silver, the deposit of silver being about 2 oz. per sq.ft. The stamps crush the ore to pass a 35-mesh screen and the pulp consists of about 11 parts water to one of solids.

The plates are dressed once each day. The smaller tables are brushed with an ordinary whisk broom; the larger tables with floor brooms. No scrapers are used and a thick coating of amalgam is left on the plates.



Amalgamation Tables in the Amicus Mill of the Homestake Mining Co.

Clarifying Cyanide Solutions

By Chester Steinem*

Probably the two worst zinc-box troubles are: (1) the deposition of fine rock particles on the zinc from "cloudy" solutions and (2) the deposition of a zinc slime from complex zinc compounds in solution. The effect of the latter is principally to coat the zinc shavings making them inefficient, while the former not only has this effect but makes much short zinc, and a low-grade precipitate. Naturally the low-grade precipitate necessitates more time and flux in melting.

To clarify cyanide solutions, it occurred to me that the process now in use for purifying city water might be useful. This method consists essentially in adding a small quantity of aluminum alum in solution to the water to be purified; the "lime" in solution precipitates aluminum hydroxide, which coagulates the impurities in the water. The mixture is run through a settling basin where the coagulated portion is settled out. The water is then put through a special type of sand-filter to finish the work. The process is used on river water containing the minutest clay slime and the water is so purified as to be clear and practically free from bacteria.

---

*Mining engineer, Mogollon, N. M.

H. W. Miller and I made experiments to determine the effect of the alum on cyanide solution. First a sample of muddy "box-heads," running about $2.25 in gold and silver, was treated with alum (about 2 lb. per ton, which is a comparatively large quantity). A voluminous precipitate immediately appeared and a slight odor of HCN was noticeable. The precipitate was allowed to settle. In less than an hour all had settled except for a small quantity which floated on the surface.

After settling, the solution was titrated for cyanide and was found to run slightly higher than the original. The settled precipitate gave a good test for zinc. The solution was assayed for gold and silver and was found to have lost about 5c. per ton. Not having facilities for a quantitative analysis at hand, the relative amount of zinc precipitate was not determined.

Considering the results, the following suggests itself for mill work: A long narrow reservoir containing baffle walls similar to those in zinc boxes. If the final compartment is filled with oakum, excelsior, or a similar material the sand-filter can probably be dispensed with. The other compartments should have facilities for drawing off the coagulated material at the bottom. An extra set of zinc boxes would do for experiment. Such a scheme, while it would probably require considerable storage space, would be cheap, as alum costs but $1.75 per 100 pounds.

Bucket Elevator Catch Box

The material discharged from the top of a bucket elevator usually drops into a catch box that leads to a chute, or when wet material is being raised, to a launder. The material is thrown or dropped rather violently on the bottom of the catch box, and the boards of which it is made are soon worn out.

To prevent this wear in elevators raising wet materials, it is the practice in some of the mills in the Joplin district to put a 6-in. board or dam across the bottom of the opening of the catch box into the launder, so that a bed of pulp or tailing is retained in the bottom of the box, which effectually prevents wear from the falling material.

Safety Device for Traveling Cranes

It frequently happens in mills that men are required to work on the bridge rail of an electric traveling crane. This places them in an extremely dangerous position, even though the crane operator has been notified to that effect, for there is always the chance of his forgetting or becoming careless.

To provide against accident in such cases, it is stated in *Power*, that E. H. Marzolf has planned a safety device consisting essentially of an automatically operated switch which reverses the direction of the motor when the crane comes within the danger zone.

With large cranes a flat bar or T-rail is often used instead of a trolley wire, and in such cases the application of the safety device is simple. Holes are drilled in the bottom rail about 15 or 20 ft. apart and through them are hung short bars about 2 ft. long. Ordinarily these are kept up out of the way, but when a man is working on the track he lets down the nearest bar to the place at which he is working.

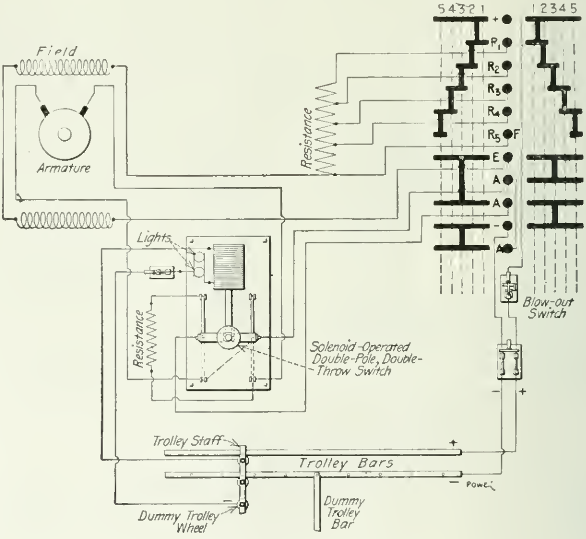


Diagram of Connections

If the crane is traveling toward him and the operator does not stop it before coming to the auxiliary rail, a dummy trolley wheel carried on the main trolley staff will make contact with the rail. This closes the circuit through a solenoid which throws a double-throw double-pole switch and reverses the polarity of the armature. A diagram of the connections is herewith shown.

A resistance is placed in series with the armature to prevent damage to the latter from the sudden rush of current. A red light is in series with the solenoid so as to indicate to the operator what has happened.

Gold Absorption by Mills

A brief enumeration of some of the sources of shortage in the first month's output of a modern mill is given by H. A. White (*Journ.* Chem. Met. and Min. Soc. of South Africa, Jan. 1912). There is some concentration in the mortar box itself. The launder to the elevating plant picks up a little gold in any small crevices; the tailing wheel or pump, especially the former, has been known to gather a rich coating; the tube mills have been known to yield as much as 500 oz. of gold upon removal of the lining. Besides the amalgamation plates, the succeeding launders and traps will not yield their full share to the first cleanup.

If in addition it is considered that all the rock crushed cannot be completely treated in the crushing period, that a fair amount of gold is in the working solution, that a large amount of partially coated zinc must be left in the extractor boxes, that new furnaces and pots absorb some gold, and that some valuable byproducts formed are not immediately treated, it is clear that the usual statements to shareholders after a first month's run are considerably more than mere soothing syrup. A considerable capital is necessarily locked up in this way, though it is seldom provided for when estimating on the cost of a mill and required working capital.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Ore Extraction at Detroit Copper Co.

The report of the Detroit Copper Mining Co. of Arizona, gives an interesting comparison between the costs of extracting ore by the various systems introduced in its mines since 1907. Up to that date square setting alone was practiced.

Slicing System: The figures show that 90.55% of the tonnage now being mined, by the slicing system, is done at a cost of only 81.6% of the cost of extracting by the square-set and fill method, and that the consumption of timber by this method is 9.03 bd.ft., compared with 10.19 bd.ft. per ton of ore in square setting.

Gopher-and-Fill System: While only 0.35% of the tonnage was mined by this system it is shown that it is 51.7% cheaper than the square-set and fill method. The timber used per ton of ore, only amounted to 1.8 board feet.

Block-Caving System: Next to the gopher-and-fill systetm, block caving is indicated to be the cheapest method of extraction, 2.74% of the ore stoped was mined by this system. The cost is shown to be only 54.8% of the cost of square set and fill, while the timber required per ton of ore is just slightly above the gopher-and-fill system. The consumption as shown is 1.85 bd.ft. per ton of ore.

Underhand Square Set and Back Filling: About 2.17% of the tonnage mined was taken out by this system, the cost was 127.1%, compared with square set and fill at 100% as a basis. The timber used by this method averaged 14.99 bd.ft. per ton of ore, which is the highest consumption shown.

Total Timber Consumption: Including timber used in development, the consumption per ton of ore in 1906 was 17,518 bd.ft., the figures for 1911 show that only 9.75 bd.ft. were used per ton of ore, a reduction of 44.3% in the use of timber.

Trenching at Cobalt

At the Nipissing mine, in the Cobalt district, Canada, prospecting for vein outcrops has been carried on extensively by surface trenches. During a three-year period, 91.9 miles, or 485,232 ft. of trenches have been made by the company, as shown by its annual reports.

The average depth of the trenches in 1908 was 4.1 ft.; in 1909, 3.4 ft.; 1910, 2.7 ft.; and the average depth of all work during that period, 3.37 ft. Assuming an average width of 2 ft. would give 6.74 cu.ft. per linear foot of trench. All the work was done with an average of 78 men during working seasons, equaling 18½ months. Allowing a total of 500 working days, the average day's work was about 970 linear feet, or 6537 cu.ft. of trenches. This would indicate that the average work per man on trench work under similar conditions should be approximately 12.5 ft. of trench, averaging 3.37 ft. in depth, or about 84 cu.ft. The average cost per foot of all the trenching was 23.2c. in 1908; 15.2c. in 1909; and 13.9c. in 1910. The average cost of the 91.9 miles was approximately 17.3c. per foot.

Machine Drilling at Alaska-Treadwell

The data given in the accompanying table are derived from the report of the Alaska-Treadwell mine for the fiscal years ended May 15, 1907 and 1911.

MACHINE DRILL DATA, ALASKA-TREADWELL MINE

	1907	1911
Footage drilled during year	....	920,545
Tonnage broken	..	1,021,765
Footage drilled per ton broken	....	0.90
Average machine shifts per day, in ore	36.08	39.28
Average machine shifts per day, in waste	0.71	4.59
Average machine shifts per day, total	36.79	43.87
Average tons broken per machine shift	34.21	32.74
Average footage drilled per machine shift	36.16	29.42
Cost per machine shift:		
Labor	$6.91	$6.86
Explosives	3.05	2.62
Supplies, power, repairs, etc.	4.13	4.02
Total	$14.09	$13.05
Rate of drilling per machine shift, feet:		
Stoping	....	27 -34.3
Station cutting	...	33.0 -43.9
Raising	..	25.1 -35.6
Drifting	....	28.3 -42.7
Tonnage broken per machine shift:		
Stoping	....	32.40-45.59
Station cutting	...	1.28-28.32
Raising	..	4.02-10.70
Drifting	....	4.88-15.23

The stopes in this mine are from 50 to 60 ft. wide, which probably accounts for the high tonnage broken per foot of hole drilled.

An average of 1 ton was broken for 1.07 ft. of hole drilled. During the year 1911 no work was done in the opencut. The records for 1907 show that an average of 72.2 tons was broken and 44.31 ft. drilled per machine shift in the opencuts. Machine drillers are paid $3.50 and helpers $3.25 per day. During the year 1907 machine drillers working in the opencuts were paid $4.50 per day. The rock is of medium hardness.

Copper Queen Unit Labor Costs

At the Copper Queen in Arizona an average of one man is employed underground for every 400 annual tons mined, and for the total men employed in the mining department, the average is about one man for every 330 annual tons mined.

The hospital department employs one man for every 112 men employed in other departments.

The store department has one man for every 12.1 men employed around the works.

Miscellaneous work requires one man for every 28,250 annual tons treated.

The average number of employees in all departments is, one for every 227 annual tons treated at the reduction works.

In the reduction works at Douglas one man is employed for every 895 annual tons treated. The labor is divided as follows: Unloading ores, fuel, flux and supplies, one man for every 19,700 annual tons; sampling, one man for every 17,300 annual tons; smelting, one man for every 2950 annual tons; converting, one man for every 2960 annual tons ore, or 1 man for about 5200 annual tons of matte treated; power plant, one man for every 23,500 annual tons; mechanical department, shops, repairs, and construction, one man for every 4030 annual tons; office, laboratory and engineering, one man for every 23,500 annual tons treated.

Data on Mining in India

The Ooregum Gold Mining Co., situated in the Province of Mysore, India, has been operated since about 1888. The reports issued by the company show that the percentage of waste discarded from the rock hoisted is about 10.7%. The average tons of unsorted ore produced annually per man employed are approximately 29.4 tons, and the average tons of sorted ore 26.2 tons. Of the 4600 men employed at the property when the report was issued, only 96 were Europeans, the remainder were nearly all coolies, 66% of them working underground. On this basis the annual tons mined per man employed underground is 44.5 tons of unsorted ore. During this period only one foot of development was done for every 9.25 tons of unsorted ore mined, of which 27.2% was sinking.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

A Combined Hydraulic Mining and Dredging Plant

A hybrid between dredging and hydraulic mining is described by Charles Janin (*Bull.* A. I. M. E., Mar., 1912). The Blue Gravel hydraulic mine, at Smartsville, Calif., was an early-day producer, but was shut down by the Débris Commission. The Tarr Mining Company will attempt to satisfy the law as follows:

The gravel bank will be hydraulicked to a sump in front of a stationary dredge building of concrete and sheet iron, where a regular steel-girder dredge ladder, equipped with 52 seven-foot buckets elevates the gravel to a trommel 45x6 ft., with ½-in. holes. From the screen the undersize flows to gold-saving tables with Hungarian riffles having an approximate area of 4600 sq.ft. The oversize passes to a belt conveyor 570 ft. long, in two sections, each operated by a 50-hp. motor. A 100-hp. motor is used on the digging ladder, and a 30-hp. motor on the trommel. At the end of the belt-conveyor stacker two Bleichert tramways are being constructed to afford a larger dumping ground for the tailings.

The fine material, after passing the gold-saving tables, goes through a tunnel about half a mile long, and is elevated to revolving screens, the oversize going to the tailings dump, the undersize to Overstrom tables. The idea is to save the black sand, with any accompanying gold and platinum. The concentrator stands several hundred feet from the Yuba River, and a concrete dam will be constructed to give a settling basin for tailings. If this experiment is successful, it will undoubtedly mean that other properties will be operated in the same way.

High Potential Transmission in South Africa

The British South Africa Co. has under consideration a 600-mile, 150,000-volt transmission line from a 60,000-hp. turbine-generating station at Victoria Falls in Rhodesia to the Witwatersrand. In order to enable the plant to be operated continuously at full load and consequent high efficiency (*Power*; Feb. 27, 1912), a pumping station is contemplated on the Crocodile River, only about 100 miles from Johannesburg, where there will be motor-driven pumps installed. During periods of light load on the main station these will be operated by the surplus power from the turbine station to store water in a large reservoir to be built on the adjacent hill. During periods of peak load, auxiliary dynamos will be operated by this supply of stored-up water. To provide against interruptions of the system by shutdown of the water-power plant, it is also proposed to build a 20,000-hp. auxiliary steam plant about 100 miles from Johannesburg.

Lactic Acid for Cleansing Filter Leaves

At the Colburn-Ajax mill, in Victor, Colo., a new method for treating filter leaves is in use. The process consists (*Met. and Chem. Eng.*, April, 1912) of the use of lactic acid instead of the hydrochloric acid commonly employed.

The use of hydrochloric acid for dissolving the calcium compounds which collect on filtering mediums has some disadvantages. The fibers of the filtering medium are rendered hard and stiff and are completely destroyed in time. Troubles in handling, high transportation charges, freight and dues on return of empties, breakages, etc., also the fact that the commercial acid of 20° Bé contains less than a third of true hydrochloric acid, make the final cost excessive. No practical method for economically regenerating this acid, after being used, has thus far been brought forward. Further, sulphuric acid which forms calcium sulphate on the filter leaves is always present in commercial hydrochloric acid.

It is claimed that lactic acid is as effective as hydrochloric in dissolving the incrustations and that it renders the fibers of the filtering medium soft and pliable, thereby giving it greater efficiency and longer life. A 10% solution of lactic acid at a temperature of 150° F. is said to give excellent results.

Lactic acid being non-volatile and non-corrosive is transported in barrels at ordinary freight rates. It costs at the factory slightly more than hydrochloric, but this is more than offset by lower transportation charges and no return freight on empty carboys. Further, lactic acid contains no sulphuric acid. Finally, lactic acid can be regenerated for re-use from calcium lactate in the following simple manner:

The apparatus for regenerating the lactic acid consists of a sulphur-burning furnace, an air blower and pipes connecting the furnace with a perforated pipe placed at the bottom of the acid-treatment tank. The regeneration is accomplished as follows: The furnace is charged with ordinary sulphur, the latter ignited and the sulphur fumes forced through the calcium-lactate solution, by means of the air blower, until all of the calcium is precipitated, while the lactic acid is thereby regenerated. In practice it is stated that 3 lb. of lactic acid are regenerated with a consumption of less than 1¼ lb. of sulphur.

At the Colburn-Ajax mill it is found convenient to remove a single leaf of the filter whenever it becomes necessary and give it a simple scrubbing with a 1% solution of lactic acid at ordinary temperature and then replace the leaf in the basket. In view of the small amount of lactic acid used and the low freight rates to Victor, regeneration of the lactic acid is not practiced at this mill. The patents for this process are owned by the Moore Filter Co., 170 Broadway, New York.

Utilizing Storage Battery Sludge

The sludge of lead peroxide and sulphate which collects in course of years in storage batteries has a value in view of its lead content; but, according to the *Zeitschrift für Electrochemie*, its transport to lead smelteries has been costly and difficult on account of the associated acid. Washing and pressing are out of the question mainly on account of the extremely fine state of division of the peroxide. According to a German patent (No. 236,343) these difficulties are overcome by mixing the sludge with slaked lime. The resulting mixture quickly sets to a firm cake. An alternative plan is to mix the sludge with the sulphite liquor from sulphite cellulose works, the lead peroxide being thus reduced to lead sulphate. Molasses may also be used for the reduction of the peroxide. In all these reactions so much heat is set free that much of the water is evaporated.

Titanium Chloride Test for Gold

Titanium chloride may be used for the detection of gold, according to Stähler and Bachran (*Journ. Soc. Chem. Ind.*, p. 1261, 1911). When a few drops of the aqueous solution of titanium chloride are added even to an extremely dilute solution of gold chloride an intense violet coloration is formed. One part of gold in 30,000,000 parts of water may be thus detected.

A New Type of Gravity Plane

By J. J. Smith

A cable, one end hooked to the loaded cars, passes around drums, thence down the incline to the empty cars which are pulled up by the descending load. In order that loaded cars may descend always on the same track and empties ascend on the other, a novel device is used to throw the short end of the cable to the head of the loaded-car track at the end of every trip.

Self-acting or gravity planes are commonly used in transporting the output of mines from the sides of the mountains down to the valley below. Their merits are so obvious, as to need no comment but in some cases the design is such as to call for more labor for operation than seems to be desirable.

There are several types of self-acting planes, three of which are:—

(1) That in which the material is dumped into a car that runs on the incline exclusively and from which the material is transferred to other cars or to bins at the lower end of the incline.

(2) That in which a platform car receives mine cars from the mine tracks at the upper level and delivers them to other tracks at the lower level.

(3) That in which the mine cars themselves are sent down the incline loaded and brought back empty, precisely as they are on any other portion of the track, but through the operation of a rope instead of a motor of some standard haulage type.

Where the material is sticky or difficult to handle, or where it is friable and breakage is to be avoided, the first type is not desirable as it involves two handlings of the material.

The second type is objectionable on account of the difficulty of placing the platform car at top and bottom so as to make the rails on the platform register accurately with those of the stationary tracks; also on account of the difficulty of locking the cars on the platform securely and conveniently at the top and releasing them easily at the bottom.

DOUBLE TRACK INCLINES PREFERABLE

It is, therefore, the third type which is most commonly used and with which this article deals. This type may be subdivided into three varieties known respectively as the two-rail, three-rail and double track planes. In the first case a single track is used except at the middle of the plane, where a piece of double track must be provided with automatic switches to let the loads go down one side of the double track and the empties up the other.

The second variety has two tracks, but the central rail is common to both, except at the passing place in the middle, where the central rail branches into two separate rails far enough apart to permit the passage of the cars. This does away with the necessity for frogs and automatic switches and is, for this reason, decidely better than the two-rail plane. Both of these are open to the objection that the car does not travel in a straight line from top to bottom, but has to turn out of its course and return to it in entering and leaving the central passing-tracks. This is objectionable for the reason that derailments are much more likely to occur at such points than on straight tracks, and what is more important, the rope cannot travel in a continuous straight line down a set of narrow rollers, but is swung out of its course and back again when the car enters and leaves the passing space.

The third variety has two separate and distinct tracks running in an unbroken straight line from top to bottom.

The problem of proper maintenance of good rollers is more important than any other, except the problem of labor cost, on the self-acting plane, and for this reason I have always preferred the comparatively small additional expense of the two-track or four-rail plane to the slight saving in first cost to be made by the use of the two- or three-rail planes. It is for this reason that the incline to be described is of the double-track type, though it is probable that it could also be adapted to the other types, if that were desirable.

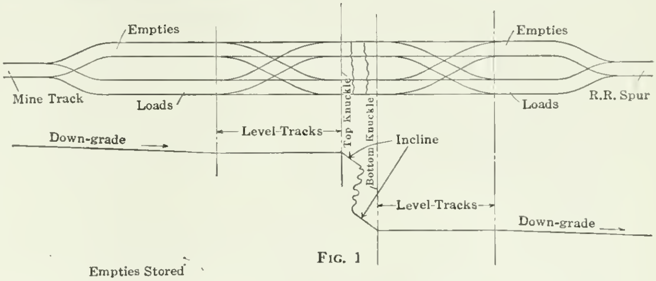


FIG. 1

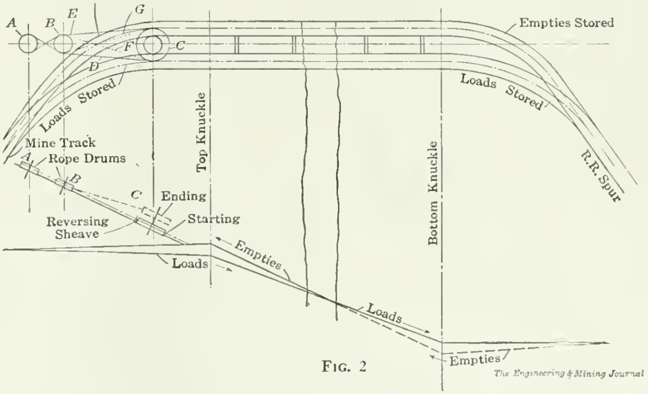


FIG. 2

LAYOUT OF TWO TYPES OF TWO-TRACK INCLINES

The ordinary type of four-rail plane, in which cars are attached to each end of the cable, requires much track room at the head and also at the foot for gathering- and sorting-tracks. Calling the two sides of the plane *A* and *B*, when a trip of loads is sent down *A*, a trip of empties is brought up the other side. *B*. Next a trip of loads must be sent down track *B* and a trip of empties brought up track *A*. This means that both loads and empties are handled on both tracks and in order to sort these out it is necessary to have, not only the storage tracks for loads and empties at top and bottom, but a system of double cross-overs so that the loads from the loaded-car storage track at the top can be delivered to either side of the plane and from either side of the plane delivered again to the loaded-car storage track at the bottom, with an exactly similar arrangement for taking the empties from the empty-car storage tracks at the bottom. In Fig. 1, the necessary tracks to do this are illustrated diagrammatically.

It will be seen that in all four cross-overs and two 4-frog crossings are required, and this in turn involves a sufficient amount of level track to install these at top and bottom. This track must be level or have just sufficient grade to equalize the labor of handling the loads down and the empties up this grade, because cars must be handled continually in both directions over both sets of tracks.

This always means expensive hand tramming at both top and bottom of the incline, and unless the tonnage is very large the necessary labor to handle the smallest permissible unit will run to a considerable cost per ton of material handled. Moreover, in the hilly country where these inclines are usually installed the level space necessary for the installation of the switches and cross-overs is not always obtainable without difficulty and heavy expense.

Traffic on Either Side Should be in The Same Direction

Experience with inclines of this type led me to believe that if some means could be devised whereby the loads would travel always down one side of the incline and the empties always up the other, the grades could in all cases favor the traffic so that the cars, whether empty or loaded, would run by gravity with consequent great reduction of the amount of hand tramming necessary. Also if the dead space necessary for the cross-overs be eliminated, it would still further reduce the hand tramming necessary, and would also reduce greatly the difficulty and expense of getting a location that would permit suitable terminals for the top and bottom of the incline.

A glance at the tracks shown in Fig. 2 will convince the most skeptical of the advantages of such a design whatever disadvantage he may believe it to have in practice. There is simply a single switch at the top and one at the bottom through which the traffic always passes the same way when going in the same direction so that spring switches may be used still further to simplify the operation.

It will be noted that in Fig. 2 the incline for loads starts at a little lower elevation and stops at a little higher elevation than that for the empties, and, therefore, the empties are raised by the incline through a slightly greater height than that through which the loaded-cars descend. This difference seems greater in the sketch than it really is, because the main portion of the incline, where the tracks are at the same level, is broken out to save space. Actually there is needed only a difference of two or three feet at each end to secure gravity shifting of both loads and empties for any reasonable amount of storage. The amount actually required for any given case is simply twice the easy-running grade for the given conditions multiplied by the length of storage track necessary.

Cable Difficulties

If these advantages were not offset by some correspondingly great difficulty this type of plane would have been in universal use from the earliest days of railed tracks. The difficulty will be obvious to anyone familiar with such matters. It is that with the ordinary arrangement of rope drums, etc., each car would run over the rope leading to the other car every trip and that the ropes would pull diagonally from the head of one track to the foot of the other every other trip. In other words, on every alternate trip the ropes must cross. To avoid this difficulty was the problem the solution of which is the only excuse for this article.

It is true that the ropes must cross somewhere because they must go from a definite point in the center line of one track over to a point in the center line of the other track every other trip if they are to fulfill the primary condition for successful operation that the ropes must travel in a straight line up and down the center of the incline tracks.

Cable Shifted by a Reversing Sheave

But there is no objection to the crossing of the ropes if they do so at some point above the travel of the cars on the incline. Therefore, if, between the two ropes a sheave be inserted approximately the same diameter as the distance between the centers of the two incline tracks, and if the two ropes on one trip run in straight lines from their drums up or down the center of their respective tracks just touching the sides of this sheave, and if, before the next trip, this sheave be turned over laterally so that its bottom side will be on top, each rope will be thrown over to the center of the opposite incline and the problem will be solved.

The ends of the ropes at top and bottom are carried across from the tracks they have just traveled over to those opposite and are hooked to their respective trips on those tracks. Another trip is then run, the sections of the rope being held in the center line of the tracks by the reversing sheave until the trip is completed. The sheave is then turned half over again, but in the opposite direction of rotation so that the ropes are restored to their orginal position. Each rope, in turn, thus takes down a loaded trip on the loaded-car track and brings back an empty trip on the empty-car track. In Fig. 2, this is illustrated diagramatically.

In the actual installation, to be described later, as in several others, the type of rope drums used was what may be called the "figure 8" type, consisting of two drums or sheaves with four or five grooves in each, set one behind the other, a half-groove width out of line with each other. The rope then winds a half or three-quarters turn around each sheave and runs to the next groove in the other sheave, and so from one drum to the other until the grooves are filled.

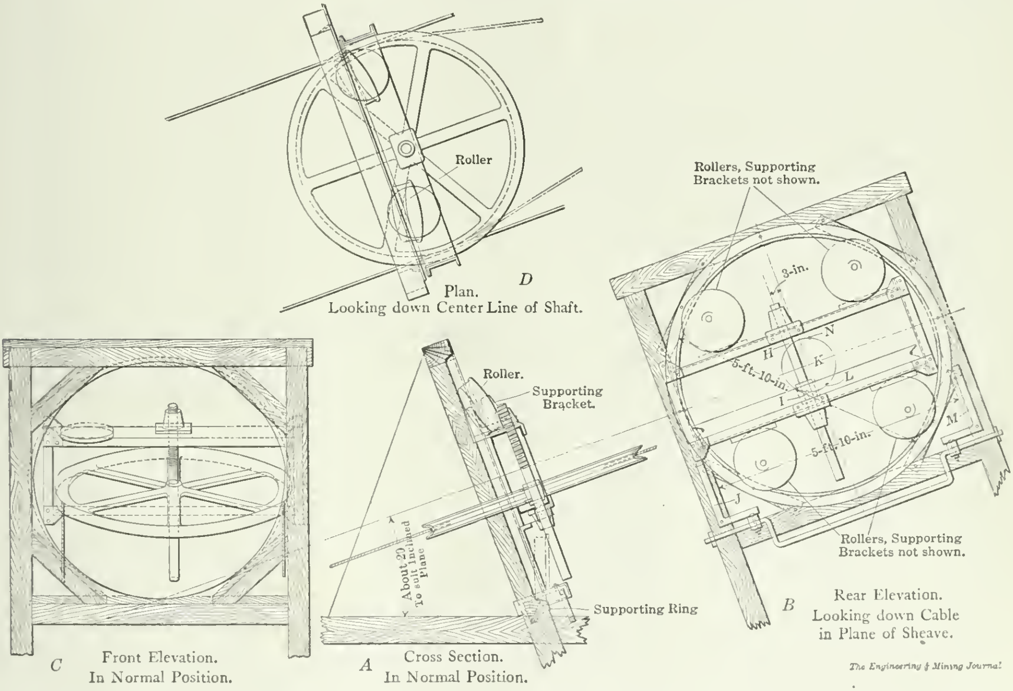
This is a well-known type of twin drums for self-acting planes and has the advantage of requiring only a length of rope equal to one length of the incline, plus the length wrapped around the drums, and that the drums themselves are small and inexpensive, whereas, if a drum be used large enough so that each half of it will contain the rope for one track of the incline, it requires almost twice as much rope and much larger and more expensive drums. Moreover, with this type of drum the lower end of the rope is worn out much more rapidly than the upper end, whereas, with the figure-8 type the whole length of the rope is worn about equally.

These drums, being small and light, are set so that their plane is approximately a prolongation of the plane of the incline. This causes the rope to wind on them without guide sheaves which is a desirable arrangement. These rope drums are indicated as *A* and *B* in the diagramatic sketch, Fig. 2. The sheave for shifting the ropes from one incline to the other is called the reversing sheave, indicated by *C* in the sketch, and lies in the same plane as the other two. The position of the ropes is indicated for one trip by the letters *D* and *E*. In this case the ropes just touch the sides of the reversing sheave and run in the center of the incline tracks in line with the sides of the drum *B*, which winds and unwinds them. On the next trip their positions are shown by the dotted lines *F* and *G*. It must be understood that the reversing sheave *C* is turned over not in the sense of a half revolution each time, but in the same way that a dinner plate would be turned upside down and back again.

Reversing Sheave Carried on an Invertible Frame

The questions will at once arise in the minds of all as to how is it possible to support the reversing sheave *C* without either of the ropes fouling its supports in passing back and forth, and as to how is it possible to turn it upside down and back without more labor than is involved in shifting the cars by hand. The answer to the first question is, by supporting the frame of the reversing sheave not on a central pedestal, but on a ring surrounding it and large enough for the ropes to pass through without touching. The answer to the second question is, that the lowering of the load supplies power for this purpose, if convenient means can be found for applying it. The drawing, Fig. 3, shows the details by which both objects are accomplished.

In Fig. 4 is shown the framework supporting both the rope drums and the reversing sheave, all on the slope on which they were actually used at a certain installation. The incline is to the left with the knuckle some 20 or 25 ft. away, so that the center of the reversing sheave is 8 or 10 ft. above the ground and the cars run under the framework which supports it.


Roller
D
Rollers, Supporting Brackets not shown.
3-in.
N
H
K
L
I
5-ft.-10-in.
5-ft.-10-in.
M
J
Rollers, Supporting Brackets not shown.
Roller.
Supporting Bracket.
About 20° To suit Inclined Plane
Supporting Ring
B
C
A
The Engineering & Mining Journal

Plan. Looking down Center Line of Shaft.

Rear Elevation. Looking down Cable in Plane of Sheave.

Front Elevation. In Normal Position.

Cross Section. In Normal Position.

Fig. 3. Details of Automatic Inverting Guide Sheave

Details of the Reversing Sheave

In Fig. 4 *A* may be called an inclined plan, looking down normally upon the sloping plane in which the drums and reversing sheave lie. *B* is an inclined rear elevation showing the reversing sheave in its frame, looking down the sloping plane with the rope drums removed. The details of the construction of the reversing sheave in its supporting ring and rotating frame are best shown by Fig. 3 where *A* is a central section; *B* a normal rear elevation; *C* a vertical front elevation, and *D* an inclined or normal plan.

The reversing sheave with its shaft is clearly shown. It is supported in a rectangular frame of structural steel which carries on its exterior surface four rollers mounted in suitable brackets. The supporting ring is an angle section with an obtuse angle, welded and turned true on its conical face. The rollers are also conical and laid out so as to roll truly within the large cone of the ring. Of this more anon.

It will be seen that the channels which constitute the principal transverse members of the rotating frame are far enough apart so that the reversing sheave can move through a considerable distance in the direction of its axis and that one end of its shaft is threaded, this thread engaging with a corresponding thread in one of the supporting journals of the shaft.

It will further be observed that the center of the shaft is set three inches to the left (Fig. 3, *B*) of the center supporting ring. The reversing sheave is an ordinary sheave, wood filled preferred, the spaces between the arms of which are filled in with iron weights bolted together so as to make it a solid disk of the thickness of the arms. This is only for weight for a purpose which will presently be evident.

It is self-evident that if the reversing sheave were set centrally in the revolving ring the whole structure could be turned into any position indifferently with only the effort required to overcome the friction of the conical rollers, which are purposely made large and their shafts small to reduce this friction as much as possible.

As the revolving frame is balanced relative to the center of the supporting ring, it is further evident that the location of the center of the sheave controls the location of the center of gravity of the structure as a whole and that in the position as drawn, the center of gravity is three inches to the left of the center of the revolving frame, and about six inches below it.

Power for Inverting Frame Supplied by Descending Load

Assume that this is the condition of things at the beginning of a trip and that the pitch of the screw shaft of the reversing sheave is such that the revolution of the latter by the movement of the cars brings it at the end of the trip to a corresponding position *H* above the center which is six inches above the center of the revolving ring (which, of course, is also the center of rotation of the structure) and three inches to the left of it. The weight of the reversing sheave being about 1200 lbs. it is obvious that the structure will not stay in this position without being held there, for which purpose the latch J is provided.

If now this latch is removed from under the end of the revolving frame, the structure as a whole will swing exactly as if it were a pendulum with its center at the center of the supporting ring K and its weight raised up to the position H, and that when released it would go beyond the center to as great a height on the opposite side, except for the friction required to move it, but, in any event, to a considerable distance beyond point L diametrically opposite to H. In doing this the projecting end of the structural frame pushes aside the opposite latch M, and after it has gone as far as its inertia will carry it drops back again as any other pendulum would do until it is caught by the latch M on its way back.

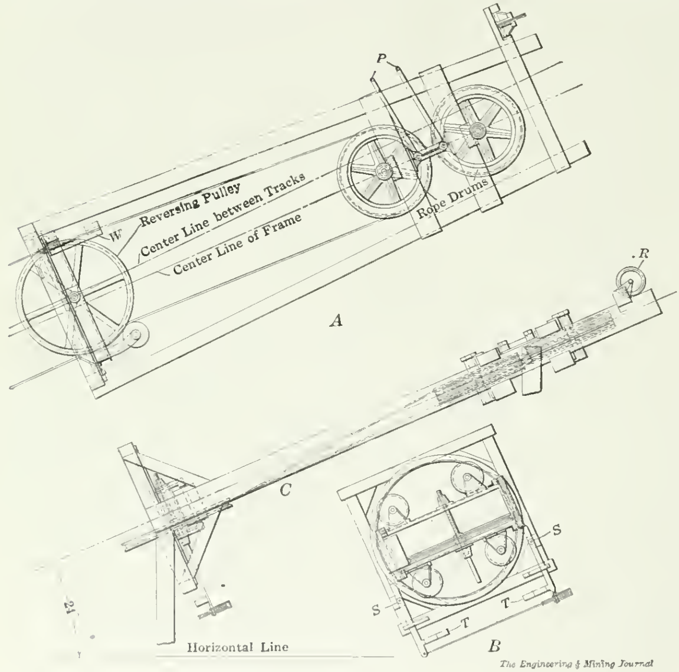


FIG. 4. GUIDE-SHEAVE AND BRAKE-DRUM STRUCTURE

The whole structure is now exactly upside down from what it was at the start. The sheave is again six inches below the center, but its axis is three inches to the right of the center instead of to the left, as before.

On the next trip of the cars the sheave is revolved in the opposite direction (as the rope travels the opposite way) but as the screw has been turned upside down, rotation in the opposite direction raises it again. This may not be apparent at first sight, but it is easy to assure ones self that it is correct by considering that if the direction of the rope travel were reversed without the sheave having been turned upside down, it would have traveled downward, of course. But as the whole structure has been turned bodily upside down, what was downward before becomes upward now. Therefore, on the next trip the center of gravity of the sheave travels from the position L vertically up to the position N, and at the end of the trip, if latch M be released, it will make exactly the same pendulum movement as before passing its initial position I, throwing aside the latch J and be stopped by the latter on its return to its initial position I. The next trip sends it up to H and on release it goes once more to L. Thence on the following trip to N again and so on. The supporting ring is made large enough so that the ropes leading from the sheave pass through it without touching either at the top or bottom of their travel.

The desired object is thus accomplished. The loads run always on one track; they run down hill to the top of the incline and down hill away from the bottom of the incline. The empties run by gravity to the foot of their incline and by gravity away from the head of their incline. The loaded-car, rope always travels straight down the center of its incline. The empty rope always starts with its end and upper portion on the opposite track from that on which the major portion of it lies, but this is straightened out as soon as the strain comes on the rope and without its dragging. The means by which this latter is accomplished will later be specified in detail.

It may be well to explain here that two of these inclines were built with different working angles, and in the latter some minor changes were incorporated to overcome slight defects found by experience in the first, which however, did not interfere with its successful operation. Fig. 4 was the design made for the first of these, Fig. 3 for the second, hence the slight differences between the two.

CONICAL RING UNSATISFACTORY

Particular attention must be called to the conical ring with its surface approximately horizontal at the bottom, because this design was adopted with the idea that it would prevent the flange of the rollers from bearing too heavily on the face of the ring at the top of their travel and so make it turn more easily. This involved the use not only of the conical ring, which was more difficult and expensive to make than a cylindrical one would have been, but also the use of conical rollers all mounted at a double angle in space on the structural frame which constituted a difficult piece of laying out for the draftsman and crooked construction for the mechanics. When it was completed it was found that not only the structure as a whole tended to slide out of the supporting ring at the bottom, but that it tended to tip away from it at the top, though it was supposed that the center of gravity would always be within the ring and that this would not happen. This made it necessary to provide small flanges on the inside of the supporting ring, which were a nuisance and increased the friction of operation.

A more careful analysis of the forces involved eventually showed some conditions into which it is not necessary to go in detail further than to say that they explained the reason for the tipping of the revolving structure away from the supporting ring at the top. As a result of this discovery, too late to be of benefit in that installation, I am convinced that it is not only simpler, cheaper and easier to use a cylindrical supporting ring and cylindrical rollers set parallel with the axis of the structure, but that this construction is necessary to eliminate the two evils of sliding out at the bottom and tipping back at the top and would result in a structure that would revolve with less friction than the one shown, to say nothing of the gray hairs saved to the draftsman.

It will be obvious that in the open position of the ropes they barely touch on the sides of the revolving sheave, and as this is heavy some little pressure against it by the rope is necessary to raise its weight by means of the screw. In the crossed position of the ropes there is, of course, contact in plenty. The result was that the sheave tended not to be screwed as far in one direction as it was in the other, with the result of working to the limit of its travel, and striking against its frame after a sufficient number of trips.

To obviate this difficulty a roller was introduced in the second design, as shown in Fig. 4, *A*, which gives the loaded rope about the same amount of contact with the sheave in the open position that it has in the crossed position, but which runs free of the rope when the latter is in the crossed position. This overcomes this trouble successfully.

By a little care this roller can also be made to serve as a counter-balance for the light end of the structural frame, which must be somewhat longer on one end than on the other for constructional reasons that are apparent from the design. The weight *W* in the same figure was intended as a counterweight to hold the frame in at the bottom, but would not be needed if the cylindrical supporting ring were used.

The drum brake levers *P* are also shown in this view. They are made separate for these drums and the brake bands are made independent, although in some designs one brake strap is connected to the other in figure-8 form, the same as that in which the ropes pass around the drums, but I do not recommend this design for the reason that if any portion of either brake strap or other connection gives way, both brakes are instantly rendered slack and useless, whereas, when both are made independent and are given independent levers, if one fails it does not affect the other, which will generally be sufficient to control the trip in safety to the bottom.

ONLY ONE OPERATOR REQUIRED

On account of the elimination of hand tramming or shifting it is easy for one man to attend the head of these planes, hook on the cars, take off the car brakes, take hold of the band brakes and control the trip to the bottom, but in order to do so his operating station must be close to the knuckle where he can have an uninterrupted view of the trip. Safety demands that the drum brakes shall be held automatically and that the operator shall relieve them to the extent necessary for controlling the speed.

On this account there is provided a small sheave *R* (Fig 3) and a rope running from the end of the band-brake levers back over this sheave to a barrel full of rock suspended on the end of the rope. Another rope leads in the opposite direction from the levers to the operator's hand-lever whereby he can lift the weight of the barrel of rock sufficiently to relieve the brakes and control the trip, but if he leaves his position or his rope fails the weight will apply the brakes and bring the trip to a standstill.

FRAME CONTROL AND SAFETY DEVICES

It is very desirable to have some means of operating the latches which control the revolving frame without the operator having to go up to them. The design in Fig. 4, *B* looks good, but was not successful in practice as there was too much inertia. Its principle is quite obvious. The latches, fulcrumed at the point *S*, were held in their vertical position by the weight of the arms *T*. A small rope passed from the lower end of one latch around a light sheave on the bottom of the other to the operator's lever, and was attached on the opposite side of the fulcrum from the brake rope, the idea being that when the latch rope was tightened the two latches would be drawn together at the bottom and the revolving frame released, whichever latch might be holding it. But the situation of the latch fulcrums *S*, as shown, involved too high an angular velocity and too much inertia in the long ends of the latches when the swing of the revolving frame brushed the latches aside. Spring-actuated latches with the fulcrum further removed from the latching point should have been used.

The arrangement of drawing both brakes together with a single movement of a single rope is a good one, and attaching this rope to the operator's lever as described enabled the whole plane to be operated with the one lever because tightening upon the brake rope slacked off on the latch rope and conversely the latch rope could only be tightened after the brake rope was slacked off and the brakes firmly set by the suspended weight.

While on this point of safety and convenience of operation it may be well to describe a simple automatic safety device which only allows one trip, or in this case, one car, to go down the incline at a time and which cannot be tied back out of operation for the convenience of the operator. This is illustrated in Fig. 5. The sketch, while rough and crude, is no more so than the device it represents, nevertheless it worked successfully.

Just above the knuckle of the loaded-car track a short post is set in the ground as a hitch for the foot of an inclined timber, the top of which is supported by a taller post. The diagonal timber is, of course spiked to both its supporting posts to prevent dislodgment under stress.

The vertical plane of this inclined timber is parallel to and a short distance from the side of a car on the loaded-car track. It supports a heavy bolt which acts as fulcrum for a revolving hook, which is shown in three positions in the plan view. This hook has a long shank projecting beyond the fulcrum in the opposite direction so that the hook end is only a little heavier than the shank. The fulcrum is normal to the line of the supporting timber and the plane of revolution of the hook is parallel to the latter.

The design and support of the hook are such that the hook end can be turned uppermost and will remain there, held by friction though in unstable equilibrium. When in this position *A*, the shank of the hook projects out slightly beyond the line of the car body. When the latter comes along it strikes this shank and pushes it away from the track. This throws the heavy hook end around beyond the range where friction can hold it, and it tends to swing clear around but the back end of the car body prevents it from doing so until the car has gone by, as shown by position *B*, in solid lines. After the car has gone by the hook swings around and comes to rest with its center of gravity at the lowest point in the position *C*. It will be seen that its point then projects past the line of the car body and that if a runaway car comes along this hook will catch it in front and low down. The inertia of the car forcing it ahead, the point of the hook holds it, swings it sideways and throws the car off the track if it is coming with such speed that the hook cannot stop it without derailing.

On account of the flat angle at which the hook works and the comparatively large friction of its hub, there is no trouble whatever in putting it into a position where it will remain inverted, so that the operator loses no time by having to set it each time, at the same time it is impossible for him to throw it out of use or get more than one car by it without re-setting it, unless he takes the hook off and throws it away.

THE WORK OF THE OPERATOR

There may be some skepticism concerning the statement that one operator can handle the upper end of one of these inclines, but the method of operation is as follows:

A car from the string on the loaded-car track is released and brought down on its own brake to a position just above the hook. The car brake is then set, the rope shackled on, the safety hook is then set to the clear position, the car brake released and the car allowed to run forward until the slack is out of the rope, which occurs just before it reaches the knuckle. This is perfectly safe because the drum brakes are tightly set. The operator then goes to the brake lever, releases it, and the car is lowered to the bottom.

To prevent the possibility of the things which we all know cannot possibly happen, but which sometimes do nevertheless, a safety device is desirable to prevent the empty car from running back over its knuckle down the incline after it is unhooked. Of course, the grade is down from the knuckle toward the mine on the empty-car track, but if the knuckle, which ought to be quite sharp, should settle a little, an accident might occur in this way. To prevent it a long oak plank was spiked to the ties just below the empty-car track knuckle in such a position that its upper end projected above the knuckle and was struck and depressed by the axles of the empty cars as they passed over it, the end standing a little higher from the track than the axles. If a car started to run down this track this heavy plank ran between the axle and the car bottom, stopping the car short.

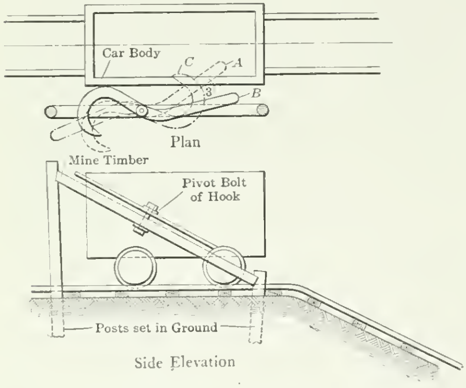


Fig. 5

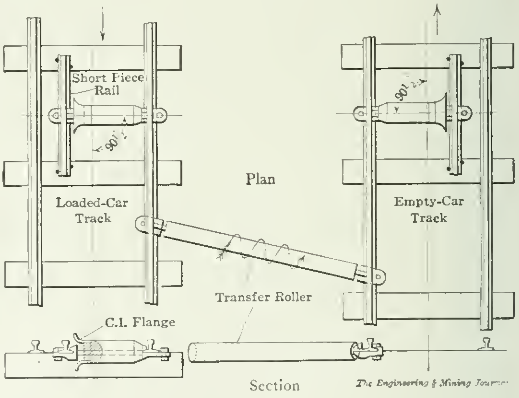


Fig. 6

Safety Device and Transfer Idlers for Gravity Plane

Rollers Used to Shift the Rope

It is obvious that the transfer of the rope from the loaded to the empty-car track must occur at every trip, and in order that the design shall be successful in any proper sense, this necessity must be met by means which will be convenient and will prevent the dragging of the rope. Fig. 6 shows the details of the rope rollers used on the inclines and also the transfer rollers used for shifting the rope from the loaded- to the empty-car track. As the tracks run in an unbroken straight line the rope is not subject to any lateral swing, but is stretched in a straight line down the center of the incline. Because the rope must shift from the loaded- to the empty-car track it is necessary to use a type of roller which will facilitate its movement in that direction.

Construction of Rollers

Similarly on the empty-car track the roller must be of a type to receive the rope delivered to it laterally. The general features of the design are roughly shown by the sketches. A wooden roller is used the top of which is level with the top rail, but the roller is coned down the next rail so that the surface of the cone clears the flanges on the car wheels. The bearing is a small casting which fastens to the bottom of the rail. It has on the inside a clip or groove, which hooks over the rail flange from below and the upward extension of this hook carries the bearing proper. On the outside it is held to the rail by a single bolt, so situated that about ⅛ in. of the rail flange has to be cut away to let it in. The slight notch so made causes the bolt to lock the bearing in position lengthwise of the rail as well as hold it laterally and vertically. On the opposite end the roller extends a short distance beyond the center of the track and terminates in a cast-iron bell-shaped flange. The same type of bearing is used on this end of the roller and it is supported on a short piece of rail spiked from tie to tie. This is much more substantial and satisfactory than the sloped plank spiked to the ties so often used, and is a permanent fixture.

It will be noticed that the roller stands at an angle with the center of the track of about half degree less than a right angle, measuring from the line of approach of the rope. This is not a necessity in this design, but is done to give the rope a tendency to travel like a screw thread along the roller as it runs. This carries it over to the cast-iron bell on which it alternately climbs above the angle of repose and slips back below it. This tends to prevent the rope from starting a groove in the roller and then cutting it in two. The pull on the rope tends always to restore it to the center line, while the slight angle of the roller tends always to carry it from this, with the result that the rope is always hunting laterally on the rollers and cannot cut into them.

Of course, if travel took place in both directions this would soon throw the rope over the end of the roller on the opposite end from the bell, but the only travel of the rope that takes place in this direction is that which occurs early in the trip when the rope is in process of being transferred bodily to the empty track, therefore, any travel in this direction contributed by the rollers is a benefit. The probabilities are that they could be set at a considerably greater angle than here shown with proportionately greater beneficial results.

The transfer rollers consist of plain cylindrical rollers set at an angle of 10 or 15° from the line of the normal to the tracks in the direction shown. A moment's consideration of what must happen when the rope rests upon them is sufficient to show that they cannot fail to transfer it from the loaded to the empty-car track, as shown by the helix indicated. The surfaces of these also are set level with the tops of the rails and their bearings can be of the same type as those for the track rollers, but they should come flush with the top of the rails, there being no necessity of providing room for the wheel flange to pass in this case. Once the rope is delivered to the empty-car track both the pull of the car and the diagonal set of the track rollers tend to carry it up the cone at the edge of the rail to the cylindrical surface of the roller and so over against the flange. Thereafter its action is precisely the same as that of the loaded-car rope. It is worth while to pay some little attention to the design of these rollers and their bearings with the object of increasing both their durability and that of the rope which they carry. On the average mine incline the rollers are in a condition not ornamental in themselves nor useful for the rope.

Money expended in making both the rollers and their bearings more substantial pays a heavy interest either in subsequent replacement avoided or in reduced wear on the rope, if they are not replaced as required.

The rollers here described were first roughed out then bored from end to end. An iron mandrel turned down to a relatively small but substantial bearing at the ends was driven through the bored hole and tightly wedged to place. They were then turned up on this mandrel, a shoulder being turned for the reception of the flange at the same time. The flange was made with its fit on the roller a diverging cone, and after being slipped into place on the roller, wedges were driven into saw-kerfs that spread the wood within the flange out into the divergent cone, which thereby secured the flange in its place for the life of the roller under ordinary circumstances.

UPPER KNUCKLE SHOULD BE CARRIED ON TIMBERS

It will be observed that the knuckles on the empty-car track are appreciably more acute than those on the loaded-car track because at the bottom the traffic is down toward the incline and then up, and at the top on leaving the incline is immediately down again, so that the direction of the grade on the approach is the reverse of that of the incline proper at both top and bottom, but on the loaded-car track this is not the case because the grade of the track is toward the incline at the top and away from it at the bottom.

In order to secure this condition the top knuckle in particular, on the empty-car track needs to be built quite substantially. It is, in ordinary cases, two or three feet higher than the loaded-car track at the same point, therefore, if made of dirt it tends always to creep away from this high point. For this reason it is as well to support the rails at this knuckle on timbers suitably framed together to give the required angle and maintain it without support from the earthwork immediately below the knuckle.

One would, at first thought, suppose that it would not make any difference if the empty and loaded-car track knuckles were not in the same vertical plane at right angles to the incline; that is to say, one of them could be a little further up or down the incline than the other without producing any objectionable result, provided the conditions were the same at both top and bottom, but this is not true for the reason that when the rope is stopped at the end of the trip, its length must be such as to have delivered the empty-cars to the proper point, while on starting the next trip down its length must also be correct for putting the loaded car in the proper position in relation to its knuckle, consequently the knuckles in both planes should be opposite each other.

The objection to the type of incline which I have attempted to describe consists in the fact that it is not possible to throw one together in a few days without surveys, plans, and almost without consideration, as can undoubtedly be done with some of the better-known types, especially where they lie on comparatively flat ground. If only temporary use is to be made of the incline it is doubtful whether the type here described is worth the thought that should be put upon its proper design and installation. If it is to be used for a sufficient period for operating costs to be a consideration, then, in my judgment, the trouble and expense necessary to make a survey of the ground and an intelligent design of the incline will be money well expended.

I do not say anything as to first cost because while the equipment of the type here described is a little more elaborate and expensive than that of the ordinary type, the amount of trackage, and above all, the amount of room necessary at the top and bottom for the various switches, etc, for the ordinary type will often more than equal the higher equipment cost of the type here described. These points must all be given due consideration and each case decided on its merits.

I do not advocate the type of incline I have described for universal use, but I know there are conditions, particularly those where the operation will be of some duration, where its installation will pay handsomely as compared with that of any other type.

GENERAL CONSIDERATIONS

A point too often ignored in the location and design of self-acting planes is the shape of the hillside, over which they are to work. Engineers are as prone to chose a hillside convex upward in the vertical plane as they are to choose one concave upward, if the former comes in a more convenient position, but this is, in my judgment, bad practice for three reasons:

(1) With a concave hillside it is possible to see the trip without interruption from top to bottom, and if the operator's position be chosen as described in this article, this can easily be done, whereas, if the hillside be convex, the operator loses sight of the loaded-car early in the trip and has no further information of what is going on until the empty comes in sight over the brow of the hill.

(2) The inertia of both cars has to be overcome by the gravity effect of the load at the beginning of the trip, also the whole weight of the rope on the empty side has to be overcome. For this reason the energy required is a maximum at the beginning of the trip and a minimum at its end. With a concave incline the energy is developed in this same general way, that is, most of it at the beginning and little at the end.

(3) With a convex incline the weight of the rope and the tension on it due to its load both operate to pull it hard down upon the rollers, doubling the wear on both, but with the concave incline the tension due to the load and the weight of the rope tend to swing the rope into a catenary and make its pressure upon the rollers a minimum.

LEVEL TRACKS AT BOTTOM OF INCLINE

I had never appreciated how far it was possible to go in this direction until a few years ago when I saw an incline, probably 300 ft. long in all, with a total drop of about 40 ft., all of which I should say was in the first 100 ft. or so, the remainder of the track being perfectly level. The incline was properly laid out, the maximum slope being at the upper end, amounting, I should say, to 30 or 35° and decreasing smoothly until the level track was reached. It will be seen that the empty car had to be brought up the steepest part of the grade when the loaded car was running on level track. When I first saw it I said to the superintendent, an old friend, that I did not see how it could possibly work, but he promptly had a trip run and demonstrated to my entire satisfaction that it not only could work, but did so smoothly and satisfactorily. The track was in good shape and the vertical curve being smooth and uniform the operator released the loaded-car so that it went away with a rush. The velocity so acquired not only took it out to the end of its travel, but also brought the empty up under the loading chute in good shape and with rapidly decreasing velocity, making its control much easier than would otherwise be the case.

From this experience and from the considerations before mentioned I am convinced that not enough attention is paid to selecting concave sites for inclines, and I believe that in many cases a stretch of level track at the bottom as an extension of the incline proper would be of distinct benefit to it from every point of view, provided the level track were joined to the slope with a smooth vertical curve.

Failure of Light Alloys

The danger of the alloys of aluminum to spontaneous disintegration has been investigated by E. F. Law (*Trans.* Farad. Soc., Vol. 6, pp. 185-198). This is apparently due to a molecular rearrangement accompanied by a marked expansion of the metal. This change can be delayed, and sometimes prevented, by chilling and working the alloys soon after making them.

The Blast Roasting of Galena

Recent exhaustive study has been made of the chemistry and physics of blast roasting, which is here summarized. An apparent forerunner of the present pot-roasting apparatus was used in Spain about 30 years ago.

At a recent meeting of the Institution of Mining and Metallurgy, C. O. Bannister contributed a paper "On the Theory of Blast Roasting of Galena," which will be a classic of its subject, revealing a wealth of careful and intelligent experimental research and settling many questions that have heretofore been in doubt.

Mr. Bannister's Conclusions

We shall here repeat only Mr. Bannister's conclusions, which are as follows:

(1) The older theories relating to the formation and subsequent reactions of peroxides, plumbites and plumbates are wrong; when these compounds are formed it is only in minute quantity, quite insufficient to affect the final results. The former theories depending on definite reactions between calcium sulphate and lead sulphide are also wrong.

(2) Later theories depending merely on the diluent effect of the various agents added are only partially true, as important chemical reactions take place in the presence of lime, limestone and magnesia.

(3) The oxidation of lead sulphide takes place in three stages, (i) its partial oxidation to a mixture of sulphate and oxide, (ii) a reaction between sulphide and sulphate, and (iii) a reaction between sulphide and oxide.

(4) In the presence of lime, limestone or magnesia, the sulphates of calcium or magnesium are formed in preference to sulphate of lead, leaving a much larger quantity of lead in the roasted material as oxide.

(5) Silica and calcium sulphate act merely as diluents, taking no chemical part in the reactions until a temperature of over 1000° is reached.

(6) Ferric oxide in certain physical states appears to act as a catalyzing agent, lowering the temperature of oxidation of lead sulphide and increasing the amount of lead sulphate formed during the roast.

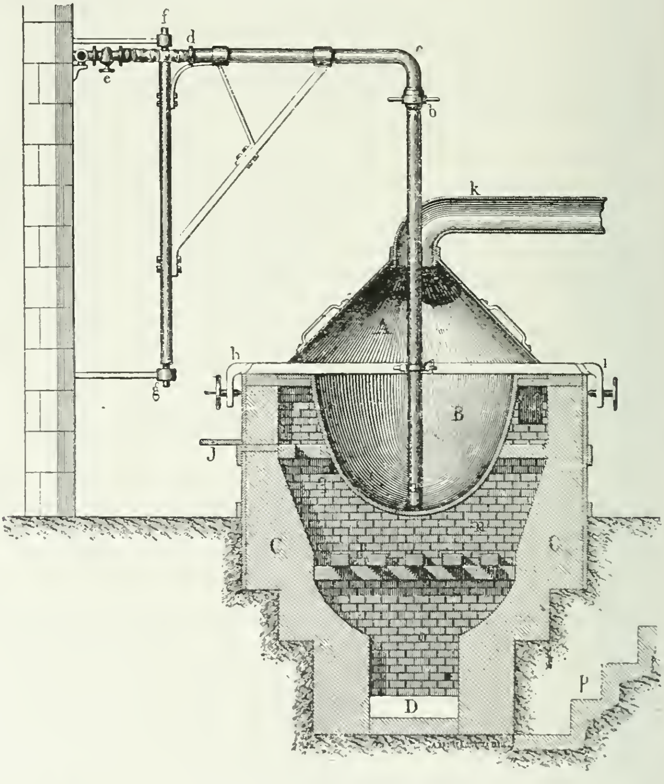
(7) Silica acts at high temperatures, 1000° and above, in decomposing lead sulphate and calcium sulphate, the latter being thus decomposed whether it be added as such or formed during the preliminary stages of the roast.

It is satisfactory to have a confirmation of our earlier ideas that lime does really play some part in the desulphurization of galena, which adds some interest to our original designation of this process as "lime-roasting." Yet we are unable to reconcile any great importance of lime in the process with some of the results that have been obtained with the Dwight-Lloyd method, which seems to be essentially one of promoting combustion by intensifying atmospheric oxidation, just as fine coal burns only with difficulty in a pile, more rapidly on a grate with an air blast through it, and almost instantaneously when blown with air into the combustion chamber of a furnace.

Apropos of the processes of Huntington-Heberlein, Savelsberg, etc., a distinguished metallurgist lately called our attention to a description of the Roswag system in "Encyclopédie Chimique," Sect. 1, Vol. V, p. 243, published in 1884, which seems to be distinctly anticipatory and worthy of reproduction out of historical interest. The following is not a literal translation, but rather is a condensed version, preserving all of the essential facts:

"Fig. 65 represents a vertical section of a roasting apparatus by means of compressed air, which consists essentially of an open ordinary pot of cast iron with a capacity of from five to six metric tons of crushed ore, at the bottom of which is placed a bath of molten lead (8 to 10 cm. thick); in this bath is plunged an iron pipe, *ab*. The valve *e* regulates the desired quantity of air.

"The pot is given a milk of lime wash at the commencement of each operation. Sulphide minerals or matte, finely broken, are charged upon the bath of lead to the quantity of five or six metric tons. The fire on the grate under the pot is then urged until the lead bath is dull red. Then the air is introduced, passing through the bath of lead and spreading itself through the charge, which becomes rapidly incandescent by the oxidation of the sulphur, and which moves in small eddies, regulated by the valve *e*. The pipe ought not to touch the bottom of the pot and should be withdrawn, from time to time, in order to cool it and to avoid its being corroded too rapidly.



Desulphurizing Apparatus, Roswag System
("Encyclopédie Chimique," 1884)

"In this system of roasting, many pots may be kept going at one time and the operation is finished in five or six hours; i.e., at the rate of a ton per hour. With a sufficient number of pots (a battery of Pattinson kettles is excellent for this purpose), and with a very small expense for combustible, because the combustion is self-sustaining, the process is very rapid and ecomonical. Not only air, but also superheated steam or even plain steam may also be used."

Apparatus Used in Spain

This process was actually in use as evidenced by the following excerpt from Sec. 2, Vol. V, of the "Encyclopédie Chimique": "Argentiferous lead-copper matte from the Herrerias works of the Marquis of Almanzora, near Villaricos, is ground to powder, and charged in an ordinary crystallization kettle, which contains a molten bath of lead about 100 cm. deep. About five metric tons of matte are then charged. When the matte is at a red heat, compressed air is introduced and in about six hours dead roasting is attained.

"The sulphurous acid disengaged, which should be useful for the manufacture of sulphuric acid, has been taken into one of the works' chimneys of high draft. It is useless to rabble or stir the charge, because all of the pulverized matte, upon the introduction of the air, oscillates and dances upon the bath of lead underneath it. The gas which escapes produces a gyratory and undulatory movement which stirs up the matte perfectly.

"It is well, however, from time to time that the workman and his assistant, who suffice for the working of six pots, i.e., 30 tons at a time, should permit the iron pipe which goes to the bottom of the pot to cool off, and that they should break off any nodules and knock off any crusts which have formed. As to rapidity, economy and ease of work, this system (which is not patented) is superior to all known methods of roasting."

The similarity of the later methods of pot-roasting to this early one is self-evident. The apparatus was indeed clumsy. We fancy that the air pipe going down through the charge was rapidly corroded and trouble on that account, together with the unhandy means for discharging the pot, was perhaps the reason why the process did not survive. The function of the lead bath is not quite clear. Likely it was to hold up any molten matte running down to the bottom, such matte under the conditions existing being blown as in a bessemer converter. The grate beneath the pot was, of course, to melt the lead and start the process. Anyway this is a good example of an early metallurgical novelty on a line that developed into importance about 15 years later.

The Situation in Mexico

Gen. Porfirio Diaz, former president of Mexico, is reported from Spain as having said recently: "The world can see now that I was no tyrant, but a severe governor who realized that an iron hand would alone keep Mexico prosperous and peaceful." As revealing the real situation in Mexico the communication of a special correspondent of the *Evening Post*, writing from the capital, published in its issue of Apr. 2, seems to us so accurate, from our knowledge of the country and its people, as to be worth repeating nearly in full, as follows:

The political situation in Mexico is sufficiently distressing. Everybody feels sorry for Mexico, for the Government, and for the revolutionary party which is fighting to destroy it. Both parties are misguided, the one in the lack of knowledge of the characteristics and limitations of the people which it would govern, and the other in its total ignorance of the meaning of liberty, namely, that liberty is not license, but stands preeminently for law and order.

Army Inadequate

From one end of the country to the other disorder prevails; burning, stealing, murder, and rapine are of every-day occurrence. The Mexican army as now constituted is totally inadequate to suppress the spreading flame. A handful of so-called disciplined troops is massed in the various larger cities, but the country at large is at the mercy of marauders. The total fighting force of the government, including rurales, cannot be over 16,000 men, in a country with 14,000,000 inhabitants, of whom 10,000,000 are of the lowest class and wholly uneducated.

Gen. Porfirio Diaz was a god to these people; his very name carried fear, his personality was overwhelming, and they were cowed into submission. The Madero revolution was instituted, based upon many undoubtedly needed and sound reforms. That was a real revolution from the beginning; its successful issue is a matter of history, and in due time Francisco I. Madero was almost unanimously elected president in perhaps the first legal election ever held in Mexico.

But the average Mexican has a fear of power, with no respect for office; that is, he has no conception of the fundamental sacredness of constituted government *per se;* hence as soon as the new government was installed, the bandits and thieves, undoubtedly fully believing that now they could practice their own free will under their own government, began their depredations, which have continued unceasingly. For a long time there was no thought of revolution; it was just a campaign of unlawful pillage, which spread from state to state.

The Zapata Outbreak

With one exception, there was no scene of military activity. That exception was the state of Morelos, south of Mexico, of which Cuernavaca is the principal city. Here a former Maderist chief, Emiliano Zapata, defied the national order to lay down his arms and disperse his troops, and continued in the field, keeping his force together and gathering arms and supplies by plundering the rich haciendas with which the state abounds, even threatening the city of Cuernavaca. At one time he came to the City of Mexico to confer with President Madero, at the latter's request, and, it is said, with every evidence of truth, that the president gave him 15,000 pesos in cash, on the understanding that he would return to his men and deliver up their arms. Zapata did return, but only to use the money for arms and ammunition and pay for his men. The depredations continued. For months that band was the only organized force against the government, and, while troops, considered to be of the best character, were sent against it repeatedly, only a few skirmishes were fought, with no visible effect, and the band continued its operations, without the least attention to the president's repeated and kindly offers of amnesty.

Government's Vacillation

Disorder which is not suppressed grows; it never stands still. The government, with all the forces at its command, was unable to suppress or did not suppress Zapata. The inevitable consequence was that its inactivity emboldened others; the disease spread; the natural cupidity of the unemployed took live form; they saw the opportunity to take from others what they could use for themselves, for one of the conceptions which they do not possess is that of the right of possession except by superior force.

Throughout all these disorders the government did pursue a "weak and vacillating policy," as was stated by a leading American resident at the recent meeting of Americans to discuss self-defence in this city. Instead of putting down disorder with cold steel, all sorts of compromises and amnesty were offered again and again without the slightest effect, only seeming to strengthen the assurance of the marauders.

President Madero is a man of education and high ideals; he is of a gentle and kindly disposition; affectionate in the extreme in his family, where the writer has often seen him; undoubtedly truly patriotic; but though he is a Mexican, he does not know Mexicans; he is a philanthropist in the midst of an unappreciative people. There is little doubt that if they would let him alone and permit him to proceed with the reforms which he has promised them and wishes to carry out, he would make a great and modern President. It is his misfortune that he represents civilization in the midst of savagery.

In the beginning there was no insurrection, it was simple brigandage. When it began to be seen that the government seemed to be unable to cope with the growing troubles, buried ambitions arose, and insinuations began to be spread as to the unfitness of President Madero for the office. General Reyes, once the idol of the people, appeared on the scene, but he smacked too much of the old régime, and soon passed away. Then Vasquez Gomez, a deposed member of the Madero cabinet, came out in opposition, spread his propaganda, and disorder developed into revolution.

Desertion of Orozco

Pascual Orozco, a strong Madero chief in the last revolution, and one of the most trusted federal generals, finally deserted the constitutional standard, and has swept the entire north down to Torreon, which he can hardly fail to capture within a very short time.

That the victorious rebel army will march on to the south, and increase in numbers as it comes, cannot be seriously questioned. Meanwhile, General Zapata is threatening Puebla, the second city of the republic; he is already in its environs, and has formally demanded its surrender. The authorities state that they have dispatched 1000 more troops to defend it.

The capital itself does not contain much of a garrison. The facts are that there are fewer than 2000 regular soldiers here, with a well-equipped police force under an unusually efficient governor, Don Ignacio Rivero, one of the strongest and most active men in the government. The foreign colonies are all armed and organized for trouble, if it comes; machine guns, rifles, and pistols are near at hand, and there are companies with officers. It is not probable that any serious trouble will break out in this city. The facts of these preparations are well known locally, and it is only locally that danger will arise, from mob violence and its accompaniments. The city will never be bombarded nor taken by storm, for, while President Madero, with his optimism and idealism, will hold his office to the last resort, nevertheless, should he see from his palace balconies the dust of the rebels under Orozco and Zapata hovering over Mexico, he must perforce recognize the inevitable and give up the city to the new power.

Government Expected to Fall

With these things in mind—actual conditions and Mexican characteristics—it appears to any thinking mind which delves beneath the surface that the Madero government must fall. If Mexico had an army it would be different, but it has not. There is no doubt that the fighting value of a federal against a revolutionist has been largely overestimated. Had the government defeated and captured Zapata in the first place, it would probably have been in complete and peaceable control of the republic to-day.

Daly-Judge Mining Company

The report of the Daly-Judge Mining Co. for the year ended Dec. 31, 1911, shows that the net gain for the year was $115,404, after the payment of a dividend of $45,000. The surplus earned interest to the amount of $18,838 which is considerably in excess of the annual drainage expense.

The total amount of prospecting and exploratory work during the year was 7498 ft. The fissure vein, which trends to the southwest through the Ontario, Daly and Daly West mines, has been proved in the Daly-Judge for a distance of over 2600 ft. and with a comparatively small amount of stoping done to date. General Manager Lambourne believes that this vein extends throughout the Daly-Judge property for its entire length, a distance of about 11,000 ft., and into the ground of the Snake Creek Mining & Tunnel Co. beyond. This is the most important of the several ore-producing veins so far demonstrated.

The production of the mine for the year was 51,875 tons of milling ore and 7,586 tons of shipping ore. The cost of mining this ore was at the rate of $3.09 per ton to which must be added $2.38 per ton for prospecting and dead work.

From the 51,875 tons of ore treated in the mill, 12,237 tons of lead concentrate and 3919 tons of zinc middlings were made. There were concentrated 4.2 tons of crude ore into one ton of lead concentrate and all products combined 3.2 tons. The milling costs are given as follows: Concentration, 51,875 tons at 79c.; general expense, 59,461 tons at 25c.; marketing cost, 22,606 tons at $1.03. This makes the total cost of mining and milling, on the basis of 59,461 tons, $6.81 per ton.

Two Janney-Richards classifiers were installed during the year, one to treat the table feed and one to treat the zinc middlings. This equipment is reported by Superintendent Mason to be making a well classified feed for the table resulting in a closer saving. A higher-grade zinc product is being made from the zinc tables; where a 30% product was formerly made it is now possible to make a 40 to 45% product. During November and December two shifts were employed at the mill, one shift during January and again two shifts beginning Feb. 7, 1912.

The report states that the present drainage facilities are equal to expectations and levels can be driven in any and all directions and to any depth desired without the danger of developing dangerous and excessive flow of water. The extension of the Ontario drainage tunnel is so far advanced that crosscutting can begin from the shaft on the 2500 level at any time desired, once that depth is gained, or from the tunnel itself.

An ore contract was negotiated last year with the International Smelting & Refining company which gives the Daly-Judge company better smelting terms than it has ever had. This contract is on a tonnage basis and will run for several years, even if the annual production exceeds that of last year materially. Owing to unfavorable circumstances existing in the zinc-smelting industry it was impossible to dispose of the zinc middlings to advantage and since last October these have been stored near the mill for future disposal. On Jan. 1, about 1136 tons of these middlings were thus stored, valued at approximately $18,000, which under more favorable conditions would have been marketed last year increasing the income to that extent.

To eliminate any possible future litigation with owners of the property along the creek carrying the tailings from the Daly-Judge, Daly West and Silver King Coalition mills, an arrangement was perfected between these three organizations by which over 700 acres of land were purchased for impounding purposes. The water is to be reconveyed to the creek after settling, thereby avoiding any possibility of trouble with the farmers, and providing for the accumulation of tailings which may at some future date be an asset.

Prussian 1910 Mineral Production

The report of the kingdom of Prussia recently issued, for the year 1910, shows the following official statistics of mineral production:

Bituminous coal, 143,771,612 metric tons, $337,424,704; lignite, 56,644,291 metric tons, $32,188,928; salt, 6,205,242 tons, $15,386,608; zinc ore, 714,855 tons; iron ore, 4,823,606; copper ore, 903,834; lead ore 133,955 metric tons, $3,292,812; other miscellaneous ores, $2,849,336. Zinc and lead ores fell off in tonnage; lignite, lead ore and miscellaneous ores in value.

There are stated to be 575,747 workers in the bituminous-coal industry; 56,186 workers in lignite; 23,056 in iron ore; 16,912 in salt; 16,059 in copper ore; 15,130 in zinc ore; 8744 in lead ore; and 3262 miscellaneous.

Colburn-Ajax Mill, Victor, Colorado

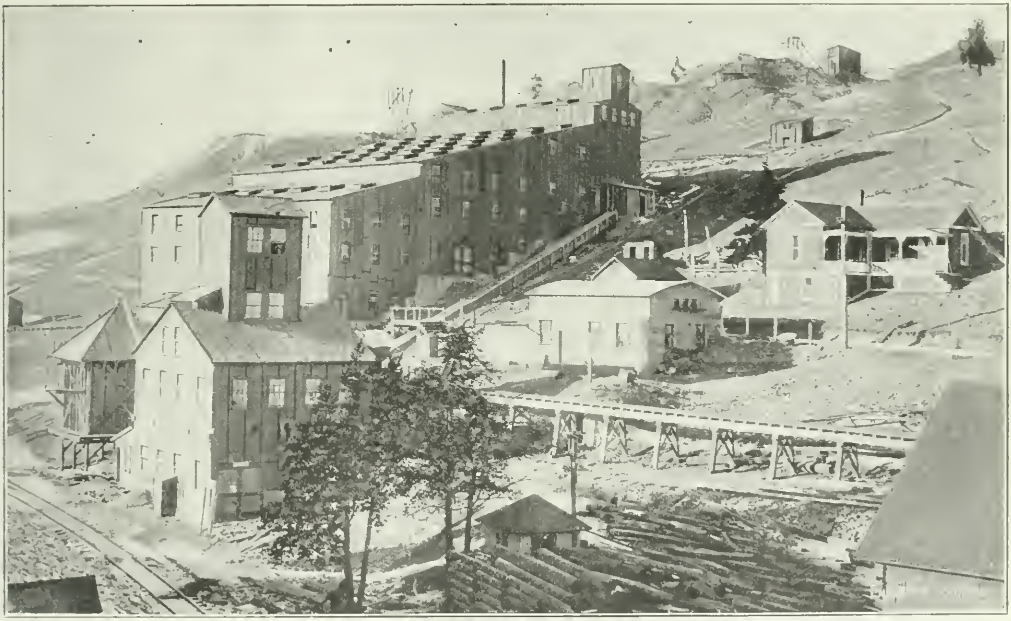
By S. A. Worcester*

A description of the mechanical features of this new Cripple Creek mill which is using the Moore-Clancy process. The dust produced in crushing is withdrawn to a special collecting house and returned to process. Many mechanical devices used to make the operations about the mill as automatic as possible.

The Colburn-Ajax mill, which was built according to my design and under my superintendence, was partially described in a previous issue of the JOURNAL,[1] and I am adding herewith a brief description of some of the features not formerly mentioned, which I think may be of interest.

SYMONS GYRATORY CRUSHER USED

The No. 5 Symons gyratory crusher used at the sampler was adopted in preference to the jaw type for the reason, primarily, that it can be operated almost without attention. In this case a specially designed cylindrical hopper of heavy-steel plate, 8 ft. in diameter and 3 ft. high above the slope, is added to the smaller cast-iron hopper furnished with the machine. Into this hopper the motor car dumps its entire load of perhaps five tons of coarse rock from the mine or dump and goes away for another load, leaving the crusher to empty itself, which it does without further attention other than occasionally to pick out the sticks and chips which come from the mine in considerable quantities. The motor-car operator attends to this.


THE COLBURN-AJAX MILL AT VICTOR, COLO. THE DUST HOUSE AND SAMPLER ARE SHOWN IN LEFT FOREGROUND

Among the desirable features of this crusher are: The small head room or mill height required, only about half that of the older types of gyratory machine; the complete and efficient oiling system, including an oil reservoir of several gallons capacity, and a small pump which constantly maintains a copious flow of oil through all important bearings; an oil-cooling device which keeps the oil from heating; and the much greater ease of repair with this short machine, as compared with the older type.

DUST COLLECTED IN SPECIAL HOUSE

One feature of this sampling plant is the arrangement of exhauster and dust house for removing dust from the various places where it is generated and preventing it from appearing in the main building; also saving the precious metals which this material contains. A 15-in. Sturtevant exhauster is piped with branches to every machine making much dust. It discharges into the peak of the roof of the dust house, which is 16 ft. square in plan with sides 16 ft. high. The sides of this house consist of a skeleton of 2x8 studding, covered with burlap. The roof has an overhang of 4 ft. This house is situated about 12 ft. from the sampler building.

The floor is covered with No. 28 steel, and a spout near the door descends from the floor to the main conveyor from sampler to mill. The burlap is held by washered tacks to ¾x1½-in. slats, placed horizontally 12 in. apart. The slats are held loosely by wood screws, allowing 1 -in. play endwise on the screw. Most of the dust blown into this house drops to the floor, but large quantities accumulate on the burlap. Whenever the burlap shows by bulging that it is commencing to choke up, the slats are rapped with a pole, which cleans the burlap quickly and effectively. The sampler building is noticeably free from dust and much labor in sweeping and cleaning is saved. When the dust becomes thick on the dust-house floor, it is scraped into the spout and delivered by the conveyor to the mill.

The three sets of Allis-Chalmers rolls are kept true by using a portable electric grinder. It is mounted on a substantial cast-iron slide rest, which is bolted to the lower portion of the roll housing, the end section of the upper portion being removed for this purpose. The upper part of the housing is made in three parts, so as to allow this grinding without removing the spouts.

---

*Mechanical engineer, Victor, Colo.

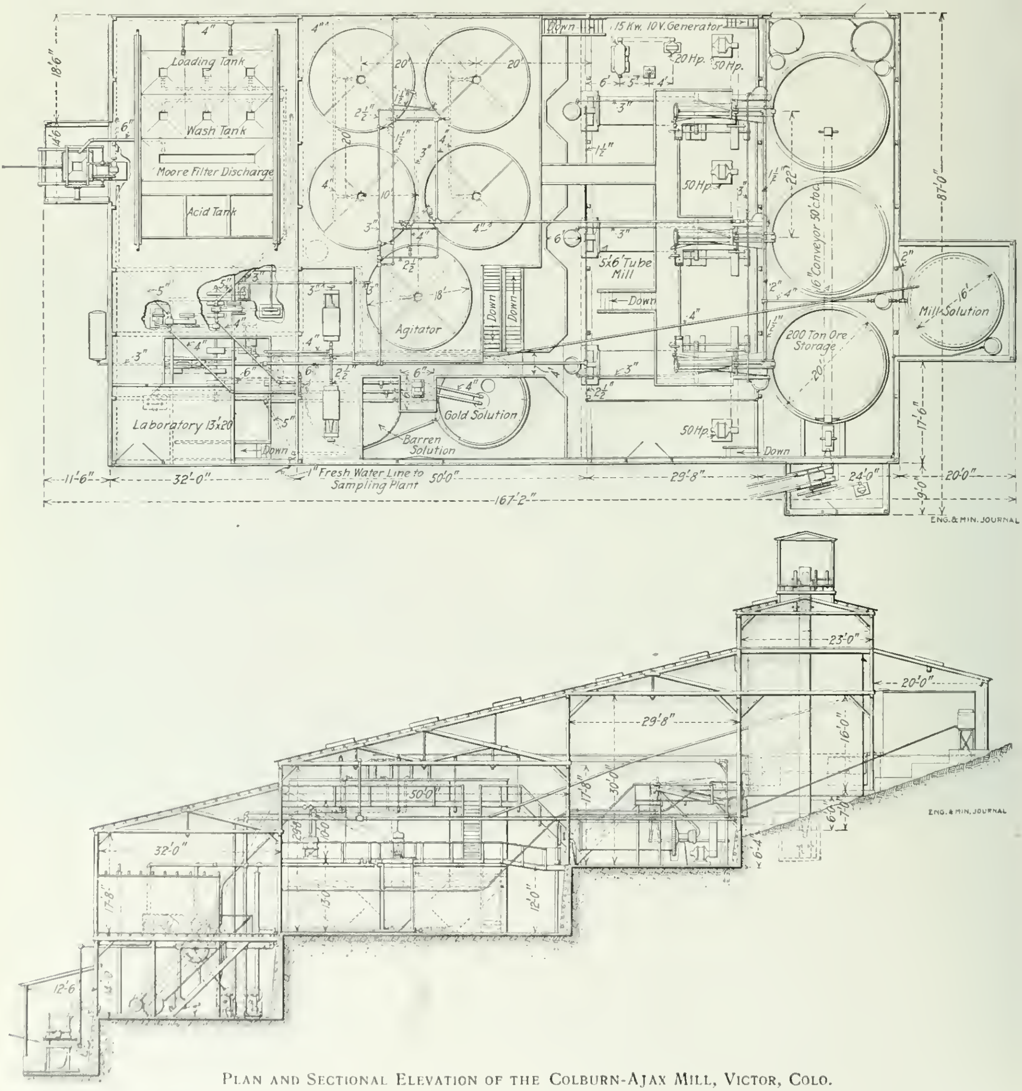
[1] Eng. and Min. Journ., Dec. 2, 1911.

The man elevator, which is now regarded as almost a necessity to every sampling plant, is situated near the center of the building, and extends from the ground floor to the extreme top elevator floor. This "man lift" is merely a 10-in. belt running vertically from one 10-in. pulley to another one and having hand or foot holds, spaced 6 ft. 4 in. between centers. These grips are fastened to the belt with elevator bolts. The openings at the floors, through which the man and belt ascend and descend, are 26 in. square.

The sample, which, in dealing with lessees, is retained until the lot of ore is settled for, is caught below the Snyder sampler in a box 18x18x18 in. outside, made of ¾-in. lumber and lined with No. 28 steel. A number of these boxes are provided and, as they weigh over 200 lb. each when full, a truck is used for moving them around the steel-plate floors of the sampling rooms, and a small friction hoist is used for lifting them to the split sampler. The boxes have trunnions, which are engaged by the short arms of the truck, or by the hoist bail.

Small Hoist for Samples

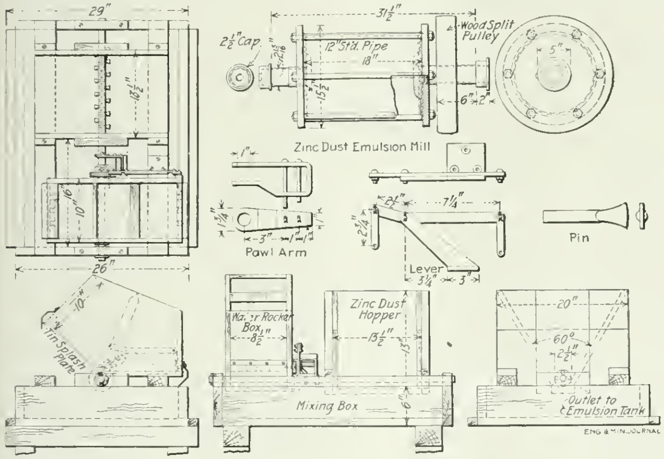
The 10-ft. operating lever of the sample hoist has a cord attached to its single end and passed over a pulley, then down within reach of the operator. The weight of this lever holds the 20-in. friction wheel normally against the wooden brake shoe. Lifting the lever a little by means of the cord allows the drum to run free, and lifting further makes the 20-in. iron pulley engage the 8-in. wood pulley on



Plan and Sectional Elevation of the Colburn-Ajax Mill, Victor, Colo.

the running lineshaft, thus hoisting the load. This hoist is just outside of the sampling room, and the ¼-in. wire rope passes over two sheaves and down through a slot in the ceiling. It hoists the sample at a speed of 30 ft. per min. and is easily managed.

For grinding the final sample pulp, a McCool sample grinder, a recent invention, is used. This machine uses 9½-in. disks for grinding surfaces, one of the disks having an eccentric movement in the vertical plane, in addition to its rotary motion. Among the desirable features of this machine are its ease of cleaning, substantial construction and complete self-lubricating arrangements. Another desirable point is the easy adjustment for fineness of product, made by a hand nut without need of any locking device, while grinding. The machine grinds with remarkable rapidity, an ordinary pulp being put through in a few seconds.



Zinc-dust Feeder and Emulsion Mill at Colburn-Ajax Mill

The ore, reduced by the sampler to approximately 10-mesh maximum size, is delivered by conveyor and belt elevator to a 50-ft. horizontal conveyor, which discharges by means of stationary trippers or end discharge, to any one of three cylindrical steel-storage bins. These bins, with flat bottoms, have a total storage of 400 tons each, with automatic discharge for 200 tons each. This gives storage capacity for several days' supply of ore and prevents the stopping of the mill in the event of a shutdown at the sampler. Each bin has a 12-in. belt feeder, surmounted by a semi-circular steel hopper 6 ft. in diameter, having a sliding discharge gate with screw adjustment.

Tube Mills for All-sliming

The belt feeds the ore direct into the classifier, a specially designed machine of the screw-conveyor type of large capacity and inexpensive construction. The screw is an inclined ribbon conveyor with its lower end and bearing completely submerged. Slime is prevented from entering this bearing by maintaining a continuous small flow of solution through it. Coarse material from the classifiers goes to 5x16-ft. tube mills, driven by 50-hp. motors. Features of these tube mills are the center-feed spirals, eliminating the feed box; the improved El Oro lining, using no bolts, or holes in the shell; collar oiling bearings; steel pinions; ample drive pulleys, 74x15 instead of 60x10 in. in size, as is common practice.

The tube mills discharge into small tanks having floats which regulate automatically the air lifts for returning the mill product to the classifiers. In addition to saving attendance, these floats economize air, using just what is necessary to prevent accumulation of pulp at this point. The slimes from the three classifiers join in a central float tank, from which they are raised by an automatic air lift to the agitators. These cone-bottomed steel tanks have central column pipes rising to half the height of the cylindrical portion of the tanks, with air jets at their bases. The agitators are so connected that continuous agitation in series may be practiced at any time, if desired. The general arrangement of piping, valves, etc., throughout the mill is also complete, so that almost any desired system of operation is possible.

Graphite Anodes and Iron Cathodes Used

The anodes for the Moore-Clancy electrolytic apparatus are of Acheson graphite, about 40 in. long and 4 in. in diameter. The cathodes are iron plates about ⅛ in. thick, 6 in. wide and 40 in. long, four to each anode. These plates, curved to a 10-in. circle, are soldered to spiders 10 in. in diameter, concentric with the anodes, making "baskets," which are submerged about 6 ft. in the pulp. The low-voltage switchboard controlling the current to the electrodes is situated on the upper floor, centrally between the four equidistant agitators. At the conclusion of the treatment the slimes pass to the Moore filter plant.

The pregnant solutions drawn by the vacuum pumps through the filter leaves are discharged into the gold tank, but if during the washing the solution becomes nearly or quite barren, it is directed to the barren-solution tank by merely closing the valve in the pump discharge leading to the gold tank, forcing the solution to rise out of the tee over the barren tank.

The suction inlet of the filter-press pump is a perforated ring of 4-in. pipe, suspended about 12 in. below the rim of the gold tank. The solution enters the tank in the center-column pipe, the lower end of which is raised above the bottom of the tank, leaving an annular opening, 12 in. high, through which the solution passes out into the tank. This arrangement of inlet and outlet makes the tank an effective clarifier, without the use of filter leaves or equivalent devices. The filter-press pump is regulated by a float in the gold solution, which opens or closes a bypass between the suction and discharge pipes, so as to maintain a nearly constant level of solution in the gold tank and to prevent the suction inlets from being uncovered.

Special Zinc-dust Feeder and Emulsifier

The pump for returning barren solution to the mill-solution tank is similarly governed by a float in the barren-solution tank. The zinc-dust feeder and emulsifier, illustrated in detail, consists of a hopper, from which the dust is fed by a flight screw conveyor into the mixing box. From the mixing box the solution which operates the rocker box washes the dust through a small pipe into the tube mill below, where it is thoroughly emulsified. The flights or pins used instead of the ordinary continuous screw seem to prevent the dust from packing in the hopper, a common trouble with this type of feeder. The rocker box, a familiar device to mill men, operated by the alternate filling and emptying of its two compartments, turns the feeder screw at each movement of the box by means of the two pawls and lever arrangement shown.

The tube mill rotates about 20 turns per min. and discharges its product into a funnel having a screen which prevents foreign materials, pebbles, etc., from entering the siphon through which the emulsion passes to the suction of the filter-press pump. The emulsion enters this suction at the tee at the edge of the gold tank. The emulsion mill is fed with the same pebbles as the larger mills, introduced through the discharge trunnion.

Fresh water comes to the mill from a large storage tank situated on the hill, so as to give a pressure of about 25 lb. at the float tank, near the mill-solution tank. This float reduces the pressure of fresh water to about 12 lb., a safe limit for discharging cakes from the Moore filter leaves. Another float maintains a constant solution pressure at the classifiers, which have separate solution cocks for regulation and for shutoff, so that in case of short shutdowns the regulating cocks are not disturbed. Floats also regulate the height of solution in the lime and cyanamide tanks and prevent overflows.

Hydraulic Crane for Operating Filter

The hydraulic crane for hoisting and traversing the Moore filter baskets is supplied with water by an air-cushion accumulator or receiver, at a maximum pressure of 275 lb. This pressure is generated by a 5x8 Deane triplex pump, governed by a Mason regulator, which operates a bypass from discharge to suction.

As the room for tailings below the mill is limited and water is expensive, it is aimed to keep the moisture at the lowest practical limit, so that the tails will pile as high as possible. The standing cable on which the tailings bucket travels rises at an angle of 15° from the horizontal, and is carried over a 105-ft. tower. It is the intention to almost bury this tower, of cheap wooden construction, before finding dumping ground farther away. It is probable that old mine stopes will be used for this purpose later. When, for any reason, the moisture becomes excessive, the tails are simply run out through a pipe and dammed up.

Nearly all of the electric equipment of this plant was furnished by the General Electric Co. The current is furnished by the Arkansas Valley Railway, Light & Power Co. from its steam generating plant at Cañon City, about 40 miles distant, at a pressure of 22,000 volts. The transformer house, which is the only all-concrete structure in this district, is a roomy building, and is equipped with aluminum-cell lightning arresters, oil switches and a complete set of recording meters. The tube-mill motors are of the hoist type, with reversing starters and large resistances, and have large overload capacity. Friction clutches are dispensed with by using these motors with large pulleys.

Among the general characteristics of the plant may be mentioned concrete foundations on solid ground for all heavy machines; all ground floors and building foundations of concrete; ample belt and pulley dimensions for all important motor and machine drives and their careful arrangement; a large number of fire hydrants conveniently situated, with hose connected and nozzles ready for use; the system supplied with water from a fire pump, which is in constant operation, so that pressure is always instantly available by simply opening one valve and closing another; a large number of chemical fire extinguishers, situated in prominent places, and a complete inter-communicating telephone system. All important wiring is carried between buildings in conduits.

Petroleum Deposits in Chile

By Cesar Zelaya*

Deposits of petroleum are known to exist in southern Chile in a zone extending from Chiloe to the Maullin River. The first discovery was made near the town of Carelmapu. Up to the present time few people have paid as much attention to these deposits as they truly merit. This is because of their remote situation, and also because their exploitation is a new thing in Chilean industry. Prof. Miguel R. Machado has published in various papers the results of his observations in the field, and has called the attention of the government and Chilean industry in general to the possibilities that there await development.

Petroleum Discovered 20 Years Ago

About 20 years ago the French government sent geologists to Tierra del Fuego to make a study of the zone and to gather data pertaining to the natural history of Patagonia and Tierra del Fuego. These geologists, upon their return to France, said that they had found deposits of petroleum in this zone, and also on a large island off the coast.

A few years later other discoveries of petroleum were made by Chileans who visited the region because rich, gold placers had been found there. These discoveries resulted in nothing because of lack of capital.

The rocks found in this zone are of sedimentary origin and correspond, in greater part, to those known as "green sandstones," composed of grains of quartz, magnetite, titanite, mica, etc., cemented by clay in some beds and by lime in others.

Gold Found in the Petroleum Field

In general these petroleum fields are covered by rock detritus that has been formed into heaps by the wind. This detrital material is of granitoid rock: granites and syenites. In other places exist thin beds of volcanic ash inclosed on all sides by gravel and sand in which gold occurs, the presence of which gave rise to the exploration done in this field many years ago.

In the geological studies on this region, made by Darwin, d'Orling, Nordenskjold, Fuchs, and the Argentine geologist, Dr. Florencio Arrieglino, it is stated that the rocks belong to the upper Tertiary, the formation in which exist many of the petroleum deposits of North America, Russia, Roumania, Turkey, Germany, Perú, China and Borneo.

A few years ago an American went to that region to explore the gold-bearing sands and gravels. In sinking a shaft he was surprised to find an emanation of gas having the characteristic odor of petroleum. A small company was formed to investigate the origin of the gases, but the enterprise came to grief through lack of capital and poor management.

Analysis of Gaseous Emanations

The gaseous emanations from shallow wells burn with a bright yellow flame, and bubbles of gas bursting in water produce on its surface the characteristic iridescence of petroleum. A sample of the gas was sent to Paris for analysis with the following results: Oxygen 3.21%, nitrogen 12.07%, equal to 15.28% contained air; oxygen 1.44%, hydrogen 0.18%, equal to 1.62% water vapor; and carbon 68.77% and hydrogen 14.33%, equal to 83.10% hydrocarbons.

The results of these analyses being satisfactory a company began to sink a series of wells, one of which was sunk to a depth of 1100 ft. This well passed, at a depth of 150 ft., through a bed of lead-bearing clay, containing grains of quartz. At 450 ft. gas was tapped and in greater quantity at 650 ft., while at a depth of 750 ft. the hole passed through a layer of cemented rock containing much calcite. From this bed which was 80 ft. thick, much gas was given off. At 1000 ft. a thick bed of sand was passed through and at 1100 ft. the well passed through a bed of fine sand composed largely of quartz, calcite, and grains of some green mineral. Unfortunately the work could not be continued on account of lack of capital.

Influence of Atmospheric Pressure on Flow of Gas

The quality of the gas found during the exploratory operations was excellent. A 3-in. tube sunk to a depth of 25 ft. produced sufficient gas for illuminating, cooking and heating at the company's plant. It was observed that when the barometer was low and the sandy ground was soaked with rain water, the capped tube gave forth from four to five times as much gas as when the barometer was high. Small quantities of liquid hydrocarbons were also noted.

The work that has been done indicates that there is a vast field for exploratory work for petroleum in this region in southern Chile, in which forests, lignites, gold-placer deposits, and sheltered seaports, will, it is hoped, prove advantages that will help to obtain the capital needed for further work.

---

*245 West Twenty-second St., New York.

New Publications

ENGINEERING AS A VOCATION. By Ernest McCullough. 5x8¼, pp. 201. David Williams Co., New York.

METAL STATISTICS, 1912. Fifth Annual Edition. 4x6½, pp. 219. American Metal Market Co., New York, N. Y.

WHO'S WHO IN SCIENCE (INTERNATIONAL), 1912. Edited by H. H. Stephenson. 6x9, pp. 323. $2. The Macmillan Co., New York.

HANDBUCH DER MINERALCHEMIE. By C. Doelter. Vol. I, Part 5. 7x10, pp. 159, paper; 6.50 marks. Theodor Steinkopff, Dresden, Germany.

JOURNAL OF THE IRON AND STEEL INSTITUTE, VOL. LXXXIV, No. II. Edited by George C. Lloyd, Secretary. 5x8¾, pp. 731, illus. E. & F. N. Spon, Ltd., London.

CONTRIBUTIONS TO ECONOMIC GEOLOGY, 1910. Part I—Metals and Nonmetals Except Fuels. Pp. 558, illus. Bull. 470, U. S. Geological Survey, Washington, D. C.

AN INVESTIGATION OF THE AIR LIFT PUMP. By George J. Davis, Jr., and Carl R. Weidner. 6x9, pp. 167, illus., paper, 40c. Bull. 450, University of Wisconsin, Madison.

AMERICAN RED CROSS HANDBOOK OF FIRST AID, Lithuanian Edition. By Charles Lunch and M. J. Shields. 4½x6, pp. 170, illus.; 30c. Blakiston's Son & Co., Philadelphia, Penn.

GEOLOGY AND ORE DEPOSITS NEAR LAKE CITY, COLORADO. By John Duer Irving and Howland Bancroft. Pp. 128, illus. Bull. 478, U. S. Geological Survey, Washington, D. C.

GEOLOGIE DU CANTON DE FABRE, COMTE DE PONTIAC. By Robert Harvie. Pp. 36. Ministère de la Colonisation, des Mines et des Pecheries, Bureau des Mines, Quebec, Canada.

THE BURKETOWN MINERAL FIELD. Silver, Lead and Zinc Mines. By Lionel C. Ball. Pp. 57, illus. Publication No. 232, Geological Survey of Queensland, Brisbane, Queensland.

THE EVERYDAY USES OF PORTLAND CEMENT. Second Edition. 5¾x8½, pp. 348, illus., paper, 1s. 6d.; stiff cover, 2s. 6d. The Associated Portland Cement Manufacturers, Ltd., London.

STEAM POWER PLANTS, THEIR DESIGN AND CONSTRUCTION. By Henry C. Meyer. Third edition, rewritten and enlarged. 6x9½, pp. 219, illus.; $2. McGraw-Hill Book Co., New York.

PRELIMINARY REPORT UPON THE OIL AND GAS DEVELOPMENTS IN TENNESSEE. By M. J. Munn. Pp. 46, illus. Extract from Bull. No. 2, State Geological Survey of Tennessee, Nashville.

SURFACE WATER SUPPLY OF THE UNITED STATES. 1909. PART XI, CALIFORNIA. By W. B. Clapp and F. F. Henshaw. Pp. 256, illus. Water-Supply Paper 271, U. S. Geological Survey, Washington, D. C.

THE OAKS AND EASTERN PORTION OF THE ETHERIDGE GOLDFIELDS. By E. O. Marks. Pp. 30, illus. Publication No. 234, Queensland Geological Survey, Brisbane, Queensland.

INVESTIGATIONS OF EXPLOSIVES USED IN COAL MINES. By Clarence Hall, W. O. Snelling and S. P. Howell, with a chapter on the natural gas used at Pittsburg by G. A. Burrell. Pp. 197, illus. Bull. 15, Bureau of Mines, Washington, D. C.

MITTEILUNGEN AUS DEM EISENHUETTENMAENNISCHEN INSTITUT DER KONIGL. TECHN. HOCHSCHULE AACHEN. Vierter Band. Edited by F. Wüst. 7¾x11, pp. 231, illus., paper; 16 marks. Wilhelm Knapp, Halle a. S., Germany.

REPORT ON THE GEOLOGY AND MINERAL RESOURCES OF THE CHIBOUGAMAU REGION, QUEBEC. By the Chibougamau Mining Commission. Pp. 215, illus. Department of Colonization, Mines and Fisheries, Mines Branch, Quebec, Canada.

NOTES ON THE LATER CENOZOIC HISTORY OF THE MOHAVE DESERT REGION IN SOUTHEASTERN CALIFORNIA. By Charles Laurence Baker. 7¼x10½, pp. 51, illus., paper. Bull. of the Dept. of Geology, University of California, Berkeley

MINERALOGY By F. H. Hatch. Third edition, rewritten and enlarged. 5x7½ in., pp. 261, illus.; $1.40. Whittaker & Co., London; Macmillan Co., New York.

The new edition of this well known work consists of two parts, the first of which is devoted to the properties of minerals in general; the second is a catalog of the properties of the more common rock-forming and ore-making minerals. The author has given much attention to his classification of minerals, but the book does not contain tables for quickly establishing the identity of a specimen by field tests and does not emphasize those characteristics by which a mineral can be readily distinguished from others which it closely resembles.

THE TECHNICAL ANALYSIS OF BRASS AND THE NONFERROUS ALLOYS. By William Benham Price and Richard K. Meade. 5½x7, pp. 267; $2. John Wiley & Sons, New York.

This book gives the determination of aluminum, antimony, arsenic, bismuth, cadmium, cobalt, copper, iron, lead, magnesium, manganese, nickel, phosphorus, silica, sulphur, tin and zinc in their various alloys, beside special chapters on specific combinations, such as phosphor bronze, babbitt metal, etc. There is also a good chapter on alloys in general, and one on the general art and practice of electro-analysis. This is a useful reference book for the foundry or general commercial chemist.

METALLURGY, VOL. 1. By Herbert Lang. Pp. 255, Illus., $3. McGraw-Hill Book Co., New York.

This is the first volume of a series on general metallurgy. It deals chiefly with ore crushing, ore sampling, roasting, and smelting smoke. Consequently it does not proceed very far into its subject, and we are able only to surmise what the full treatment is going to be. We gather from the author's preface and from the character of this introductory volume that he has projected an analytical and comparative metallurgy in contradistinction to the ordinary descriptive treatise. Such a book is really needed, but the rank and value of any offering of this kind will depend, of course, upon its workmanship. Mr. Lang's cannot be properly judged from his partial presentation. The initial volume undoubtedly possesses both merit and defects. We feel that it suffers from its prolixity.

DIE SCHWERSPATHLAGERSTAETTEN DEUTSCHLANDS IN GEOLOGISCHEN, LAGERSTAETTENKUNDLICHER UND BERGWERTHSCHAFTLICHER BEZIEHUNG (The Barite Deposits of Germany, from the standpoint of the geologist, the student of ore deposits, and the miner). By Richard Bärtling. Pp. 188 + VIII, illus. 6.40 marks. Ferdinand Enke, Stuttgart.

Doctor Pärtling has prepared an interesting and valuable work upon one of the minor but still important industries of Germany. Germany is the leading source of heavy spar, as the following statistics of the world's production in metric tons for 1907, taken from p. 176 of the book, will show: Germany, 215,000; United States, 59,492; England, 42,646; Italy, 15,432; France, 11,150; Canada, 1829; Sweden, 559; Spain, 314.

Barite is employed in largest amount as a pigment either in the purified and finely ground condition, or else in combination with zinc sulphide in lithopone. It is also extensively employed in the chemical industries.

Barite is widely distributed in Germany, but the most productive regions are in the central-eastern portion of the Empire. It is a common veinstone, whether mixed with metallic ores, with earthy minerals such as calcite, fluorite, and quartz, or in veins by itself. We are chiefly familiar with it in veins in this country, usually in limestones. It also forms in Germany an extraordinary bed, and is not unknown in gravels or placers. The bed of barite which is the chief single source of the mineral in Germany, is found at a little town called Meggen in the valley of the Lenne River in Westphalia. It is the most peculiar and interesting of all the deposits. Resting on middle Devonian shales below, is found an extended bed of pyrite, which appears to have been deposited on the shales in regular sedimentary succession. It is covered above by a bed of limestone also of the Middle Devonian and is followed by Upper Devonian and Carboniferous strata. The pyrite is extensively replaced in its upper side and at times for its full cross-section with black, bituminous barite. Doctor Bärtling concludes that descending solutions of some oxidized barium salt have changed the pyrite to barite with removal of iron, but without essentially affecting the amount of the sulphur contents. After the replacement, the sedimentary series was folded in the Upper Carboniferous times, so that we conclude that the barite was deposited in the later Devonian and the earlier Carboniferous. The deposit now appears in a pair of synclinal folds with an intervening anticline and with both strike and dip faults.

With regard to the barite in many of the German veins, Doctor Bärtling brings out a very interesting relationship, first emphasized by Professor Krusch. Whatever the wall rocks were, though they be as old as the ancient gneisses, the veins appear where the *Buntsandstein* (or colored sandstone) of the Triassic either now covers the wall rocks, or did in the past. This sandstone yields waters with appreciable barium percentages and is regarded as the source of the mineral. Doubtless decomposing feldspars in the sandstone are its primary source.

Doctor Bärtling reviews the methods of milling, purifying and manufacturing of barite and closes his work with the statistics of production. The book should prove of much interest to those engaged in the barite industry, wherever situated.

J. F. Kemp

PERSONAL

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

R. S. Botsford, of London, left that city, Mar. 25, for Vladivostok, Siberia.

C. Colcock Jones has returned to Los Angeles from Douglas County, Nevada.

Algernon Del Mar has been appointed engineer of the Wilshire Bishop Creek Co., of California.

H. F. Lefevre left New York, Apr. 8, for Guatemala, where he expects to remain about a month.

Kirby Thomas, of New York, is in Florida, making an investigation into some phosphate deposits.

Robert E. Cranston left San Francisco, Apr. 5, for Bodie, Mono County, Calif., expecting to return in about two weeks.

Philip Argall & Sons, of Denver, Colo., have been appointed consulting engineers for the Ozark Smelting & Mining Company.

Dwight E. Woodbridge has been in Alabama on professional business, and was in New York last week, going thence to Washington.

H. A. Linke has been appointed manager of the Nevada Central Copper Co. at Cedar, Nev. He left Chicago for the mine last week.

Arthur Scott, a graduate of McGill University, succeeds C. H. McMillan as general manager of the Dominion Steel Co. at Sydney, Nova Scotia.

Herbert L. Tuttle, lately of Mexico, has been appointed superintendent of the Cherryvale works of the Edgar Zinc Co., succeeding the late John C. Dods.

E. M. White, formerly manager for the Warrior Copper Co., has been appointed manager for the Manitou Copper Co., operating in the Globe district, Arizona.

Mowry Bates has resigned as manager of the Hughes Porcupine Mines, Ltd. He intends taking a few months' rest and visiting Mexico during the summer.

J. Sam Coupal, manager of the Compañia Minera de Santa Lucia, Oaxaca, Mexico, has returned to the United States. His address is at 821 East Fourth St., Boston, for the present.

R. G. Lott is mine foreman, C. T. Harris is master mechanic, L. Stewart and J. I. Kane are on the engineering staff of the Tiro General mine at Charcas, San Luis Potosi, Mexico.

H. Z. Bixler, formerly chief engineer of the Republic Iron & Steel Co., and recently with the Youngstown Steel Co., has been named chief engineer of the Brier Hill Steel Co., Youngstown, Ohio.

George L. Hoxie and Meade Goodloe have formed a partnership as engineers, with offices at Los Angeles, Calif., and at New York. Mr. Goodloe was formerly manager of the Imperial Copper Co. in Arizona.

W. N. Brown and G. D. S. Clarkson, both formerly with the Geological Survey, have formed the firm of Brown & Clarkson, mining and topographical engineers, with office in Southern Building, Washington.

James Daley, smelter at the open-hearth furnaces of the Ohio works of the Carnegie Steel Co., has resigned to accept the position of superintendent of construction with the Brier Hill Steel Co., at Youngstown, Ohio.

A. W. Newbery has left Ocampo, Mexico, owing to the closing of the mines of the Sierra Mining Co. there, and is now assistant general superintendent for the Mammoth Mountain Mining Co. at Isabella, Kern County, California.

Frank H. Probert announces that the firm of Weed & Probert has been dissolved by mutual consent and that hereafter he will continue in practice as consulting engineer and mining geologist with headquarters in Central Building, Los Angeles, California.

William C. J. Rambo and L. G. E. Bignell have formed a partnership as the Rambo-Bignell Engineering Co., to engage in mining and metallurgical engineering, office in First National Bank Building, Denver, Colo. Mr. Rambo was until recently superintendent of the Grand River Coal & Coke Co. at Cainesville, Mo. Mr. Bignell was for seven years with the Denver Engineering Works Co. as district manager.

Paul Kreuzpointer, a metallurgist for 32 years in the employ of the Pennsylvania Railroad Co., at Altoona, Penn., retired Mar. 25, having attained the age of 70 years, and his name goes on the pension rolls of that corporation. The announcement of Mr. Kreuzpointer's retirement has attracted wide attention, for he is probably one of the best known metallurgists as well as one of the longest in service in Pennsylvania, and his work has had an international influence.

OBITUARY

Elisha Robinson died at Parker's Landing, Penn., April 3, aged 79 years. He was one of the pioneer oil operators in Pennsylvania and remained in the business up to the time of his death.

Elias Cohn died at Aspen, Colo., April 2, aged 55 years. He was born at Fulton, Mo., and went to Colorado in 1889. He settled in Aspen and had been engaged in mining there ever since. For many years he represented the interests of D. N. Hyman, of New York. One of his achievements in mining was the unwatering of the Smuggler mine in 1910, by the installation of the Free-Silver shaft. Mr. Cohn was active in all questions affecting the civic progress of Aspen, and was president of the school board. He left a widow and two daughters.

Robert Maffett died at Bayonne, N. J., Apr. 8, aged 53 years. He was general superintendent of the works of the Orford Copper Co., at Bayonne. Mr. Maffett was born in Clarion, Penn. He married Mabel, daughter of John J. Thompson, who was a brother of Col. Robert M. Thompson, the founder of the Orford Copper Co. Practically the whole of his business life was spent with the Orford Copper Co. He entered the refinery as a foreman about 20 years ago and worked his way to the top. Besides his widow he leaves one son, John Thompson Maffett, a student at Yale.

Societies and Technical Schools

American Institute of Mining Engineers—The New York Section was to hold a meeting at the Engineering Societies Building New York, April 12, at which Carleton Ellis was to address the section on the subject of "Flameless Combustion." In connection with this lecture, a demonstration of the process of flameless combustion was arranged in the city.

International Society of Mining Accountants—This society was organized in March. Its objects are to promote the science of accounting and allied subjects connected with the production of the useful minerals and metals on the American continents, by means of an annual meeting for social intercourse and the reading of practical papers on accounting, etc., and the publication of the proceedings in an annual volume. There will be two classes of members, active and honorary. Membership is open to any person interested in the objects of the society, provided he is actively engaged in mining or allied industries. The secretary is W. H. Charlton, 46 Hooker Ave., Detroit, Mich.

Munich Technical Museum—A small committee of directors of the German Museum in Munich, holding high offices, arrived at the end of March in the United States. The visitors are Count Podewils, late Prime Minister of Bavaria, Dr. von Borscht, mayor of Munich, and Dr. von Miller, Councillor of State. Munich possesses the finest collection of technical achievements in the world embodied in the German Museum. This museum is an exhibit of technical art and science, and as such is a recorder of the evolution of technical science in the world. The mission of the committee is one taken in the interest of technical brotherhood, especially with the purpose of bringing the German Museum into close touch with institutions in the United States devoted to the history of technical science. The committee, having only a limited time, would naturally like such Americans as sympathize with their mission to come forward with a view to facilitating an early communication.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Apr. 4—The present activity in California mining is indicated not only by the reopening and development of old mines, but also by numerous installations of new equipment in producing properties, and the construction and reconstruction of dredges. In Tuolumne County 20 new stamps have been added to the mill at the Dutch mine and 40 stamps will be dropping by Apr. 15. At the Black Oak mine the new tube mill and 75-ton cyanide plant should also be in operation by Apr. 15. The new 20-stamp mill at the Poundstone mine in Amador County is practically completed. In addition to the new electric hoist, compressor and pump plant at the Plymouth Consolidated two new plunger pumps have been ordered for immediate delivery. A new electric pump is being installed at the Champion mine in Nevada County. In nearly every district in the state there is activity in the way of added equipment and improving the facilities for extraction and treatment of ores.

In the dredging fields the Natomas Consolidated is rushing work on the reconstruction of No. 8 dredge, and on the new No. 10 dredge. The Union Dredging Co., of Philadelphia, has just started a 9-cu.ft. bucket dredge at Folsom and the Gaylord Mining Co. has installed a reconstructed 6-cu.ft. bucket dredge at Whiskey Bar in Placer County. The new suction dredge constructed for the Northern California Gold Mining Co., at Jelly Ferry on the Sacramento River, in Tehama County, is ready to dig. The Calaveras Dredging Co. has completed its 5-cu.ft. bucket dredge at Jenny Lind, in Calaveras County, and it is now operating. The Yuba Construction Co.'s shops at Marysville have orders for four dredges for Alaska and construction is under way. The heavy snow in March gave promise of sufficient water for the coming season, though there will not be an over-abundance now that there is no likelihood of further storms. There is prospect that there will be early developments in the new camps in Modoc and Plumas counties in the northeastern part of the state.

The president and members of the executive committee of the Farmers Protective Association visited the Mammoth smeltery at Kennett, on Mar. 26, to renew the complaint that the crops are being damaged by fumes. It is alleged on the contrary, by the officials of the Mammoth and some of the farmers not interested in smoke complaint, that the damage is the result of a long dry season and severe north winds, and that the blight extends beyond the possible reach of smoke from the smeltery.

Butte

Apr. 3—The output of copper of the Washoe and Great Falls smelteries, during March, was 25,900,000 lb. This includes ore from the Tuolumne and North Butte mines, and a small amount of custom ore, and shows a decrease of about 1,550,000 lb. from February. The East Butte company produced over 1,000,000 lb. in March, which made the production of the Butte district about 27,000,000 lb., for the month.

The Bradley process plant, which will operate on the slimes at Anaconda, has been started, but will not go into regular operation until all necessary adjustments have been made.

Orders have been received from B. B. Thayer, president of the Anaconda Copper Mining Co., to close the coal mines belonging to the company, situated at Belt, on June 30. At the time of Mr. Thayer's visit to Butte, in January, the officials of the mines were notified of the fact, and were told that the employees would be given notice sufficiently in advance for them to prepare for the suspension. The mines have been operated for 17 years, though not at full capacity all of the time. During March, 216 men were employed there.

Denver

Apr. 4—The Cripple Creek tonnage for March was 76,514 tons, of a gross value of $1,184,100. Of this amount, 4050 tons went to the smelteries, the value being $243,000. The annual booklet of the Colorado Springs Mining Exchange is authority for the statement that during the 20 years which have elapsed since production commenced in 1891, a total production of $296,680,734 has been made. The production for 1911 is given at $15,658,684, an average of $1,329,890 per month.

As the deep levels of the large mines have now been unwatered, it seems probable that the output this year will be increased over 1911. The real unwatering of the Cripple Creek mines began when the workings of the El Paso group were connected with the deep drainage tunnel by a drill hole. A similar project is now said to be underway in the Quartz Hill section of the Central City district, in Gilpin County, to connect the lower workings of the Kansas and Kansas-Burroughs groups of mines with the Newhouse tunnel by drill holes. These groups, comprising the Phœnix-Burroughs, University-Kansas, Conley-Burroughs, Pease-Kansas, Kansas-Burroughs and Monroe mines, are said to have been taken over on lease and bond by Frederick Burger and John Savre of Denver. All these mines are well equipped and work is to commence soon. The Newhouse tunnel cuts two of the veins of this group, 350 and 600 ft. below the bottoms of the shafts, and it is believed that most of the mines on Quartz Hill will be unwatered by this work.

In Leadville the shipments of zinc-sulphide ores are increasing, 150 tons per day going out from the Colonel Sellers, and a good tonnage also from the A. Y. & Minnie, Wolftone, Castle View, Robert Emmet and others. In March the output from the Wolftone was about 12,000 tons; Yak tunnel, about 10,000; Iron-Silver, 4000; Stars Consolidated, 4000; Ibex, 7000 and from South Evans about 6000 tons. The March output for this year was 70,000 tons compared with 50,000 tons in March, 1911. The Arkansas Valley plant has five furnaces in operation, which is greater than for many years.

Salt Lake City

Apr. 4—The date set for the completion of the remodeling of the Utah Copper Co.'s Arthur plant, is Aug. 1. Eight of the 13 sections are in operation, and the ninth is practically completed. The combined capacity of the Arthur and Magna mills will be 20,000 tons per day, and during the summer the management expects to increase production to that amount. Heavy snows have kept the ores moist, making them difficult to handle, so that at present it is not so much a question of mill capacity as of tonnage mined. The output for February was 8,612,729 lb., and with both mills running at full capacity the monthly rate will be about 13,000,000 lb. The Bingham & Garfield R.R. has operated satisfactorily throughout the winter and no delay in transportation has been experienced.

The second lead stack of the International smeltery, at Tooele, has been tried out and is ready for operation.

The Snake Creek drain and operating tunnel, in the Park City district, has been completed for 4065 ft., which is less than half the projected length. In August a cave-in stopped the work, and it was found necessary to concrete the tunnel for 300 ft. This has proved successful, and the tunnel has progressed over 1000 ft. beyond the concreting. The face is in hard siliceous limestone, making good progress possible. Thirty men are employed, working two shifts. The flow of water, though still large, has diminished somewhat.

Wallace, Ida.

Mar. 27—The lower tunnel at the Stewart mine is now in working order and ore is being hauled through it. The wiring is completed and the generators are in operation. The ore is being dumped into the large bins, from which it will go by the new surface tramway to the railroad ore bins. It is estimated that the new tunnel will reduce the cost of production about $1 per ton, figuring on a production of 15,000 tons per month. As soon as milling facilities are arranged for, these figures are expected to be doubled. About 2500 tons of concentrates per month are now being shipped to the smelteries, besides a small tonnage of first-class ore picked from the sorting-plant belt. The February report of the company shows net earnings of nearly $45,000. The company has never paid a dividend, but has a cash reserve.

Deadwood, S. D.

Apr. 4—The Golden Reward company has adopted as a policy the leasing of a number of its smaller mines, and these are now in the hands of men who are preparing to operate energetically during the summer. Under the terms, the milling ore produced by these properties is treated at the Golden Reward cyanide plant, at Deadwood. Company operations will be confined to two or three of the larger properties, including the Astoria, where a roaster is to be built as soon as weather conditions permit.

Negaunee, Mich.

Apr. 6—The new 8-hour shift regulation is giving satisfaction to both miners and operators. At several mines a greater tonnage is being hoisted on an 8-hour shift than was formerly hoisted in 10 hours, and this is gratifying to the operators. The day-shift miners are enabled to go to and from their work by daylight. Under the old 10-hour system, the men had to be at the shaft in underground clothes at 7:10 a.m., and they came up about 5:45 p.m.; due to delays in getting to and from the working place and to taking more than an hour at lunch, the net time of working was usually between 8 and 9 hours. The new rules make actual working time the significant factor, specifying full 8 hours.

The Employers' Liability and Workingmen's Compensation law has been passed by the Michigan legislature, and general satisfaction is felt over the result. It is hoped that in the future the majority of cash settlements for injuries to miners will not go to the lawyers, as has been the case in the past.

Toronto

Apr. 5—During the coming season the Ontario Bureau of Mines will send several parties into the northern part of the province. The first expeditions will be on geographical exploration work and will be specially commissioned to look into the adaptability of James Bay for shipping purposes. Other parties, however, will examine the Pre-Cambrian formations to determine what they offer in the way of minerals. The geological conditions in that part of the country are favorable for the discovery of deposits similar to those of Cobalt and Porcupine. Large deposits of iron ore are known to exist, and coal has already been discovered. Large portions of northern Ontario are practically unexplored and no part of it has as yet been prospected in a thorough manner. During the last few weeks many prospecting parties have left for outside points, in order to take in supplies when traveling is easiest.

The nickel mines of the Lake Superior Corporation, situated in the Sudbury district, are reported to have been sold to one of the Sudbury nickel companies.

Sudbury, Ont

Apr. 6—A considerable change has occurred in the general situation in this district since last season. Up to that time there had been only two strong, active companies in the field, the International and the Mond companies. The Booth interests, of Ottawa, had large holdings on the north range. The other properties were in the hands of local men or under control of companies with small available capital. The efforts of other companies to enter the field have heretofore been frustrated.

In the early autumn of 1911, several negotiations were undertaken by interests which claim to represent Mackenzie & Mann, and options on the Murray, Kirkwood and other mines were taken. Later other strong interests, presumably allied with a large American company, appeared in the field, seeking options and making investigations. It is difficult to tell just what this company has secured in the field, but it is known that its agents are investigating the nickel situation from the standpoint of availability of properties and of the metallurgical phases.

Since Jan. 1, agents of a German metal firm of international standing, have been seeking options in the Sudbury field. The result of this new life in the nickel business has been to take from the market a number of properties which were seeking buyers, and to give some hope of independent operations in the district. It has been known for some time that the International Nickel Co. controls the sale of the output of the Mond company, thus giving these two strong companies practically a monopoly in the nickel market, and with their large holdings and rich mines there was little inducement for either of them to buy any of the outside prospects.

A mining engineer who has made a careful study of the Sudbury district, considers that the opportunities for developing mines outside of those now known, are excellent. It is expected that some of the recent activities will lead to an intelligent and extensive exploration of the ore contact, which approximately represents the circumference of an elongated bowl, 30 miles long and 16 miles wide. It is understood that active drilling will be commenced soon, and the exploration in the district for the coming season is expected to exceed that of any previous year.

Porcupine

Apr. 5—The opening of the Dome 40-stamp mill, at Porcupine, on Mar. 30, was made the occasion of a public celebration under the auspices of the South Porcupine Board of Trade. A large number of invitations were sent out, in response to which many mining men, and others from a distance, attended. All the directors of the Dome were present and the mine and mill were thrown open to visitors, several hundred of whom witnessed the dropping of the stamps. Parades, bonfires and public entertainments were features of the celebration, and in the evening a banquet was held at the Majestic Theater, in honor of the visitors, at which Ambrose Monell, president of the Dome, reviewed the history of the mine and outlined the position and prospects of the enterprise.

In the course of his address, which was marked by a distinctly conservative tone, he said that as to the outlook for the camp there is no reason to believe that the orebodies are contained in only a few properties. The development already accomplished has placed the camp farther ahead in the same space of time as regards future possibilities, than any other camp he has known. Charles W. Merrill, of San Francisco, the designer of the Dome mill, said that after a study of conditions in Porcupine he has come to the conclusion that there are few districts superior for the economical extraction of gold from its ores. Porcupine has abundance of water, and its labor is of a comparatively high class. Not only are conditions favorable for high extraction, but the ore itself is one of the best that it has ever been his experience to meet with. As to the results of the Dome mill, they have not gone far enough to enable him to make a positive prediction, but he believes it safe to say that the mill will make a recovery of not less than 95 per cent.

The Mining News

The Current History of Mining

Alaska

FAIRBANKS DISTRICT

About $2400 per week are being cleaned up from the 5-stamp mill at the Rhoades mine. The vein varies from 6 to 30 in. in width.

Newsboy—The 5-stamp mill will commence running about May 1. The shaft is now past the 300-ft. level. The vein is 4½ ft. wide and will average $40 per ton.

Newsboy Extension—The 5-stamp mill is being completed at the foundry of Brumbagh & Hamilton. The mortar is the largest casting ever undertaken in Alaska. Mr. McGillvrey and Walter Fisher are the lessees.

Spalding—Captain Spalding recently made a trial run of the 3-stamp mill which he has been erecting at this mine. Water for the mill will be pumped from the shaft until the spring thaw. The mill will work on $100 ore.

Alaska-Treadwell—During February, 62,020 tons of ore were crushed, yielding $130,050 gross and net $26,595. Operating expenses were $88,391; construction $15,064; development, 1020 ft. The ore averaged $2.11 per ton.

Arizona

COCHISE COUNTY

Arizona United—On this property, at Johnson, the 720-ft. level is being advanced to cut the contact ore zone. Recently copper ore of good grade was encountered in the face. The other development consists of a shaft inclined at 40° 820 ft. deep and several crosscuts in the foot wall of the shaft. The present developments confirm the claim that the shaft was sunk under the contact, which it appears has a dip of about 30°. Last year ore was taken from 820 ft. in the shaft, which is below the water level in the district.

GILA COUNTY

It is reported that the American Smelting & Refining Co. is securing options on low-grade copper prospects near Christmas, a town about 25 miles south of Globe.

Inspiration—The experimental mill has been started again and J. M. Callow is conducting another set of tests. The trestle connecting the portal of the main tunnel with the site of the new steel warehouse is nearly completed. Engineers are working on plans for the mill and development of the orebody.

Barney—Churn-drill hole No. 2 is 420 ft. deep. A road is being built to the site of hole No. 3, which will be a union hole, drilled at the junction with the Live Oak and Southwestern Miami properties, the expense to be shared equally by the three companies.

Superior & Boston—Development work continues on the 12th level. Drifting is being done on the Great Eastern vein east and west of the north crosscut, and the driving of the crosscut to the southeast of the shaft continues.

Needles—The Guggenheim interests have acquired options on this group of claims in the Miami district, and will do some drilling. These claims are west of the Barney group, now being explored by the General Development Co., and northwest of the Schulze group, about to be drilled by the South Live Oak Development Company.

Southwestern Miami—There are continued reports that ore is being found in the holes being drilled by this company.

Miami—The annual stockholders' meeting will be held in New York on Apr. 17.

MARICOPA COUNTY

It is reported that Colonel Dravo will soon undertake operations on his property in the Gold Camp district. The Mexican mill has been dismantled and the property abandoned.

Maschacerty—This mine is idle. It has a 60-stamp mill.

SANTA CRUZ COUNTY

Pioneer—Word is being sent out that this smeltery, about 20 miles south of Tucson, is ready to sample and buy copper ores. The freight on the lowest grade of ore from Patagonia is $1.50 per ton, and from Calabases and intermediate points, $1 per ton. The latter rate will apply to shipments from Calletano and the Santa Rita Ranges.

R. R. R.—This mine, in the Patagonia Mountains, shipped five cars of ore running 15% copper last autumn. The owners, R. R. Richardson and N. E. Crepin, started a tunnel to strike the ore 125 ft. below the lowest shaft, and encountered it at a distance of 500 ft., opening considerable high-grade chalcocite ore. Several men were negotiating for the mine before the ore was struck and it is thought that interests connected with the Shannon Copper Co. have secured the mine. This is the most important strike made in the Patagonia Mountains since the famous World's Fair mine.

California

AMADOR COUNTY

South Jackson—The machinery for the hoist and other surface equipment has been received, and the work of construction is in progress.

Poundstone—The new 20-stamp mill is expected to begin crushing ore about Apr. 15. The mill was built by the D. D. Demarest Co., in the Pacific shops at Altaville, Calaveras County. The stamps weigh 1050 lb. each and are rated to drop 100 times per min. The East Eureka Mining Co. is owner, and E. A. Davis, of San Francisco, is manager.

CALAVERAS COUNTY

Nuner—A recent cleanup of the waste dump at this gravel mine on Stockton Hill, near Mokelumne Hill, yielded $30 per 6-hr. day for six days. This is one of the gravel mines that were operated with inadequate methods. C. G. Nuner is owner.

ELDORADO COUNTY

Natomas Consolidated—This and the Natomas Land & Mining Co. have filed deeds conveying to the Natomas Water Co. an extensive system of ditches, dams, reservoirs, water rights and other rights.

FRESNO COUNTY

Valley Oil Co.—The 3400-ft. well in the town limits of Coalinga came in with a flow of 400 to 500 bbl. per day. It is the deepest well in the field and has cost $108,000 and consumed three years in drilling. The oil is 17.4 gravity. L. P. Timmins and others, of Fresno, are the owners.

INYO COUNTY

Wilshire-Bishop Creek—A new 10-stamp mill has been ordered from the Traylor Engineering & Manufacturing Co. for delivery in May. The method of treatment contemplated includes coarse crushing, regrinding and cyanidation. The initial power will be direct water power.

MODOC COUNTY

It is expected that there will be a stampede into the new camp of High Grade, beginning about May 1. A correspondent in Nevada writes us that there are many inquiries about the new camp, especially from Colorado and that a special train is scheduled to leave Denver on Apr. 15 for High Grade. He says that he has seen specimens of some of the prospects there, which specimens look all right, but he has no first-hand information.

Nevada County

Brandy City—The gold-saving apparatus installed on trial by the Automatic Gold Separator, Ltd., of Los Angeles, is reported to be in successful operation at these hydraulic mines, owned by the Hydraulic Mines Co. The company operates six giants. The separator operates on the tailings.

Plumas County

Gold Leaf—This prospect, in the Argentine district, has been bonded to the Feather River Consolidated Mines Co., a new incorporation organized by Cripple Creek, Colo., men. The 5-stamp mill at the Bluff City mine will be moved, and used at this property. Should the development warrant, new stamps will be added.

Santa Barbara

Palmer-Union-Blochman—No. 4 well is flowing 1200 bbl. per day. No. 5 well is being cleaned out, and the indications are for a good producer. No. 6 is in the oil sand.

Shasta County

It is said that the results of experiments warrant the installation of the three additional electric furnaces, contemplated for some time past, for smelting iron ore at Heroult. The samples of pig iron recently produced are said to be of good quality.

Sierra County

Snowden Hill—Good gravel has recently been uncovered at this mine near Mountain House.

Blue Channel—Kinnenberg Brothers have resumed work on this gravel property, near Downieville.

Sovereign—Ore crushing has been resumed here after a two weeks' shutdown for mill repairs.

Rainbow—An air compressor and machine drills have just been installed at this mine and work will be rushed.

Siskiyou County

Blue Ledge—This copper property of 27 claims, in the Siskiyou Range, has been sold by Robert S. Towne, of 52 Beaver St., New York, to the Compañia Metalurgica Mexicana, of the same address. Patents were secured in January. A large sum has been spent in development. A smeltery is contemplated, but the situation has not been decided upon.

Tehama County

Northern California Gold Mining Co. The suction dredge built by this company at Jelly Ferry, 14 miles from Red Bluff, is about ready for operation. It differs from the ordinary suction dredge and is provided with a digger attached to the suction drum, the invention of Victor A. Strom, of Alameda. The company has 270 acres of placer ground about 40 ft. deep.

Colorado

Clear Creek and Gilpin Counties

Grand Republic—A group of 13 claims, with an area of 140 acres, about one mile southwest of the portal of the deep drainage tunnel, is owned by this company and a contract for sinking the Little Stella shaft from 90 to 210 ft., has been let to Calloway & McClain. The veins carry gold and copper.

Cripple Creek District

Jennie Sample—W. Millar & Co., of Victor, have secured a three years' lease, and the plant at the mine shaft has been started again.

Hillside—A five years' lease on this mine, on Womac Hill, owned by the Erie Mines Co., of Buffalo, N. Y., has been given to R. D. Lambert, of Cripple Creek.

Vindicator—During March the mine shipped 130 cars of ore.

El Paso—The output of this Beacon Hill mine for March was 100 cars of ore.

American Eagles—The output for March was about 17 cars of $60 ore

Elkton—This mine is reported to be shipping about 2500 tons per month of 1-oz gold ore.

Granite—At the 800 level of the Gold Coin shaft, on the Dorothy vein of this company, 2 ft. of rich sylvanite ore have been opened.

Cripple Creek Consolidated — The charter has been renewed for 20 years. J. F. Humphrey, of Colorado Springs, is president.

Amazon—This company has been reincorporated for 20 years. F. G. Peck, of Colorado Springs, is president.

School Section—A supposedly poor vein, opened years ago, has been explored by Superintendent Montague, and 3 ft. of $20 ore have been opened.

Lake County—Leadville

Lucerne The mine, near the head of East Fifth Street, has been leased by Thomas Simpson, who is cleaning out the old workings, retimbering and installing an electric hoist.

Lovejoy—Prospecting by crosscuts and upraises from this tunnel is being done by J. Clarence Hersey, and small streaks of good ore are being worked. The tunnel is now in 1000 ft., the breast being under the crest of the hill, which divides California and Iowa Gulches.

Hellena—The 40-ton experimental mill is completed and will be started soon. If successful the capacity will be increased. Mine and dump ore will be treated and there are between 1500 and 2000 tons of the latter.

Rattling Jack Regular shipments of carbonate-of-zinc ore are being made by the lessees.

Sugar Loaf Consolidated—The breast of the tunnel and three raises are all in silver-lead ore. The tunnel is now in 3800 ft. and the raises connect with the old Sherill vein.

Ouray County

It is stated that the pyritic smeltery at Ouray, will begin operation May 1, as all the stock in the company has been subscribed for, payable during April. Col. Thomas B. Crawford, of Denver, is president.

Red Mountain Reduction, Refining & Smelting—This company, which owns most of the early paying mines in the Red Mountain district, in the vicinity of Ironton, is to be reorganized, and at a meeting held in Philadelphia, Feb. 8, it was proposed to form a new company with a capital stock of 5,750,000 shares, $1 par value. The company owns the Guston, Yankee Girl, Tennessee, Vanderbilt, Joker Tunnel and other properties.

San Juan Region

Tomboy — During March the mill crushed 9600 tons of ore, yielding bullion $35,000, and concentrates, $44,000. Expenses were $47,000 and profit $32,500; $2480 were spent on permanent improvements.

Idaho

Boise County

The Government suits against the Barber Lumber Co. have been settled. The large sawmill on the Boise River, five miles above Boise, has been closed for several years pending the settlement of these suits. While the company has given out no information as to its plans, it is expected that a railroad will be built into this district soon. This is looked forward to by owners of lode claims, and will probably be the signal for renewed activity in mining in that district.

Moline—This company, which has been operating a 5-ft. Risdon dredge near Placerville, has exhausted its ground and is dismantling its boat.

Boston & Idaho—The new boat of this company on Moore Creek, is making a record of about 8000 yd. per 24 hr. The company has 20 men reopening the Banner mine, 20 miles east of Idaho City, preparatory to sampling.

Coeur d'Alene District

Bear Top-Orofino—The faulted part of the vein, lost two years ago, has been discovered, after an expenditure of about $25,000. The vein was found in a crosscut from the lower tunnel. A drift has been run on it, since, and has been in low-grade milling ore until recently, when an orebody 8 ft. wide was cut. The depth at this point is about 630 ft. The mill has been turning out 18 tons of concentrates per day, and a 50-ton car was shipped recently.

Amy—This property has made its initial shipment of two cars of ore. The mine is in the Pine Creek district and has excellent prospects.

Vulcan—Work is to be resumed at this property. The mild weather has melted the snow and there is plenty of water to run the compressor. The tunnel is in 2600 ft. The work will be done by day labor, at least until the vein is cut.

Guelph—This company, operating near Burke, has contracted for 100 ft. of tunnel, to be driven immediately.

Carney—Some fine specimens of bornite were brought to Wallace from this property, near Mullan. The vein is said to contain a quantity of finely divided mineral besides streaks of coarser material, from which the specimens were obtained.

Illinois

It is expected that the pottery of the smelting works of the American Zinc, Lead & Smelting Co., at Hillsboro, will be completed about the middle of this month. A Garrison-Whipple condenser machine is to be installed. It is expected that the plant will be ready to begin smelting with three blocks of furnaces about the end of the summer.

It is understood that the International Smelting & Refining Co.'s plant at East Chicago, Ind., will stand on 151st St., between Alexander Ave. and the new canal. This will be just across from the Goldschmidt Detinning Co.'s plant.

The Granby Mining & Smelting Co. has begun the construction of its new smelting works at Rose Lake, in East St. Louis, Illinois.

Michigan

COPPER

New Arcadian—This company has two drills in operation. One is drilling hole No. 23 in the horizon of the Baltic formation; this hole is down about 890 ft. The other drill is working near the Franklin boundary line in Section Nine.

Mass—An improvement has occurred in the grade of the rock in B shaft, especially in the 13th level drift. The hoisting equipment at C shaft is being erected and the new rockhouse is about completed. Unless something unforseen occurs, this property will be in shape to double production by June 1. At present, shipments amount to about 350 tons of rock per day.

Indiana—The vertical shaft is down about 700 feet.

Superior—The West lode, which was first encountered a few months ago, a short distance from the hanging wall of the main lode in the lower levels, has been exposed at all levels from the 12th to the 17th, and is opening ground that will be of material benefit to the property; in some places it is especially rich.

Allouez—The structural steel of the new rockhouse at No. 2 shaft has been erected and the permanent equipment is being finished. It is expected that by June 1, this shaft will be in regular commission.

Old Colony—The second drill has been received and will be placed in commission soon. The present drill continues hole No. 13-A, but it is operating in a badly shattered formation, which may necessitate the discontinuance of the hole.

North Lake—The report for the year ended Dec. 31, 1911, shows total expenses of $20,923. It is stated that the results of diamond-drill holes Nos. 3, 7 and 13 indicate that some promising veins run through the property and that No. 3 hole is the most desirable place to commence active mining work. The shaft will be sunk vertically and all lodes showing copper will be thoroughly explored by a crosscut at a depth of about 1000 feet.

South Side—Stockholders voted recently to sell the property to the Naumkeag Copper Co., for $22,515 cash and 7740 shares of the latter company, issued at $10 per share.

Union Copper Land & Mining Co.—The report for 1911 shows $8670 cash on hand at the end of the year. No. 5 hole was sunk 1439 ft. vertically with favorable results and was followed by Nos. 6, 7 and 8 holes. In three holes a copper-bearing amygdaloid was disclosed, which President Fay states is of commercial value and apparently identical with the Quincy-Pewabic lode.

Copper Range—Extensive improvements are being made in the regrinding department of the company's stamp mills. Some of the devices used by the Calumet & Hecla company in its mills at Lake Linden will be adopted.

IRON

Zimmerman—At this mine of the Spring Valley Iron Co., in the Iron River district, preparations are being made to increase the output. A new steel shafthouse has recently been completed by the Wisconsin Bridge & Iron Co., at shaft No. 2, and a large gyratory ore crusher installed. A new engine house and boiler houses have been erected, and a 25-drill Ingersoll-Rand air compressor set up. Forty underground tram cars have been purchased of the Lake Shore Engine Works, and a drill sharpener of the Ingersoll-Rand company.

Republic Iron Co.—At the mines of this company, at Republic, hoisting of ore is now in progress through three shafts. Changes in underground practice at this mine have been adopted; water drills with hollow drill-steel have been successful in allaying the dust caused by drilling in the hard formation; carbide lamps have been adopted by all miners, each of whom buys his own lamp, the company furnishing the carbide. Carbide has been found to give a better and cheaper light.

Penn Iron Mining Co.—At the mines of this company, at Vulcan, a new electric hoist has been constructed by the company's engineers. The drum was purchased from the Lake Shore Engine Works, and the motor from the General Electric Co.

Minnesota

MESABI RANGE

Grace—This mine, recently acquired by the Inland Steel Co., has been pumped out and will be a shipper this season, as will also the company's Laura mine.

Norman—Newspaper dispatches state that the fee-owners of this mine have filed a cancellation of the lease, under which the Steel Corporation is operating the property, alleging mismanagement.

Leonard—Work has been pushed all winter, even to the extent of stockpiling pit ore, and it is understood that shipments are being planned to reach 2,000,000 tons this season. The mine is operated by the Oliver company, and is one of the Hill leases.

Montana

BUTTE DISTRICT

Anaconda—At the Tramway mine, on Friday, Mar. 29, the engineer pulled a skip of ore into the sheave wheels, causing the wreck of the hoisting and chippy-cage compartment sheave wheels, and forcing the immediate temporary suspension of operations. A safety device has been used for the last two years at all of the principal hoisting shafts, which is supposed automatically to shut off the engine before the skip reaches the sheave wheels; in this case, however, it failed to work. The chippy cage, being lowered at the time, fell a few feet and was caught by the dogs on the safety catches. The skip in the other compartment was practically at the bottom of the shaft, and fell only a few feet.

Tuolumne—The raise from the 1800-ft. level to the North Butte company's workings, 200 ft. above, has recently holed in, and the level is now being supplied with an abundance of fresh air. Mining is showing good results on the 1800-ft. level, where a large vein of ore was recently opened, and on the 900-ft. level a good body of ore is being developed by drifting. About 150 tons per day of 7% ore were shipped to the Washoe smeltery during March, and this output will be about doubled soon. It is expected that negotiations with the Anaconda company for the treatment of second-class ore will be settled soon with mutual satisfaction. This will permit mining and shipping of the second-class ore blocked out but as yet untouched. Shaft sinking will be continued soon to the 2000-ft. level, where development work will be started.

Butte & London—On Mar. 29, the machine and blacksmith shops were destroyed by fire, entailing a loss of $5000, not covered by insurance. No damage was done to the shaft. The machinery was removed in April, 1908, when the property was closed down.

JEFFERSON COUNTY

Baltimore—Charles Whitcomb, of Helena, has secured a lease on this mine, near Boulder, and has 50 men at work. He is shipping about 50 tons of ore per day to the East Helena smeltery. The mine is worked by a tunnel about 600 ft. long.

Corbin Copper Co.—During 1911 drifting, crosscutting, sinking and raising were done as follows: Bonanza tunnel drifts, 1068 ft.; raises, 405; sinking, 75; stoping, 18,671 cu.ft.; Rosalie tunnel drifts, 707 ft.; raises, 58; stoping, 572 cu.ft.; Dow and Kathleen tunnels, 429 ft. of drifts and crosscuts. Ore has been found in several of the tunnels. A power line was built to the concentrator, and a Sullivan compressor installed.

Robert Emmet—A strike of good silver-lead ore was made recently on the 500-ft. level of this mine in the Amazon district. A crosscut was driven 150 ft. from the shaft, and it found the vein to be 18 ft. wide. Electrical machinery has been installed. The company also owns and operates the Blue Bird mine, near Wickes, both properties being under the management of W. Q. Ranft, of Missoula.

MADISON COUNTY

Nelson—This mine, near Virginia City, operated under lease with S. H. Ribbel as manager, will soon hoist ore. The Shafter mill, near the property, is being placed in condition to treat the ore. Mr. Ribbel is confident of being able to mine sufficient ore to keep the mill running steadily.

MISSOULA COUNTY

Monitor—Preparations are being made to drive a tunnel from the Milwaukee railroad tracks into the property, near Saltese, to tap the vein at a calculated distance of 6800 ft. from the mouth, and at a depth of 2160 ft. Copper ore worth $300,000 is said to have been shipped from this mine, the lowest level at present being the 700-ft. The ore carries both copper and gold.

RAVALLI COUNTY

Montana Mines—A lease and bond has been taken on a group of gold claims on Eight Mile Creek, six miles east of Florence, in the Bitter Root Valley, by the Montana Mines Co. There are three claims in the group and on two of them, the Providence and Dunstant, considerable development has been done.

Nevada

CLARK COUNTY

Duplex—Crosscutting is underway on this property adjoining the Quartette, to cut the I. X. L. vein, and exploration is being done on the New Year's Gift vein.

Chief of the Hills—This mine in the Fourth of July Mountains, four miles east of Searchlight, is being actively operated under lease by Messrs Hoine and Ray.

Bamberger-Wheatley—The Sara Nevada mine in the Fourth of July Range, belonging to this company, has been leased to John Howe and is producing. The Copper Belle, owned by the same interests, is also being operated, a new orebody having been found recently.

COMSTOCK LODE

Ophir—A shipment of 34 tons of concentrates was made last week, the gross assav value being $27,000. This was the cleanup from a run of 2000 tons at the Kinkead mill. An average of the daily run shows a high percentage of extraction obtained.

Con. Virginia—The management has decided that on May 1, the accumulated ore from the 3-compartment raise on the 2400-ft. level will be milled at the Kinkead mill. The raise is being carried along the footwall, and the ore saved has averaged between $30 and $40 per ton. The proceeds will be applied on the development and exploration work.

Union Consolidated—The new pumping plant on the 2250-ft. level of the joint winze is working successfully. The company will start two prospecting drifts from the 2500-ft. level. One will follow the footwall of the vein in a southerly direction, and the other will be driven north on the hanging wall to the Sierra Nevada ground. This vein formation is promising, and is east of any exploration work ever done on the Comstock lode.

LYON COUNTY

Nevada-Douglas—This company is reported to have 260 men on its payroll and to be contemplating an increase. The last payment on the Ludwig property has been made.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended Mar. 28, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,250	42,869
Tonopah-Belmont	2,100	28,726
Montana-Tonopah	1,014	12,871
Tonopah Extension	1,065	11,967
West End	750	9,049
Midway		180
MacNamara	365	3,672
North Star		10
Totals	8,544	109,154
Estimated value	$213,600	....

Tonopah Extension—The March production was 4618 tons, yielding bullion worth $55,300, the 30-stamp mill having treated an average of 149 tons of ore per day. In the eastern workings on the 400-ft. level, a faulted oreshoot has been found and carries high-grade ore.

Jumping Jack Merger Mines Co.—It is reported that this company is being formed to acquire and operate the Jumping Jack, Stray Dog and Indian Camp properties.

Montana-Tonopah—The company milled 4748 tons in March and the net profits for the month will probably exceed $35,000. The downward extension of the Shaft vein has now been cut on the 465- and 515-ft. levels, and at the latter has been drifted on for 75 ft. It is from 5 to 6 ft. wide and averages over $50 per ton. In crosscutting for it on the 565-ft. level, a new 3-ft. vein of $40 ore was cut.

West End—The west drift on the 500-ft. level shows over 20 ft. of $20 ore. The oreshoot in the extreme eastern workings is 8 ft. wide of good ore. The mill is treating 750 tons per week, almost solely from development of different oreshoots.

Tonopah-Belmont—The company has cut a new vein on the 12th level. The new Silver State vein, cut two weeks ago on the 11th level, is 9 ft. wide, all good milling ore. The east drift on the Lillie Belle vein shows nearly 3 ft. of smelting-grade ore. Ore pockets are now being cut in the shaft on the 13th level, and when completed, sinking will be resumed.

MacNamara—The March output was worth $18,300. The cyanide plant has been equipped with Trent agitators and the mill is treating 65 tons per day, the ore averaging $17 per ton.

WASHOE COUNTY

In the Wedekind district, near Reno, three hoists are at work, all sinking. The Arkell shaft is down about 168 ft. and the Roop shaft is down about 190 ft.

New Mexico

GRANT COUNTY

Oro Grande—This property, sometimes referred to as the "Apache Box," consists of 11 unpatented claims and a millsite, in the Steeple Rock district, being reached by wagon road, 12 miles from York, a station on the Arizona-New Mexico R.R. An examination recently made shows five wide veins of low-grade gold-silver ore. An engineer who visited the property has informed us that it is an important prospect.

SOCORRO COUNTY

George Utter will soon ship another car of zinc concentrates to Oklahoma. He receives $22.50 per ton, f.o.b. Silver City, for concentrates running 40% zinc.

Deep Down—The new gasoline hoist has been installed and the mine force increased, both property and equipment now being in readiness to make regular daily deliveries of ore to the Deadwood mill.

Ernestine—The new Blake crusher has been shipped from the factory. In March the mill treated 3200 tons of ore.

Oaks—During March 133 ft. of development were done at the Pacific mine, producing 75 tons of ore, which will be packed to the Deadwood mill for treatment as soon as the custom orebins at the latter have been emptied.

Trilby—In the course of recent development work on this group a considerable tonnage of ore was accumulated and is now being transported to the Deadwood mill. Should the results be satisfactory, it is likely a lease will be let and further development inaugurated.

Deadwood—The repairs on the engine have been made. During the unavoidable closedown, a large tonnage of custom ore has accumulated.

Ozark Smelting & Mining Co.—This company is going to build a concentrating mill at Magdalena. Philip Argall & Sons, Denver, Colo., are consulting engineers.

Oregon

JACKSON COUNTY

Governor—This mine, formerly owned by E. H. Pierce, has been sold to Messrs. Bowling, Jones and associates, of Medford. The new owners expect to begin shipping ore soon.

Little Daisy—D. G. Greger, of Salem, recently purchased this property at Takima, and development work is to be started.

Oregon Strong Ledge—A chlorination plant has been installed on this property, at Applegate, giving the mine a capacity of 100 tons per day.

Reddy-Lewis—A contract has been let by Dr. John F. Reddy, Medford, owner of this property, for another tunnel to be 100 ft. long.

South Dakota

BLACK HILLS DISTRICT

Evans Consolidated—C. C. Forester, who has been appointed general manager of this property, has been engaged in a thorough examination to ascertain the extent and grade of the orebodies. Several hundred assays have been made. He is at present in Denver, where he took some large samples for laboratory tests on mill methods. Pending these results, the work of mill construction has been postponed.

Texas

Brown Ore Development Co.—This company, at Ore City, has taken options on 28,000 acres of land in Upshur, Marion, Cass and Morris Counties. Explorations for iron ore have been going on for some time under charge of L. C. Luckel. The company, in which Charles M. Schwab is interested, is opening a large mine at Ore City.

Utah

BEAVER COUNTY

South Utah—During February, 283,838 lb. copper were produced. There were milled 21,472 tons of ore, yielding 1641 tons of concentrates, the ratio of concentration being 13.43: 1. Fifty-two tons of 13.42% copper ore were shipped. Costs were lowered and the grade of the ore milled increased, averaging 1¼% copper, with some gold and silver. The ore at present being treated runs 1½% copper.

Majestic—The gallows frame and buildings containing the dynamo, compressor and engine, at the Harrington-Hickory, were destroyed by fire recently.

Moscow—On the upper levels old stopes are being worked, and new ground will be developed. The monthly output is about four cars of ore, worth $1000 per car. Twenty men are employed.

JUAB COUNTY

Tintic shipments for the week ended Mar. 29 were 182 cars.

Swansea—An improvement is reported in the shipping ore from the 940-ft. level, and sulphides, in which there is some galena, are said to be taking the place of oxidized iron.

Opohongo—A donkey engine will be installed to be used in continuing the winze below the 700-ft. level.

Tintic Mining & Development—An electric hoist and gallows frame will be installed on the tunnel level. The intention is to sink the shaft to the 500-ft. level before drifting.

Iron Blossom—Good copper ore has been opened on the 600-ft. level, and a winze sunk 50 ft. in ore below this level. It is stated that the management intends to prospect the fissure at depth.

Beck Tunnel—The March output was 20 cars of ore. Steady shipments are being made.

May Day—During the year ended Mar. 31, 1912, lease ore amounted to 3626 tons, and ore shipped on company account, 3372 tons. Receipts were $63,982 and expenditures $63,915. Conditions at the mine show much improvement over those at the end of the year preceding. Recently new ore has been discovered in three places. The mill has been closed down during the development of shipping ore.

Gold Chain—The orebody, found on the 200 level, has been drifted on for over 150 ft. on the 400 level. The same vein has been opened on the 700, where a winze has been sunk 50 ft. in ore. The ore is stated to assay about $25 per ton.

SUMMIT COUNTY

Thompson-Quincy—A heavy flow of water has made timbering necessary. The water is regarded as an indication that the limestone contact is not far distant. There is some high-grade ore in the face of the drift.

Daly-Judge—The company has arranged for the disposal of its zinc middlings and shipments have been resumed. On Jan. 1, 1136 tons of zinc middlings were in storage, having been allowed to accumulate since October. The zinc tables are yielding an improved product, the grade having increased from 30% to 40 or 45 per cent.

UTAH COUNTY

Eureka Leasing & Mining—There is a 900-ft. tunnel on this property, in the Santaquin district, giving a depth of 500 ft. A good-sized orebody was recently opened.

Eva—This property is three miles north of the Eureka Leasing; an incline shaft has been sunk 550 ft., mostly in lead-silver ore.

Nebo Highland—About 10 days ago a snowslide swept away the cabins on this property, half a mile north of the Eva. No work has been done since. Ore has been opened in the 300-ft. inclined shaft.

Virginia

Old Dominion Sulphur Co.—The company has been incorporated to develop and mine a deposit of pyrites in Stafford County, 10 miles from Fredericksburg. The officers are: President, Albert Fogg, Camden, N. J.; vice-president, C. C. Watton, Norfolk, Va.; secretary and treasurer, W. Sparkling, Petersburg, Va. The property owned covers about 300 acres.

Washington

FERRY COUNTY

The following companies in the Republic district have recently installed Oliver filters, with reported success: Rathvon Reduction Works, North Yakima Power & Reduction Co., San Poil Mining Co., and British Columbia Copper Co. Attempts to cyanide these ores have usually failed, partly through difficulty in filtering the pulp, but this type of filter is said to have been successful in this work.

The smeltery returns for January and February show that the ore shipments from the Republic mines during that time aggregated 7222 tons as follows: Republic Mines Corporation, 5195 tons; Insurgent, 252; San Poil, 604; Quilp, 91; Knob Hill, 1080 tons.

North San Poil—A new orebody has been encountered at this mine, assaying $35 per ton. Operations are to be enlarged under James W. Taylor, Republic, who is manager.

Canada

British Columbia

Granby—Eight furnaces are in operation at the Grand Forks plant, and about 3500 tons of ore per day are being produced from the Phœnix properties. No decision has been reached yet for equipping the Hidden Creek mine.

Ontario

The Black Jack and Gold Hill mines, in the Lake-of-the-Woods district, are to be reopened by the owner, Bannell Sawyer. A 3-stamp mill is to be installed.

Ontario—Cobalt

Cobalt shipments for the week ended Apr. 5 were: Coniagas, 184,400 lb.; McKinley-Darragh, 137,980; Cobalt Townsite, 78,000; La Rose, 77,338; Nipissing, 65,112; Cobalt Lake, 65,500; Buffalo, 56,635; Temiskaming, 54,934; Trethewey, 53,000; Crown Reserve, 42,130; total, 813,079 lb. Bullion shipments were: Nipissing, 24,875 oz.; Crown Reserve. 22,234; total, 47,109 ounces.

The Dominion Safety Explosives Co. will build a factory on Peterson Lake, for the manufacture of its explosives. Several of the directors of the Cobalt Lake mine are interested in this new project. The product of the company is Dinitrolite, an explosive which has been used at the Cobalt Lake mine for several months, and which is stated to have given entire satisfaction. A feature of this explosive is its unusual safety.

Nipissing—The annual report for 1911 is expected to show net earnings in excess of $2,000,000. The production was about 5,200,000 oz. of silver, at a cost of about 14c. per lb., comparing with 14.72c. for the previous year. Less development was done, but high-grade reserves were increased.

Casey—A report to the stockholders states that work is being done on a true fissure vein, which has been drifted on for 17 ft. It is nearly 10 in. wide and is stated to have produced ore running from 6200 to 10,000 oz. per ton.

Ontario—Porcupine

Roche—Trenching has disclosed a new vein of quartz about 3 ft. wide.

Crown Chartered—This company will install a 10-stamp mill as soon as machinery can be delivered. The west crosscut on the 100-ft. level has been run through 16 ft. of ore, and the raises from this level pass through rich ore.

Kelso—A shipment of 700 tons of nickel ore is being made from this mine, situated 2¼ miles from Iroquois Falls, in Clergue Township. The ore will be treated at the Summit smeltery, in Pennsylvania, and was taken from a 5-ft. vein, on which the shaft is down 45 ft. It will be put down to the 100-ft. level, and drifting done to test the length of the orebody In places the vein carries a high percentage of nickel, but the general average is low.

Hollinger—No. 4 vein has been cut on the 200-ft. level, where it shows a width of 4 ft. of quartz. This increases the amount of ore estimated for this vein in the annual report.

McIntyre—A new vein has been encountered on the 200-ft. level, from No. 1 shaft. The crosscut is in 15 ft., and the center of the vein shows a good streak of high-grade ore.

Three Nations—A blind vein, 15 in. wide and carrying free gold, has been opened in the crosscut at the 100-ft. level.

Ontario-Sudbury

Wahnapitae Power Co.—The flume burst on Apr. 1 and the water rushed through the power house, wrecking some of the machinery and nearly drowning the three attendants. It will be nearly a month before the plant will be in running order again, and in the meantime the Garson mine of the Mond Nickel Co., the Whistle mine of the Dominion Nickel-Copper Co., the Moose Mt. mine and the city of Sudbury will be without power or lights.

Mexico

Chihuahua

San Toy—This company is continuing explorations from the bottom levels of the Central shaft which, in December, 1911, was deepened to the 1400-ft. level, at which depth the ore-bearing limestone stratum of the district was reached. A level has been driven north nearly to the property line and extensive diamond-drilling done in an effort to find an orebody at the deeper horizon, but so far without results. The ore already opened was between the 460- and the 660-ft. levels and disappeared at 800. The company was making large shipments until the interruption of railroad service by the insurrection in February, the ore going to Torreon. The stock is largely held in Pittsburg, where the company was financed under the direction of Charles M. Schwab. Donald B. Gillies is president.

Hidalgo

Cortez—Operations during 1911 are said to have been satisfactory. The financial statement on Dec. 31, 1911, shows: Buildings and improvements, $2804; development, construction and exploration, $95,238; loans, $20,000; cash, $103,042 and $128,018 excess of current assets. Olof Wenstrom is consulting engineer and general manager.

Oaxaca

Compañia Minera de Santa Lucia—Work has been permanently suspended at the property near San Geronimo. The zone of enrichment was passed and ore was entered at ground-water level. The ore at this point was insufficient to develop a low-grade mine and transportation is by mule-back 90 miles to the railroad. The shutdown was not due to revolutionary troubles.

San Luis Potosi

Tin deposits near San Luis Potosi have been examined for English interests, represented by F. A. Kesselhurth, an option on the property having been taken. Other tin explorations are planned.

Tepic

Purisima—Owing to an accident to the boiler, the mill has been temporarily shut down. It is intended to replace the steam plant by a gas-producer plant, to furnish power for the mill. Development work is being continued.

Zopilote—During February, a filter plant of local design and construction was installed, and another 75-ton masonry leaching tank has been added to the equipment of the cyanide plant. The addition of another Wilfley table to the concentrator permits of continuous operation of the reverberatory furnaces for treating the second-grade concentrates by the lixiviation process, affording a considerable saving over the former method of shipping this class of product to the smelteries.

South America

Chile

Braden—It is reported that some new methods of ore treatment are to be tested. Present operations will not be interfered with. The most important of these experiments is said to be one to be conducted by the Mineral Separation Ltd., of London, which is now erecting, at its own expense, a 250-ton plant for this purpose. Successful tests are said to have been made on the ore already, showing a high extraction. Good progress is being made on the Braden company's leaching plant. Two units of the concentrator are in operation and the third is being adjusted. More chilean mills will be added. Nos. 1 and 3 tunnels at the Teniente mine are advancing in good ore.

Africa

London dispatches state that petroleum has been discovered in the Mozambique district, in East Africa.

Asia

Chosen

Oriental—Cable dispatches state that the March cleanup was $127,000. Full returns for February show that the cleanup for that month amounted to $125,208. Two of the mills were closed in February, one all month and the Maibong since Feb. 21. The latter shut-down was caused by a flooding of the workings of the Chara mine, due to old workings cracking open under the river. Hoisting ceased as all available power was used for unwatering.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, Apr. 10—Everything in the coal trade just at present is uncertain, depending entirely upon the labor situation. In the West the process of voting on the compromise agreement and the arrangement of district schedules are in progress. It seems to be generally expected that the compromise will be ratified, though as yet this is not certain. In the Pittsburg district the operators expect that work will be resumed in the mines about Apr. 22, but this may be postponed. The same conditions prevail in Ohio and Indiana.

In the anthracite region everything is closed down. The operators and miners meet in Philadelphia today, but the result of the conference is entirely uncertain and may not be known for two or three days. The wage question can probably be adjusted, but the trouble will be over the recognition of the union. There has been some friction locally over the question of repairs at the mines, but no serious differences.

The strike in Great Britain seems to be practically at an end, and the miners in most districts are gradually going to work.

Anthracite shipments in March were heavy, being 6,596,687 long tons, or 599,793 tons more than in March, 1911. For the three months ended Mar. 31 the total shipments were 16,971,959 tons in 1911, and 18,209,351 in 1912; an increase of 1,237,392 tons, or 7.3%, this year.

Austrian Coal Trade—Imports and exports of fuel in Austria Hungary, year ended Dec. 31, metric tons:

	Imports	Exports	Excess
Coal..........	11,872,928	609,737	Imp. 11,863,191
Brown coal.. .	34,381	7,063,981	Exp. 7,029,600
Coke	702,707	299,915	Imp. 402,792
Briquets.	56,597	133,918	Exp. 77,321
Total.......	12,666,613	8,107,551	Imp. 5,159,062

Imports are chiefly from Germany and Great Britain; exports mainly to Germany.

IRON TRADE REVIEW

New York, Apr. 10—The whole iron and steel market presents a better aspect. Specifications for steel products are coming in at a greater rate, shipments are heavier, and prices show a firming-up tendency. The majority of steel plants are operating at full capacity and have such an accumulation of specifications on hand that, with specifications coming in at such a good rate they regard full operations as assured until midsummer. Then the real test will come as to the new prices. The great bulk of the material was contracted for at low prices to July 1, and outside of odd lots bought from time to time the mills do not have a chance to benefit by the advanced prices until fresh contracts are made. It is the intention to interpret contracts strictly, and cancel everything unspecified by July 1. Even then, however, it will probably be found that many consumers and distributers will be stocked and will require smaller shipments for a while.

The pig-iron capacity of the country today is approximately 34,000,000 tons a year, counting as available capacity furnaces which operated when prices were higher than at present, but which would probably lose money at present prices. The present production rate is very close to 29,000,000 tons, making 85% of the capacity in operation. The steel-works furnaces are doing much better than the merchant furnaces, operating at close to 95% of capacity while the merchant furnaces are doing less than 75%. Idle merchant furnaces will hardly come into blast except at higher pig-iron prices, particularly when coke is so high priced. Connellsville furnace coke for shipment this week sells at $2.65, ovens, against $1.50 last November, while pig iron has advanced an average of only 25 cents.

Pig iron continues active and purchases are running now over into third quarter. Furnaces are generally asking advances on second-half contracts, but they are still apt to give way on good orders. There is, however, probably a range of 25 or 50c. higher on orders running well into second half.

Pig Iron Production—The monthly reports of the blast furnaces, as collected and published by the *Iron Age*, show that on April 1 there were 238 coke and anthracite stacks in blast, having an aggregate daily capacity of 77,900 tons; an increase of 4200 tons over March 1. Making allowance for the charcoal furnaces, the total production of pig iron in the United States in March is estimated at 2,428,800 long tons. For the three months ended March 31 it was 6,626,700 tons.

Baltimore

April 8—Exports for the week included 344,600 lb. galvanized pipe to London; 398,600 lb. iron pipe to Antwerp. Imports included 5183 tons cupreous pyrites from Huelva, Spain; 11,750 tons iron ore from Cuba.

Birmingham

Apr. 8—Holding pig iron at $11 per ton, No. 2 foundry, Southern manufacturers are not yet anxious for business for delivery during the last half of the year. Sales are being made for delivery during the third quarter under $11 per ton. It is even announced that before the first of the present month one of the large companies of this section sold a cast-iron pipe-making concern, 60,000 tons of iron, delivery to be made during the balance of the year. It is understood that the price for this product was under $10.50 per ton, No. 2 foundry basis. There is much business in sight but whether the consumers are going to pay the new price remains to be seen. The steel situation in the Southern territory is also improving, and it is announced there will be need for a fairly steady operation of the big rail mill of the Tennessee company at Ensley through the next three months at least, on orders in hand and in sight. Charcoal iron is holding $22@22.50 per ton, with no change in demand or in make.

Scrap iron is a little more active while the brass and bronze workers announce a decidedly better condition now than for some time past.

The iron manufacturers in the Southern territory are still figuring on concessions in the way of freight rates with no prospects of an early improvement in this line.

Chicago

Apr. 9—The iron and steel market has strengthened notably in the last week. Sales of pig iron have increased, several contracts having been made for last-half delivery, the tonnage of each of which is larger than of any contracts previously made this year—5000 to 10,000 tons. The buying is by the harvester manufacturing and other large interests. As a consequence, Southern No. 2 iron has advanced to $10.75@11, Birmingham—$15.10@15.35, Chicago—on general sales, while special lots bring $11.25, Birmingham. These prices represent an advance of 25@50c. over prices of a week ago. Northern No. 2 brings $14.50 at the furnace on the average, with some sales 25c. above or below this price. The demand is largely for Southern now, though it has increased for Northern and for Lake Superior charcoal iron, which sells for $16.50@17.50, the wide variation being due to different requirements of buyers. There is still a large demand, in the aggregate, for small lots of pig iron, from general founders, who continue the policy of buying often and for a comparatively short time ahead.

In the finished-goods market the chief activity is in structural steel, which is selling largely for building and bridge requirements. The price now holds up well to 1.35c. minimum for material up to 15 in. on nearly all business. Railroad supplies are selling well in comparison with past weeks, with large rail contracts still few. Bars are in good demand but competition is still keen with Pittsburg and local production is in excess of needs. Soft-steel bars are quoted at 1.25@1.33c. and iron bars at 1.15@1.20c., Chicago. Billets are quiet at $27 for openhearth. Plates are in increasing demand for railroad needs, with 1.35c. minimum on ¼-in. tank plates. General business conditions are good with strength in many lines affecting the iron and steel market.

Cleveland

Apr. 8—Additional sales of ore are noted. Prices quoted have been generally adhered to, except that there is reported to have been some cuts in Old Range nonbessemer.

Pig Iron—A number of small sales are reported, but no large contracts. Prices, Cleveland delivery, are $15.15 for bessemer, $13.25@13.80 for No. 2 foundry, $12.50@12.75 for forge.

Finished Material—Specifications on contracts are large. New orders are chiefly small, but there are a good many of them. Prices are generally firmer.

Philadelphia

Apr. 10—More or less business in pig iron is temporarily held up on account of the firm attitude of makers. Large sales have been made in basic, foundry and malleable, but the transactions are below the indications of a week ago. The impression prevailed that some makers would accept business at concessions, but while there were two or three instances of weakness, the rest held out firmly for prices named in answer to inquiries. The activity in Western markets is reflected in the East, and it is believed that most of the business now pending will be closed on terms advantageous to makers. No. 2 foundry has done better than for several weeks. Low-grade foundry has advanced 25c. on recent contracts. Southern makers are asking a little more money and have squeezed some sales into this territory. The indications today are that quite a number of large New Jersey, New York and New England concerns will definitely and promptly close for iron, part of which will be scattered over third-quarter delivery. The smaller foundries are ignoring all signs and are buying all the iron they need and would be willing to pay more if they must when they want it. No. 2 X foundry is $15.25; gray forge, $14.25; basic, $14.50. Two or three brands of Southern gray forge are available at $13.75 per ton.

Steel Billets—Billets are in improved demand, among the smaller buyers whose stocks are practically exhausted, and forging billets are occupying most attention.

Bars—The movements in merchant bar are more active to large buyers and to the jobbing trade as usual at this time. Mills are well supplied with assortments, and orders are filled with promptness. The inquiries for common iron far exceed those for refined.

Sheets—The business booked for the week shows that the smaller buyers are in the market, and that they are looking ahead, placing more liberal orders for summer distribution.

Pipes and Tubes—A general improvement is reported in tubes.

Plates—Plate business does not present much activity, as measured by orders placed. Many quotations have been withdrawn; outside figures are now maintained, and no concessions will be considered.

Structural Material—Orders for shapes have fallen off as to local requirements, though there is quite a lot of business pending.

Scrap—The desirable grades of scrap are going quickly at holders' prices, and country supplies are pouring in.

Pittsburg

Apr. 9—The iron and steel trade is exceedingly active, mills operating close up to full capacity. In fact, the industry is threatened with a shortage of unfinished steel, specifications on billet and sheet-bar contracts being very heavy. Finishing capacity is in excess of steelmaking capacity. In plates, shapes, sheets and tinplates operations are close to the actual capacity of the mills. In rails, wire and pipe there is considerable slack, but in all lines there is heavier production than in the closing months of last year.

Minimum prices are 1.10c. on bars and 1.15c. on plates and shapes, and these prices are really exceptional, the majority of producers quoting 1.15c. on bars and 1.20c. on plates and shapes.

Pig Iron—The Republic Iron & Steel Co. has bought 40,000 tons of bessemer pig iron at $14.25, Brier Hill furnace, and 40,000 tons of basic pig iron at $13, Struthers furnace, for delivery over the next few months. The American Steel Foundries has bought 10,000 tons of basic for second-quarter delivery at Alliance at about $13, Valley furnace, while another consumer has bought 10,000 tons of bessemer at $14.25, Valley furnace. An inquiry for 6000 to 8000 tons of basic for the Colonial Steel Co. has been pending for some time, while this week inquiries appeared for 5000 tons of basic from the Commonwealth Steel Co. at St. Louis and 15,000 tons of the same grade from the Andrews Steel Co. at Newport, Ky. By the active buying of bessemer and basic in the past 30 days the stocks of these grades have been entirely eliminated and the statistical position of merchant pig iron in this district has become very good. The current consumption is not below the current production, and may be somewhat above it, while there is no likelihood of any of the merchant furnaces coming into blast unless they can obtain from 50c. to $1 above the present market. Ore is lower, but the decline from the actual selling prices of last year is small, and the present decline was fully discounted. Coke, on the other hand, is at least $1 a ton higher than the average price done on contracts for this half-year, and the idle furnaces do not have contracts. We quote: Bessemer, $14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; gray forge, $12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg, and for early delivery, second-half deliveries being quoted at higher figures.

Ferromanganese—Spot metal continues scarce and fancy prices are paid for small spot lots, $42@45, Baltimore; but the regular market remains at $41, Baltimore.

Steel—The market is higher, as very little unfinished steel is available. For many weeks the leading local producer has been entirely out of the market, while other producers have been getting filled up. Offerings of steel made in the Pittsburg district are extremely limited, and the sellers in Youngstown are quoting higher prices. We quote billets at $19.50@20 and sheet bars at $20@20.50, bessemer or openhearth, f.o.b. maker's mill, Pittsburg or Youngstown. Rods are $25, Pittsburg.

Sheets—The sheet market is gradually stiffening, owing to mills becoming well sold up. For weeks some important producers have been running full and have been practically out of the market, prices being made by a few mills which were still anxious for business. The market is now quotable at 1.85c. for black and 2.85c. for galvanized, as minimum prices, since these figures are very rarely shaded, and then only in limited areas, while actual sales of fair tonnages have been made at 1.90c. for black and 2.90c. for galvanized. About three weeks ago the leading interest advanced its minimum on galvanized to 2.90c., and while it lost some business thereby it did not lose as much as expected. Later it advanced its minimum on black to 1.85c. It is not unlikely it will make further advances in both before next report. We quote: Blue annealed, 10 gage, 1.35@1.40c.; black, 28 gage, 1.85@1.90c.; galvanized, 2.85@2.90c.; painted corrugated, $1.35 per square; galvanized, $2.50 per square.

St. Louis

April 9—The demand for pig iron seems to be slowly improving and the volume of inquiries is quite large. Most of the business is for small lots ranging from 100 to 500 tons. While the coal strike is not quite settled as yet there is no doubt that Illinois will be working again within 30 days and possibly before. Consumers are much relieved at the turn the coal situation has taken which will undoubtedly result in considerable more activity along industrial lines another month. The demand for finished products and railroad supplies is quite good.

Southern No. 2 foundry iron is being quoted at $10.50@10.75 Birmingham $14.25@14.50 St. Louis for both immediate and third-quarter delivery. Northern No. 2 iron is quoted at $14.25@14.50 per ton.

Coke is in good demand, though a trifle easier than last month, as consumers were then trying to accumulate a stock on hand on account of anticipated strikes. Good foundry coke is quoted at $5.10@5.20 per ton St. Louis.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for two months ended Feb. 29, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1911	1912	Changes
Exports	$36,298,183	$40,253,484	I. $3,424,301
Imports	6,020,633	4,292,031	D. 728,602
Excess, exp.	$31,808,560	$35,961,453	I. $4,152,903

Increase in exports, 9.3%; decrease in imports, 14.5%. The leading articles of iron and steel were, in long tons:

	Exports		Imports	
	1911	1912	1911	1912
Pig iron	25,737	27,450	30,354	18,638
Scrap	8,877	17,413	2,676	1,663
Billets, blooms, etc.	35,284	28,202	6,150	2,905
Bars	21,514	25,245	6,542	3,657
Rails	63,007	63,707	....	814
Sheets and plates	43,812	71,386	426	404
Structural steel	30,374	35,132	...	131
Wire-rods	1,661	6,050	3,164	2,817
Wire	28,042	32,672	.....	......
Nails and spikes	8,373	17,681	.....	......
Tinplates	4,070	9,004	6,650	611
Pipe and fittings	14,999	22,263	.....	......

Imports of wire are not reported in quantities; values were $205,479 in 1911 and $165,463 in 1912. Exports of mining machinery in 1912 were valued at $1,009,222, a decrease of $195,597 from last year.

Iron Ore Trade

Sales of Lake iron ore continue to be made at the prices noted last week: Old Range bessemer ores, base 55% iron and used 0.45 phosphorus, $3.75; Mesabi bessemers, $3.50; Old Range nonbessemers, base 51.5% iron, $3.05; Mesabi nonbessemers, $2.85; all f.o.b. dock, Lake Erie ports.

A strong effort is being made to place ores with Eastern furnaces, and it is reported that Old Range nonbessemers have been offered as low as $2.80, which would work out about 8.3c. per unit, delivered. It is probable that some ore can be placed. The sale of Lake ore in the East is helped by the recent sharp increase in ocean freight rates, which will discourage the import of Spanish and Swedish ores. Not only have rates advanced, but charters are hard to get.

METAL MARKETS

New York, April 10—The metal markets generally are strong, but less excited.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January	110	111	July	112	......
February	115	109	August	117	......
March	112	111	September	111	......
April	114	......	October	112	......
May	118	....	November	111	......
June	115	......	December	110	......

Year 1909, 115; 1910, 115; 1911, 112.
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Feb. 1912	$ 10,589,295	$ 2,937,274	Exp. $7,652,021
" 1911	424,733	5,805,844	Imp. 5,381,111
Year 1912	12,504,497	8,078,517	Exp. 4,425,980
" 1911	1,348,409	15,346,674	Imp. 13,998,265
Silver			
Feb. 1912	5,121,776	3,780,477	Exp. 1,341,329
" 1911	4,453,171	3,897,946	Exp. 555,225
Year 1912	11,149,681	8,138,486	Exp. 3,011,195
" 1911	10,104,247	7,449,372	Exp. 2,654,875

Exports from the port of New York, week ended Apr. 6: Gold, $365,325, chiefly to Argentina; silver, $1,175,739, to London and Paris. Imports: Gold, $473,993; silver, $356,817, from Mexico, Central and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was rather a heavy demand for India and some gold was also taken for Berlin. In New York, some gold is still going to Argentina.

Iridium—Prices are steady at $64 per oz. for pure metal.

Platinum—The market is quiet, with no change in prices. Dealers quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Mar. 28, that the market and the prices remain generally unchanged. The large producers are doing little business. The small producers and the starateli sell their platinum to local speculators. After the Easter holidays the offer of platinum by these producers will increase and this will cause a fall of prices; but this will be only local and temporary. The quotations are: in St. Petersburg, 38,100 rubles per pood for crude metal, 83 per cent. platinum; at Ekaterinburg, 9.30 rubles per zolotnik for the same grade—equal to $37.34 and $34.97 per oz., respectively.

Silver—The market continues steady without any new feature. The Indian bazaars are at present in the market. The future course depends much on hte action of China and the bearing of the new loans, if they are negotiated.

SILVER AND STERLING EXCHANGE

Apr.	4	5	6	8	9	10
New York	58⅞	58¾	58¾	58⅝	58¾	58⅝
London	27⅛	....	27 1/16	....	26⅞	26⅞
Sterling Ex.	4.8695	4.8695	4.8680	4.8670	4.8690	4.8690

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Mar. 28, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India	£2,408,300	£1,698,300	D. £710,000
China	702,800	415,000	D. 287,800
Total	£3,111,100	£2,113,300	D. £ 997,800

India Council bills in London averaged 16.05d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

	Copper		Tin	Lead		Zinc	
Apr.	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
4	15⅞ @16	15.70 @15.80	43⅛	4.20	@4.12½ 4.15	6.45 @6.55	6.30 @6.40
5	15⅞ @16	15.70 @15.80	43⅛	4.20	4.12½ @4.15	6.45 @6.56	6.30 @6.40
6	15⅞ @16	15.70 @15.80	43⅛	4.20	4.12½ @4.15	6.45 @6.55	6.30 @6.40
8	15⅞ @16	15.70 @15.80	43⅜	4.20	4.12½ @4.15	6.50 @6.70	6.35 @6.55
9	15⅞ @16	15.70 @15.80	43⅝	4.20	4.12½ @4.16	6.50 @6.70	6.35 @6.55
10	15⅞ @16	15.70 @15.80	43	4.20	4.12½ @4.15	6.50 @6.70	6.35 @6.55

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The uncertainty following the wabbling of the London standard market toward the close of the week for which we last reported became dispelled on Apr. 4 when the domestic market settled upon the basis of about 15⅞@16c., delivered, usual terms, the lower figure applying on domestic business and the higher on shipments to Europe, whither the freight rates are now higher than ordinarily. Sales of electrolytic aggre-

LONDON

Apr.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
4	70	70⅞	75	197	192¾	16 3/16	25⅜
5	.	....	....			...	..
6				..			...
8	.						....
9	70½	71⅜	75¼	198¼	194¾	16¼	25½
10	69 5/16	70 3/16	74¼	197	194½	16 3/16	25½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. = £1 ± 0.21¾c.

gating some millions of pounds were made to Europe, chiefly to speculators on Apr. 4 and Apr. 9, the business during the intervening period being insignificant owing to the holidays. The demand from manufacturers, both home and abroad, has been but small and at the close the market is dull. Electrolytic is offered domestically at 15⅞c., delivered, usual terms. Lake copper seems to be available at 16c. from all quarters, and some sales at that price, with and without discounts, have been reported, but there has been no activity in this market. It is natural there should be a lull in the buying after the heavy purchases which were made during March. Producers are now well booked ahead, and no pressure to sell has been occasioned by the smaller business that has presented itself. Consumption both in this country and in Europe continues excellent. The market closes with Lake copper at 15⅞@16c., and electrolytic copper in cakes, wirebars and ingots at 15.70@15.80c. Casting copper is quoted nominally at 15½@15⅝c. as the average for the week.

The London market for standard copper was closed most of the week. On Thursday, Apr. 4, spot sold at £70, and three months at £70 17s. 6d. There was no exchange until Tuesday, Apr. 9, when the market opened 10s. higher. On Wednesday, under pressure of realization by speculative holders, the market declined over £1, and closes at £69 6s. 3d. for spot, and £70 3s. 9d. for three months.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 17@17¼c. base, carload lots at mill.

Copper exports from New York for the week were 7434 long tons. Our special correspondent gives the exports from Baltimore at 1094 tons.

Tin—The prolonged holiday in Europe interfered with business both here and abroad. The end of the coal strike in England induced the large tinplate manufacturers of Wales to make heavier purchases, and a strong and advancing market was the consequence. Business on the London Metal Exchange is increasing in volume.

In this market, a fair business was done in future tin among dealers at prices somewhat below the foreign levels. The close in both markets is rather easier, at £197 for spot, and £194 10s. for three months, and at 43c. for April tin, at New York.

Lead—The market is quiet. New York is quoted at 4.20c., and St. Louis is slightly easier at 4.12½@4.15 cents.

The London market for Spanish lead is quoted at £16 3s. 9d. and English at 2s. 6d. higher.

Spelter—Some tonnages have moved during the last week, although the market cannot be characterized as otherwise than dull. The business has been for April, May and June deliveries, about equally divided, at prices from 6.55@6.35c., St. Louis, realized during the latter part of the week. There has been irregularity among the transactions reported by various sellers for the same deliveries, indicating that buyers have not been "shopping." The recent recession in the European price enables Kansas smelters to pay the duty on imported ore, offer the spelter from it at about 6.45c., and still realize as much as by exportation, but the increased supply available in this way is not large. However, the tension in the spelter market is apparently less than it was a little while ago. The market closes at 6.35@6.55c. East St. Louis, according to delivery, and 6.50@6.70c. New York.

The London market is slightly higher, good ordinaries being quoted at £25 10s., and specials at £25 15s. per ton.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7⅛c. per lb., New York.

Other Metals

Aluminum—Business is on a fair scale and prices are firm and unchanged. Quotations are 20@20½c. per lb. for No. 1 ingots, New York. The foreign market is reported steady.

Antimony—Business remains fair and prices are unchanged. The quotation for Cookson's is 8c. per lb., and for Hallett's and U. S. 7¾c.; while 6⅞@7c. is named for Hungarian, Chinese and other outside brands.

Quicksilver—Demand is good, but there is still some range in prices. New York quotations are $42@44 per flask of 75 lb., with the usual advances for small quantities. San Francisco is $42.50 for domestic orders and $40 for export. The London price is £8 12s. 6d. per flask, with £8 7s. 6d. quoted from second hands.

Zinc and Lead Ore Markets

Platteville, Wis., April 6—The highest price paid this week for zinc ore was $53.50; the base price, 60% zinc, was $51@53. The highest price paid for lead ore was $54; the base price, 80% lead, was $53 per ton.

SHIPMENTS, WEEK ENDED APR. 6

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Galena	793,200	....	....
Mineral Point	756,200	....	....
Shullsburg	368,600	....	....
Hazel Green	345,600	....	....
Benton	222,800	65,720	621,500
Harker	199,760	....	....
Livingston	185,000	....	....
Platteville	169,300	....	100,000
Cuba City	106,400	....	154,800
Rewey	79,000	....	....
Linden	65,010	....	60,000
Highland	31,600	....	......
Total	3,322,470	65,720	936,300
Year to date	53,409,640	1,447,330	5,647,190

Shipped during week to separating plants, 1,371,435 lb. zinc ore.

Joplin, Mo., Apr. 6—The high price of zinc sulphide ore was $59.50, the base price, per ton of 60% zinc, $50@57. Zinc silicate sold on a base of $25@28 per ton of 40% zinc. Average price, all grades of zinc, $50.42. Lead sold as high as $57 per ton, with a lower tendency at the week-end, $55 being the best offer . The average price, all grades lead, is $55.02 per ton.

SHIPMENTS, WEEK ENDED APR. 6

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,454,690	.....	1,193,350	$148,637
Joplin	1,915,970	....	246,170	49,040
Galena	762,640	......	127,260	22,630
Duenweg	629,010	264,180	33,480	21,234
Alba-Neck	648,460	......	..	17,508
Oronogo	609,100	......	78,750	14,955
Cave Springs	423,920	......	33,720	12,800
Carl Junction	429,920	......	......	12,465
Springfield	398,500	......	35,490	11,510
Miami	327,200	.....	117,730	10,430
Jackson	389,830	......	9,780	10 400
Granby	214,970	270,850	10,690	8,350
Carthage	191,500	.....	.....	4,979
Spurgeon	62,310	128,300	6,010	3,645
Aurora	......	75,360	35,000	1,990
Badger	23,500	......	4,610	725
Totals	11,481,520	738,690	1,932,040	$351,298
14 weeks	139,398,530	8,108,500	22,697,600	$4,004,646

Blende val., the week, $297,311; 14 weeks $3,271,407
Calamine, the week, 10,817; 14 weeks 115,002
Lead value, the week, 53,170; 14 weeks, 628,237

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.68
April	38.88		37.47		56.37	
May	38.25		36.79		55.21	
June	40.50		38.18		56.49	
July	40.75		38.36		58.81	
August	42.50		41.28		60.74	
September	42.63		41.29		59.33	
October	42.38		40.89		54.72	
November	45.10		43.25		57.19	
December	44.13		40.76		62.03	
Year	$41.15		$39.90		$56.76	

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

This has been the first wholly good week of this year for outputting and the roads are permitting some of the outlying stock, purchased several weeks ago, to be hauled to the railroads for loading out. There is little, if any, ore on top of the ground unsold, and advance purchases cover almost a full week's output of ore yet unmined. It has been years since a similar condition was known, if it ever was purchased so far ahead of the output. Approximately 3500 tons are scattered around in small lots where loading has been out of the question, but it is all sold.

Chemicals

New York, Apr. 10—The general markets are steady and show little change for the week.

Copper Sulphate—Business is good and prices are unchanged. Quotations are $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Spot supplies are still scarce, while demand is good. For white arsenic $3.75@4 per 100 lb. is named for spot; while $3.50@3.75 per 100 lb. is asked for futures.

Nitrate of Soda—The market is active and prices are again firmer, 2.40c. per lb. being quoted for spot nitrate and 2.35@2.40c. for futures.

Messrs. Mortimer & Co., New York, report the position of nitrate in the United States, on Apr. 1, as follows, in long tons:

	1911	1912	Changes
Stocks, Jan. 1	12,790	9,000	D. 3,790
Imports, 3 mos	158,422	82,100	D. 76,322
Supplies	171,212	91,100	D. 80,112
Deliveries, 3 mos	154,712	87,600	D. 67,112
Stocks, Apr. 1	16,500	3,500	D. 13,000
Afloat for U. S.	100,000	100,000	....

Quantities afloat include all cargoes due to arrive at United States ports before July 15 next.

Petroleum

The monthly report of the *Oil City Derrick* gives the number of new oil wells completed in March as follows: Pennsylvania and West Virginia, 313; Lima-Indiana, 31; Kentucky, 19; Illinois, 54; Kansas-Oklahoma, 408; Texas-Louisiana, 96; total, 912. In all the divisions there were 921 wells completed, 80 more than in February. The new production was 44,902 bbl., an increase from the February report of 1377 bbl. There were 165 failures among the completed wells, and 78 gas wells, a total of 243, leaving 678 oil producers. On the last day of March there were 503 rigs up and 1088 drilling wells, a total of 1591. This was an increase of 53 in rigs and 132 of wells drilling.

California production is reported at 6,893,432 bbl. in February.

MINING STOCKS

New York, Apr. 10—On Apr. 4, the Exchange was still active, but with an irregular movement of prices. Amalgamated Copper advanced and Steel common was strong. On the Curb, dealing in mining stocks was only moderate. Copper stocks were most in demand, generally at small advances.

Apr. 5 was a holiday, both on the Exchange and the Curb. Apr. 6, the Exchange was generally active. Steel common was especially strong. On the Curb, Lehigh Valley Coal Sales Co. and the Standard Oil stocks advanced. Other mining stocks were firm.

April 8 the markets were active, with large sales, and prices a little irregular, but generally strong. On the Curb mining stocks were active and advanced, but toward the close there were heavy profit-taking sales, and some consequent reaction.

April 9 the liquidation, which began the previous day, continued for a time, but the market then firmed up and closed strong, remaining so on Apr. 10, with continued advances in copper and steel stocks. On the Curb, business was active on both days, especially for the copper stocks, which were in good demand. Cobalt stocks were also firm.

At auction in New York, Apr. 4, sales were made of 200 shares Little Chief Mining Co., at $2 for the lot; 500 shares Silver Cliff Mining Co., $1 for the lot; Comstock Tunnel Co., 2000 shares, 13c. per share; $1000 first-mortgage bonds at 15, and $500 income bonds at 13; 200 shares Silver King Mining Co., $13 for the lot.

Boston, April 9—The copper-share market has gained added momentum during the week, although at the present writing trading has quieted down a bit. Naturally, reactions have occurred but prices hold wonderfully firm considering that many stocks are selling at their highest points in many years, while others are selling at record prices. Among the last named are Mayflower and Old Colony, the former rising $4.50 to $17.75 during the week's time and the latter $3.50 to $1.75 per share.

As in all bull markets much is heard of rich copper being encountered and this was the case in New Arcadian, which is up to $6.12½ on news that rich copper ground has been encountered at a depth of 1075 ft. Per contra, Utah Consolidated took a perpendicular drop of $7.25 to $12.75, with subsequent recovery to above $14. The issue of the annual report brought free selling with the above damage to the stock. A $3 advance in Lawson's Trinity to $9.50 and First National on the Curb to above $4 have been conspicuous features the past few days.

A $5 advance in Butte & Superior shares to $33 is accompanied by rumors

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Jan.	Feb.	March
Alaska shipments	3,701,010	....	4,987,916
Anaconda	26,350,000	27,450,000	25,900,000
Arizona, Ltd.	3,200,000	3,020,000	....
Copper Queen	6,748,264	6,046,860	7,197,121
Calumet & Ariz.	4,544,000	4,452,004	4,652,000
Detroit	1,941,970	2,068,370	2,246,238
East Butte	1,520,000	1,440,000	....
Mammoth	1,665,319	1,722,954	.....
Mason Valley	600,000	1,100,000	....
Nevada Con.	6,309,228	4,888,790	..
Old Dominion	2,044,000	2,039,000	.....
Ray	2,475,945	2,140,000	.....
Shannon	1,550,000	1,300,000	[illegible]
South Utah	189,678	283,838	..
United Verde*	2,000,000	2,250,000	..
Utah Copper Co.	8,156,612	8,612,739	..
Lake Superior*	17,500,000	19,000,000	..
Non-rep. mines*	8,400,000	8,000,000	....
Total production	98,896,026	....	..
Imports, bars, etc.	31,790,590	18,976,513	....
Total blister	130,686,616	....	....
Imp. in ore & matte	8,340,740	10,432,438	..
Total	139,027,356	....	..
Miami	2,235,647	2,475,996	...
Brit. Col. Cos.:			
British Col. Copper	538,190	860,003	....
Granby	1,607,558	1,773,496	..
Mexican Cos.:			
Boleo	2,315,040	2,204,720	2,424,800
Cananea	3,552,000	....	....
Moctezuma	2,732,867	2,687,712	2,446,731
Other Foreign:			
Cape Cop., S. Africa	784,000	786,440	..
Kyshtim, Russia	....	....	..
Spassky, Russia	795,200	649,600	..
Famatina, Argen.	172,480	....	..
Tilt Cove, Newf'd.	153,257	109,059	.
Exports from:			
Chile	8,064,000	6,720,000	.
Australia	7,056,000	7,164,000	...
Arrivals in Europe†	13,144,320	10,868,680	...

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
III, 1911	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566

VISIBLE STOCKS

	United States	Europe	Total
IV, 1911	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,112,400	204,082,388
IV	62,367,557	136,819,200	199,186,757

Figures are in pounds of fine copper U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

of an increase in the stock and rights to ensue. Lake Copper has been less active although steady in price.

The good feeling has also spread to the Curb, where everything is strong and active.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1	....	$0.005
Algomah, Mich	Jan. 22	....	1.00
Belcher, Nev	Apr. 8	Apr. 30	0 10
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah	Feb 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.50
Bullion, Nev	Apr. 30	May 20	0.05
Cedar-Talisman, Utah	Apr. 20	....	0.005
Con. Imperial, Nev	Apr. 30	May 23	0.01
Con. Virginia, Nev	Apr. 24	May 16	0.20
Crown Point, Nev	Mar. 28	Apr. 19	0.05
Ely Con., Nev	... .	....	0.05
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0.05
Hancock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
Lehi Tintic, Utah	Feb. 29	....	0.01½
Leonora, Utah	Apr. 15	Apr. 30	0.0125
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	....	1 006
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1	....	0.10
Sierra Nevada, Nev	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz.	Jan. 15	....	1.00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Wabash, Utah	Mar. 19	Apr. 10	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52 222	59 043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53 325	......	24.483	24.595	......
May	53.870	53.308	......	24.797	24.583	......
June	53.462	53.043	......	24.651	24.486	......
July	54.150	52 630	......	25.034	24.286	......
August	52.912	52 171	......	24 428	24.082	......
September	53 295	52.440	......	24.567	24.209	......
October	55 490	53.340	..	25.596	24.594	......
November	55.635	55.719		25 680	25.649	......
December	64 428	54 905	. ...	25.160	25.349	......
Year	53 486	53.304	. .	24 670	24 592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	14 094	12.680	14 337	55.600	62.760
February	12 256	14 084	12.611	14 329	54 974	62 893
March	12 139	14.698	12 447	14.868	54 704	65.884
April	12 019	...	12 275		54 034	. ..
May	11.989	. ...	12.214		54.313	......
June	12 385	. .	12 611		56 365	.....
July	12 463	....	12.720	..	56 673	. ....
August	12 105		12 634		56 266	.....
September	12 201	.. ..	12.508		55 253	.....
October	12 189	.	12.370		55 170	. ..
November	12 616		12.769	.	57 253	. ..
December	13.552		13 768		62 068	....
Year	12 376		12 634		55 973	

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	
February	41 611	42 962	August	43 319	. .
March	40 157	42 577	September	39 755	. ..
April	42 185		October	41 185	..
May	43 115		November	43 125	. .
June	44 606		December	44 655	
			Av. Year	42 281	..

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4.435	4 334	4.327	13.009	15.619
February	4 440	4.026	4 266	3 946	13 043	15 738
March	4.394	4.073	4 238	4.046	13 122	15.997
April	4 412	......	4 262	......	12.889	......
May	4 373	......	4.223	......	12 984	.....
June	4 435	......	4 292	......	13.260	....
July	4 499	......	4.397	......	13 530	.....
August	4 500	......	4 406	......	14.260	......
September	4 485	.....	4 356	......	14 744	......
October	4.265	......	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	15.648	.....
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	6.499	5 368	6.349	23 276	26 661
March	5.563	6.626	5 413	6.476	23 016	26.048
April	5 399	......	5.249	......	23.743	......
May	5.348	......	5.198	......	24.375	......
June	5 520	......	5 370	......	24.612	......
July	5 695	......	5 545	.. ..	25.006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	......	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.796	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14 76	$14.00
February	15 90	15.03	14 50	13.28	14 81	14.01
March	15.90	14.95	14 65	13.66	14.96	14.10
April	15 90	......	14 65	......	15 00	......
May	15.90	......	14 30	......	14 72	......
June	15 90	.. ..	14 06	......	14.56	......
July	15 90	. ....	14 03	......	14 53	......
August	15 90	. ....	14 00	......	14 47	......
September	16 90	. ....	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Apr. 9

Name of Comp.	Bid.
Acacia	.05½
Cripple Cr'k Con.	.01¾
C. K. & N.	.17⅛
Doctor Jack Pot.	.06
Elkton Con.	.62⅝
El Paso	.78½
Findlay	.04¼
Gold Dollar	.14½
Gold Sovereign	.02¼
Isabella	.12⅛
Jack Pot	.06
Jennie Sample	.04½
Lexington	01
Moon Anchor	01
Old Gold	03¼
Mary McKinney	.79¼
Pharmacist	.01¾
Portland	.88
Vindicator	.73⅞
Work	.01

SALT LAKE Apr. 9

Name of Comp.	Bid.
Beck Tunnel	16½
Black Jack	21½
Carisa	‡ 15
Cedar Talisman	02
Colorado Mining	.30
Columbus Con.	22
Daly-Judge	5.95
Grand Central	65
Iron Blossom	1 27½
Little Bell	39
Lower Mammoth.	04
Mason Valley	12.50
May Day	.15
Nevada Hills	2.40
New York	‡.05¼
Prince Con	1 20
Silver King Coal'n	1.70
Sioux Con	‡.04
Uncle Sam	.20
Yankee	‡ 15

TORONTO Apr. 9

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡7 50	Hollinger	11 90
Hudson Bay	‡70.00	Imperial	06
Temiskaming	.39	Pearl Lake	20
Wettlaufer-Lor.	.63	Porcu. Gold	43
Apex	‡ 04	Porcu. Tisdale	‡ 03
Central	‡5 00	Preston E. D.	11
Crown Chartered	‡ 28	Rea	55
Doble	‡ 45	Standard	‡ 13
Dome Exten.	.68	Swastika	.23
Foley O'Brien	.30	West Dome	‡ 40

SAN FRANCISCO Apr. 9

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.09	Belmont	10.15
Belcher	.85	Jim Butler	.72
Best & Belcher	.19	MacNamara	.25
Caledonia	4.10	Midway	.37
Challenge Con	.31	Mont.-Tonopah	3.42½
Chollar	.13	North Star	.31
Confidence	1.00	West End Con.	2.12½
Con. Virginia	.73	Atlanta	.30
Crown Point	.80	Booth	.10
Gould & Curry	08	C.O.D. Con	.09
Hale & Norcross	.40	Comb. Frac	.18
Mexican	3.45	Jumbo Extension	.43
Occidental	65	Pitts.-Silver Peak	1.42½
Ophir	1.37½	Silver Pick	.10
Overman	2.55	St. Ives	.30
Potosi	.10	Tramp Con	.01
Savage	31	Argonaut	2.00
Sierra Nevada	.44	Bunker Hill	‡5 50
Union Con	1.25	Cent. Eureka	.28
Yellow Jacket	1.30	So. Eureka	‡5.00

N. Y. EXCH. Apr. 9

Name of Comp.	Clg.
Amalgamated	83
Am. Agri. Chem	61
Am.Sm.&Ref.,com	87⅞
Am. Sm. & Ref., pf.	107½
Am. Sm. Sec., pf. B	87
Anaconda	43⅞
Batopilas Min	2⅛
BethlehemSteelpf	63⅞
Chino	29
Federal M. & S., pf.	‡43
Goldfield Con	4¼
GreatNor.,ore.,ctf.	42½
Homestake	94
Miami Copper	26¼
Nat'nalLead,com.	58⅝
National Lead, pf.	109
Nev. Consol	20¼
Pittsburg Coal, pf.	85
Ray Con	20
RepublicI&S,com.	24⅝
Republic I & S, pf.	79¾
SlossSheffi'd,com.	48¾
Sloss Sheffield, pf.	‡100
Tennessee Copper	41¾
Utah Copper	65
U. S. Steel, com	72⅜
U. S. Steel, pf.	113
Va. Car. Chem	54⅜

N. Y. CURB Apr. 9

Name of Comp.	Clg.
Barnes King	.25
Beaver Con	.45
Braden Copper	5⅝
B. C. Copper	5⅜
Buffalo Mines	‡1¼
Butte & Vipond	‡.53
Caledonia	70
Con. Ariz. Sm.	⅝
Davis-Daly	1⅜
Diam'field-Daisy	14
Ely Con.	5/16
Florence	.81
Giroux	6¼
Gold Hill Con.	¼
Greene Cananea	9⅜
Greenwater	09
Guggen. Exp.	223
Inspiration Con.	20⅜
Internat S. & R.	‡128
LaGrange Placer.	‡2⅞
Kerr Lake	2 15/16
La Rose	3¾
McKinley-Dar-Sa.	1⅝
Min. Co. of A. new	3⅛
Nev. Utah M. & S.	1/16
Nipissing Mines	8⅛
Ohio Copper	1 13/16
Pacific Sm. & M	9/32
Precious Metals	‡1⅜
Ray Central	2½
Red Warrior	‡1½
South Utah M. & S.	1¼
Standard Oil (Old)	880
Stand'd Oil of N.J.	398
Stand'd Oil Subs.	508
Stewart	1¼
Tonopah	7⅞
Tonopah Ex	2
Tri-Bullion	⅛
Tularosa	1
United Cop., pfd.	15
Yukon Gold	3¾

LONDON Apr. 10

Name of Com.	Clg.
Camp Bird	£1 10s 6d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 15 0
Mexico Mines	6 15 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 1 3

BOSTON EXCH. Apr. 9

Name of Comp.	Clg.
Adventure	5⅜
Algomah	6¾
Allouez	45
Am. Zinc	28
Ariz. Com., ctfs.	6
Benanza	.51
Boston & Corbin	7⅜
Butte & Balak	4½
Calumet & Ariz	74¼
Calumet & Hecla	493
Centennial	21½
Con. Mercur	.07
Copper Range	63½
Daly West	7
East Butte	14⅞
Franklin	15¼
Granby	47
Hancock	33½
Hedley Gold	‡18
Helvetia	1½
Indiana	16
Island Cr'k, com.	‡43
Island Cr'k, pfd.	86½
Isle Royale	27½
Keweenaw	2
Lake	46¾
La Salle	6
Mass	7⅝
Michigan	3¼
Mohawk	64
New Arcadian	6
New Idria Quick.	‡6⅞
North Butte	33
North Lake	7
Ojibway	5⅝
Old Dominion	54¼
Osceola	118
Quincy	87
Shannon	14½
Shattuck-Ariz.	20½
Superior	33¼
Superior & Bost.	2½
Tamarack	30
Trinity	9⅜
Tuolumne	3⅞
Union Mines	‡2¼
U. S. Smelting	38¾
U. S. Smelt'g, pf.	48¾
Utah Apex	3
Utah Con	14⅝
Victoria	5⅛
Winona	6¾
Wolverine	112
Wyandot	2¾

BOSTON CURB Apt. 9

Name of Comp.	Last
Ahmeek	285
Bingham Mines	3½
Boston Ely	2
Boswyocolo	09½
Butte Central	7¾
Cactus	16
Calaveras	3 00
Chief Cons	1 13/16
Corbin	2¼
Cortez	1
Crown Reserve	3⅛
First Nat. Cop.	3 5/16
Majestic	71
Mazatan	‡¼
Moneta Porc.	19
Nevada-Douglas.	4 5/16
New Baltic	4½
Oneco	3¾
Raven Copper	.44
Rhode IslandCoal	05
San Antonio	‡3
S. W. Miami	8¼
South Lake	6½
Trethewey	.65
United Verde Ext.	.45
Vulture	‡5 00

‡Last quotation.

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.

505 Pearl St., New York.
6 Bouverie St., London, E. C.
Unter den Linden 71, Berlin.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Editorials:
  Production of Lead.............. 773
  Senator Smoot's Bill.............. 773
  Arizona-Morenci Copper Co....... 774
  Australasian Gold Production.... 774
By the Way......................... 775
Ratio of Copper to Pig-Iron Consumption ....James Douglas 776
Mining Engineers Organizing in Germany 776
New Hydro-Electric Plant in Southwest Missouri 776
Correspondence and Discussion:
  Senator Smoot's Bill....The Tomahawk Lode....The College Man Underground....Atomizing Metals ....The Steel Used in Drilling.... Byproduct Coke Ovens............ 778
North Star Annual Report.......... 779
Mining Affairs in Germany......... 779
Appraising Mines 780
William A. Lathrop................ 781
Production of Fuller's Earth in Florida 782
German 1911 Potash Exportation... 782
The Steel Corporation and Labor... 782
Details of Practical Mining:
  *Target for Mine Surveying.... Shaft Water Used to Drive Fan ....Preventing Freezing of Air Exhaust....*A Safety Hook for Hoists....Splicing Wire Rope.... *A Tunnel for Steam Pipes....A Cheap Mine Road....Placing Air Pipes in Shafts....*Lowering the Water in a Choked Shaft....Gasoline Locomotive for Calumet & Hecla 783
Details of Metallurgical Practice:
  *Take Up Device for Elevator Belts....A Flexible Decanting Hose....*A Simple Vortex Classifier....An Old Device for Plugging Furnace Taps....*Tram Car for Concentrate 787
The Cost of Doing Things.......... 789
Notes from Current Literature..... 790
*Cyanide Mill Metallurgical Records ....E. H. Webster 791
Development at Collahausi, Chile. Manuel C. Gonzales 794
Gloomy Outlook on the Rand....... 795
*Motor Trucks for Mines........... 796
Air in Pyritic Smelting. E. W. Walter 797
Jarbidge, Contact and Elk Mountain Districts, Nevada 798
Florida Phosphate Production..... 798
*The High Grade District, California..........Algernon Del Mar 799
Michigan Iron Ore Reserves........ 799
Allis-Chalmers Co. 804
New Publications 805
Personal, Obituary and Societies... 806
Editorial Correspondence 807
Mining News 809
Markets 815
*Illustrated.

The Engineering and Mining Journal

Vol. 93. APRIL 20, 1912. No. 16

Production of Lead

Our revised statistics of the production of lead in the United States in 1911 are given in the accompanying tables, the first of which is based on reports received by all of the refiners, classified as in previous years, i.e., the lead reported as "desilverized" and "antimonial" is the product ol the refiners treating Western and foreign bullion, while the production of the Missouri and Illinois refiners is entered according to the main sources of their ore supply. Some of the Missouri lead is desilverized, but this is not enumerated separately. Many of the refiners treat lead scrap and dross. The amount of refined lead derived from such old material in 1911 was 3916 tons.

PRODUCTION OF LEAD IN 1911
(REFINERY STATISTICS)
(In tons of 2000 lb.)

Class	1910	1911
Domestic:		
Desilverized	217,490	211,041
Antimonial	9,098	8,916
S. E. Missouri......	145,387	155,008
S. W. Missouri.....	20,729	25,993
Totals	392,704	400,958
Foreign:		
Desilverized	90,473	89,487
Antimonial	4,892	4,929
Totals	95,365	94,416
Grand totals......	488,069	495,374

Our second table, showing the distribution of lead production according to States, is based upon the reports of crude lead, as returned by the smelters rather than the refiners, except in the case of one interest, which is both smelter and refiner. Allowing for the refined lead obtained from scrap, dross, etc., it appears that while the refiners' production was larger than the smelters' in 1910, it was a little smaller in 1911. The smelters' reports are as near as we can come to the mines. There may, perhaps, have been an even greater increase in the mine production of lead in 1911 than our statistics show, inasmuch as a large quantity of lead ore was accumulated at the Tooele works, whereof the smelting was not begun until 1912.

PRODUCTION OF LEAD IN 1911
(SMELTERS' PRODUCTION)
(In tons of 2000 lb.)

State	1910	1911
Arizona	1,399	4,392
California	1,038	529
Colorado	34,711	28,730
Idaho	99,840	116,524
Kansas	1,343	2,500
Missouri	160,642	173,787
Montana	1,795	2,492
Nevada	2,119	1,076
New Mexico	1,730	1,381
Oklahoma	1,860	1,950
Utah	57,158	54,538
Wisconsin (a).......	3,400	3,944
Other States	177	912
Undistributed	1,429	1,760
Zinc Smelters.........	1,988	3,511
Totals	370,629	398,026

The statistics for 1911 exhibit several interesting features. Among these are the continued growth in the production of Missouri, and the continued decline in that of Colorado, but most surprising is the great jump upward in the output of Idaho. The increase in the lead production accredited to the residues received from the zinc smelters reflects the more extensive use by them of Rocky Mountain ore.

Senator Smoot's Bill

It is encouraging to have the introduction in Congress of a bill abolishing the law ol the apex. The wonder is that such a bill was not introduced and passed long ago. The best opinion in the mining industry has been for a long time in favor of discarding the inadequate and troublesome law of the apex and substituting something like the Mexican law. This opinion has been iterated and reiterated by industrial organizations and by the technical press. President Roosevelt appointed a commission to report upon the matter, and knowing the composition of that commission it is not difficult to guess the nature of its report. However, the report was pigeon-holed. We should like to know why? Perhaps Senator Smoot will cause its publication, now that it has been brought to his attention. We should like to have also an explanation of the mysterious, malign influence that has so long delayed this reform.

But much as we desire an improvement in our mining system, we do not like Senator Smoot's bill. It will be foolish to substitute one bad law for another. The reasons why Senator Smoot's proposal is bad are pungently stated by H. V. Winchell, in a communication published in this issue. Mr. Winchell is a high authority on this subject, being not only a mining geologist of the highest rank, but also the chairman of the mining-law committee of the Mining and Metallurgical Society of America. We endorse all that he says in his present communication, which we commend to the attention of every one of our readers and to the members of Congress.

Arizona-Morenci Copper Co.

Somebody interested in the Arizona-Morenci Copper Co. evidently believes in giving the investing public two or three bites at its cherry. First brought out as the Copper Mines Co. of Arizona, Ltd., it subsequently became the Arizona-Morenci Copper Co., which was extensively advertised in Great Britain in 1910. In our issue of May 22, 1910, we made some unfavorable remarks about it.

Somebody has lately been advertising in a similar way in the English and Scotch papers. In these last advertisements no one is cited as vouching for the truth of essential statements that are made, as, for example, the assertion that "The Arizona-Morenci Copper Co.'s ground is intersected by the same lodes with the same values as now being worked by the adjoining and surrounding mines." The adjoining and surrounding mines are chiefly those of the Arizona Copper Co., Detroit Copper Co. and Shannon Copper Co. It is not true that in this district there are "some half dozen companies, all of which are highly successful and whose net earnings aggregate more than $10,000,000 annually."

The only honest way to handle such a property as that of the Arizona-Morenci Copper Co. is to organize a development company for the purpose of ascertaining if it contains orebodies of commercial value, not to undertake to delude ignorant people in the present way. The advertisements that have come to our notice are unsigned and evidently inspired by someone who aims to sell stock through the medium of the exchange, the point of the advertising being in the paragraph that "The 7 per cent. participating preference shares of the Arizona-Morenci Copper Co. of $5 (£1) each have a free market on the London stock exchange at about 6s." The company has 1,000,000 of the participating preference shares. In the promotion of two years ago they were offered at 21s. per share. Since then the company has done a little prospecting, but recently even that has not been in evidence.

Australasian Gold Production

The official returns of gold production for all the Australian states have now been collected, except for South Australia, and for that state a close approximation is made. The figures, with those for the Dominion of New Zealand, are given in the accompanying table, in fine ounces. The Northern Territory appears for the first time separately. Heretofore it has been under the administration of South Australia and its production has been included with that state; it is now directly administered by the Commonwealth.

GOLD PRODUCTION OF AUSTRALASIA

In fine ounces

	1910	1911		Changes
West'n Australia	1,470,632	1,370,867	D.	99,765
Victoria..........	569,644	503,541	D.	66,103
Queensland	441,400	381,845	D.	59,555
New South Wales	188,857	181,121	D.	7,736
Tasmania........	37,048	32,992	D.	4,056
South Australia..	6,603	5,100	D.	1,503
Northern Ter.....	....	5,600	I.	5,600
Commonwealth	2,714,184	2,481,066	D.	233,118
New Zealand.....	446,421	411,390	D.	35,031
Total	3,160,605	2,892,456	D.	268,149
Total value.....	$65,329,705	$59,787,066	D.	$5,542,639

The smallest decrease shown in the table is in New South Wales, where mining and prospecting were fairly active. Queensland lost chiefly on account of some interruptions to mining and milling at Mount Morgan. The loss in New Zealand was due almost entirely to the reduced output from the Waihi mine. In Victoria nearly all the old districts had a diminished production.

The total value of the Australasian gold output for 10 years past is given in the second table.

AUSTRALASIAN GOLD OUTPUT, 10 YEARS

Values

1902. .	$80,528,316	1907. ..	$75,849,319
1903. . . .	89,220,102	1908.. .	73,314,671
1904..	87,241,662	1909.. .	70,982,807
1905. . ..	85,979,779	1910. ..	65,329,705
1906... . .	82,358,207	1911 .	59,787,060

The year 1903 was that of maximum production, when the great mines of the Kalgurlie district in Western Australia were at the height of their prosperity. Since then the decline has been continuous, and has been largely due to the decrease in Western Australia, though the other states have shown losses, with few exceptions. The total decrease in 1911, as compared with 1903, was $29,433,036, or 33%. In 1910 and 1911 the losses were almost the same, that in 1910, as compared with 1909, being $5,653,100, or 8%; while 1911 lost $5,542,639, or 8.5%, as compared with the previous year.

Australasia, alone of all the great gold producers, has shown such a continuous decrease. The Transvaal has had heavy gains yearly from the beginning, interrupted only in the two years of the Boer war. The United States and Russia have had occasional small setbacks, but upon the whole have gained largely during the 10 years. Mexico increased its gold production up to last year, when the revolutionary troubles and the unsettled state of the country caused a decrease which, it is to be hoped, will only be temporary. Canada lost in production after the first rush from the Yukon placers was over, as was to be expected; but is showing its ability to recover steadily. The cause of the decrease in Australia seems to be twofold; it is found partly in the diversion of labor to other industries, but more largely in the fact that no new goldfields have been opened and comparatively few new mines in the older districts to take the place of those gradually being depleted. Prospecting seems to be at a low ebb, and there is nothing new in prospect, except in the remote and isolated Northern Territory, the resources of which are still largely unknown.

The simple exposition of colloidal solutions and suspensions in Doctor Jones' article, on p. 800, should be of especial interest to cyanide chemists of the "old" school, and to engineers generally who had only a smattering of the "old" chemistry. Then an atom was the ultimate division of matter and precipitates were precipitates—nothing more nor less. They did not always come down when they were expected, and it was simply assumed that the expected compound was not formed. It was not suspected, at least not taught, that the reason for failure might be that the electrical charge of the colloidal particles prevented them from clotting or precipitating and that this may, under certain conditions, be overcome through the addition of electrolyte. In analysis, we were formerly inclined to look upon the precipitate as the "natural condition of matter" in a solid state in a liquid. The "new" chemistry, however, has demonstrated that colloidal suspension is the normal state, and that the precipitate is in a sense the unnatural condition.

By the Way

"Have you had any experience as an office boy?" inquires an employer in Brooklyn *Life*. "I should say I had, mister; why, I'm a dummy director in three mining companies now."

The *Boston News Bureau* quaintly remarks in a recent issue that "Hayden, Stone & Co. have done all they could to keep the price of Butte & Superior down." While these efforts were being exerted, Butte & Superior rose from $7 to $32 per share. Just supposing Hayden, Stone & Co. had been bulls instead of bears!

"The Stock Exchange has gone wild over Nigerian tin company propositions," reports the London *Economist*. "Fresh concerns have their shares introduced every day. Jobbers haunt a drafty street up till past seven o'clock on raw March evenings; four hundred or more job daily. The public has bought largely."

Bewick, Moreing & Co. seem to have made a very good thing out of Porcuine, their Northern Ontario Exploration Co. having made £81,481 profit out of "the operations at Porcupine and elsewhere since incorporation in January, 1911." Inasmuch as no gold was produced at Porcupine, it is evident that this profit must have been derived from operations in the stock market, especially in the matter of Hollinger shares. The statement is not quite savory.

If one has never heard a Cornish mine-captain direct his men, the following may not be appreciated; it is none the less true, however: It was in a northern Michigan mine that a captain stood on a level calling down to his men: "'Ow meny of 'ee are 'ee d'yyown there?" Promptly came the reply from the attentive men below: "Three, cap'in!" "'Alf of 'ee cum hup 'ere." Thereupon followed an argument as to how the order should be carried out.

In the organization of the Naumkeag Copper Co. by the General Development Co., the majority of the stock fell into the hands of the latter and its associates. This is not at present for sale. More or less stock passed into the hands of other persons as consideration for property turned in. We understand that some of this stock is being offered for sale at $25 per share. It is not considered by the organizers of the company to be worth that. It is figured that the stock stands to them at $7.75 per share, and is fairly rated at $10, the increase representing appreciation in value from consolidating a group of isolated properties. Prospective purchasers of stock that is offered ought to know the opinion of the organizers of the company. They ought to consider also that the company is purely a development enterprise. The property may not contain any payable copper and the money spent in looking for it may be a total loss. This remains to be proved. In the meanwhile nobody should be under any misapprehension.

Our neighbors to the north seem to be acquiring the gentle art of the American superlative. A Gowganda dispatch in an Ontario paper reports that the mine has "a vein which mining engineers have stated to be the biggest in Canada—" After seeing this in cold type, the author concluded he had described too modestly the peerless, awe-inspiring mineralization he had in mind, so the scope of the comparison was increased to exclude everything else "on the continent." Only the thought of the Katanga copper field deterred him from making it the biggest "in the world." However, with the abundance of "geologic formations," the use of the name of a world-famous gold mine, and the clairvoyancy of the examining engineer, the property should manage to pull through. "The vein has been traced for over a mile and runs from two to 16 ft. wide, consisting mainly of quartz, calcite and different irons. . . . The vein runs through all formations, keewatin, slate, granite and diabase. . . . At present a shaft is being sunk in the keewatin and is down 65 ft. now. The vein is gaining a foot in ten, but is still leached. . . . An engineer who inspected the work being done states that at least 25% copper should be obtained when the shaft is down to the water level, which will be about 100 ft. down." The mining engineer who sent us this clipping wrote that he hesitated to think what the production of the porphyry coppers and of the Amalgamated would look like, if this property ever gets to the producing stage.

The Mexican *Herald*, commenting in a recent issue on the present situation, states that it has always been a staunch and outspoken supporter of the constituted government of Mexico. "We do not," it says, "feel that any other policy is proper for foreign residents here and we fully believe that in Mexico, as in any country that elects its executive by popular suffrage, the president should enjoy the support and coöperation of his countrymen to the end of his legal term. We have said this repeatedly in the strongest language we could command. We repeat it today. We can foresee nothing in the overthrow of Mr. Madero but indefinite continuation of trouble. If during the first six months in office of the president of a democracy he be overthrown by revolutionary and dictatorial methods, what hope is there that his successor will not suffer a like fate unless he is strong enough immediately to become the military master of this country? Probably no ruler in history has been obliged to depart more radically and more quickly from the practice of the high ideals of democracy and civil government with which he entered office, than has Mr. Madero. We have been one of those to suffer from the application of the ruthless iron hand that disregards all law in the accomplishment of its purpose. But our own troubles do not blind us to the fact that the forcible overthrow of this administration, the legality of whose election is not questioned, would mark the end of Mexican democracy for a long period, and necessarily set up a dictator whose first arbitrary acts would be the signal for a new movement against him. If American intervention ever comes in Mexico it will only be because conditions in this country have reached such a state that intervention will be asked for by a thousand Mexicans for every American in Mexico who will want it. If intervention ever comes it will be under such circumstances that the vital questions at issue will not be the preservation of the country, the autonomy of the nation, but the safety of the lives and property of native and foreigner alike from a state of anarchy and chaos."

In the JOURNAL of Nov. 16, 1907, p. 931, Floyd W. Parsons called attention to the occurrence of gold and silver in the coal of the Cambria Fuel Co.'s mines in Wyoming. The coal contained from nothing up to $2 in gold when the coal was selling for $1.50 at the mine. The samples from 31 cars of coke showed an average of $2.46 in gold and $0.28 per ton in silver. Assays made by the company's chemist showed $10 per ton in the boiler house ashes and $2 per ton in gold in the sandstone overlying the coal seam. In a recent bulletin, No. 499 of the U. S. Geological Survey, R. W. Stone, commenting on this occurrence, states that there is more gold in the splint and bony coal than in the best bituminous. It may be associated with pyrites, which occurs commonly in the splint and "pine needle" coal. As there are no known dikes or veins within many miles of the coal mine at Cambria, the gold cannot be explained as derived from such a source. That the gold was introduced in the quiet waters of the swamp, either in solution or as very fine particles in suspension, and deposited there by precipitation or by gravity is not impossible nor yet readily conceivable. The most plausible explanation seems to be that the sands which submerged the swamp and now form the roof of the coal bed were derived in part from old gold-bearing alluvium. It was noted above that the sandstone roof carries some gold. Currents which transported the sand and the grit which occurs in some places a few feet above the coal certainly were strong enough to transport fine gold. While the sand was being deposited the gold may have worked down into the underlying bog and is now found in the coal.

Ratio of Copper to Pig-Iron Consumption

By James Douglas*

The high price of copper has excited speculation as to its cause. The following statistics may help to solve the problem. They give the quantity of pig iron and copper consumed in the United States during the 16 years from 1896 to 1911, and the quantity of pig iron and copper consumed by the world during the 15 years from 1896 to 1910. The column of production of iron for this country represents approximately its consumption, inasmuch as the trifling imports of iron and steel are nearly balanced by our exports. The home consumption of copper is taken from "The Mineral Industry" and is calculated on the production, plus importation, minus exports. As larger or smaller quantities are carried in stock from year to year, the following years are bracketed, namely, 1897 and 1898, 1899 and 1900, 1906 and 1907. These couples then correspond approximately with the average and with the consumption of other years. The figures also closely bear out those that I prepared on this subject for the Journal of Apr. 7, 1906, and are confirmed by Brown and Turnbull in their "Century of Copper."

The production of copper shows slighter variations than that of iron, due to the fact that the copper miners, being unprotected by the tariff, have no inducement to restrict their output to the demands of a home market, but have for many years sustained commercial relations with the world at large.

What is peculiarly interesting is the ratio of the consumption of copper to that of iron. During the 16 years covered by the table the consumption of the United States has been one ton of copper to 83 tons of pig iron, whereas during the 15 years illustrated in the table of the world's consumption of copper the ratio has been one ton of copper to 79 tons of iron. So uniform is the proportionate use of the rarer to the baser metal the world over that the ratio of the consumption of copper to iron has never risen above 1:71, nor fallen below 1:86. There have been years of extraordinary divergence from this ratio, but they are rare. For instance, during 1910 the percentage increase of pig iron over 1909 was 7.58%, though the average for 15 years was only 6.03%, while the increase of copper production in 1910 over 1909 was only 1.47%, as against 6.04% for the average. If, therefore, there has been a demand for copper in the ratio of one ton of copper to 79 tons of iron, and if that ratio is to be maintained, the measure of value of copper must be measured by the capacity of the world's copper mines to keep pace with the demand for iron, and the capacity of the world's iron mines to meet that demand. Viewing the world's sources of supplies of rich iron ores compared with the world's scanty sources of supply of correspondingly rich copper ores, the visible supply of iron is in excess of the visible supply of relatively rich copper ores; and therefore a lower grade of copper ore must be steadily drawn upon to supply the world's increasing demand, and this demand, if provided from leaner and still leaner ores, can only be satisfied at what certainly will not be a low price.

DOMESTIC PRODUCTION AND CONSUMPTION OF IRON AND COPPER, 1896–1911

Year	Pig Iron Produced and Consumed		Pig Copper Produced		Per Cent. of Copper to Iron	Tons Pig Iron Produced to One Ton of Copper	Copper Consumed in the U.S., Long Tons	Tons of Pig Iron Consumed to One Ton of Copper	
	Long Tons	Per Cent. of Increase	Long Tons	Per Cent. of Increase					
1896..	8,623,127	..	208,760		2.42	41	102,083		83
1897.	9,652,680	11.94	223,825	7.22	2.32	43	122,501	87	78
1898.	11,773,934	21.97	239,241	6.89	2.03	49	122,382		96
1899.	13,620,703	15.68	259,517	8.47	1.91	52	174,822	83	78
1900..	13,789,242	1.24	268,229	3.36	1.95	51	155,169		88
1901.	15,878,354	15.15	271,949	1.39	1.71	58	196,836		81
1902.	17,821,307	12.23	288,342	6.03	1.62	62	213,300		84
1903.	18,009,251	1.05	319,043	10.65	1.77	56	224,026		80
1904.	16,497,033	*8.50	372,233	16.35	2.25	44	215,264		77
1905.	22,992,380	39.38	390,733	4.97	1.70	59	273,653		84
1906.	25,307,191	10.07	409,652	4.84	1.62	63	298,472	90	85
1907..	25,781,361	1.87	392,518	*4.18	1.52	66	240,098		107
1908.	15,936,018	*38.19	423,302	7.84	2.66	38	218,153		73
1909..	25,795,471	61.86	493,453	16.57	1.99	52	313,905		82
1910..	27,298,545	5.83	484,933	*1.72	1.78	56	339,132		80
1911..	23,647,451	*13.37	491,647	1.38	2.08	48	316,350		75
	292,424,048	9.21	5,537,377	6.01	1.89	53	3,526,146		83

*Decrease.

THE WORLD'S PRODUCTION AND CONSUMPTION OF IRON AND COPPER, 1896–1910

Year	Pig Iron Produced and Consumed		Pig Copper Produced		Per Cent. of Copper to Iron	Tons Pig Iron Produced to One Ton of Copper	Copper Consumed, Metric Tons	Tons of Pig Iron Consumed to One Ton of Copper
	Metric Tons	Per Cent. of Increase	Metric Tons	Per Cent. of Increase				
1896.	31,015,302	.	384,493	....	1.24	81	384,500	81
1897..	33,513,073	8.05	412,088	7.18	1.23	81	390,081	86
1898.	36,658,272	9.39	440,972	7.01	1.20	83	439,254	83
1899	40,457,341	10.36	478,200	8.44	1.18	85	467,700	86
1900..	39,599,457	*2.12	499,200	4.39	1.26	79	512,700	77
1901.	40,950,692	3.41	534,800	7.13	1.30	77	494,200	83
1902.	44,342,579	8.28	553,300	3.46	1.25	80	582,500	76
1903.	47,113,730	6.25	591,300	6.87	1.26	80	586,700	80
1904.	46,069,501	*2.22	647,900	9.57	1.41	71	662,400	70
1905..	54,054,783	17.33	693,900	7.10	1.28	78	727,400	74
1906.	59,074,861	9.29	712,900	2.74	1.21	83	722,600	*82
1907..	60,680,014	2.72	703,000	*1.39	1.16	86	657,300	92
1908..	48,640,479	*19.84	744,600	5.91	1.53	65	698,300	70
1909.	61,217,064	25.86	854,100	14.70	1.40	72	782,800	78
1910..	65,860,260	7.58	866,640	1.47	1.32	76	861,000	76
	709,247,408	6.03	9,117,393	6.04	1.29	78	8,969,435	79

*Decrease.

---

*99 John St., New York.

Mining Engineers Organizing in Germany

Our Berlin correspondent informs us that a German society of mining engineers and metallurgists is being formed with the object of furthering close coöperation between the science and the practice of mining. The society aims to be a representative body of mining engineers, to become a center for German mining engineers and to form a link between those at home and abroad. Further information and applications for membership should be directed to the Hill Publishing Co., Berlin, N. W. 7, who will pass them on to the promoters of the society.

New Hydro-electric Plant in Southwest Missouri

A 15,000-hp. hydro-electric power plant is being erected near Forsyth, Mo., on the White River in the Ozark Mountains. The three-phase alternating current generated at this place will be transmitted at 66,000 volts, 43 miles northwest to Springfield, and thence 80 miles west to Joplin. Connection will be made at Joplin with the transmission system of the Empire District Electric Co., which now supplies light and power service to the southwest Missouri lead and zinc mining district. An agreement with the latter company provides for the delivery of surplus power from the Ozark plant when required and the interchange of power during deficiency or interruption in either case. The plant is expected to be completed by Apr. 1, 1913. The General Electric Co. will furnish the electrical equipment.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Senator Smoot's Bill

Senate Bill 6194, entitled "A Bill to amend section 2322 of the revised statutes of the United States relating to mineral locations," was introduced by Senator Smoot on Apr. 5, 1912, read twice and referred to the Senate Committee on Public Lands. This bill reads as follows:

> Sec. 1. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that Section 2322 of the Revised Statutes be, and the same hereby is, amended to read as follows: "Locators of all mining locations heretofore made on any mineral vein, lode or ledge situate on the public domain, their heirs or assigns, shall have the exclusive right of possession and enjoyment of the lands so located and of the veins, lodes, or ledges apexing therein, as permitted by the customs, regulations and laws in force at the date of their locations, but from and after the passage of this act the locators of mining locations upon any mineral vein, lode, or ledge, or of a deposit of mineral or minerals in place, situate on the public domain, their heirs or assigns, shall, subject to such other rights as pertain to claims located prior to the passage of this act, have the exclusive right of possession and enjoyment of all the surface included within the lines of their locations and of such veins, lodes, ledges, and deposits of mineral or minerals in place as lie within the block of ground bounded by vertical planes passing through such surface lines, and no such locator, his heirs, or assigns, shall have the right under such location to follow any vein, lode, ledge, or other deposit outside of the limits of such claim.
>
> "Sec. 2. That notice of location of all mining claims, lode, or placer, made after the date of the passage of this act, must be filed for record with the register and receiver of the land district within which the lands are situated within one year from the date of each location, and unless final entry and payment be made for such claims within seven years after date of location, exclusive of the time covered by pending adverse claims, all rights thereunder shall cease."

It is certain that our mining laws are in need of revision and it is equally certain that the majority of those familiar with the operation of our present system are opposed to the extra-lateral-right principle. It is probable, on the other hand, that no general revision can be accomplished until a more insistent and wide-spread demand forces the serious attention of Congress.

That there is, however, serious danger of the passage of patch-work legislation which will involve the miner and prospector in greater confusion than that under which he now labors, is illustrated by this very bill, S-6194. It might well be called a bill to provide for locating the upper part of veins and depriving the discoverer of the fruits of his discovery beyond his surface boundaries. There are two objections to this bill, which will readily present themselves to the mind of any intelligent reader:

In the first place, it is vague and indefinite as to the character and identity of the "mineral or minerals," for whose location it attempts to provide. Our law has heretofore been all too general on this point, but it has at least specified "valuable" metallic minerals. Under the present act, it might be possible to locate "any mineral vein, lode or ledge, or deposit of mineral or minerals in place" such as salt, phosphate rock, potash rock, or even ledges or dikes carrying precious stones or magnesia or alumina or what not. Of course there should be provision in the law for the working of these and all other mineral substances under some form of possession by the operator; but their nature, comparative value and mode of occurrence should be taken into account and special laws framed accordingly.

The worst defect in the proposed bill lies in its attempt to abolish the extra-lateral-right provisions without at the same time doing away with the requirement for "discovery." Under this bill a prospector might, after discovering a vein, locate a mining claim 600 ft. wide (the maximum width, but only 300 in some States) and thus acquire the title to so much of the vein as lies vertically beneath his surface boundaries. If the vein dips at an angle of 45°, he must stop mining at the maximum depth of 600 ft. (or 300 if he complies with the law in making his location). He cannot locate the land on the dip of his vein until he gets there in some way with underground workings, because he cannot make a discovery. Hence he either loses his vein through the location of the adjacent property by others under some other mineral discovery, or by virtue of some other method of acquiring land, or it must remain unappropriated until he reaches it in the downward pursuit of his vein.

The difficulties certain to arise under such a law require no further description. It is incredible that such legislation could reach final passage without correction, and attention is called to it chiefly because of the example which it affords of the necessity for careful consideration of mining law revision by all who are in any way interested in the future of our mining industry and the development of our remaining mineral resources.

HORACE V. WINCHELL.

Washington, D. C., Apr. 11, 1912.

The Tomahawk Lode

I have no doubt that a large number of the JOURNAL readers are familiar with the fact that E. J. Hulbert discovered the Calumet & Hecla mines. Mr. Hulbert was one of the first explorers in the copper country, and few men knew this district better than he did. There is a story told about Mr. Hulbert and his explorations on the Lakes, which a large number of people believe true, but there are others who question the story.

It runs thus: Mr. Hulbert, after his discovery of the C. & H. conglomerate, continued his exploring and discovered a lode richer in copper than the Calumet & Hecla. This he kept secret for some time. Meanwhile he was making some land deals with a mining company. The mining company in this deal got the best of Mr. Hulbert, and he was so much hurt over the outcome of the deal that he told of the discovery of the lode, which he called the Tomahawk, but said he would never tell the location of it, and left this part of the country, finally going to Rome.

It is generally believed that the Tomahawk lode is a conglomerate, because it is richer than the Calumet & Hecla. The late Fred McKenzie, who was editor of the Calumet *News*, was an intimate friend of Mr. Hulbert, and corresponded with him in Rome. I was well acquainted with Mr. McKenzie. Mr. McKenzie wrote to Mr. Hulbert and told him that if he knew of a rich lode, it was not just the right thing to do to keep it a secret, as in that case it would do him or anyone else no good. Mr. McKenzie sent him my address and asked him to write me a letter and tell me about it, and Mr. Hulbert wrote me a long letter, of which the following is part:

He said he was exploring in this district, that he discovered near the east quarter post of Sec. 2, township 55, range 33, a large rock richer in copper than the Calumet & Hecla conglomerate, but it was not the same kind of rock. This rock at first appeared to be the outcropping of a lode, but in blasting into it it proved to be only float from some other lode as yet undiscovered but evidently a rich one

Mr. Hulbert's conclusions seem to be that as there was considerable overburden where the rich rock was found, that the lode must be some distance to the west, from which the rich rock was broken, as the appearance here is that in the glacial age all the floats were carried to the east. There is one thing in connection with this Tomahawk lode worthy of note. By consulting the map of this district, it will be noticed that the Hulbert float was on the line of the outcropping of the lode from which a rich diamond-drill core was taken a few months ago, from hole No. 16, on the Mayflower property, in Sec. 8, township 56, range 32. The rich rock was found about one-quarter of a mile east of the Oneco property.

Joseph Hosking.

Osceola, Mich., Mar. 28, 1912.

The College Man Underground

There was a time within my memory when the notion was prevalent among the mining men of Colorado that underground was quite the proper place for the college man, but the idea was vested with a sinister significance. But in these later days, the old-time prejudices are giving way before the fact that the college man is no longer oblivious to the value of a knowledge of the smaller practical details, but is working determinedly with the intention of getting more intimately in touch with them.

In those early days the impractical "book miner" and his imperfectly understood "theories" were the subjects of profane and unpublishable comments on the part of "practical" men, who had sledged their way up from the ranks. That many "practical" men had attained positions of importance, from which vantage points they could, if they chose, employ college men was sufficient evidence for the mining men to convince them that a college education, so far as mining was concerned, was of little or no value, and that the time spent in getting it was little better than wasted. But time and better acquaintance are bringing the two ogether. The college man is appreciating more fully than ever before the value of first-hand knowledge of the smaller practical details of his chosen profession and the "practical" man is daily facing problems the only solutions of which are o be found in a broader and deeper knowledge of the basic principles; access o which has, in large measure, been denied him by the necessarily narrow scope of his operations.

But in taking his course in the colege of hard knocks, the practical man has more or less consciously developed he commercial sense. In this the college man is sadly deficient. His college trainng, insofar as its money getting features may be considered, makes him a salary seeker. He meditates on a better job at a higher salary. The practical man, who not infrequently pays the salary, may well be imagined as saying to himself in his complacent moments: "Well, I didn't need to go to college after all. There are plenty who did it for me."

The college course cannot impart a knowledge of the practical details, neither does it develop the business sense, which leads to the idea that the college man might well work underground until he can lay aside from his wages enough to keep him in "grub" while he develops a prospect or works a lease "on his own hook." If he should find it necessary to go out among the moneyed men to promote his proposition, he would find opened up before him a broad field filled with educational opportunities. Though this field has been discredited by its having been the stamping ground of fakirs and charlatans, it is none the less legitimate. His operations in this field would not only broaden immensely his understanding of the business of mining in its ramifications, but would generate within him a spirit of independence and self-reliance that has its spiritual and money value. Such a course might land him in the president's chair of a prosperous mining company, instead of halting him half way at the desk of the superintendent.

R. D. O. Johnson.

Medellin, Colombia, Mar. 28, 1912.

Atomizing Metals

The recent advertisements of the atomized-metal makers recall the expedient by which a friend of mine used to make test lead about a dozen years ago. The lead was melted in a small kettle and poured by hand into an iron amalgam retort; in the bottom of the retort a hole was bored, into which any one of a number of small nipples could be screwed. These nipples were pierced with holes varying from $\frac{1}{32}$ to $\frac{1}{16}$ in. in diameter. The lead flowed through the hole and was allowed to fall freely through the air. A little below the exit was a flattened pipe which delivered a blast of air at a pressure of 2 lb. per sq.in. against it. This jet was inclined slightly downward.

The flowing stream was immediately disrupted and blown off to one side. The lead as it fell formed a more or less solid cake, which, however, broke up when placed on a sieve. If the air blast were cold, the lead particles were beautifully white and free from oxide, and could be molded by simple hand pressure into "snowballs." I once saw a number of samples of his product, the particles of which appeared to be about 60 mesh.

He told me that he once sent a sample to a test-lead manufacturer asking for bids on a similar grade of material, and received the answer, "We cannot afford to polish each grain by hand, considering the present price of test lead." The manufacture was given up by him when the manufacturers eventually improved the grade of their lead.

Thomas McKittrick.

New York, Apr. 11, 1912.

The Steel Used in Drilling

Much has been written pertaining to the results achieved by drills of modern design. Little, however, has been published in regard to the steel of which the drills bits are made. The time has now come when any further increase of drill power must be attended by the use of stronger and better steel, for even some of the machines now in use strike so hard a blow that trouble is frequently experienced from the bending of the best grades of high-carbon drill steels, or under the shower of rapid blows of the air-hammer drill the phenomenon called "crystallization" causes annoyance through the breaking of cutting edges and shanks of the bit.

There has been a tendency even among the contractors to dispense with use of large steel, and inch or 1¼-in. steel is now the standard in most drilling work. The hollow steels, particularly the round section, are gaining favor, and their adoption is rapidly extending. The star or cross-section is highly esteemed in the West, because of the greater clearance afforded for the ejection of cuttings.

The air-hammer drill has been a stimulus to steel manufacturers to produce a higher quality of material, and some are now investigating the merits of alloy steels. One company has already placed a vanadium steel on the market and a Western company has given an order for a consignment of chrome steel for experimenting with drill bits of that material. It is a growing opinion that these alloy steels will ultimately be proven not only to be superior to ordinary drill steel, but absolutely necessary if more powerful machines are built. At present, however, alloy steels for drill bits have not been proven to be better than the best American and Swedish drill steels.

Drill Sharpener.

Victor, Colo., Apr. 6, 1912.

Byproduct Coke Ovens

On p. 497 of the Journal of March 9, 1912, is given a list of byproduct coke ovens operating in the United States, as of Jan. 1, 1910. The following additions will bring it up to Jan. 1, 1911 (cf. *Journ. Ind. and Eng. Chem.*, March, 1912). *Koppers*: Woodward Iron Co., Woodward, Ala.; Tenn. C. I. & R.R. Co., Corey, Ala. *Rothberg:* Cleveland Furnace Co., Cleveland, O.; Lackawanna Iron & Steel Co., Lebanon, Penn. *Didier:* Lehigh Coke Co., South Bethlehem, Penn.

H. J. Martin.

New York, Mar. 23, 1912.

North Star Annual Report

A summary of the results of operations for the year ended Dec. 31, 1911, at the property of the North Star Mines Co., at Grass Valley, Calif., is given in the accompanying financial statement, which has been prepared from data given in the annual report recently issued. The most striking difference between the years 1910 and 1911 is the lower yield from the ore milled; $13.683 for 1910, as compared with $10.745 for 1911. The difference was due in part to more systematic working of the stopes throughout the mine, without effort to mine the richer ore exclusively. The operating costs for 1911 were 27c. per ton less than for 1910, and this reduction was accomplished in spite of more care being taken in sorting out waste in the mine and on the surface, which, of course, reduces the tonnage per unit of vein area worked. The cost of development work was also reduced 7c. per ton, so that the total cost for operation and development was 34c. less for 1911 than for the previous year.

NORTH STAR FINANCIAL STATEMENT, 1911

Receipts

Balance on hand, Jan. 1, 1911..		$1,045,514
North Star mine production, 98,400 tons, less 2999 tons sorted out, leaving 95,401 tons of ore milled containing $10.985 per ton:		
Yield by amalgamation	$790,300	
Yield by cyaniding concentrate	71,561	
Yield by cyaniding tailing	163,226	
Loss in tailing.....	23,000	
Total gold in ore..	$1,048,087	
Total gold recovered, $10.745 per ton		1,025,087
Interest and dividends received		42,273
Total		$2,112,874

Disbursements

Operating expenses:	Per ton milled	Total
Mining	$3.317	$316,438
Milling	0.526	50,220
Concentrating	0.138	13,155
Cyaniding	0.541	51,571
Bullion	0.031	2,922
Miscellaneous	0.311	29,713
General	0.163	15,557
Taxes	0.282	26,928
Accident and benefit	0.064	6,129
Total	$5.373	$512,633
Less sundry receipts	0.028	2,708
Total operating expense	$5.345	$509,925
Development	0.487	46,481
Total operating and development	$5.832	$556,406
Cincinnati Hill development		46,445
Property purchases		11,620
Champion mines option.....		154,701
Dividends, 27-30, 17%.....		425,000
Balance, Dec. 31, 1911......		918,702
Total		$2,112,874

In the annual report for 1910 it was indicated that a small quantity of ore remained available in the upper workings, or above the 2700-ft. level. This ore, amounting to 7450 tons, was mined early in 1911, and the resources of the upper mine are now exhausted and work has been discontinued there. All the workings below the 2700-ft. level are operated through the Central vertical shaft. The ore mined below the 2700-ft. level was broken chiefly in the stopes at the 3000-, 3400- and 3700-ft. levels; the quantity was 90,590 tons, from which 2999 tons of waste was sorted.

Development work in extending drifts and raises was done between the 3000- and 5300-ft. levels. Ore of fair grade was found at the 5300 or lowest level, indicating the continuance in depth of profitable ore. It is not possible to make any precise statement of the ore reserves, as the vein is so irregular in size and so erratic in its tenor of gold, but it may be said that the new ground opened is likely to yield a supply of ore equal to that extracted during the year and developments indicate that the present scale of operations can be maintained for several years to come.

The results of exploration work on the Cincinnati Hill claim were disappointing, and as further work does not seem to be justified, it must presently be abandoned.

Early in 1911, the company obtained an option on the Champion group of mines, situated at Nevada City, about six miles from Grass Valley. This property comprises a number of mines and claims, some of which have been large producers in the past, and covers an extensive area of promising ground. An examination was made and some preliminary work undertaken, but it was found that there was no possibility of reaching any reasonable conclusion as to the value of the property within the time specified in the option, which was accordingly surrendered. Subsequent negotiations resulted in the taking of a new option, effective until July 2, 1913, under which active operations were carried on during the last six months of 1911. Much work has been done in cleaning out and retimbering old levels, repairing and retimbering shafts, installing new pumps and other machinery, and generally in bringing the property to a condition now about reached where actual opening of the ground can be undertaken. Development and exploration work will be vigorously carried on during the coming year in the hope that enough will be accomplished to justify an estimate of the value of the property, which will enable the company to decide whether to exercise or abandon its option. The reopening of this group of mines, practically abandoned and with many of the workings filled with water, was warranted, in the opinion of the directors, by the history of the district and by the geological conditions, which seem to indicate that the veins continue in depth; and the directors have accordingly felt justified in providing the necessary funds from the accumulated surplus of the company, believing that an opportunity is offered of acquiring at a moderate price a property for which, if developed and operated under economical conditions, a prosperous future may reasonably be expected.

Mining Affairs in Germany

JENA CORRESPONDENCE

The all absorbing topics in Germany's financial and mining circles during the last month or two have been the dissensions in the board of the Hohenlohe Werke Aktien-Gesellschaft, which reached their climax in the resignation of two directors and the dismissal of the managing director, and the coal miners' strike in the Ruhr district, which ended in a fiasco.

DISSENSION IN HOHENLOHE COMPANY

The Hohenlohe Werke A. G., commonly though incorrectly referred to as the "Princes' Trust," is an Upper Silesian concern, which owns extensive coal fields, part of which are developed, zinc mines and reduction works. The majority of the stock is owned by Prince Hohenlohe, a wealthy landed proprietor; the minority interests are represented by the Deutsche Bank, which had two seats on the board. The managing director, having incurred the wrath of the prince by some disastrous investments in Norwegian ore and in German potash mines, by opposing the plan of opening up the coal fields of Gleiwitz and by extravagances committed in improving the grounds of the general manager's residence, an investigation was ordered of the internal affairs of the management, and was made by chartered accountants of the Deutsche Treuhandgesellschaft (guaranty trust company), of Berlin. Thereupon the two directors representing the Deutsche Bank resigned from the board in evidence of their disapproval of what they considered unwarrantable proceedings.

They claimed that the above mentioned investments were ventures sanctioned by the full board, that by opening the coal fields of Gleiwitz at the present time the Upper Silesian market, which is already overstocked, would be deluged and the valuable coking coal of the Gleiwitz field would have to be sold at a sacrifice. The expenditure of 1,200,000 m. for improvements upon castle Michalkowitz, the general manager's residence, and its park, distributed over a space of six years, was not considered extravagant. Meanwhile the chartered accountants went through their work and found nothing disparaging to the management. Nevertheless, Managing Director Lob was removed from his position, and Mr. Trippe appointed to take his place. Despite all this unpleasantness the Deutsche Bank is continuing its business relations with the prince's concern by underwriting 40,000,000 m. of bonds for it, secured by a mortgage on the Hohenlohe mines and works.

STRIKE OF COAL MINERS

Following this sensation came the coal miners' strike, which was foreshadowed months ago, but did not take shape until after the British miners' strike was in full swing. The most conspicuous place of operation was the Ruhr district, where about 370,000 men are employed at the mines. The employees of the mines are compelled by law to join the *Knappschaft*, a mutual-aid society which affords relief to the sick, invalids, widows and orphans from a fund that is maintained through fixed contributions from the mine workers and the employers, the latter having to pay at least one half of the former's quota. All fines and dockings likewise flow into this fund, which is administered by a board of managers selected in equal numbers by employees and employers. The board of managers is under the surveillance of a government council.

By virtue of the right of coalition the mine workers have, however, organized besides separate trade unions for the promotion of their special interests in regard to wages, time of work and kind of work and for accumulating and maintaining a strike fund. In the Ruhr district there are quite a number of these unions. The five more prominent ones in numbers of members are the following: (1) The social democratic, or "old" miners' union; (2) the Hirsch-Duncker miners' union; (3) the Polish miners' union; (4) the Christian miners' union; (5) the "yellow" miners' union. As its name implies, politics plays an important part in the organization of the social democratic union, and it is the most grasping and restive of all. Nos. 2 and 3 pay less attention to politics than to their own particular interests. No. 4 is influenced to some degree by its religious advisers. No. 5 is, on the whole, loyal to its employers. It derives its name from the yellow color of its member cards.

OPERATORS OFFER 10% INCREASE

It was rumored that in consideration of the rise in the price of coal and the growing dearth of the commodities of life, the coal operators would raise the wages of their employees about Apr. 1 by 10%. This did not satisfy the social democrats; they clubbed together with the Hirsch-Duncker and the Polish unions, the others declining to join, and presented a list of 10 demands to the operators through their leaders, foremost of which was a demand for an increase of 15% in wages and a reduction of working time from 8½ to 8 hours.

The operators declined to arbitrate with other than the workmen's committees from their own mines, and so the strike was proclaimed on Mar. 10, when a vote was taken at a convention of delegates from the different mines assembled at Herne, Westphalia, an overwhelming majority pronouncing in favor of the strike. Needless to say incendiary speeches *à la* Dennis Kearney were made by agitators to stir up the feelings of the wavering ones. On Monday, Mar. 11, about 58% of the workmen did not go to work.

In the meanwhile the government had quietly distributed 6000 state police over the most populous parts of the district to prevent outrages and protect the men willing to work. When, however, riots broke out in several places and it was feared that the police would not suffice to keep order, a military demonstration was made by the government by sending a few regiments of infantry and some squadrons of cavalry to Dortmund, a good distributing point for troops. This had a good effect.

The number of strikers fell off from day to day and, finally, when the operators gave notice that those who did not return to work within three days would lose their jobs, there was a general stampede from the ranks of the strikers. When the leaders saw their game would be lost, they called another meeting of delegates to Bochum for Mar. 19, and advised their followers to return to work. A vote was taken upon this proposition and a majority of the delegates, although not a large one, concluded to give in. So the strike was declared off, and on Mar. 20 most of the strikers reported for work.

STRIKE LASTED ONLY NINE DAYS

The strike had lasted just nine days, and benefited, if anyone, the operators only, for they were able to dispose of their old and deteriorated stock at enhanced prices. None of the iron works had to be shut down on account of the strike. Upper Silesia would have been able to reconquer most of its ground lost to the British, if the government had had the foresight to provide for cars to move coal and coke at a livelier rate. But, as usual, there was a great shortage. This is an argument against state ownership of railroads.

The strike fever crept slowly all over the coal districts of Germany, only in a minor degree, and did not affect the lignite districts. It is now dying out fast. In Bohemia the coal miners do not seem to have come to rest yet. As far back as Mar. 9 the two miners' unions, the Czech national and the Czech anarchist, had a meeting at Brünn, at which it was resolved to send three delegates to each pit and present the following demands to the managers: (1) Establishment of a minimum wage of 5 kronen ($1.06) per shift; (2) revision of the tributes; (3) 8-hour shifts. No settlement has been reached yet and most of the mines are idle.

Explorations in the Trans-Baikal province in Siberia have shown several large deposits of tungsten ore, but none of them has yet been worked.

Appraising Mines

The following remarks of J. R. Finlay, delivered before the Harvard Engineering Society of New York[1], are of particular interest in connection with his appraisal of Michigan iron and copper mines, published in the JOURNAL some months ago.[2] Mr. Finlay said in part:

My appraisal of the copper mines met, I think, little opposition in Michigan, but in the East it raised quite a storm of dismay and disapproval because it was too low. I had the pleasure, therefore, of finding myself denounced as a bear and a bull at the same time. The work had been pursued on a logical basis, and, if it was right in one case, it was right in the other. If it was wrong in one case, it must be wrong in the other, and for the same reason. It was extraordinary to please nobody. Independent and disinterested engineers were good enough to show a marked approval of the work. It was perfectly evident that the attacks of the appraisal came from two sources and were dictated by two opposite points of view.

THE POINT OF VIEW

The copper valuations were thought to be too low by men who were interested in the stocks and had little or no interest in taxes. The iron valuations were thought to be too high by men who had no interest in stocks, but who were highly interested in taxes. The iron men worship only one god; his name is not Mammon, but "Cost Per Ton."

The difference in the point of view is sufficient to explain the vast difference in the valuations that had ruled in the two groups of properties. The stock owner and speculator lives on an exaggeration of hopes; the plain mine operator is oppressed by an accumulation of fears. He has to face, unsupported, the dangers and uncertainties of the mysterious underground, and he has to warn his owner or associate constantly against entertaining hopes that may not be realized. The stock seller profits by an irresponsible optimism to support which he has to flout as pessimism what is really common sense. The plain miner clings to the conditions of the moment, sees little except his ever present difficulties and denounces as visionary the man who tries to take a bird's-eye view, reducing his ups and downs to the plane of averages, or who values his plant at more than it cost.

MINING STOCKS GENERALLY QUOTED TOO HIGH

That mining stocks are generally quoted at too high prices is generally known to, and deplored by, mining engineers. It is so well known that most men in the business feel that to buy mining shares is not a serious investment in property, but a speculation in human nature. I am not speaking of the innumerable wild cats that are palmed off on the ignorant, but the great dividend-paying stocks. I can prove this by a few facts that anyone can understand.

---

[1] Harvard Engineering Journal, January, 1912.

[2] Eng. and Min. Journ., Sept. 9, 16, 23, 30, and Oct. 14, 1911.

In 1910, twenty-one leading copper companies produced 1,045,000,000 lb. of copper. Calculating their average price as a mean between high and low quotations for the year, their average value was $754,000,000. The dividends paid were $35,800,000, equal to 4.76 per cent.

In the same year, 21 leading railroad stocks, calculated in the same way, showed a dividend of 4.96 per cent.

Fearing that 1910 might be an off year for the copper business, I looked up the record of the same mines for a period of five years ending with 1910. During those years copper averaged over 15c. per lb. The average dividend on the average selling price was 5.19 per cent.

Mining an Exhaustive Enterprise

These facts are so easily understood as scarcely to require comment. It is perfectly evident that the copper shares are too high. The railroad dividends are a real profit on a stable investment. The mining dividends are a return of capital as well as interest. The railroads are a better property year by year, the copper mines are sure to play out. No amount of iteration can add much to the force of these plain facts. This great mass of property is yielding to the investor only the interest that he can get on a thoroughly secured bond or mortgage. It is doing nothing whatever to return the principal. The true logic of the situation is that the dividends of these copper mines, instead of being a gain of $35,000,000 a year are to the actual investor a loss of $35,000,000 a year, for the public must be prepared sooner or later to lose the purchase price in a lump at the date when each mine will be exhausted, or it must, in order to make good the principal, forego the enjoyment of the interest which it should properly be able to spend; for it is plain to make good the principal on these investments the whole dividend will have to be put into a sinking fund. Whether such a sinking fund could be made to cover the purchase prices by the time of the exhaustion of the mines, is itself a doubtful proposition.

Modern Methods Hasten Exhaustion

The salient fact about the mining business is that it involves the rather rapid exhaustion of individual deposits and groups of deposits. The increasing efficiency of modern methods introduces economy very largely by increasing the speed of the operations and diminishing instead of increasing the life of the mines. Advancing knowledge of the geology of ore deposits and more comprehensive methods of exploring and finding them, while largely preventing the stoppage of operations through mere failure to find the ore, really hasten and make more thorough and certain the final exhaustion of each unit. The function of science in prolonging the life of the mining business really lies in widening the field in which fresh deposits are found.

All these observations are, to the mining engineer, so trite as to be threadbare. I am sure that most of you are fully aware of the truth of them. You do not need to be told that the dividend on a mining stock should be more than the interest on a bond, or the dividend on the stock of a growing railroad. What I think you do not know and the public does not know is the fact that the average dividend of good copper mines makes such a low return on the average price. I did not know it myself until I recently looked it up. It comes in very handy, however, as an illustration of how utterly impossible it would be for any sane engineer to make a serious report on the valuation of copper mines which would not be disappointing to the average stockholder.

Effect of Over-popularity

You will observe that I am speaking in general terms and using the average of a number of properties. I am not attacking anybody. Nothing could be more absurd than to expect the owner of shares to sell them for less than he could get for them. It is probable that this kind of investment is suffering from over-popularity, just as other kinds of enterprises have in innumerable cases.

It is probable that copper shares are more overvalued than other mining stocks just at present, because they are popular; but this is recent and may not last long. It is only within the last 10 years that speculation in copper stocks has become widespread.

In other mining stocks, the public seems to have better appreciation of the realities. The Treadwell group of mines are probably as long-lived as any, or almost any, of the copper mines, but the shares have sold at prices which gave a dividend return of 13%; many of the Cripple Creek gold mines yield from 12 to 20%; the Homestake shares about 7%, and Goldfield Consolidated over 30 per cent.

It is generally supposed in this country that gold mining is a much more risky and generally less productive venture than copper mining. This idea has some foundation, so far as the United States is concerned, but as a general proposition it is a great mistake. The value of the annual gold production of the world is fully twice that of copper; the margin of profit is quite as large and the life of the mines fully as well assured. There have been times when gold mining has taken the form of a craze, but the present is not one of those times.

William A. Lathrop

William A. Lathrop, president of the Lehigh Coal & Navigation Co., and the Lehigh & New England R.R., one of the foremost men in American coal-mining circles, died Friday, Apr. 12, at the City Hospital, Wilkes-Barre, Penn., following an operation for appendicitis. His condition had been critical for several days, and a number of specialists had been summoned to his bedside.

Mr. Lathrop was 58 years old. He was born in Springville, Susquehanna County, Penn., and acquired his earlier education at the schools of that town. Later he entered Lehigh University, and in 1875 was graduated with honors as a civil engineer. He afterward took a course in mining and received his degree of mining engineer from the same institution. For two or three years after his graduation, he was employed in various minor capacities, both in the anthracite mines and on railroad work in the Wyoming and Lehigh districts of Pennsylvania. Mr. Lathrop subsequently became assistant to Robert H. Sayre, chief engineer of the Lehigh Valley, and filled this position with great credit for several years. He was later associated with Major Irving A. Stearns, of Wilkes-Barre, and for a time took over the management of an iron-mining enterprise in northern New Jersey.

In 1881, when the Southwest Virginia Coal Co. required a superintendent and mining engineer to open up its prospects in southwestern Virginia, Mr. Lathrop was selected for the position. He started the mines which have since become the center of the Pocahontas field, and incidentally laid out and built the present town of Pocahontas.

After several years of labor under great difficulties in this pioneer work in Virginia, he returned to Pennsylvania to take charge of the bituminous mines of the Lehigh Valley Coal Co. at Snowshoe, in Center County; in 1888 he was made superintendent and general manager of all the Lehigh Valley mining operations, succeeding the late Frederick Mercur. Mr. Lathrop remained at Wilkes-Barre in this capacity until 1902, when he resigned to take the presidency of the Webster Coal & Coke Co., operating in central Pennsylvania, and later was made president of the Pennsylvania Coal & Coke Co. When that company leased its mines and lands to other interests, he became president of the Lehigh Coal & Navigation Co., with headquarters in Philadelphia, succeeding Lewis A. Riley. To his constructive

---

Note—Abstract from "Coal Age."

ability, foresight and perception of the necessities of the future are largely due the many improvements which the "Old Company" has already carried out and still has under construction, including the Panther Creek drainage tunnel, the direct railroad connection with the Lehigh & New England R.R. and the erection of a great central power plant, which has just been begun.

Mr. Lathrop was a member of the State Commission appointed by Governor Tener a few months ago to devise a plan for the protection of the surface of the anthracite region from damage by mine caves. He was a trustee of Lehigh University, president of several coal companies, a director of the People's Bank, of Wilkes-Barre, and of the Fourth National Bank, of Philadelphia, a member of the American Institute of Mining Engineers, the Mining and Metallurgical Society, the Union League, University, Art and Downtown clubs, of Philadelphia, the Westmoreland Club, of Wilkes-Barre, and the Pennsylvania Society of Sons of the Revolution. Although, in recent years, much of his time was spent in Philadelphia, Mr. Lathrop made his home at Dorranceton, near Wilkes-Barre. He leaves a widow and one daughter.

Production of Fullers Earth in Florida

The production of fullers earth in Florida in 1911 was about 25,000 tons; in 1910 Florida produced 18,832 of the 32,822 tons of fullers earth mined in the United States, according to a recent report by E. H. Sellards of the Florida Geological Survey.

The Southern Fullers Earth Co. and the Owl Commercial Co. were combined during 1910, and reorganized under the name of the Floridin Co. During 1911 this company continued the operation of two plants in Gadsden County, one at Quincy, and one at Jamieson. A new plant, that of The Fullers Earth Co., began operating in 1911 at Midway, in Gadsden County. In Manatee County the Atlantic Refining Co. mined, as in former years, at Ellenton. The Florida Fullers Earth Co., also near Ellenton, operated during a part of the year.

German 1911 Potash Exportation

There were exported in 1911 from Germany 11,549,730 metric quintals of raw potash salts such as kainite, kieserite, etc., valued at $7,601,720. Of this quantity 6,425,734 quintals went to the United States. Potassium sulphate was exported to the extent of 1,095,548 quintals, valued at $4,462,500; of this quantity 569,695 quintals went to the United States. The amount of potassium-magnesium sulphate exported was 2,825,742 quintals valued at $4,764,760; of this quantity 1,437,746 quintals went to the United States. Potassium chloride exported amounted to 3,297,342 quintals, valued at $11,735,780; of which 2,292,398 quintals went to the United States. On Mar. 1, 1912, there were 97 works in the potash syndicate.

The Steel Corporation and Labor

At the annual meeting of the United States Steel Corporation, on Apr. 15, the eight members of the board whose terms expired were reëlected for three years: Henry C. Frick, William H. Moore, Norman B. Ream, James H. Reed, Percival Roberts, Jr., Charles Steele, Peter A. B. Widener, and Robert Winsor. The routine proceedings at the meeting presented nothing special.

STEEL LABOR CONDITIONS

The interest of the meeting centered in the report of the Committee on Labor Conditions, which was appointed last year on motion of Charles M. Cabot, of Boston, who has since been active in various ways in investigating and discussing the labor question. The committee was headed by Stuyvesant Fish, and had prepared an elaborate report.

Immediately after the reading of the annual report for the year, Chairman Gary took up the vexatious question of labor conditions. He supplied the stockholders at the meeting with a pamphlet containing replies to a circular letter, and a booklet describing the result of an investigation of hours of labor in the steel industry, made by John A. Fitch, of the Pittsburg Survey, at Mr. Cabot's request, and sent by him to 15,000 stockholders.

Judge Gary said that only 92 replies had come in from the list of 15,000 addressed, and of these only 13 were in favor of an eight-hour day. Most of this number, he added, came from clergymen and women. In further explanation of the attitude of the Steel Corporation, Judge Gary gave out copies of a circular letter sent to stockholders on Mar. 12, which briefly set forth Mr. Cabot's contentions and explained what the Steel Corporation has endeavored to do in the amelioration of labor conditions.

The report took up the labor problems under four heads, the "seven-day week and long turn," the "twelve-hour day," the "speeding of the workman," and the "repression of the men." This report condemns the seven-day week and the twelve-hour day, and makes suggestions for reductions in hours from these extreme limits wherever possible. Of the speeding of the workman, however, the report fails to find any abuse of the bonus or piece-payment system, and, in fact, praises this means of effecting *esprit de corps* in high terms.

The committee seemed somewhat in doubt as to what is meant by "repression of the men," and says:

"If it involves the question as to what measures the officers of the Corporation should adopt for the suppression of organizations that in the past have, at times, proved irresponsible and incapable of self-control, that have advocated and ofttimes insisted upon what are believed by many to be fallacious theories and practices, then, at least, the charge may well be open to discussion.

"As a committee of stockholders we do not believe the final solution of the problems involved in this question has been reached. We do believe the present methods are preferable to the old for all concerned, and that the Steel Corporation, in view of the practices often pursued by labor organizations in steel mills in past years, is justified in the position it has taken.

"That the method of employment of today must prove to be the best for the future is a question on which there may well be a difference of opinion. The interests of society and the community at large will not best be served by that type of mind, whether it be employer or employee, which bases action on the assumption that might makes right. On the contrary, the adjustment of the relations between employer and employee is a task for men of sound minds, reciprocal natures, broad sympathies and courage, men who believe that the future may be made better than the present. May it not be reasonably hoped that such men, whether they be officials or wage earners, may more and more be found working together to bring forward the day when employer and employee shall enter into a common administration of industrial interests?"

The reading of the report was followed by a sharp discussion. It was attacked by Mr. Cabot and defended by Mr. Fish, and there was some sharp personal discussion between Mr. Cabot and Judge Gary. A strong plea was made for a further investigation, but no action was taken.

Apparently this ends the matter, so far as official action by the Corporation is concerned. There is little doubt, however, that there will be further agitation on the part of Mr. Cabot and those who are associated with him.

A special meeting of the stockholders of the Guggenheim Exploration Co. is to be held on Apr. 17 to vote on reducing the par value of the stock from $100 to $25 per share. The company is capitalized for $22,000,000, and four shares of new stock will be exchanged for one share of old. It is said that the company will apply for listing on the New York Stock Exchange. The stock has recently been selling at about $225 on the curb market.

Details of Practical Mining

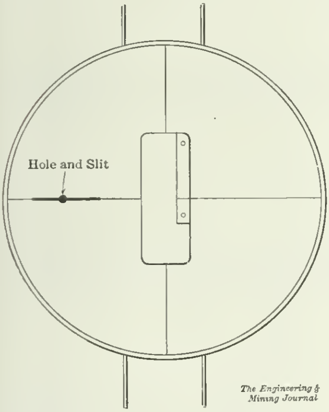
Accounts of Useful Ways of Doing Many Things in the Day's Work

Target for Mine Surveying

By Walter R. Hodge*

To the transitman who has need for a target underground, the rig shown in the accompanying sketch may be of interest. It is used in some of the mines of the Mesabi Range and I believe originated there.

A hole 0.05-in. diameter is bored in the target on the sides opposite the thumb-screw, midway between the center and edge of the target. Extending on either side of the hole for ¾ in. is a slit of a V-shaped section, the narrow end of the section cutting the front surface of the target. In practice a candle or lamp is held behind the target so that the level line shows as a narrow bar of light by which the target may be set accurately.



Target for Underground Surveying

Shaft Water Used to Drive Fan

At the Bowhill colliery in Scotland, the problem of ventilating one of the lowest seams was solved in an ingenious manner by utilizing the water that drained into the upper part of the shaft to drive a Pelton wheel connected with a Sirocco fan.

The mine, in common with many others in the district, was operated through a wet, downcast shaft, the water from which formerly drained into a sump at the bottom and was pumped to the surface. The lining of the shaft was cut and a collecting ring provided to divert the water into a tank which was installed in a room cut in the wall of the shaft for the purpose.

The ring and tank were 295 ft. above the bottom of the shaft. A 4½-ft. Pelton wheel was installed at the level of the lowest seam and was driven by the water collected in the tank in the shaft and conducted to the wheel through a suitable pipe.

The Pelton wheel drove a Sirocco fan of the double inlet type, 5 ft. in diameter, capable of delivering from 60,000 to 90,000 cu.ft. of air at a water-gage pressure of one to three inches. In order to stop the fan a bypass valve was provided by which the water could be diverted from the Pelton wheel and discharged directly through the pipe leading from the shaft tank to the sump to which the main mine pumps were connected.

Preventing Freezing of Air Exhaust

Alcohol is used to prevent freezing at the exhaust of the air-operated shot drills in use at the site of the new station in New York of the N. Y. C. & H. R. R.R. The New York Central railroad has had occasion to do an enormous amount of core drilling within the last 15 years, and in this work several types of drills have been used. One of the most interesting outcomes of the work is the freezing-prevention appliance that can be readily adapted for use on any small air-operated machine where trouble is experienced from freezing at the exhaust.

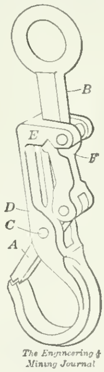
Alcohol is admitted to a vertical part of the air-supply pipe and close to the machine. The device used for feeding the alcohol is attached to the feed pipe as is a lubricator. It consists of a piece of 1½-in. pipe about 12 in. long, fitted with bushings at the top to take a piece of ½-in. pipe six inches long. The small pipe is closed by a valve. The other end of the 1½-in. pipe is fitted with bushings to take a 3-in. piece of ½-in. pipe, to which a valve and an elbow are attached and into the elbow another short piece of ½-in. pipe is screwed. The threaded end of the last-mentioned pipe is screwed into a hole tapped into the air pipe so that when screwed tight the 1½-in. pipe is parallel to the air pipe.

By opening the top valve, the 1½-in. pipe can be filled with alcohol. That valve is then closed, and, when the machine is operating, the lower valve is opened just enough to permit drops to pass slowly. The admixture of alcohol vapor in the air effectually prevents freezing at the exhaust. The 1½-in. pipe, which has a capacity of about one pint, is usually filled with alcohol twice per shift.

A Safety Hook for Hoists

A patent was recently granted in Great Britain for the safety hook shown in the accompanying sketch, the operation of which is apparent. The opening of the hook is closed by the simple lever *A*, one end of which is attached to the sliding member *B* as shown.

When the rope is slack the sliding member slips to its low position opening the hook by raising the end of the lever *A*. Upon taking up the slack of the hoisting rope, the hook opening is closed by the lever. The pull of the rope does not come on the pin *C*, but upon the part *E* of the body of the hook *D*, a projection *F* of the sliding member engaging the part *E* of the body.



A Self Locking Hoist Hook

The angle of inclination, in stoping by the shrinkage method, should be such that the broken ore will run freely when drawn off; otherwise removal of the ore will be difficult, and hence costly, as it is often impossible to enter the opening after a large amount of ore has been withdrawn.

---

*Mining engineer, 134 College Ave., Houghton, Mich.

Splicing Wire Rope

Wire rope is susceptible of almost perfect splicing and the operation is so simple, states F. L. Johnson in *Power*, that it may be learned in an hour by any mechanic who is at all skillfull in the use of ordinary tools. For all kinds of transmission rope the long splice is used and should not be less than 16 ft. in length for ½-in. rope and increasing to 30 ft. for the larger sizes.

Where the splicing must be done in position, rope blocks are used to draw the wire taut, as in Fig. 1, care being taken to make fast far enough from the ends to leave plenty of room for the splice and the men who make it. If possible, it is better to hold the rope taut, mark the splice on both ends, by securely winding with No. 20 annealed-iron wire, throw it off the sheaves and make the splice on the floor or staging, as may be most convenient.

The strands of both ends are unlaid, back to the points wound with wire, the hemp core cut off and the ends of the rope brought together with the strands interlaced, as shown in Fig. 2. Any strand, as *a*, Fig. 3, is now unlaid and closely

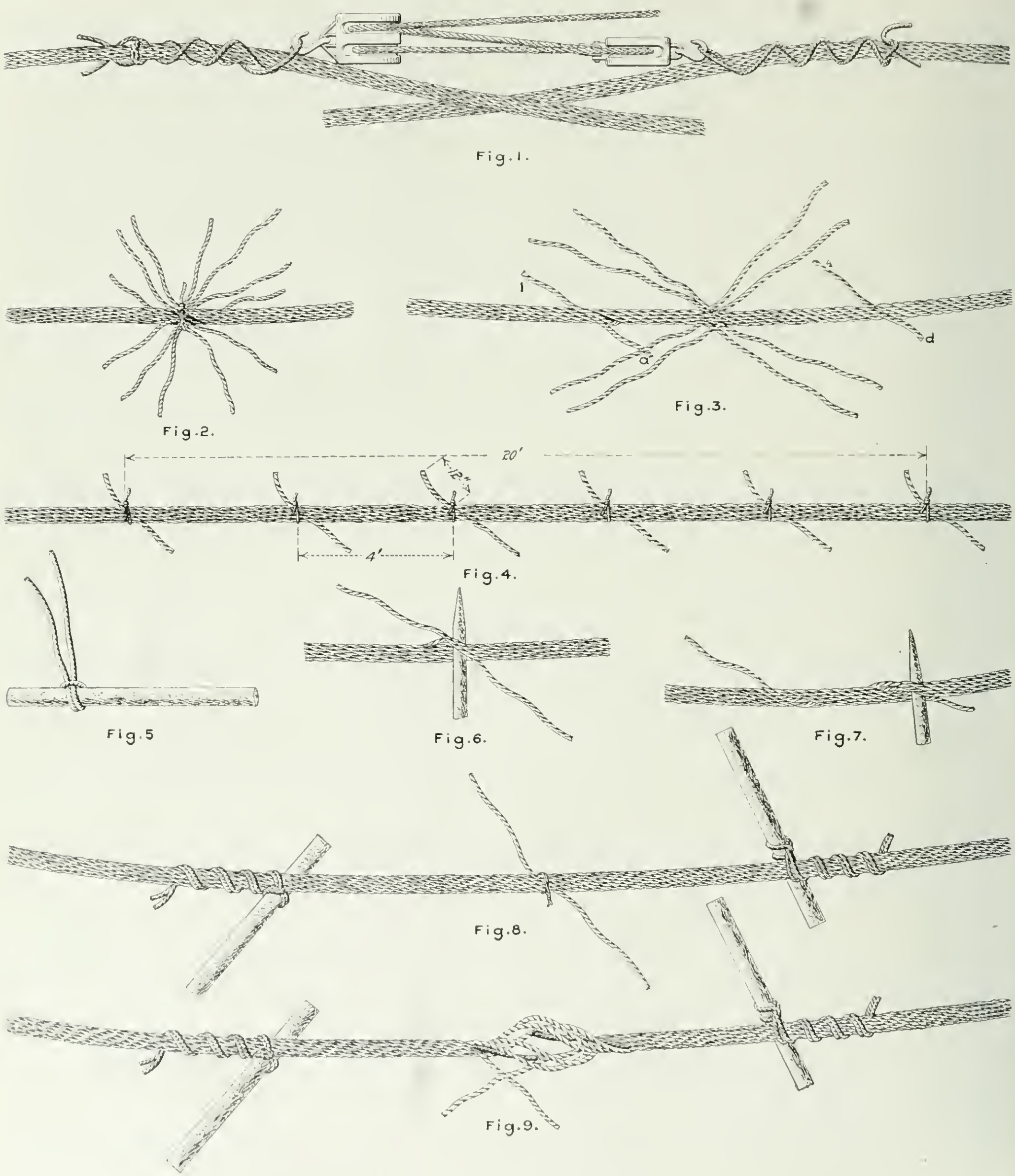


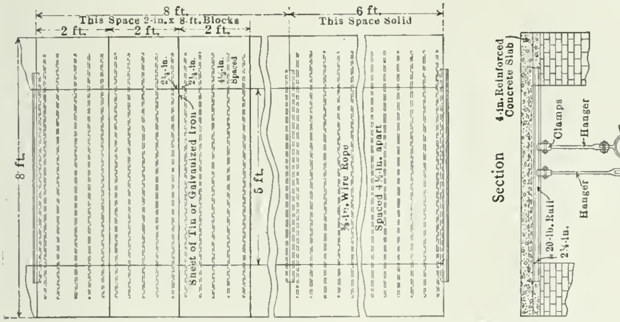
Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5 Fig. 6. Fig. 7. Fig. 8. Fig. 9.

Methods of Splicing Wire Rope

followed by the corresponding strand 1 of the other end of the rope which is pressed closely into the groove left by the unlaid strand. The unwinding of one strand and the inwinding of the other are continued until all but about 12 in. of strand 1 is laid in, when *a* is cut off at the same length and both strands securely tied with cord. Strands 4 and *d* are next treated in the same way and the process is repeated with each pair of strands until all are laid and cut, the projecting ends being tied as shown in Fig. 4 to prevent unwinding.

When this has been done the splice is bent and worked in all directions until the tension in all the strands is equal and the rope as flexible there as elsewhere. If this is not done and there is more tension in some of the strands than in others when a stress is put on the rope, these strands will pull into the rope, making a bad looking and weak splice.

Next, the open or free ends of the 12 strands are carefully trimmed and wound with fine wire. Two rope-and-stick clamps, Fig. 5, are now secured to the rope, one on each side of an end crossing, as in Fig. 8, for the purpose of untwisting the rope to allow tucking the strand ends into the middle of the rope.



The Engineering & Mining Journal

STEAM-PIPE TUNNEL WITH CONCRETE ROOF

There are two ways of tucking in these ends. They are first straightened with a mallet; the long ends of the rope-clamp handles are twisted in opposite directions, separating the strands and exposing the hemp core, which is cut off and pulled out between the points to where the tucked-in strands will reach and the ends forced into the place formerly occupied by the core.

This is most easily done with the aid of a marlin spike, which is passed over the strand that is to be tucked and under two strands of the rope, Fig. 6, and moved along the rope spirally following the lay and forcing the free end, as shown in Fig. 7, into the core space.

In the other method the strands are more widely separated by untwisting the rope with the clamps, Fig. 9, slipping the free end in between the strands and correcting slight kinks by the use of a mallet. The order in which the ends are tucked in is immaterial. Some operators prefer to tuck all the ends pointing in one direction before any of those pointing the opposite way, while others finish each pair of ends in series.

If the foregoing directions are intelligently followed the splice will be uniform with the rest of the rope, of nearly equal strength throughout, and after a few hour's use it will be almost impossible to detect the splice. Four-strand hemp ropes can be spliced in the same way this splice being known among riggers as the long splice.

A Tunnel for Steam Pipes

In many of the mines of the Lake Superior copper country it is the custom to carry the steam pipes in tunnels from the boilers to the hoists and other machinery. The air pipes are carried along with the steam pipes, where they have the same direction of travel.

At the Baltic mine such a tunnel is covered with reinforced-concrete slabs. There are two sizes of tunnel used. One with a span between walls of five feet and the other with a span of three feet. The side walls are of stone and the pipes are suspended from 20-lb. rails put in along the wall at intervals of about 20 ft. or just so as to catch the pipes near the flanges. These rails are cut one foot longer than the span so as to have a hold of six inches on each wall.

The manner of swinging the pipes from the rail by a combination of clamps, hanger rods and collars is shown in the accompanying drawing. This rail is carried about three inches below the concrete roof so that the rails can be made to help carry the form timbers for the roof by putting in wedges to be knocked out later. Of course, intermediate supports are also required. The concrete slabs are reinforced by means of single strands of ⅜-in. wire rope obtained by unlaying 1¼-in. hoisting rope that had been discarded as no longer good enough for use in the shafts. The slabs are made to have a hold of 18 in. on each side, being eight feet long for the five-foot span and six feet long for the three-foot span. These reinforcing ropes are cut one foot shorter than the length of the block, or slab. In the slabs for the five-foot tunnel they are put in at 4½-in. centers while in the three-foot tunnel they are put in at six-inch centers.

The slabs are formed in place. For a stretch of from 40 to 60 ft. the slabs are formed to stay in place. Then four slabs that are detachable are made by placing a piece of paper or some other such material along the walls to break the bond between the concrete and the masonry, while between slabs a piece of wood or tin that will break the continuity of the slabs in that direction is put in. Wood strips are the best as they shrink and can be taken out most easily after the concrete has set. These removable slabs are made two feet wide. By taking off the four, a length of pipe about 20 ft. long can be put in place as the tunnel is about five feet deep. It is not convenient to work a pipe along the bottom of the tunnel for more than about 30 ft. or so. The concrete slabs are four inches thick and are made of a 1:3:5 mixture.

A Cheap Mine Road

By S. H. Brockunier*

Recently I had occasion to build 2600 ft. of a side-hill road to the Erie mine, for the double purpose of cutting off a mile of distance and a stretch of deep snow. I had only a week to complete the road and the problem was further complicated by fallen trees three or four feet in diameter, and several hundred feet of swampy ground, so I decided to place main reliance on dynamite.

The first day only two pairs of men were put to work, one pair at each end of the road, in order to see how much they would accomplish and how many men would be needed. In this way I estimated that eight men would complete the road in seven days; as a matter of fact the ditching of the swamp detained them a day longer and eight days were actually consumed in the construction.

The men were given 40% dynamite, fuse, caps, augers, and bars. They were told to put five-foot vertical holes along the upper side of the proposed road and loosen the earth with dynamite, regulating their charges so as to move the earth as much as possible towards the downhill or lower side. In this way not a pick was used on the entire road and shoveling was reduced to a minimum. When a fallen tree was encountered it was bored for a charge of dynamite, blasted in two, and pushed out of the way.

---

*General manager, Erie Consolidated Mines Co., Nevada City, Calif.

The swamp was corduroyed with eight-foot slabs blasted from fallen trees. These slabs or poles should have been 12 ft. long because if shorter they rock too much in soft mud. Cutting and splitting trees with dynamite is an easy method when compared with axe, saw hammer and wedges and the necessary men to handle such tools. The total cost of this road was, seven boxes of dynamite $49; fuse and caps, $13; labor $202; total $264. This is at the rate of 10c. per lineal foot for an eight-foot road. The day the road was completed a 6000-lb. load was drawn over it with ease and it has been teamed over steadily ever since.

Placing Air Pipes in Shafts

Extensions of the compressed-air mains in the Champion shafts of the Copper Range Consolidated Co., in the Lake Superior copper country are made in 200-ft. lifts. The work is commenced by placing a tee in the shaft opposite the station at the bottom of the lift; then carrying up the piping for 200 ft. to connect with the air main already in position.

The tee at the lower station is securely fastened by an iron yoke to a carrier timber. The pipes are then lowered and put together until the next level above the station is reached. There another tee is put in the line immediately above and below which yokes are used both to anchor the main and to prevent swinging at that point. When this tee has been put in place the other pipes are lowered and, by using a pipe of the necessary length, the top of the extension is brought to within six or eight inches of the bottom of the main already in place. A flange is screwed tightly home on the upper end of the top pipe and yokes are attached to anchor the line in position.

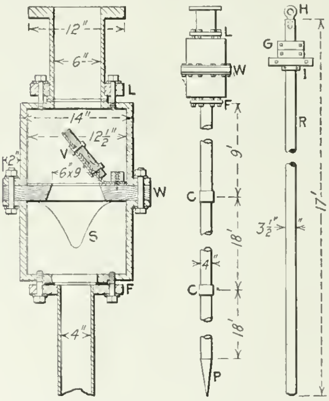
The connection with the part of the main already in place is made after 1 p. m. on Saturdays at which time no drills are running in the mine so that the air can be shut off without interfering with mining work. Jacks are placed under the lower end of the extension pipe and the yokes are loosened so that all the weight comes on the jacks.

The blind flange on the lower end of the part of the shaft main already in place is removed. The flange on the upper end of the extension is turned in the direction of unscrewing so that the bolt holes in upper and lower flanges are in line. The little loosening usually necessary does not cause leakage. Then the 200-ft. length of pipe is raised by the jacks until the flanges come tight together. The flanges are then bolted together, usually with a gasket between to make a tight joint. The yokes, of which there are two for each 100-ft. length of pipe, are then tightened to hold the main in position.

During the operation, large wrenches are used to prevent turning of the upper part of the line when the extension is being raised. Making the connection takes an hour; two men are needed at the jacks, four at the yokes and two, with the boss timberman at the point where the connection is made.

Lowering the Water in a Choked Shaft

In the JOURNAL of March 9, 1912, an article was published under the above caption being a portion of a paper contributed to the Institution of Mining and Metallurgy by Cyril Brackenbury. In this article a special valve box and suction pipe were described. The pipe was provided with a pointed end so that it could be driven through the debris that choked the Harvey shaft, and be used as the suction pipe for the centrifugal sinking pumps that constituted part of the unwatering equipment. At the request of several members of the institution, Mr. Brackenbury has provided[1] a sketch of the valve box, suction pipe and rammer which is reproduced in the accompanying illustration.



Section of Valve Box (Enlarged Scale) Suction Pipe Rammer

VALVE BOX AND APPLIANCES

In Figs. 1 and 2 the screw flange *F* on the top of the pointed suction pipe, is shown bolted direct to the bottom of the cast-iron valve box, with two rubber washers making a watertight connection. In Fig. 1 the position of the strainer bent in a synclinal fold is shown by the line *S*. The strainer is attached at the ends to the 2-in. wooden plate *W*, which is bolted between the halves of the iron valve box. A hole 6x9 in. is cut through the wooden plate to allow the water to pass up through the valve box into the pump. A thin iron plate is fastened on the upper side of the wood, and an ordinary light clack-valve is attached, to fit the 6x9-in hole. At the top of the box a short length of 6-in. pipe is fastened in the same manner as the suction pipe below, except that the flange *L* is loose instead of being screwed. The top of this short pipe can be connected to the U-piece at the bottom of the pump by means of flexible piping, or by an ordinary reverse bend. It is possible to do without the short length of pipe, and make direct connections between the top of the valve box and the bottom of the flexible pipe or reverse bend.

Fig. 2 is given in order to show the method of using the pointed suction pipe and valve box. The 4-in. pipes used are sometimes as long as 18 ft., but they have been drawn short for convenience.

The rammer *R*, which must weigh about 500 lb., is made from a piece of old iron shafting 3½ in. diameter and about 17 ft. long. A handle *H* is screwed into the top to which the rope is connected. A small iron ring *I*, and two or three glands *G*, are fastened firmly on the rod near the top. The ring *I* forms the hammer surface which strikes the top of the flange when driving the pipe. A screw flange similar to *F* is screwed to the first length of pipe, which carries the conical steel point *P* at the bottom. The rammer is inserted in this pipe and is operated by several men alternately pulling and slacking off on a rope passing over a single block. After the first pipe has been driven down for almost its entire length, the screw flange is taken off and a sleeve coupling put in its place, to which another length of pipe is screwed. The process is repeated until the point at the end of the 4-in. pipe has been driven down below the bottom of the choke. The point is then blasted off and the upper length of pipe fastened to the valve box.

Gasoline Locomotive for Calumet & Hecla

The Calumet & Hecla Mining Co., has purchased a 7-ton gasoline locomotive for use at the smeltery where there are many track curves of short radius. The gasoline locomotive will be used for hauling supplies. It is to be given a thorough test and if found satisfactory it is probable that a few more will be purchased eventually to replace the small steam locomotives now used for hauling concentrate from the stamp mills to the smeltery.

---

[1] Bull. 90, I. M. M.

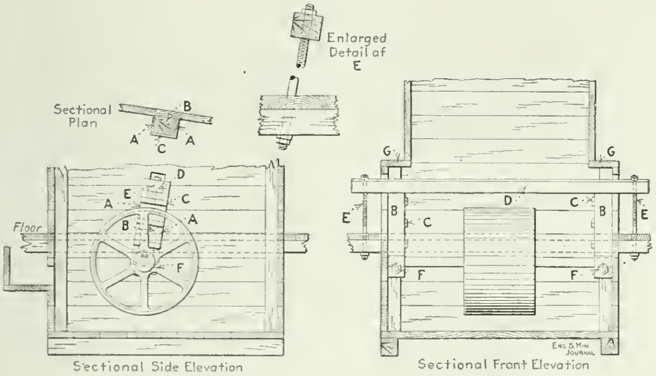
Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Take Up Device for Elevator Belts

Belt elevators for raising wet pulp and tailing are used in all the mills of the Joplin district. In some mills the device for taking up the slack of the elevator belts described in the JOURNAL of Jan. 21, 1911, is used, in others the screw take-up device shown herewith.

To each side and within the lower part of the elevator housing two 2x6-in. guides *A*, *A* are nailed at a distance of 4 in. apart. These guides are parallel to the line connecting the centers of the upper and lower pulleys. Between each pair of guides a piece of 4x6-in. timber *B*, of suitable length is slidingly mounted and is held from falling out of the guides by the cleats *C*. The lower end of each of these timbers is forked to carry the shaft of the lower pulley.



SCREW TAKE-UP DEVICE FOR LOWER ELEVATOR-PULLEY

Slots are cut in the side of the housing and above the floor line so that a transverse 4x6-in. timber *D*, which is longer than the elevator housing is wide, can be extended through the elevator housing through the slots mentioned and rest between the guides and upon the upper end of each of the timbers *B*. The slots are of such a length as to permit an up and down movement of the transverse timber between the guides of about 18 inches.

Near each end of the transverse timber *D* and outside of the elevator housing, a hole is bored through which the upper end of one of the take-up bolts *E* passes. The lower end of each of these bolts is held by a nut in the floor beams of the mill. The upper ends are threaded for a length of 18 in. or more. It will be seen that upon tightening the nuts on the upper end of each of the bolts *E*, the transverse timber *D* will be drawn down in the slots and press the timbers *B* downward in the guides, thus lowering the pulley and tightening the elevator belt. The forked ends of the timbers *B* are usually provided with a bolt *F* which prevents the pulley dropping in case the belt breaks.

The elevator housing is generally made 20 in. wider in the lower than in the main part as shown at *G*, so that the overhang protects the sliding timbers and their guides from the spillage from the buckets. The device has the advantage over the lever tightener in that the adjustment part of the take-up mechanism is outside the housing.

A Flexible Decanting Hose

By W. P. LASS*

The concentrate from the Frue vanners in the Alaska-Treadwell and affiliated mills is cyanided after regrinding in tube mills at the new cyanide plant. Agitation in cyanide solution is effected in Pachuca tanks in which the concentrate is allowed to settle at the end of the operation and the clear supernatant solution is decanted.

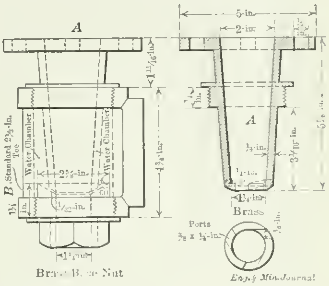
Decantation takes place[1] through a flexible hose which is made by wrapping canvas coated with tar around pieces of old boiler-tubing, 3 in. in diameter and 4 in. long, spaced ¾ in. apart. The canvas between the short lengths of tubing is wrapped with wire, making the diameter of these spaces slightly smaller than that of the tubing, thus insuring flexibility as well as avoiding the shifting of the tubing.

Attached horizontally to the top of the flexible hose is a 3-in. slotted pipe. In operation this slotted intake floats by the aid of two adjustable air-cylinders. The arrangement of these cylinders permits the submergence of the intake pipe to any depth desired.

A Simple Vortex Classifier

The details of a simple type of vortex classifier that is used in some of the mills of southwestern Missouri, are shown in the accompanying drawing.

The classifier can be used either in the pockets of a launder-type classifier or in a deep-pocket classifier as is shown in the drawing. In the pocket form the pulp is allowed to build up to give the proper slope to the bottom, whether there be one or more hydraulic attachments in the pocket. In both types a baffle board is used above the pocket proper.



VORTEX PLUG IN JOPLIN CLASSIFIERS

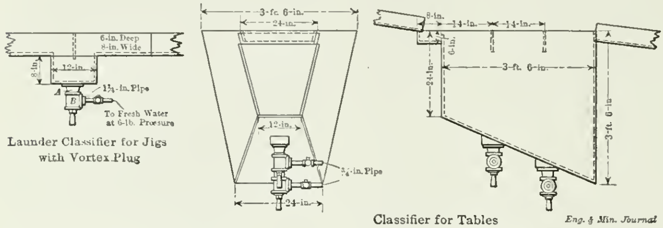
The details of the hydraulic attachment are shown enlarged. The attachment consists of a brass casting *A*, which fits into *B*, a standard 2½-in. tee which is fitted with a bushing so as to take the sorting water from a ¾-in. pipe. The water from the water chamber formed by the tee passes through vortex openings in the bottom of the casting *A*, the brass fitting *C* being screwed into the bottom of the tee until there is only about 1/32 in. opening between the casting *A* and the nut *C*. The pulp that settles past the vortex current is drawn off through the fitting *C*, the flow being regulated by means of wooden plugs of which several are provided with different size holes bored through them. This whole attachment bolts to the bottom of the classifier proper.

---

*Cyanide superintendent, Alaska-Treadwell Gold Mining Co., Treadwell City, Alaska.

[1] Bull. A. I. M. E., February, 1912.

The construction of this hydraulic attachment is simple indeed. A cheap tee is used as the outside container with two cheap brass castings that are as easily replaced, owing to the simplicity of the design, as the inside parts. Moreover, the classifier is capable of a certain amount of adjustment in regard to the vortex by changing the distance between the interior parts. A peculiarity of the vortex is that it is directed downward. In this way clogging from shut-downs is less liable to happen, while the ease with which the whole device can be taken apart permits its being cleared readily in case clogging should result from the use of dirty sorting water.



Launder Classifier for Jigs with Vortex Plug

Classifier for Tables equipped with Vortex Plugs.

VORTEX PLUGS ATTACHED TO LAUNDER AND TABLE CLASSIFIERS

An Old Device for Plugging Furnace Taps

While superintending the operation of a small blast furnace smelting copper ore, at a mine in one of the Southeastern states, an engineer found, in a scrap pile a device that was designed to take the place of the cone of brasque usually employed for plugging the discharge tap for a blast furnace.

This device had consisted of a hollow egg-shaped knob of copper, the long axis of which measured four or five inches. The larger end was bored and threaded to take one end of a 1-in. pipe about 6 ft. long; the other end of the pipe was fitted to a tee. Within the 1-in. pipe a smaller, but longer pipe extended through a bushing in the tee up into the hollow knob. In operation water was introduced by attaching a small hose to the part of the smaller pipe extending through the tee and several inches below the bushing. The water escaping from the end of the smaller pipe into the hollow knob filled that space and returned by the annular passage between the two pipes to the tee, to the side outlet of which a discharge hose was attached.

When slag and matte ceased to run from the furnace after tapping, it was the intention to push the knob of the device into the tap-hole and hold it there until the slag rose above the tap, then the cold knob was expected to form a chill of slag and plug the hole. This it did, but the furnaceman had to hold the device until the slag level rose above the tap and while thus waiting slag would run past the point and chill, making it difficult to remove the device when the chilled slag had plugged the tap. So effectually was the tap plugged when the chill did form that sledging the bar was always necessary to open it again. To add further to the furnaceman's troubles he was constantly tripping over the two lengths of hose, and when these were hung from the roof of the shed they were in the way. The device is described as it is possible that others have thought of a similar scheme, but have not anticipated the objections.

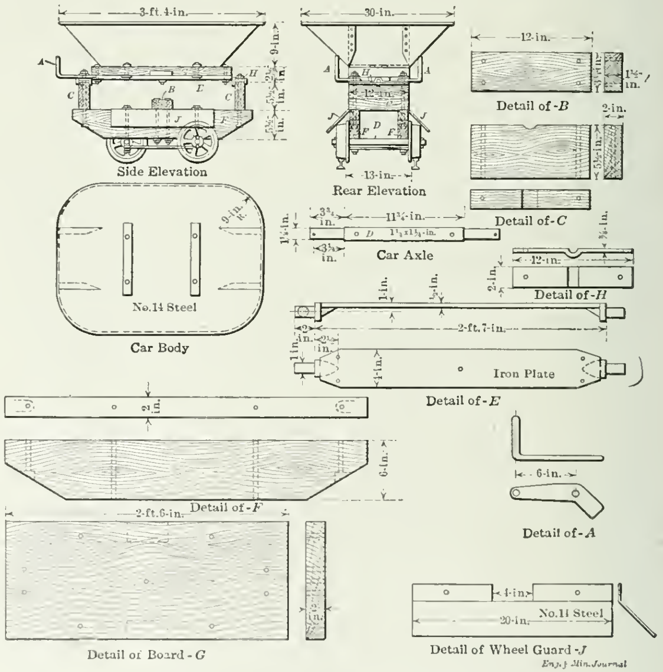
Tram Car for Concentrate

The details of the side-dumping car used in the Joplin lead and zinc district for tramming concentrate from the jigs and tables to the bins just outside the mill building, are shown in the accompanying drawing. The body is made of No. 14 iron riveted together at the four rounded corners.

The car truck, as the detail drawing shows, is made of 2-in. oak main pieces, *E*, tied together by the bearing pieces *C*, and the cross brace, *B*, at the center, which last limits the dump of the body so that it cannot come down far enough to mash the guard plates *J*, that are bolted to the truck to keep the concentrate from running down on the wheels and axles while the car is being dumped.

The dumping of the car and its load is prevented by the arms, *A*, which are bolted to the rear bearing piece *C*. The car is low. Its top comes only about 2½ ft. above the floor. It seems to be well adapted to the carrying of concentrate when it is necessary to shovel the concentrate from the boxes of tables and side-dump them into the receiving bins.

Owing to the fact that the box of the car is riveted at the corners water drains out of the concentrate as it is trammed to the bins. On that account the coarse concentrate is loaded in first to make a bed for the fine concentrate.



TRAM CAR FOR CONCENTRATE USED IN JOPLIN MILLS

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Labor Output of the U. S. Steel Corporation

The United States Steel Corporation, according to its annual report, operates 149 manufacturing plants, consisting of 125 blast furnaces; 35 bessemer converters; 270 openhearth furnaces; 653 rolling mills; 58 wire mills; 55 pipe and tube works; 16 tin-plate mills; 19 bridge and structural plants; 36 galvanizing and tinning departments; four splice-bar and rail-joint shops; five spike, bolt and nut factories; five departments for cold-rolled products; 24 iron, steel and brass foundries; 11 sulphate of iron plants; five cement plants; 70 warehouses; and 24 miscellaneous works. Besides these plants it owns, or operates, 79 iron mines in the Lake Superior district; 10 are situated on the Menominee Range; 10 on the Marquette; nine on the Gogebic; one on the Baraboo; five on the Vermilion; and 44 on the Mesabi Range. In addition to these it owns or controls a large acreage of undeveloped lands. In Alabama it owns 21 iron mines and in Georgia, two.

In the Northern districts it owns 136,348 acres of coking-coal lands, 94,153 acres of steam coal and 24,374 acres of surface. On these lands it operates: 78 coke plants, at which are 23,947 bee-hive ovens and 1172 byproduct ovens. In addition to these, there are 31 coal plants not connected with the coke plants. The Southern coal and coke properties consist of over 300,000 acres, on which are six coal plants, operating 23 mines; 10 coal-washing plants, and seven coke plants, the latter comprising 2947 beehive ovens. During 1910, the average number of employees for all the properties was 218,435, and in 1911, 196,888 men, including those employed by the transportation department.

Tons per Man

Iron ore mines: The average tons of iron ore mined per year, per man employed in the iron-ore mines during 1910, was 1490 tons, and for 1911, 1380 tons. The average for the two years is 1435 tons per man.

Coal and coke: The figures in the report include tons of coal mined and coke manufactured, 73.6% of the tonnage thus reported is manufactured coke for the year 1910; and for 1911, 56.8%; or an average of 69.9% for the two years. Based upon the tons of coke and coal not included in the coke production, the average tons per man for the year 1910 was 786, and for 1911, 849 tons. An average of 817 tons for the two years.

Manufactured and miscellaneous products: The figures reported include cement and miscellaneous products. The actual number of men employed in each separate department cannot be extracted from the report, however, the tonnage thus included will not materially affect the average for the steel products. The annual tons per man employed in 1910 in these departments was 212 tons, and in 1911, 205 tons. An average of 208 tons for the two years.

General average: Of the total products, including tons of ore produced from the mines, coke manufactured, coal mined not included in the coke production, and other manufactured products, the average tons per year per man was 390 in 1910, and 378 in 1911. The average for the two years is 385 tons. Of manufactured products, not including coke, the average tons per year per man employed in mining, coal and coke industries, furnaces, mills, etc., was 168 tons in 1910, and 163 tons for 1911. An average of 166 tons for the two years. These averages do not include men employed, or tonnage handled by the transportation department, except for the total average men employed for 1910 and 1911, as stated.

Labor Output of the Republic Iron & Steel Co.

The Republic Iron & Steel Co. operates 29 mining properties, of which 20 are iron mines, seven coal and coke properties and two limestone quarries. The properties are divided into two divisions: The Northern, which consists of 15 iron mines, three in Michigan and 12 in Minnesota; and three coal and coke properties in Pennsylvania. The Southern division consists of five iron mines, four coal and coke properties, and two limestone quarries, all in the Birmingham district, Alabama. Of the 10 blast furnaces owned, five are in Ohio, two in Pennsylvania and three in Alabama. Ten active plants were in operation in 1911, six of which are in Youngstown, Ohio, two in Indiana and two in Illinois. Two bar-iron mills in the Birmingham district and one in Toledo, Ohio, were inactive during the year.

The finished products of the company are merchant-iron bars, bessemer and openhearth-steel bars, light structural and agricultural shapes, standard and hand spikes, bolts, nuts, turnbuckles, cold-drawn bars, tubular products, bessemer and openhearth billets and sheet bars, and foundry, bessemer and basic pig iron.

Tons per Man

Iron Ore Mines—During the last five years the average annual tons of iron ore produced per man employed at the mines is as follows: 1907, 611 tons; 1908, 850 tons; 1909, 999 tons; 1910, 999 tons, and in 1911, 1049 tons. Years 1907 and 1908 were during a period of low production.

Coal Mines and Coke Ovens—The annual reports of the company do not give the tons of coal mined; the tonnage reported is manufactured coke. Based upon this tonnage as reported, the average annual tons of coke produced per man employed in the coal mines and at the coke ovens has ranged as follows: 1907, 306 tons; 1908, 311 tons; 1909, 383 tons; 1910, 388 tons, and in 1911, 397 tons.

Finished and Semi-finished Products—Figured on the average men reported as employed at the works and the annual tons reported, the average annual tons of manufactured product per man employed in the works is as follows: 1907, 92.4 tons; 1908, 89.6 tons; 1909, 135 tons; 1910, 123 tons, and in 1911, 107 tons.

Furnaces — Based upon the average men reported as employed at the furnaces and the annual tons of pig iron produced, the average annual tons per man ranged as follows: 1907, 348 tons; 1908, 489 tons; 1909, 616 tons; 1910, 550 tons, and in 1911, 546 tons of pig iron. The limestone consumption, based upon the total tonnage mined in the last five years and tons of pig iron produced, is apparently about one ton for every six tons of pig iron produced.

Compressed Air per Ton Mined

Compressed air is used according to the report of the Copper Queen, at the rate of 0.0102 cu.ft. per min. per annual ton of ore produced. If this is the maximum amount required it checks well with the rated capacity of the compressors required at the Goldfield Consolidated, Goldfield, Nev., where two compressors are used with a rated capacity of 1500 cu.ft. each per min. Based on an output of 330,000 tons annually, this is approximately 0.0091 cu.ft. of air per minute for an annual ton.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Austrian Radium Monopoly

According to a recent statement in the Austrian press, the government has bought the only two privately owned radium mines at St. Joachimsthal. The purchase price is said to be $609,000 for the two mines "Sachische Edelleutestollen" and "Hergottszeche," writes Consul W. L. Lowrie in the *Daily Consular and Trade Reports*.

During the last four years many efforts have been made by various financial institutions of Germany and France to purchase these deposits of pitchblende. It is estimated that the two mines will annually yield about 3 grams of radium and 3000 kg. of uranium salts, the latter valued at $30,000. It is claimed that the annual production will be 5 grams (valued at $400,000) as soon as the factory at Joachimsthal is in full operation, using the ore from the mines recently acquired in addition to that taken from the old silver mine which has hitherto been the source of supply.

Centrifugal Slimes Filter

Before the Society of Arts recently, a paper was read by W. J. Gee on "The Separation and Grading of Solids Suspended in Liquids." This new process (*Engineer*, Feb. 12, 1912) consists in passing the liquid through a rapidly rotating drum, whereby the solids are caused by centrifugal force to be deposited on the removable lining of the drum, while the liquid passes away clear of all suspended matter. The current passes from end to end, with the result that the solids are deposited in graded order, the coarser near the inlet end and the finest near the outlet end, all the intermediate grades being deposited between the extremes.

Australian Tin Scrap Plant

Arrangements are nearing completion, says *Daily Consular and Trade Reports*, for the establishment of a factory at Sydney for the extraction of steel and tin from tin clippings, the residue of the canning industry. Large quantities of tin clippings are available annually for export purposes in Australia. It is known that 3500 tons are exported yearly to Germany. Recently a company was formed with a capital of £15,000, for the establishment of a factory at Sydney. The managing director of the Flushing (Netherlands) Electro Tin Works has gone to Australia to forward the enterprise, and those interested are confident of rapidly establishing the necessary works in a Sydney suburb. A number of contracts have been arranged with firms in a position to supply clippings.

Oil in Wyoming

The Lander and Salt Creek oil fields of Wyoming are the subject of a bulletin, recently reissued by the U. S. Geological Survey. Oil was discovered in this field by Bonneville in 1833, but until 1867 it was practically unknown except to hunters and trappers. The first drilling was done in 1883, and although the wells were productive they were, on account of keen competition, soon abandoned. The wells remained packed until recently, when operations were resumed on a more extensive scale.

Perhaps the most interesting well in the Salt Creek oil field is one drilled in 1910, which struck oil under pressure in shale at a depth of 1176 ft. This well yielded an unusually large amount of oil for a shale well. The oil is said to make an excellent fuel, and as it contains a heavy asphalt base, is good for oiling roads.

Titatium or Zirconium Glass

The glass formed by fusion of silica with oxides of the carbon group, preferably titanic or zirconium oxide (Fr. pat. 432,786) has been found very resistant from the chemical and thermal points of view, and is more easily worked than pure quartz glass. The product is known as siloxide. The strongest of the zirconium glasses (Z-siloxide), contained 1% of ZrO, while the best thermally contained 0.5 per cent.

The titantium glasses (T-siloxide, 0.1 to 2% of Ti) have a somewhat lower resistance to compression than quartz glass (*Journ. Soc. Chem. Ind.*, Mar., 1912), but resist transverse fracture better than the latter, and are superior even to zirconium with respect to thermal properties.

Early Uses of Platinum

A few days ago W. Burton read a note before the Manchester Literary and Philosophical Society, says the *Engineer*, Feb. 16, 1912, on "The Earliest Industrial Uses of Platinum," in which he stated that the metal had been employed by Wedgwood in the latter half of the eighteenth century for coating pottery. Attempts had previously been made with gold for the same purpose, and platinum, then little known, offered equally attractive results, specimens of modern work being shown. Platinum ores were at one time ordered to be thrown into the sea by the Spanish government, owing to the metal being used for debasing the coinage.

Diffusion of Metals

A remarkable example of diffusion of solid metals has been observed by Messrs. G. Bruni and D. Meneghini, and is quoted in the *Electrical World*. A nickel wire was coated with copper by electrolysis to a thickness such that the two metals were in the same proportions as in the alloy constantan—40% Ni., 60% Cu. The compound wire thus formed was then maintained at a temperature of about 1000° C. for 157 hr. Its resistance was 0.0260 ohm at the start, and was measured at intervals. It gradually rose to 0.2105 ohm, at which it became practically constant. This indicated that the wire had become converted to constantan, and the fact was proved by chemical analysis.

African Freight Cableway

A Bleichert cableway in German East Africa is described in *Engineering News*, Feb. 29, 1912. It covers a distance of 5⅛ miles in an air line, and ascends 4995 ft. in that distance. To avoid excessive spans (6000 ft.) there are two angle stations, through which the haulage cables run, but where the main cables come to an end, and are put under tension. The cars go through on tracks, the change being made by manual labor. Some of the sections have a gradient as high as 41°. The cars are built to take logs up to 46 ft. long, and consist of two carriages with no other connection than the cable and the load. Owing to danger from termites, all stations and supports are steel construction.

Nodulizing by the Grondal Process

According to an estimate in *Echo des Mines*, Feb. 15, 1912, about 200,000 metric tons of nodules are made yearly in England from "blue billy," while the production of the world is given at over 1,000,000 metric tons of nodules, corresponding to 650,000 metric tons of iron.

Cyanide Mill Metallurgical Records

By E. H. Webster*

Metallurgical balance sheets are of value in exposing differences between theoretical extraction and actual bullion recovery. A complete set of forms for recording the essential data is given, together with suggestions as to methods of obtaining this information.

Readers of technical journals on this side of the Atlantic, during the last year or two, have been treated to numerous articles describing modern South African milling practice, with accounts of the magnitude of the plants, the efficiency of the crushing machinery, the perfection of the treatment schemes, the low costs attained, etc. This matter has been of great interest to metallurgists and mining men in general; much information of value has been elicited by the work of the Rand metallurgists and mechanical engineers, and the reports and discussions of the various technical societies of the Rand have almost brought some readers to believe that operations there are but little short of perfection, and that in comparison therewith our American and Mexican practice is crude and amateurish in conception and execution.

East Rand Proprietary Shortage

In view of these glowing accounts of modern Rand attainments, it was somewhat disconcerting to learn from the Johannesburg correspondence[1] that at one of the foremost of these new concerns, the East Rand Proprietary Mines, "£50,000 worth of gold had been let go to waste out of two or three separate cyanide plants without anyone knowing anything about it." Not that the difficulty of getting bullion recovery to correspond with theoretical extraction is new, on the Rand or elsewhere—witness the former Rand and Westralian institution of the "secret reserve"—but it is surprising to realize that the discrepancy between theory and fact in the work of a supposedly well managed company of this character, could have grown to such magnitude without having been the subject of earnest attention and prompt remedial action, at some earlier stage.

Subsequent developments seem to show that this loss was not entirely a metallurgical one, the above statement being made in an attempt to cover the accumulated shortages due to inaccuracies in the estimates of tonnage and grade of ore treated, and to ascertain irregularities on the part of the management as to the time of making cleanups so that an increased yield could be reported for a given period.

While this occurrence, taken in connection with the Victoria Falls electrical power troubles, the failure of the City Deep mill, and the shortcomings of the Randfontein Central (all of which your correspondent mentions), tends to shake our confidence in the efficiency of latter-day Rand engineering and to cast the shadow of doubt over much of the information emanating from that field, it emphasizes the necessity which exists at many mines of lesser magnitude, of a metallurgical balance sheet. By this I mean, a metallurgical account, showing monthly and cumulatively the total metals delivered to the mill, the distribution of these to the various departments of the plant, the actual recovery in bullion and other marketable forms, the metals held in the form of slags and other secondary products, the loss in tailings, and the metals which should still exist in the mill at each periodical cut-off, whether in coarse ore bins, pulp and fine ore in sundry stages of treatment, zinc boxes or presses, or mill circulation. For the purposes in view, all this information should appear in terms of units of weight, values being neglected.

Accuracy of Tonnage Estimates Important

As the value of any system of metallurgical accounting rests directly on the accuracy of ore weights and metal assays, the determination of these basic facts should be the subject of most careful consideration and investigation on the part of the mine manager. The basis or starting point of the metallurgical account is the dry tonnage charged to the mill, and it is of the utmost importance that this tonnage be ascertained within the smallest practical limit of error. Whether the charge be made on the basis of tonnage actually passed through the crushing machinery, or on that of tonnage delivered to the mill bins, is largely a matter of conditions and individual preference.

Certain difficulties and indeterminate errors usually attend calculation on the basis of tonnage delivered to mill bins, except in mills of very modern design, where the ore is sampled automatically and weighed before reaching the mill bins; or in small mills, and mills close to the mine mouth, where it is practicable to empty the mill bins before cut-off. In the former case, the tonnage in bins at the time of cut-off is covered by the balance entry for metals existing in mill, the mill being charged with the dry tonnage and assays delivered to its bins. In the latter case, the ore should be weighed in the cars or tramway buckets before it enters the mill bins. As sampling of an intermittent stream from a rock breaker is unreliable in the extreme, the samples for value and moisture should be taken at regular intervals between the ore feeders and the crushing machines.

If the mill bins are allowed to run empty at cut-off, the tonnage crushed is the tonnage delivered. This method will give results as close to the truth as is practicable, little or no change in the moisture being suffered while the ore is in transit through the mill bins. If the bins are not allowed to run empty, errors will be introduced into the calculation, varying with the grade of the ore and the ability of the superintendent or foreman to guess the quantity lying in the bin and for which allowance must be made.

Automatic Weighing at Hedley

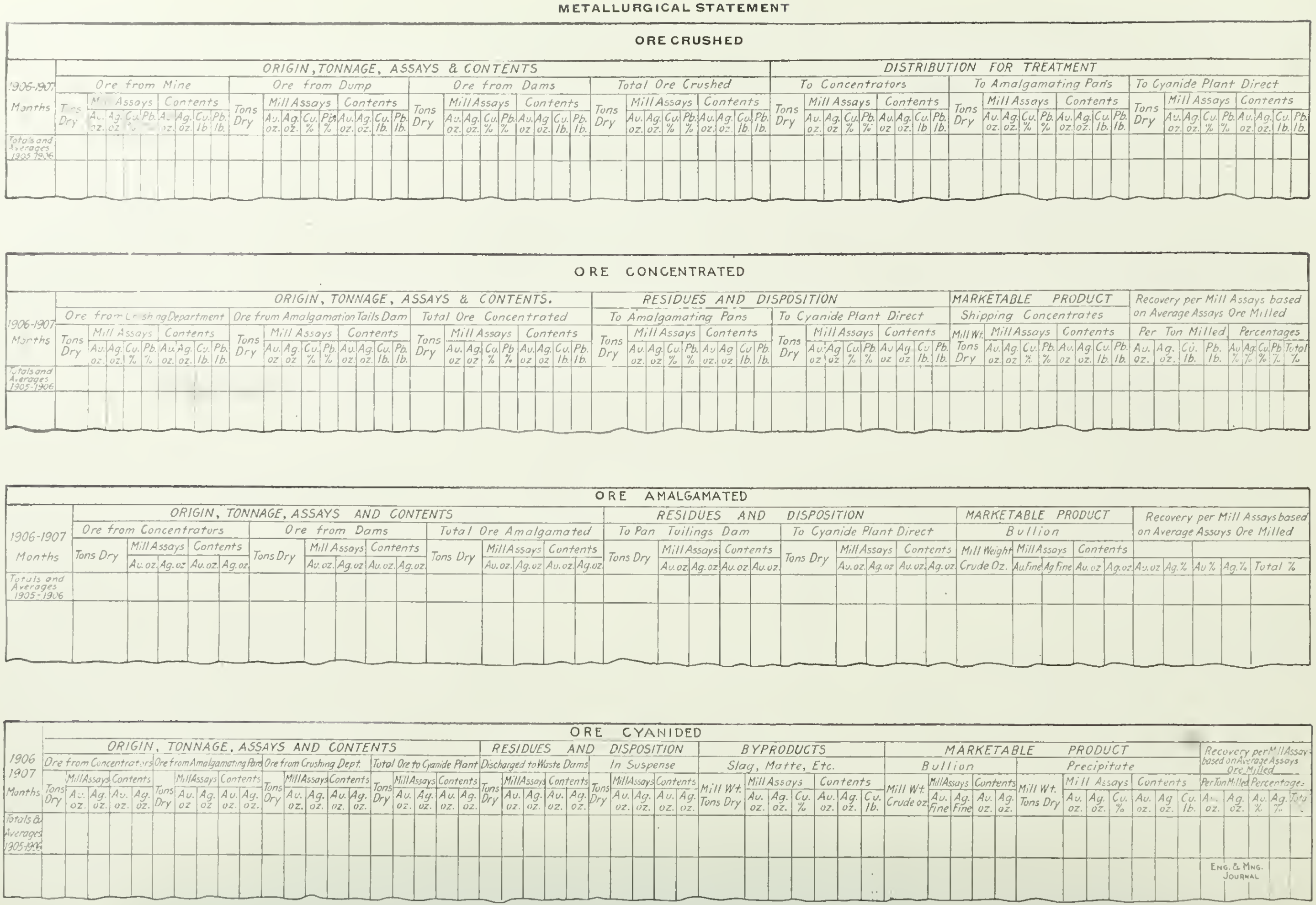
In cases where the ore has not been passed through a sampling mill, the best method of ascertaining tonnage and value of mill feed, in my opinion, is that employed by Frank A. Ross at the mill of the Daly Reduction Co., Hedley, B. C., and described by him in the ENGINEERING AND MINING JOURNAL of Oct. 24, 1908. I give a brief outline of this scheme, with certain additions which should improve its operation. A scale car of standard pattern, with registering beam, runs on a track above the feeder hoppers. This car is filled from the mill-bin gates and trammed to the hoppers as required. Before dumping, the beam is brought to balance, a ticket inserted in the sliding counterpoise, a lever pressed, and the ticket dropped into a slotted box near the hopper. Once a day or once a shift, these tickets are collected and footed, giving an accurate record of the moist tonnage delivered to each battery or crushing machine.

Sampling is effected by an apron or door between the feeder chute and the crushing machine. At regular intervals (variable at will) this apron, thrown by a solenoid governed by an electric clock or controller of standard design, diverts the ore stream for any period of time desired. The sample so taken falls into a receptacle or on a conveyor belt, and is cut down and prepared for assay in the usual manner. Though not pertinent to the subject of this article, this method of handling mill feed has other advantages, as Mr. Ross remarks. In efficiency tests, etc., the work of one crushing machine may be checked against another; the machines may be more closely watched as to their individual performances; and at a mill treating custom ores, ores from different mines, or ores the treatment of which calls for certain definite mixtures, these mixtures may be readily made and

---

*Los Angeles, Calif.

[1] Eng. and Min. Journ., Dec. 16, 1911.



METALLURGICAL STATEMENT

ORE CRUSHED

1906-1907	ORIGIN, TONNAGE, ASSAYS & CONTENTS																																				DISTRIBUTION FOR TREATMENT																										
Months	Ore from Mine									Ore from Dump									Ore from Dams									Total Ore Crushed									To Concentrators									To Amalgamating Pans									To Cyanide Plant Direct								
	Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents			
		Au. oz.	Ag. oz.	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.		Au. oz.	Ag. oz.	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.		Au. oz.	Ag. oz.	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.		Au. oz.	Ag. oz.	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.		Au. oz.	Ag. oz.	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.		Au. oz.	Ag. oz.	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.		Au. oz.	Ag. oz.	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.
Totals and Averages 1905-1906																																																															

ORE CONCENTRATED

1906-1907	ORIGIN, TONNAGE, ASSAYS & CONTENTS.																											RESIDUES AND DISPOSITION																		MARKETABLE PRODUCT									Recovery per Mill Assays based on Average Assays Ore Milled								
Months	Ore from Crushing Department									Ore from Amalgamation Tails Dam									Total Ore Concentrated									To Amalgamating Pans									To Cyanide Plant Direct									Shipping Concentrates																	
	Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents				Tons Dry	Mill Assays				Contents				Mill Wt.	Mill Assays				Contents				Per Ton Milled				Percentages				
		Au. oz.	Ag. oz.	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.		Au. oz	Ag. oz	Cu. %	Pb. %	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.		Au. oz	Ag. oz	Cu. %	Pb %	Au. oz	Ag. oz	Cu. lb.	Pb. lb.		Au. oz.	Ag. oz	Cu. %	Pb. %	Au. oz.	Ag. oz	Cu. lb.	Pb. lb.		Au. oz	Ag. oz	Cu. %	Pb. %	Au. oz	Ag. oz	Cu. lb.	Pb. lb.	Tons Dry	Au. oz.	Ag. oz	Cu. %	Pb. %	Au. oz	Ag. oz.	Cu. lb.	Pb. lb.	Au. oz.	Ag. oz.	Cu. lb.	Pb. lb.	Au. %	Ag. %	Cu. %	Pb. %	Total %
Totals and Averages 1905-1906																																																														

ORE AMALGAMATED

1906-1907	ORIGIN, TONNAGE, ASSAYS AND CONTENTS															RESIDUES AND DISPOSITION										MARKETABLE PRODUCT					Recovery per Mill Assays based on Average Assays Ore Milled				
Months	Ore from Concentrators					Ore from Dams					Total Ore Amalgamated					To Pan Tailings Dam					To Cyanide Plant Direct					Bullion									
	Tons Dry	Mill Assays		Contents		Tons Dry	Mill Assays		Contents		Tons Dry	Mill Assays		Contents		Tons Dry	Mill Assays		Contents		Tons Dry	Mill Assays		Contents		Mill Weight	Mill Assays		Contents						
		Au. oz.	Ag. oz.	Au. oz.	Ag. oz.		Au. oz.	Ag. oz	Au. oz.	Ag. oz.		Au. oz.	Ag. oz	Au. oz.	Ag. oz		Au. oz	Ag. oz	Au. oz	Au. oz.		Au. oz.	Ag. oz	Au. oz.	Ag. oz.	Crude Oz.	Au. fine	Ag Fine	Au. oz	Ag. oz	Au. oz	Ag. %	Au %	Ag. %	Total %
Totals and Averages 1905-1906																																			

ORE CYANIDED

1906 1907	ORIGIN, TONNAGE, ASSAYS AND CONTENTS																				RESIDUES AND DISPOSITION										BYPRODUCTS							MARKETABLE PRODUCT												Recovery per Mill Assays based on Average Assays Ore Milled				
Months	Ore from Concentrators					Ore from Amalgamating Pans					Ore from Crushing Dept.					Total Ore to Cyanide Plant					Discharged to Waste Dams					In Suspense					Slag, Matte, Etc.							Bullion					Precipitate											
	Tons Dry	Mill Assays		Contents		Tons Dry	Mill Assays		Contents		Tons Dry	Mill Assays		Contents		Tons Dry	Mill Assays		Contents		Tons Dry	Mill Assays		Contents		Tons Dry	Mill Assays		Contents		Mill Wt.	Mill Assays			Contents			Mill Wt.	Mill Assays		Contents		Mill Wt.	Mill Assays			Contents			Per Ton Milled		Percentage		
		Au. oz.	Ag. oz.	Au. oz.	Ag. oz.		Au. oz	Ag. oz	Au. oz.	Ag. oz.		Au. oz.	Ag. oz.	Au. oz.	Ag. oz.		Au. oz.	Ag. oz.	Au. oz.	Ag. oz.		Au. oz.	Ag. oz.	Au. oz.	Ag. oz.		Au. oz.	Ag. oz.	Au. oz.	Ag. oz.	Tons Dry	Au. oz.	Ag. oz.	Cu. %	Au. oz.	Ag. oz.	Cu. lb.	Crude oz.	Au. Fine	Ag. Fine	Au. oz.	Ag. oz.	Tons Dry	Au. oz.	Ag. oz.	Cu. %	Au. oz.	Ag. oz.	Cu. lb.	Au. oz.	Ag. oz.	Au. %	Ag. %	Total
Totals & Averages 1905-1906																																																						

ENG. & MNG. JOURNAL

FIG. 1. FORM FOR RECORDING METALLURGICAL DATA AT CYANIDE MILLS

varied as wanted, precisely as in smelter charges.

Automatic Tailings Sampler Best

If a determination of the tonnages of crushed material distributed to different departments is required, automatic time samplers, worked by an electric clock or controller, will give results most closely approximating the facts. The sample of the final mill tailings should be taken by an automatic time sampler. If the flow from the plant is intermittent, as from some types of vacuum and pressure filters, the pulp should be dumped into a tank of ample capacity to handle the surges at each cycle, equipped with some suitable device for maintaining a regular and continuous discharge. I understand that at Santa Gertrudis (Pachuca) the Merrill press residues are sluiced into a Dorr thickener, the continuous underflow from which is sampled. This would appear to be a satisfactory procedure, as it furnishes a proper sample and at the same time clarifies the return water.

FIG. 2. TREATMENT DATA FOR THE MONTH OF . . , 191

Year to Date

Crushing. Oz Tons Oz.

The batteries ran hours, or %, of a possible . , figured on a . -stamp basis.

The ore crushed, its origin, assays and contents, are as follows:

	Tons		Oz.
Surface ore .		@	
Ore from old dumps		@	
Mine ore:			
100 level. N. stope.		@	
200 level. S. stope . .		@	
300 level S stope . .		@	
Total ore to mill . . .		@	
Held in bins		@	
Total ore crushed		@	

Crushed per stamp per 24 hours running time, . . tons.

Tailings treatment:

Tailings from dams, passed through classifier, etc . . . . @

Total material treated . . . . . . @

Concentrating:

The Wilfley tables ran . hours, or %, of a possible . figured on a -table basis.

Concentrates produced, tons @ . oz.

Recovery by concentration, . % of total contents, or oz. per ton of mill feed

Fine grinding:

The tube mills ran . . . . hours, or % of a possible . figured on a . -mill basis

The tube mills delivered to the cyanide department, net tons of finely ground material, averaging oz., and containing

Cyaniding:

Stock of silver in mill per previous report

Total charge to cyanide department

The agitators handled charges, of varying density.

The filter was operated for . . . cycles, or . % of a possible . discharging . tons of residues averaging oz., or oz. per ton of mill feed, and accounting for oz.

Solutions, pulp, zinc, etc., were on hand at close of month, estimated as containing oz.

The indicated recovery by cyanidation was . % of total values entering mill, or % of agitator heads, being oz per ton of mill feed, or . . oz. per ton of charge; gross

Cleanup and melting

This department handled . . tons of precipitate, assaying oz. per ton, or about . fine, and produced bars to inclusive, weighing crude oz., average fineness. , total fine ounces.

Deducting silver produced from remelting former byproducts . . . Oz

and adding . byproducts held for future remelting

The actual bullion recovery appears as

The indicated bullion recovery being, as above

The apparent overclean (or underclean) is

Metallurgical results Oz. % % %

Recovery, *indicated:* Concentration . .
Cyanidation
Total indicated

Recovery, *obtained:* Concentrates
Bullion, etc
Total obtained

		Lb	Lb.
Sodium cyanide (125-130%) consumed:	Per ton treated Per ounce recovered		
Zinc consumed.	Per ton treated. Per ounce recovered		
Lime consumed.	Per ton treated Per ounce recovered		
Pebbles added:	Per ton ground Per ounce recovered		
Crushing and grinding parts renewed: (Specify battery or tube mill)	Per ton crushed or ground Per ounce recovered		

Whatever the sampling, weighing, and assaying methods may be, the data obtained from them are part of the general mine accounting, and should be assembled and compiled in the manager's office from day to day, for transfer to the metallurgical balance at monthly intervals. In this work (as well as in a variety of metallurgical and engineering calculations) the use of a Brunsviga calculating machine will be found most advantageous, as insuring accurate computations with a minimum of clerical staff. There may be other machines of equal speed and accuracy, but the Brunsviga is a simple, portable device, and has the great advantage of substantial construction and comparative freedom from the necessity of repairs. At mines far from repair shops and mechanics expert in fine machine work, this is a most valuable feature.

Tabulated Forms Convenient

To illustrate the method of accounting suggested, I give herewith a tabulated form (Fig. 1) which was introduced by me several years ago into the metallurgical records of a well known Mexican mine, arranged to suit conditions ruling at the time. It will be noted that it provides for concentration, amalgamation, and cyanidation; and, as the residues from the two former operations were ultimately delivered to the cyanide department, the division showing metals in mill at cut-off, headed "In Suspense," appears only under "Ore Cyanided." If tonnage were held back in the amalgamation and concentration work, similar divisions would be introduced into the respective tabulations, the total metals in suspense in the mill being obtained by combining the figures appearing in the three divisions. At few mills, however, is the treatment such that this would be necessary.

It is practically impossible to estimate in detail (by sampling, measuring, and assaying), with even a reasonable degree of accuracy, the metals existing at any determined moment of cut-off in a modern agitation mill in continuous operation, with agitators, thickeners, excess-pulp tanks, solution tanks, zinc boxes, etc., all more or less charged with materials of different character and value. At such a mill, moreover, to shut down and clean up monthly is not even to be thought of. The information required in order to form an approximate judgment as to whether the plant is really turning out the metals called for by the daily records must be sought in some other way.

It requires little foresight, and involves no particular inconvenience, to arrange the treatment so that the tonnage in suspense at cut-off does not vary materially from month to month. If the grade of the ore treated is not subject to wide fluctuations, observation of the balances appearing in the "In Suspense" column will give as close a check on the actual recovery as can be had without a cleanup. After the first couple of months, these balances will reflect closely the state of affairs in the mill, as regards checking of actual recovery with the theoretical figures. If the mill is doing close work the balance will be nearly constant from month to month, whereas any shortage or overrun of importance will be shown by an increase or decrease of the balance figures. If closer watching is required, the cut-off must be more frequent; but this might involve too much work except in extraordinary cases, or at mills which ship unmelted precipitate.

The "In Suspense" column of such a statement should receive the careful attention of the mines manager, and any variations not accountable for by difference in grade of ore in mill at cut-off, imperfect cleanup as compared with usual practice, or other causes which will suggest themselves, should receive prompt investigation. As in every other business, the only way in which a correct inventory of stock on hand can be obtained is to take one. At least once a year, the balance appearing as in suspense should be verified by a general cleanup, which may be combined advantageously with an overhauling of the mill. Few plants are kept in such operating condition that an occasional overhauling will not improve their work; and advantage may be taken of this repairing to check the production definitely, without undue loss of running time.

RECORDS BASED ON MILL ASSAYS ALONE

The metallurgical balance-sheet should be prepared from mine assays of crude ore and products, no consideration being given to assays of smelters or refiners to whom the products are sold. With reasonable care and diligence, sampling and assaying can be done as accurately at the mine as at the refinery, and where there is a conscientious effort to ascertain the exact metal contents of shipping product, on the part of the mine force, I should be inclined to support their results as against the average smelter returns. From the nature of the operations, however, differences between mine and smelter assays are inevitable; but as they occur in the selling of the product, and are linked with differences in metal prices as between mine estimates and smelter returns, I prefer to consider them in a correction statement forming part of the general business accounting of the concern, of which the metallurgist should receive a copy.

It has been my experience, also, that marketing the product of a mine or mill very frequently suffers from laxity and imperfect knowledge on the part of agents, banks, and others to whom it is consigned for realization. After all, selling the product of a mine does not differ materially from selling that of a farm or factory—the ablest salesman gets the best of the deal, even in assays, and there is no valid reason why the record of a good metallurgist, doing efficient work at a plant, should be charged with losses arising from deficient marketing ability on the part of a selling agent.

At certain mines where the treatment is simple and the conditions admit of a close estimate of the quantity of metal in the mill at cut-off, a statement along the lines of the second form (Fig.2), combining the production account with sundry other milling data, might be preferred. A form of this kind was used by me, while manager of an isolated Mexican property, and served at the same time as part of my monthly report to the head office. It will be noticed that in addition to data concerning the work of the month, the form shows also totals for the year, up to the date of report, of such items as tonnage and contents of mill feed, concentrates, precipitate, bullion, tailings, etc. As used, it was typewritten; but a properly printed and ruled form, with additional columns at the right for cumulative figures covering whatever other treatment data might be required, would be found much more convenient to prepare.

While the arrangement of these metallurgical statements is defective in certain particulars, they will serve to illustrate the desirability of a method of checking actual production with indicated recovery of metals. With the necessary alterations and additions to fit individual cases, they will be found useful (and sometimes very enlightening) at many mines where the cyanide process is in use.

Development at Collahuasi, Chile

By MANUEL C. GONZALES*

The name of the company formerly known as the Cia. Minera de Collahuasi,—La Grande has been changed to Société Françaisé des Mines de Cuivre, Collahuasi, La Grande. This is a stock company with a capital of 15,000,000 francs. The home office is 43 Boulevard Haussmann, Paris, France; there is also an office at Iquique, Chile.

The water level has been reached in most of the mines of the company, and there appears to be an abundance of sulphide ores composed of the minerals covellite, chalcocite and chalcopyrite. The work of development at the principal mines assures a continuance of the present rate of shipping export ore, 3000 metric tons per month, for a long time. The export ore contains not less than 25% copper.

There are reserves of low-grade ores amounting to 250,000 tons assaying 9% copper, 12 oz. silver and 8 grams gold per ton, and the quantity of bonanza ore that was left in backs and pillars probably amounts to 100,000 tons containing from 21 to 25% copper.

It is expected that a number of aerial tramways will be built to connect the different mines with the railroad station that connects the district with the port of Antofogasta.

The Collahuasi company is planning to build a concentrator of 500 tons daily capacity in the Huiquintipa gulch. It is probable that ores from other mines in the district will be sent to this mill for beneficiation.

The development of a large tonnage of low-grade sulphide ore has caused the directors to consider building a smeltery. Water-jacket furnaces and basic converters will be used. If the mill and smeltery are built a large number of mines that can produce low-grade ore will be able to resume production. At present the ore cannot stand the high tariff for transportation to the coast by rail.

---

*Mining engineer, Casilla 326, Iquique, Chile.

Magnesite Deposits in Venezuela

SPECIAL CORRESPONDENCE

On the Island of Marguerita, near the northern coast of Venezuela, deposits of magnesite of good quality are found in layers or strata of unknown thickness. The main deposits are about a mile from the port of Porlamar and three miles from the port of Pambatar. These ports are accessible and good for vessels of any draft.

Magnesite is not considered by the mining laws of Venezuela as a mineral, properly speaking; that is to say, the exploitation and exportation of magnesite do not require the holding of mining patent or the like, as would be the case with other minerals, but the owner of the land can freely make use of magnesite, just the same as any other product.

According to executive decree of the government of Venezuela, dated May 11, 1908, magnesite and other similar substances shall pay as land taxes, one bolivar (about 20c.) per metric ton. An analysis of an average sample gave: Magnesia, 46.34%—equivalent to carbonate of magnesia, 96.94%. One American company is now shipping from these deposits and other American interests are engaged in explorations.

Manganese peroxide is used as an oxidizer in the manufacture of chlorine and oxygen, and of potassium permanganate, as a drier in paints and varnishes, as a decolorizer of glass and in the manufacture of dry batteries and Leclanche cells. As a coloring material, manganese is used in coloring glass, brick and pottery. Several manganese salts are used in drying cloth and as paint.

Gloomy Outlook on the Rand

Johannesburg Correspondence

Mismanagement at some mines, lessened profits due to lowering of the grade of ore at others and failure of certain milling operations have engendered distrust, making it difficult to raise necessary capital for present operations or for financing new undertakings.

The outlook for 1912 on the Rand is by no means bright, and one of the signs of depression is the fact that the Central Mining & Investment Corporation ("Ecksteins," or the "Corner House") has decided to engage in no new work for some time, and has dismissed its chief mechanical and electrical engineers, and about 20 others, including draftsmen. There are generally a lack of confidence and acute disappointment among investors that make it impossible at present to raise money for new schemes and to complete existing enterprises.

The reasons for this state of affairs are unfortunately numerous. The case of the East Rand Proprietary mismanagement I have already dealt with. It was the case of a mine boomed as capable of paying 40% dividends for 40 years, when it was well known that developments in the Angelo Deep portion of the mine showed, to say the least, an alarming increase in the percentage of "unpayable ore" in the lower levels. Shares which stood a year ago at £5 can now be purchased for half that sum, and a debenture debt of £1,500,000 and £300,000 more capital must still be raised.

POOR RESULTS AT CITY DEEP MILL

To this must be added the disappointment experienced at the City Deep mine. This mine was hailed as one of the genuine mining prizes of the Rand, and no money was spared to make the surface equipment the finest and most modern in the world.

It is stated that £50,000 were spent on tram lines, embankments, trestles, etc., connecting the shaft and mill. The steel and concrete design of the mill was heralded as the last word in mill construction and the whole mill was electrically driven. Since then, I believe, an auxiliary steam plant was laid down, adding largely to the cost.

As soon as this new mill started, troubles commenced. Vibration was excessive, the tops of the cast-steel casting vibrating, it is said, ⅛ in. The Laschinger patent camshaft bearings acted well, except for the shearing of some small studs or bolts, due to the vibration; but the exceedingly long heads caused trouble, the guides placed on top of the boxes being ineffective. These heavy heads gave trouble because the adhesion between them and the stems, despite the degree of taper given, was often insufficient. Also the shanks of the shoes showed a tendency to break off. The cast-steel frame, which held the Laschinger bearings, was bolted to the tops of the concrete king posts. Owing to the vibration, this frame started cracking and had to be patched in many places.

MANY ALTERATIONS AT MILL

I believe I am right in saying that a portion of the mill has been practically rebuilt as regards the battery framing and that the weight of stamps has been reduced by shortening the heads. The most striking commentary on the success or failure of the mill is that in the mill recently erected on the Modder B. mine, this design has been abandoned and wooden king posts have been reinstated. These facts have not hitherto been made public, and the design of the mill is believed to have been successful.

These alterations have caused enormous expense, but there appears to have been trouble in the mine also. A distinguished engineer, when he last visited the Rand, protested against the practice of calling ore developed, when it was merely driven under. It is believed that he referred to the City Deep. Certain statements were made before the mill was completed as to the amount of ore developed, but this ore was not cut up into blocks ready for stoping, as it was proposed to work the mine on some new scheme. The mine was not apparently in a position to produce the tonnage anticipated, and its performances have so far been most disappointing.

MINE MANAGEMENT CHANGED

The whole system of management of the mine has been reorganized, the consulting engineer being changed and two managers being dispensed with in rapid succession. Shares have fallen from £4 to near £2, and the mine is in debt to an unknown amount. Shortage of labor was advanced as an excuse for nonfulfillment of program, but the causes lie deeper. Fortunately the quarterly development results continue to show reefs of good width and value, and the mine is undoubtedly a fine one at the present depth. The first level was driven over 10,000 ft. on a rich section of the main-reef leader.

The falling off in grade of the Main Reef West mine furnished a disappointment, and shares fell heavily because of poorer development results and reduced grade and profits. Capital expenditure on the large Randfontein Central mine, having exceeded anticipations and the mine having failed to supply the new 600-stamp mill with ore, the shares have also fallen. Shortage of labor is said to be the cause for this failure.

The older mines of the Randfontein South have small shafts and the workings are becoming deeper, causing greater trouble in hoisting. The opening of some parallel reef bodies lying to the west of the Randfontein reefs which show payable ore is the bright spot in this connection. The West Rand Consolidated, on which it was at one time proposed to erect 1000 stamps, has, so far, showed low-grade ore, and small profits from the 80-stamp mill already erected. Shortage of labor and the need of extra capital for an enlarged scheme of operations have proved a serious drawback, but the capital of the mine is already large and the grade of the mine appears to be lower than anticipated.

The policy of centralization and reorganization adopted in connection with the large Crown Mines amalgamation has taken longer to perfect than anticipated, and here again capital expenditure has exceeded expectations. No special information is made public as to the development results in the lowest workings, but as far as known ore above the average grade is being mined at present, to repay capital expenditure. In the rich Ferriera Deep mine, the grade and profits have fallen, as the result of bad mining in the past. About 400,000 tons of tailings were sent down to pack stopes to secure them and the shaft. Several rich stopes have become inaccessible for a time, owing to movements of ground.

GLOOM IN THE GERMISTON DISTRICT

The most gloomy outlook is furnished by the deep mines of the Germiston district. Of these, the Simmer East, on which nearly £1,000,000 was spent, has passed into the hands of the debenture holders. The occurrence of faults and dikes, and of ore under the average grade of the outcrop mines above produced this result. A working profit of a few thousand pounds per month was made, but not enough to repay debentures and provide interest. Over a year ago the consulting engineer of the Consolidated Gold Fields made the admission that the grade to be expected from the Jupiter and Simmer Deep mines, working the reef between 3000 and 5000 ft. on the dip of the celebrated Simmer & Jack mine, was not more than 5 dwt. per ton, and the last quarterly reports of these mines show what such a grade means in profits at that depth.

The Jupiter mine reported 2368 ft. of development work and this footage only allowed of 14,652 tons of payable ore being described as fully developed. There were 92,100 tons crushed, at a cost of 18s. 5.7d. per ton, showing a working profit of 2s. 0.4d., or a total of £9350. Capital expenditure on plant and buildings absorbed £22,137, and shaft sinking, £8657; development, £7815; but development account was charged £8969 to working cost. From these figures, the mine appears scarcely to be making any real profit, let alone paying for capital expenditure. On this mine over £1,000,000 was spent.

The Simmer Deep reported 3180 ft. of development, exposing 167,830 tons of ore presumably of payable grade; 146,700 tons were crushed at a cost of 15s. 11.7d. per ton, but the grade was so low that the profit was only 1s. 2d. per ton. The total working profit was £8582, but interest and debenture redemption absorbed £13,956 and capital expenditure £2407. The estimated loss, profit tax included, was £3799 for the quarter. On perusing these figures, one is led to ask if these mines can keep running under present conditions. Apparently development results are not improving and the outlook here is certainly not encouraging.

Losses from Poor Ore and Labor Shortage

The Knights Central is meeting with poor ore in depth. The water, which used to trouble the Knights Deep, now troubles the Witwatersrand Deep, and pumps to deal with 3,000,000 gal. per day have had to be installed. Development in the lower levels continues good.

Owing to shortage of labor, the Cinderella Consolidated has abandoned raising ore from its deep workings on the dip of the reef below the bottom of the 4000-ft. vertical shaft. What the real position of this deep-mining venture really is, is not known publicly, but shares have fallen.

The East Rand Extension, Boksburg and Van Dyk mines are closed down, owing to poor development, and work has been greatly restricted on the Rand Collieries, where the reef has proved erratic in gold content, and required a large further capital expenditure to bring it to the producing stage. There are about 2,500,000 tons of payable ore fully developed.

Trouble at Benoni Mill

The Benoni mine is in a serious position. So far, the Way-Arbuckle slimes plant seems to have proved a failure. Alfred James predicted the failure of the screw slime elevators, and centrifugal pumps appear not to have been a success. The extraction obtained from the first operations was poor and the ore is of low grade, so that at present the mine is heavily in debt and may have to close down.

The Apex mines, developing on the dip, have almost exhausted available capital and may close down also. The Randfontein Deep mine has stopped shaft sinking and closed down, owing to water difficulties and the need of raising fresh capital.

Some Bright Spots

The bright spots of the picture are not plentiful. The Brakpan mine has started work and is giving favorable results. Steady development work is going on at the Van Ryn Deep, the State mines, the Modder Deep, the Rand Klip, the Springs and Daggafontein mines. The New Modderfontein and the Modder B. mines continue to give excellent returns. The Modder B. mine has started its plant without any hitch, and the grade of ore mined has been excellent.

A large number of old outcrop mines that have been steady producers for 25 years are rapidly approaching the end. The Salisbury and Jubilee mines and the Celdenhuis closed down in 1911, and the York mine, Champ d'Or, Ferreira, Spes Bona, Jumpers, Glencairn, May Consolidated and Treasury are nearly worked out, and several will close down in 1912. The prospects for 1912 are somewhat clouded, owing to the cessation of work on development mines, the difficulty of raising fresh capital, the fear of further legislation on the eight-hour day and other questions, including compensation for miners' phthisis.

Tasmanian Mineral Production in 1911

The Secretary for Mines for Tasmania has already issued his report for the 1911 production. This is as follows, the items standing in order of descending value: Tin ore, 3953 tons; blister copper, 6022; silver-lead ore, 61,501; gold, 31,101 oz.; coal, 57,067 tons; copper ore and precipitate, 2286; wolfram, 70; bismuth, 15; osmiridium, 272 oz. (valued at £1888); and shale, 500 tons. The 1911 mineral production is valued at £1,349,497, as against £1,432,193 for the previous year.

Motor Trucks for Mines

Although the work of hauling to be done at most mines is over rough roads and under unusually severe conditions the gasoline-motor truck is in some districts beginning to displace both the horse and the mule. In desert regions, where the conditions are disadvantageous for making records, the motor truck is being introduced. It has one paramount advantage over draft animals under such conditions in that no water has to be carried for drinking purposes. Water holes in the desert are usually far apart, and the substitution of the motor for the draft animal would be warrantable for humane reasons if not for economy.

One instance of the use of motor trucks at mines is the Mack truck recently purchased from the International Motor Co., by the Jersey Valley Mines Co., for use in hauling supplies to its property near Battle Mountain, Nev. It is shown in the accompanying illustration. The first trip made by this motor was over a desert road. A drag of two 9-ft. lengths of 90-lb. rail was fastened behind the motor and dragged for 46 miles to smooth the ruts from the road that had been made while hauling freight by mule wagons. A gang of four men followed the drag to remove loose stones. This motor is making the 92-mile round trip in 16½ hours running time; 9½ hours going out with a full load of 15 tons and returning empty in 7 hours. The time taken by a 12-mule team for a 6-ton load was three days going out and two days returning, not including the one day's rest between trips.

Motor Truck of the Jersey Valley Mines Co., Near Battle Mountain, Nev.

Another company using the motor truck is the Pioneer Smelting Co., which has a smeltery near Tucson, Ariz. It is using a Saurer motor truck that carries 6½ tons of ore at a trip. After having traveled 1730 miles the solid rubber tires show little wear. The motor travels 94 miles per day using 1 gal. of cylinder oil and 20 gal. of gasoline. It transports about 40 tons of ore daily over a distance of 7¼ miles.

Air in Pyritic Smelting

By E. W. Walter*

Experience indicates that a silicious skeleton at the tuyeres is not essential to maximum oxidizing effect, that impure air is detrimental and hot blast in partial pyritic smelting is advantageous as the smelting capacity is increased and profits augmented, although no greater degree of concentration is effected.

In the practice of pyritic smelting, it was early noted by several metallurgists, particularly Herbert Lang, that the vital principles rested on three main features: (1) A large volume of air to oxidize the pyrite, with consequent development of heat. (2) The presence of sufficient free silica to flux the ferrous oxide formed. (3) The curtailment of coke to the greatest extent possible to permit oxidation of the pyrite by the air.

THE BESSEMERIZING ACTION

Great stress was initially laid, by metallurgists reasoning from an academic standpoint, upon the advantage of a large volume of air at very low pressure, and even fan blowers were advocated for such conditions, in the belief that pyritic-furnace oxidation rested in slow gradual roasting of the sulphides from the top of the furnace charge to fusion zone. In actual practice it was soon discovered that to deliver the volume of air necessary for pyritic effect, the furnace resistance had to be overcome, which called for pressure. With volume and pressure came the marked activity of oxidation and the abandonment of the slow roasting explanation of pyritic effect, to the one of bessemerizing action. In this sense, the easily fusible pyrite melting in the upper zones of the furnace shaft and trickling downward, is met by the oxidizing blast and converted into ferrous oxide, which in turn seizes with avidity the adjacent free silica from the quartz in the charge and from a certain silicious skeleton formed in the lower furnace shaft from former charges.

SILICIOUS SKELETON NOT ESSENTIAL

It has been repeatedly expressed by many metallurgists that the highest oxidizing effect of the blast is obtained, only after the tuyere zone has become encrusted with this sponge-like silicious skeleton, whereby the blast volume is broken into innumerable streamlets of highly-heated air from its passage through this porous skeleton, and further that this skeleton is being added to or taken from according to the requirements for silica of the ferrous oxide produced. George A. Guess in his article "Notes on Pyritic Smelting" published in the JOURNAL of Jan. 13, 1912, doubts the necessity of such furnace conditions at the tuyere zone, and cites most excellent concentration without such silicious skeleton. My own experience is in perfect accord with that of Mr. Guess. Such conditions at the tuyere zone, are not, in my opinion, the essential requirements for pyritic smelting, but rather the effect of the cooling influence of the large volume of blast, which must necessarily become heated to perform its function, and in so doing, cools the tuyere zone, forming the skeleton in question. This is proven to my mind, by the fact, that this skeleton is constantly changing and particularly so when blast pressure is altered, and is therefore only incident to the operation of the process and not particularly the necessary factor.

RAPID SMELTING AND HEAVY MATTE FALL ESSENTIAL

The bessermerizing effect on the trickling drops of matte descending from the upper zones is one that is continuous from the moment of formation, but reaches its highest effect in the incandescent zone, at which point the furnace is at its greatest endeavor. At this point the final degree of oxidation with consequent heat is developed and the partially formed slag from the upper zones completed. The success of the whole operation rests with the culmination of this last oxidation in this zone; air volume, air pressure, free silica and trickling matte must be harmoniously computed to bring about the acme of reaction and activity, and any disturbance of any of these essentials will soon show effect both in the matte and slag produced. It follows, to meet these conditions in actual practice, that the furnace charge should not be dense to a degree that will retard the blast nor contain elements which would raise the fusion temperature much above that of the simple singulo-silicate slag; rapidity of smelting with the charge constantly dropping, together with a heavy matte fall are essential for success.

There are, however, few places in the world where conditions are suitable for pyritic smelting using say from 1% to 4% coke, but almost all copper furnaces are smelting on pyritic principles, using say from 6% to 10% coke, depending upon the amount of pyrite in the ores. With such operation, the purity of the ores as well as their physical character, so essential in the practically true pyritic smelting, are of more or less minor importance, but the volume and pressure of the blast still maintains a premier position.

HEATED BLAST ADVANTAGEOUS IN PARTIAL PYRITIC SMELTING

While it is generally agreed that heated blast in true pyritic smelting offers no particular advantage, due to the fusibility of the charge, yet in semi-pyritic smelting due to the higher temperature required, heated blast is of great advantage. An extensive experience with both cold blast and blast heated to a temperature of 500° F. showed that, in the same furnace with the same ores, such remarkable betterment both from an operating and profit-earning standpoint, was produced by the heated blast that I feel assured that its advantages have not been thoroughly recognized. A comparison of hot- and cold-blast smelting is given as follows, prepared from data taken from records of an actual performance. The necessity of repairing the blast stoves afforded the opportunities for making the comparisons.

With cold blast 107 tons of ore were smelted with 15% or 16.05 tons of coke, which at $7 per ton cost $112.35; with hot blast, 154 tons of ore were smelted with 7% or 10.78 tons of coke that cost $75.46. The hot blast effected a saving of 5.27 tons of coke, or $36.89 for fuel expense; the capacity was increased 47 tons which at $4 per ton for treatment increased the receipts for the period by $188. The costs of operating the hot-blast stove and extra limestone required were $38 and $6.60 respectively, so that the profit made by hot-blast smelting was $180.29 more than when cold blast was used. The test was of 24-hr. duration, the hot blast had a temperature of 500° F., the matte and slag were the same in both cases, all other conditions were identical; the ore was a silicious sulphide.

HEATED BLAST DOES NOT INCREASE CONCENTRATION

It will be noted, that matte and slag produced is stated as the same, which perhaps requires some explanation in light of the general belief that heated blast would have the effect of increasing the concentration. Contrary to this belief, my experience has been, that heated blast exerts itself not to increasing the degree of concentration, but rather to expending itself in smelting more charge. The reason for this is that the smelting furnace is relieved of part of the duty of preheating the blast, the fusion zone is lower, and the whole furnace cross-section active by reason of the absence to a large extent of the silicious skeleton around the tuyere zone, thereby enlarging the active zone of incandescence.

---

*Mining engineer and metallurgist, Silverton, Colo.

With ores containing elements such as alumina and zinc and depending on the sulphides oxidized by the blast to furnish ferrous oxide for the slag, heated blast certainly is of great advantage, bringing about smoothness of operation and producing slag impossible with air at normal atmospheric temperatures.

That the blast entering the smelting furnace should be pure, uncontaminated air, was forced to my attention some years ago, while conducting some smelting experiments with blast heated to a temperature of 900° F. The blast was preheated easily and quickly by coke in an apparatus that I do not feel at liberty to describe. The products of combustion, almost entirely carbon dioxide, contaminated the air. The smelting furnace was of excellent design and for the work intended required 10,000 cu.ft. of air per minute. A short calculation amply verified by gas analyses during the experiment will show the conditions.

Taking 13.1 cu.ft. air as equal to 1 lb., 10,000 cu.ft. equals 763 lb. The specific heat of air is 0.24, therefore 0.24x763x900=164,808 heat units are required. The coke used contained 76% carbon and was equal to 11,020 heat units per lb. Therefore 14.9 lb. of coke was required to heat 763 lb. of air to 900° F. and as 14.9 lb. coke contain 76% or 11.5 lb. carbon, and 1 lb. carbon burned to carbon dioxide requires 2.667 lb. oxygen, 11.5 lb. carbon requires 30.67 lb. oxygen. As 763 lb. air contain 175.5 lb. oxygen, therefore, 17.4% of oxygen efficiency is lost in preheating. In replacement there are 42 lb. of carbon dioxide. In other words in place of pure unadulterated air, we had a mixture containing only 18.7% out of a possible 23% by weight of oxygen and further contaminated with over 5% carbon dioxide along with inert nitrogen.

Effects of Impure Air

In the experiment, the furnace was operating normally with cold blast, smelting a good tonnage and producing a fair-grade matte. The bypass for cold air was closed and the blast directed through the blast-heating apparatus. It was deemed best to make no alterations whatever with the charge, allowing the same conditions to prevail, and change only as conditions might necessitate. In the course of a half hour the blast had reached a temperature of 900° and was held at that point. Ordinarily a furnace with this temperature blast and with the same coke as with cold blast, should have "bullseyed" the tuyeres and run away, but quite the contrary happened, the tuyeres grew darker, the slag colder, the jackets became crusted and matters became so doleful, that a return to cold blast became imperative to save the furnace. A slight increase of fuel and pure atmospheric air soon put matters aright, when the experiment was repeated with identical results.

From experiment along these lines, I feel thoroughly convinced that any contamination of the air furnished the furnace will result in bad effects and mitigate against smooth operation and results. This is not surprising when it is considered that the air is delivered directly to the fusion zone, where the final oxidation is at stake and where oxygen is required to fulfill requirements and where any deficiency will show marked effect. To replace such necessary oxygen even to a small extent with an extinguishing gas such as carbon dioxide must certainly bring about deleterious results. It is a matter of considerable doubt whether any method of preheating which will in any way contaminate the air will meet with such success as marks the energy of pure unadulterated air.

Jarbidge, Contact and Elk Mountain Districts, Nevada

As the result of a geologic field examination made in 1910 by F. C. Schrader, in Elko County, Nev., the U. S. Geological Survey has published a report on the Jarbidge, Contact, and Elk Mountain mining districts. The area comprising these districts is about 35 miles long and 26 miles wide and covers about 1400 square miles. It lies in the northeastern part of the region known as the Nevada Plateau, at a general elevation of about 6000 ft., including parts of the Great Basin on the south and the Snake River valley on the north.

The first gold ore discovered in the Jarbidge district is reported to have been found in 1904 by a sheep tender, but the discovery that led to the founding of the present district was made in 1909. The developments are encouraging and the district as a whole is said to be fulfilling the promise of its surface showings. In some of the analyses of ore large percentages of potash were also determined.

The ores of the Contact district are almost wholly copper ores, but they contain also small amounts of silver and gold, and in some portions of the district lead, manganese, and zinc ores are found. The early prospectors searched for gold, but Mr. Schrader describes a number of copper properties that have been opened since 1887, many of them having been operated on a rather large scale. Railroad facilities are promised in the near future.

Mineral deposits were known in the Elk Mountain district as early as 1890, since which time work has been carried on there each year, though the district as a whole is still in the prospect stage. The chief metal of this district is copper, and gold and silver are associated with it.

Florida Phosphate Production

The fourth annual report of the Florida Geological Survey, by E. H. Sellards, shows that the production of phosphate rock in Florida during 1911 was 2,494,572 long tons as compared with 2,029,797 long tons in 1910. In 1911 the production of hard rock was 474,095 and of pebble rock, 2,020,477, while the 1910 production was 392,088 and 1,637,709 long tons, respectively.

The total domestic shipments of phosphate rock during 1911 were 1,290,779 tons; while during 1910 the domestic shipments amounted to 1,014,473 tons, from which it appears that slightly more than one-half of the phosphate produced in Florida is consigned to points within the United States.

Operating Companies

In all, 31 companies were engaged in mining phosphate in Florida during 1911. A list of phosphate companies operating in Florida during 1911 is given herewith: Armour Fertilizer Works, Bartow, Fla.; Peter B. & Robert S. Bradley, 92 State St., Boston, Mass., and Floral City, Fla.; J. Buttgenbach & Co., Holder, Fla.; Camp Phosphate Co., Ocala, Fla.; Central Phosphate Co., Dutton, Fla.; Charleston (S. C.) Mining & Manufacturing Co., Charleston, S. C., and Ft. Meade, Fla.; Compagnie Generale des Phosphates de la Floride, Pembroke, Fla.; Coronet Phosphate Co., 99 John St., New York, and Lakeland, Fla.; Cummer Lumber Co., Jacksonville, Fla., and Newberry, Fla.; Dominion Phosphate Co., Bartow, Fla.; Dunnellon Phosphate Co., Rockwell, Fla.; Dutton Phosphate Co., Gainesville, Fla.; Florida Mining Co., 165 Broadway, New York, and Mulberry, Fla.; Florida Phosphate Mining Corporation, Norfolk, Va., and Bartow, Fla.; Franklin Phosphate Co., Newberry, Fla.; Germofert Manufacturing Co., Charleston, S. C., and Jane Jay, Fla.; Holder Phosphate Co., Ocala, Fla.; International Phosphate Co., 27 State St., Boston, Mass., and Ft. Meade, Fla.; Interstate Chemical Corporation, Bowling Green, Fla.; Istachatta Phosphate Co., Istachatta, Fla.; Mutual Mining Co., Savannah, Ga., and Newberry, Fla.; Palmetto Phosphate Co., Baltimore, Md., and Tiger Bay, Fla.; Phosphate Mining Co., 92 William St., New York, and Nichols, Fla.; Pierce Phosphate Co., 2 Rector St., New York, and Pierce, Fla.; Prairie Pebble Phosphate Co., 165 Broadway, New York, and Mulberry, Fla.; Schilman & Bene, Ocala, Fla.; Southern Phosphate Development Co., Ocala, Fla.; Standard Phosphate Co., Christina, Fla.; State Phosphate Co., Bartow, Fla.; T. A. Thompson, Neals, Fla. The Amalgamated Phosphate Co. began, in 1911, the construction of a plant for the production of pebble phosphate.

The High Grade District, California

By Algernon Del Mar*

There is a mining excitement or stampede, as it is called, to the High Grade district, in Modoc County, Calif. The district has been by some compared favorably with Cripple Creek, but so far neither tellurides nor phonolite rock has been found. The country rock is a brecciated andesite, the vein matter being silicified brecciated andesite and rhyolite. The veins are from a few inches to many feet in width, varying in value from thousands to the ton in the narrow veins to an average of, say, $12 in the veins about 4 ft. wide.

The district has been thoroughly prospected on the surface, and at least four properties have been developed for a few hundred feet underground. There is nothing to get excited about, nor is there any occasion for a stampede or a boom in the district.

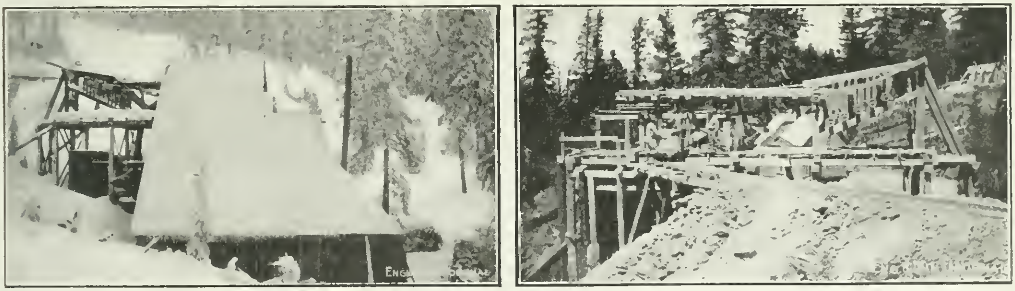
This mineral area was last year known as the Hogue district, but has been renamed this year the High Grade district by some adventurous spirits, who will, no doubt, endeavor to be on the top of the rush. Snow covers the ground from November to June, often 20 ft. deep. New Pine Creek is the nearest railroad station, on the Nevada, California & Oregon, which makes connection at Reno with the Southern Pacific R.R. The district is in the northeast extremity of California; some of it is, in fact, in Oregon. Those who are determined to go there had better wait until July, but I would advise no one to go there expecting to make a fortune overnight. That the district may produce a few good mines is not improbable, but this ground is taken up and being worked by organized companies.

The Fort Bidwell Consolidated Mines Co. has a 10-stamp mill and an aërial tramway, erected by me last year. Winter overtook us before we were prepared to be snowed in, so that the mine was not well tested before closing down. With the addition of a cyanide plant, this mine should make good. A Lane mill was erected on the Fort Bidwell side of the mountains two years ago, but has never turned a wheel. There has been no ore for it to run on. The Big Four mine erected a mill last year, but winter came on before it was started. The mine is reported to be able to supply a large quantity of low-grade ore with the chances of high-grade streaks. The Sunshine mine shows a narrow vein of high-grade ore, from which the owners have been getting out enough for a shipment.

The district may be summed up thus: Narrow, rich veins not very numerous, and bodies of low-grade material not sufficiently developed to prove their worth as mining assets. California is hardly the place for a mining boom; the psychological phenomenon suits Nevada better, so it is quite an anomaly to see a rush to a California mining district. This district would have been developed in a business-like normal way, but for the fact that certain people have seen fit to over-advertise the advantages of owning a part of it.

---

*Mining engineer, Los Angeles, Calif.



Mill and Tramway of Fort Bidwell Consolidated Mines Co., High Grade District, California

Broken Hill South Silver

The Broken Hill South Silver Mining Co., in the half year ended Dec. 31, 1911, paid 4½%, besides writing off 5% depreciation on its plant. This was on a production of 181,562 tons of ore, assaying 14.4% Pb, 14.1% Zn and 6.9 oz. Ag. The concentrator treated 181,790 tons, from which were produced 27,339 tons of lead concentrates, assaying 71.9% Pb, 5% Zn and 24.5 oz. Ag; 123,969 tons of zinky tailings, carrying 16.7% Zn, 3.4% Pb and 3.6 oz. Ag; 10,571 tons of quartz tailings, carrying 2% Pb, 9.3% Zn and 1.9 oz. Ag; and 19,911 tons of slimes, carrying 9.8% of lead, 11.9% Zn and 5.4 oz. Ag. The Amalgamated Zinc (De Bavay's) took all the current zinc tailings, and 19,953 tons of the accumulated, and the Zinc Corporation took 5298 tons from the old tailings dumps.

It is estimated that there are 1,052,983 tons of tailings available for treatment by the Zinc Corporation, and 95,402 for De Bavay's, also 281,319 tons of accumulated slimes, while the ore reserves are at present estimated at 3,000,000 tons. The handling of the capital and plant account is conservative, and the profit and loss account stands at over 50% of the issued capital.

Working costs were: Mining, $2.60 per ton of ore; filling depleted stopes, $0.39; development, $0.30; and concentrating, $0.86; total, $4.15; equivalent to $27.39 per ton of lead concentrates.

The company is investigating a new process for zinc smelting, but no details of it are given.

Michigan Iron Ore Reserves

C. K. Leith, reports to the U. S. Geological Survey an estimated reserve in the iron mines of Michigan of 124,598,164 long tons of commercial ore and 44,982,938 tons in drilled areas, or a total reserve of 169,581,102 tons. This estimate leaves out of consideration high-silica, low-phosphorus ores of even 40% grade, which have been mined on both the Gogebic and the Marquette ranges.

The probabilities of extension in every district but the Menominee are said to be so strong that it is safe to estimate that for many years as much ore will be discovered as is mined. At present the reserve probably bears a larger ratio to the total shipment than at any time in the past, and the report states that in 10 years the proportion will probably be greater. Large extensions, both vertical and areal, are inevitable. Probably not more than 10% of the area of the upper Huronian slates of the Crystal Falls, Menominee, Iron River, and adjacent areas has been explored. The total known area of iron formation is stated to be 29,267 acres, but in addition there are fully 20,000 acres of magnetic belt in which exploration has scarcely more than begun.

The general conclusion of Doctor Leith's report is that in few other regions will expenditures for large explorations yield more certain results. There is yet no indication of diminishing returns from exploration. The reserve will cease to grow only when difficulties of exploration or outside economic influences begin to limit the amount of exploration.

Further Studies in Solution

By Harry C. Jones*

Certain salts are partially broken down by water into acids and bases; such hydrolytic dissociation is followed by electrolytic dissociation. Ions necessary for precipitation. Electrolytic dissociation an essential for chemical action. A change in intrinsic energy of the molecules the cause of chemical action. Why some mixtures of solids are true solutions.

A phenomenon of importance alike to the man of science and to the engineer is diffusion. If it did not exist in solutions it would be impossible to maintain a standard solution homogeneous for any length of time. The phenomenon of diffusion is so well known, that from sheer familiarity with it we are likely to underestimate its importance; just as from familiarity with water we are liable to forget that it is far and again the most interesting, remarkable, and many times the most important chemical compound known to man.

Think of the following fact. Take a tall glass cylinder and place over the bottom some heavy solid salt—say lead nitrate—then pour water carefully upon it. The salt will dissolve and rise through the much lighter water clear up to the top of the cylinder. If the cylinder is allowed to stand for a sufficient length of time, the solution will become homogeneous throughout its entire length.

This is in reality a remarkable fact. A heavy substance rising through a much lighter medium, apparently right against the pull of gravitation. It differs in degree but not in kind from the following. Indeed, it is quite analogous to our rising directly upward through the air.

Diffusion and Osmotic Pressure Related

The distribution of the salt throughout the entire length of the cylinder is what we call diffusion. It is true that hydration, or the power of the salt to combine with water may influence in some small degree its distribution throughout the solvent; but this is not the chief cause of the distribution.

Diffusion is but a name for a phenomenon or class of phenomenon. The question is: What is the cause of diffusion? If we study the laws of diffusion, on the one hand, and the laws of osmotic pressure on the other, we will find striking resemblances between the two. Thus, Fick's law of diffusion tells us that the amount of substance that will diffuse across any cross section between two solutions of different concentrations of any substance, is proportional to the difference in the concentrations of the two solutions. This is analogous to Boyle's law for gases.

We have already studied the "principle of Soret" for the temperature coefficients of diffusion, and have shown that it obeyed Gay-Lussac's law for gases, and the temperature coefficients of osmotic pressure conform to this same law.

So closely do the laws of diffusion conform to those of osmotic pressure, that we are now justified in concluding that osmotic pressure is the cause of diffusion. When we consider how important diffusion is in the various industries, we see how important a knowledge of the laws of osmotic pressure is to the engineer.

Hydrolytic Dissociation

We have seen in an earlier chapter how the theory of electrolytic dissociation arose and what it is. It is impossible in these short papers to give much of the evidence for it. A little of the evidence will, however, appear later. Suffice it to say, although it must under these conditions, be said dogmatically, that this theory has now become a law of nature, and is as well established as any of our ordinary laws of nature. It is now generally accepted by all productive chemists, and I know of no one of any marked reputation who doubts its validity.

There is, however, another kind of dissociation which must be referred to before leaving the subject of solutions as such. It is well known that an aqueous solution of sodium carbonate reacts alkaline. Why is this? The answer usually given is that it is because sodium is a strong base and carbon dioxide being a weak acid, the strong basic properties of the sodium predominate. This is nothing but words. Sodium is not a base at all. The only thing that has basic properties is the hydroxyl ion, and, therefore, the above so called explanation explains nothing. The above question remains, then, to be answered.

Why Some Salts are not Neutral

We have now the full explanation. Whenever a salt of a weak acid or a weak base is dissolved in water, the water acts upon the salt, decomposing it directly into the *free acid* and the *free base*. Take sodium carbonate; the water first acts upon it in the sense of the following equation—

$$Na_2CO_3 + 2\,H_2O = 2\,NaOH + H_2CO_3$$

We have free sodium hydroxide and free carbonic acid formed *at first*. These then undergo electrolytic dissociation in the following sense—

$$NaOH = \overset{+}{Na},\ \overset{-}{OH}$$

$$H_2CO_3 = \overset{+}{H}.\ \overset{+}{H},\ \overset{=}{CO_3}$$

Then the question arises, why do not the hydrogen ions of the acid just offset the hydroxyl ions of the base, and the solution react neutral? This is because the base is *strong*, ie., much dissociated. The acid is *very weak*, ie., only a little dissociated. We have many more hydroxyl ions present in the solution than we have hydrogen ions, and the solution, consequently, reacts alkaline.

If a salt of a weak base and a strong acid is dissolved in water, the water acts hydrolytically upon the salt, decomposing it into the free acid and the free base. The acid being strong is much dissociated, yielding many hydrogen ions. The base being weak is only a little dissociated; therefore, yields only a few hydroxyl ions. The hydrogen ions then predominate in such a solution and it reacts acid. This action of water in breaking down salts into free acids and free bases is known as *hydrolytic dissociation*. The products of hydrolytic dissociation are always electrolytically dissociated by the water to a greater or less extent, but this is a side issue.

Hydrolytic dissociation tells us, and tells us for the first time, why it is that aqueous solutions of certain salts react alkaline, and why it is that aqueous solutions of other salts react acid.

Colloidal Solution and Colloidal Suspension

We hear much today of colloidal solutions, colloidal suspensions, and in general, of "colloidal chemistry." What does this mean?

To understand what is meant by a colloidal solution we must ask again what is a true solution? Every true solution has the three fundamental properties of solutions—osmotic pressure, lowering of freezing point of the solvent and lowering of the vapor tension of the solvent. It is, however, not enough to possess these properties to be a true solution. They must be possessed to a certain definite degree. The osmotic pressure must obey the laws of gas pressure and be of the same magnitude as the gas pressure of a gas having the same concentration as the solution. The lowering of the freezing point of the solvent must obey Raoult's law, i.e., one molecule or ion of the dissolved substance must lower the freezing point of 100 molecules of the dissolved substance about 0.63° C. Similarly, one molecule of the dissolved substance must lower the vapor tension (raise the boiling point) of 100 molecules of the solvent by a definite, known amount. These are the necessary and sufficient conditions for a true solution.

---

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

There are a number of substances which apparently dissolve in certain solvents and manifest all three of the above properties; but these properties are of a much smaller magnitude than indicated above. These are not true solutions, but colloidal solutions. Examples of colloidal solutions are starch, albumen, etc., in water.

The class in which we are especially interested here are the "colloidal suspensions." If arsenic chloride is dissolved in water and hydrogen sulphide conducted into the solution, we have yellow arsenic sulphide precipitated. If, on the other hand, arsenic oxide is dissolved in water and hydrogen sulphide conducted into the solution, we do not have any precipitate formed. The solution simply turns yellow.

In the latter case the arsenic sulphide formed is not precipitated and is not in solution. That this is not in solution is shown by the fact that it does not have any of the properties mentioned above as being characteristic of true solutions.

The arsenic sulphide formed from the arsenic oxide is in a state of colloidal suspension and is an excellent example of colloidal suspensions. Let us study briefly the properties of such a suspension.

If to the suspended arsenic sulphide an acid, base or salt is added, the arsenic sulphide is precipitated. Acids, bases and salts are the electrolytes. The addition of any electrolyte, then, causes a precipitation of the colloidal suspension. This is obviously a remarkable fact, and we must seek its explanation.

Colloidal Particles Charged Electrically

If we introduce two electrodes into a colloidal suspension and pass a current between them the colloid will collect around one pole, showing that the colloidal particles are electrically charged. Some colloids will collect around one pole and some around the other, but any given colloid will all move to one pole. This shows that some colloids are charged positively and other colloids negatively; but all the particles of any one colloid have the same kind of a charge upon them. This is a matter of fundamental importance and raises the question, how does the charge upon the colloidally suspended particles prevent them from clotting, or precipitating, as we say?

All of the particles of any given colloid have the same kind of a charge upon them. They, therefore electrically repel one another. When an electrolyte is added what takes place? If the colloidal particles in question are charged positively, the water around them is charged negatively. Where an electrolyte is added we add, of course, both positive and negative ions. The negative ions (anions) equalize the charges upon the colloidal particles, the cations equalizing the negatively charged water. Now what happens? The colloidal particles no longer repel one another electrically, at least to nothing like the original extent, and surface tension gets in its full effect. We have seen that the action of surface tension is to produce the smallest surface for a given mass. It draws the colloidally suspended particles together into large masses and we have what we call a precipitate.

Precipitation

This raises the whole question as to what is meant by precipitation in general, and precipitation is one of the most general chemical phenomena. We have precipitation in general only when ions are present, and for the reason pointed out above. If this seems strange, a moment's thought will show that it is not. When two substances are brought together which can react and form a solid that is insoluble in the solvent in question, they undoubtedly react in molecular quantities, molecule for molecule. The solid is first formed in a state of molecular aggregation, or at most only a few molecules are aggregated. These aggregates then still further aggregate until the condition of colloidal suspension is reached. These aggregates become charged electrically, the solvent taking the opposite charge, and further aggregation cannot go on—we have a colloidal suspension.

Colloidal Suspension the Natural Condition

This is, then, the natural condition of a solid when formed in a chemical reaction. It is only when we disturb the electrical equilibrium by adding electrically charged parts—ions—that the aggregating of the solid goes on and we have a precipitate. We are so accustomed to precipitates in chemistry, and they are so fundamental for both qualitative and quantitative analysis, that we are liable to look upon this condition as a matter of course—as the "natural condition" of matter in the solid state in the presence of a liquid. From what has just been said we have seen that exactly the opposite is the case. The precipitated condition is in a sense the unnatural state, the colloidal suspension being the normal state.

In many chemical reactions it is not necessary to add foreign ions in order to get a precipitate. This is because in most chemical reactions something is formed which is itself dissociated by the water, and, therefore, yields the ions necessary to form a precipitate from the otherwise colloidally suspended solid.

We can now understand the above reaction with arsenic chloride on the one hand, and arsenic oxide on the other, with hydrogen sulphide. When arsenic chloride is treated with hydrogen sulphide, arsenic sulphide and hydrochloric acid are formed. The latter is a strongly dissociated compound, and yields the ions necessary to cause the arsenic sulphide formed to precipitate.

When arsenic oxide is treated with hydrogen sulphide, arsenic sulphide and water are formed. Water is almost completely undissociated and there are, consequently, no ions present to cause a precipitation of the sulphide of arsenic. It remains in the "natural state" of a colloidal suspension.

Role of Ions in Chemistry

These facts suggest a number of lines of thought. Ions as we shall see, are absolutely necessary for chemical action; but, more than this, they are necessary for the formation of a precipitate after the solid is once produced in the presence of a liquid. Ions, are therefore, essential to all chemical analysis.

We were accustomed, until recently, to look upon a solid brought into the presence of a liquid and shaken as doing one of two things; either dissolving in the liquid forming a true solution in it, or as remaining in the presence of the liquid in a state of mechanical suspension. We had true solutions and mechanical mixtures. The former had quantitatively the three fundamental properties of true solutions. In the latter the properties of the solvent are not affected by the suspended solid particles.

We know to-day that we have a complete series of systems from the true solutions to mechanical mixtures, and every intermediate stage represented. We have true solutions, colloidal solutions, colloidal suspensions and finally mechanical mixtures, with a gradual gradation in properties from the one extreme to the other.

The last question that space will permit us to raise here in this connection is, whence the difference in the properties of these different systems? It should be frankly stated that we can not answer this question completely. This much is, however, certain. The state of division of the solid is finest in the true solution, is coarser in the colloidal solution, is still coarser in the colloidal suspension, and is coarsest of all in the mechanical mixture. It is impossible to say to-day whether this is the only difference in the solid particle. It is probably not. Other differences, however, may all be functions of this difference in the size of the particle. It was hoped that space would allow something to be said in reference to colloidal suspensions of the metals. These are prepared by passing an electric discharge between two poles of the metal under water. These metallic suspensions are so coarse-grained that the particles can be seen under the ultramicroscope. These colloidal metals act catalytically like the organic enzymes, but for more of this see my "Elements of Physical Chemistry," fourth edition, p. 252.

Colloidal suspensions play a prominent part in physiology, and in living matter in general. Indeed, colloidal chemistry is just in its infancy, and we may confidently look for very important development in this field in the near future.

SOLID SOLUTIONS

It is only recently that we have come to regard certain mixtures of solids as true solutions. Indeed, the term "solid solution" was seldom if ever used until it was made the title of a paper by Van't Hoff in vol. V, of the *Zeitschrift für physikalische Chemie*, in 1890. If used before that time it certainly had no scientific significance.

What justification have we to-day for referring to any mixtures of solids as "solid solutions?" Let us recall the three fundamental properties of true solutions. They are—osmotic pressure; lowering of freezing point, and lowering of vapor tension. Do the mixtures of solids in question have all or any of these properties? This was the question which Van't Hoff asked and answered, as we shall see, in the affirmative.

That solids dissolved in other solids lower each other's freezing points is shown by the alloys. Take Rose's or Wood's fusible metal. These alloys melt under boiling water; therefore, much lower than any of the constituents.

Is there any evidence of the lowering of vapor tension in mixtures of solids? The vapor tension of a solid is in general at ordinary temperatures very small; and therefore difficult to measure. Any change in this small quantity would also be difficult to measure. We must, therefore, look for some indirect method of solving this problem, and such was found by Van't Hoff.

Take the lead salt of dithionic acid. It decrepitates easily: i.e., if left to itself it readily flies to pieces. This shows that at ordinary temperatures it has considerable vapor tension.

Lead dithionate forms an isomorphous mixture with calcium dithionate. This means that a crystal of the lead salt has the same form as a crystal of the calcium salt, and will grow in a solution of the calcium salt or in a mixture of the lead and calcium salts, the crystal containing both salts. A crystal containing both of these salts decrepitates much less than a crystal of the pure lead salt, showing a diminution in the vapor tension of the lead salt by the presence of the calcium salt. The isomorphous mixtures are among the best examples known of solid solutions, and here we have the vapor tension of one of the solids lowered by the presence of the other.

DIFFUSION IN SOLIDS

Finally, have we any evidence of the existence of osmotic pressure in mixtures of solids? Again, we cannot hope to test this directly; but an indirect solution to this problem has been most satisfactorily furnished in the paper referred to above by Van't Hoff. Osmotic pressure is the cause of diffusion. If there is diffusion in mixtures of solids there must be osmotic pressure there to cause it—we have abundant examples of diffusion of solid through solid.

Place a porcelain crucible in a cavity cut in a piece of charcoal and heat the whole. The charcoal will penetrate clear through the walls of the porcelain crucible and can be found on the inner side.

Again, cover a zinc object electrolytically with a thin layer of copper and lay it aside at ordinary temperatures. The object will soon become white again, due to the diffusion of the zinc into and through the copper.

One of the best examples of the diffusion of metal through metal has been furnished by Roberts-Austen. He clamped discs of gold to the bases of lead cylinders and allowed these to stand in contact with one another, at ordinary temperatures, for several years. He then removed the gold disc, and cut slices of the lead cylinders and assayed them for gold. At the end of four years it was found that the gold had penetrated about 8 mm. into the lead. These results are all conclusive proof that we have diffusion of solid in solid at ordinary temperatures; therefore, conclusive proof of the existence of osmotic pressure in mixtures of solid in solid.

SOLID SOLUTION NOT A MERE NAME

Certain mixtures of solids then, have all three of the fundamental properties of true solutions in liquids as solvents, and are, therefore, just as much entitled to be called solutions as the latter.

A fairly large amount of work has been done, especially by the Italians, on the kinds of substances that can form solid solutions with one another, and some relations of interest and importance have been brought out. Thus, in the aromatic or benzene compounds only those substances can form solid solutions with one another which have the same number of "benzene rings" in their molecular structure.

Further, the properties of solid solutions have been utilized to determine the molecular weights of a few substances in the solid state. We have no reliable method even to-day for determining the molecular weight, or the number of the simplest chemical molecules aggregated to form the physical molecule of even the simplest chemical compound in the solid condition. We do not know the chemical formula of ice. We have seen that the chemical formula of water, at ordinary temperatures, is $(H_2O)_4$. We have no idea what the state of association of water is when it passes over into the solid state, and no well founded method even of attacking this problem. We do not know the formula of solid sodium chloride or rock salt.

The study of solid solutions has thrown some little light on such problems, but for this, reference must be made again to my "Elements of Physical Chemistry," fourth edition, pp. 310 to 317.

UNDISSOCIATED SUBSTANCES DO NOT REACT CHEMICALLY

It would not be satisfactory to leave the subject of solutions as such, without saying something on this important bearing of the theory of electrolytic dissociation. According to the theory of electrolytic dissociation, it is the ions or charged parts that are the active agents chemically. Molecules as such can not act chemically. Ions or charged parts may react with molecules, but two uncharged parts cannot enter into chemical reaction.

This conclusion from the theory of electrolytic dissociation is one that can be tested easily and convincingly. The way to test whether ions are the active chemical agents is to increase the number of ions present and see whether chemical activity increases. This has, of course, been done, and with the general result that chemical activity was found to increase and proportionally to the number of ions taking part in the reaction.

The sequel to this is the point upon which it is desired here to lay stress. To see whether molecules can react chemically it is only necessary to exclude all ions, and then observe the result. Special precaution must be taken to exclude ions. This will be seen to be the case, when it is pointed out that not only water but many other, indeed most liquids, possess some ionizing power. Again, temperature can produce ions, fused salts showing marked conductivity. However, ions can for the most part be excluded as follows. Dry the substances thoroughly over phosphorus pentoxide and then study the chemical behavior of the substances thus dried.

Wanklyn has shown that dry chlorine gas does not act upon dry metallic sodium, although moist chlorine reacts readily, especially at elevated temperatures.

Peculiarities of Dry Hydrochloric Acid

Baker has shown that perfectly dry phosphorus does not burn in carefully dried oxygen; but what is, perhaps more remarkable, dry hydrochloric-acid gas does not react with carbonates. Indeed, liquid hydrochloric acid made from the carefully dried gas has no trace of acid properties. It will not act on dry metals, will not decompose carbonates and will not even color blue litmus red. Dry hydrochloric acid gas dissolved in a non-dissociating solvent such as dry chloroform or dry benzene will not color blue litmus red.

Perhaps a more remarkable case is the lack of action between dry hydrochloric-acid gas and dry ammonia gas. Baker in England has shown that when the proper precaution is taken to dry both of these gases, there is not a trace of chemical action between them when they are brought together.

Most remarkable of all, however, is an experiment which I saw performed on the lecture table of the Chemical Society of London. Metallic sodium, which had been dried with special care, was plunged into sulphuric acid which had been dried with equal care. The sodium remained suspended in the sulphuric acid as quiescently as if it were immersed in ligroïn. These examples suffice to show the chemical inactivity of molecules.

Energy Changes in Chemical Reactions

The statement has often been made that chemical reactions are accompanied by thermal changes. It means to state that whenever a chemical reaction takes place there is heat either evolved or absorbed. If it is used to imply that the chemical reaction is the important thing and the energy change of subordinate importance, the statement would, as we shall see, be as far from the truth as it is possible to go.

Whenever a chemical reaction takes place we always have heat either evolved or absorbed, and usually evolved. We may have electrical energy produced, and if the reaction proceeds with sufficient rapidity we may have light. The question arises whence come these various forms of energy? From the law of the conservation of energy we know that energy can come only from energy. There must, therefore, be some form of energy in the atoms or molecules which, in chemical reactions, is converted in part into other forms.

The amount of heat energy that is produced when some chemical reactions take place is very great indeed. The most exothermic of all chemical reactions is the union of hydrogen with oxygen. The amount of heat that is liberated in the burning of coal is also large, and there are many other chemical reactions with large exothermal values.

The question is in what form is the energy in the atoms that in chemical reaction is converted into other forms? It was called intrinsic energy to distinguish it from extrinsic forms of energy. It was something inherent in the atom itself, and thus differed from heat, light, electricity, etc., which were extrinsic to the atom, and into which intrinsic energy could be, to a greater or less degree, converted.

This was, of course, nothing but a name, and explained nothing. To call the energy within the atom intrinsic, simply differentiated it from external manifestations of energy, but gave no physical conception of the nature of intrinsic energy. I remember well when I first began to teach physical chemistry 18 years ago, that it was impossible to give any adequate or satisfactory interpretation of what was meant by intrinsic energy. What was its nature, what was it doing within the atom? These were questions that naturally arose but could not be answered. Intrinsic energy was even then simply a term for something which we knew to exist, but about the nature of which we knew absolutely nothing.

Electron Theory of Thomson

This is all changed now, thanks to the electron theory. Sir J. J. Thomson, as is well known, has shown that all of the atoms of all elementary substances are complex, and are probably made up of the same constituent—electrical charges. These charges, called electrons, are moving with high velocities within the atoms. These electrical charges have been shown to have mass. Indeed, all of the mass of the atoms is probably due to the electrons; these being the ultimate units of which all matter is made up. Indeed, the term matter is a pure product of the imagination, having no counterpart in fact, cannot be detected even qualitatively by any method known to man, and was created simply to have something on which to hang energy. We could not think of energy in the abstract, and therefore imagined the existence of another entity than energy and called it matter.

The fundamental properties of what we called matter are mass and inertia; but it has been shown that all of the mass and all of the inertia of what we have called matter are probably due to the electrical charges that make up the atom. Consequently, there is no longer any occasion for assuming the existence of any entity other than energy—no occasion for assuming the existence of matter, because there are no properties which are not possessed by the energy alone, and the conception matter will doubtless be gradually abandoned.

Space will not here permit of a scientific discussion of this question. Those who may be interested in it, will find it treated in a fairly elementary manner in my book, "The Electrical Nature of Matter and Radioactivity," second edition, published by the D. Van Nostrand Co., New York.

Properties of the Electrons

The point here is that the electrons, or isolated electrical charges, have mass and are moving with high velocities. Having mass and velocity the electrons have kinetic energy; and although their mass is small, their high velocity gives them a large amount of kinetic energy. (Kinetic energy $= \frac{1}{2} mv^2$, m being the mass and v the velocity of the moving particle.)

We can then think of the intrinsic energy of the atom as being essentially the kinetic energy of the moving electrons which compose the atom, and can thus form a physical conception of what is meant by intrinsic energy.

Why Do Chemical Reactions Take Place?

We now come to the fundamental chemical question, why do chemical reactions take place? Why is it that some substances react chemically and others do not? No satisfactory answer to this question could be given until the energy changes that take place in chemical reactions were studied.

It was the French chemist, Berthelot, who, about the middle of the last century, began to study the heat changes that manifest themselves whenever chemical reaction takes place. He opened up the whole subject of thermochemistry, and from that time to the present more and more thought has been devoted to the energy changes that occur in chemical reactions. This is the natural order of events. The material changes were studied first, partly because they were the most obvious and partly because men desired the products of the reaction for one purpose or another.

One result of the study of these energy changes, is that we have now a pretty clear conception of why a chemical reaction takes place. When the two substances which are brought together differ largely with respect to the amount and potential or intensity of the intrinsic energy that they contain, they become unstable when in the presence of one another. Some of the intrinsic energy in one or both passes over into heat or other forms of energy, and the substances combine and form a system more stable under the new conditions. This is a chemical reaction, and the cause is to be found in the differences in the intrinsic energy present in the substances which react.

The old statement that "a chemical reaction is accompanied by a thermal change" is, therefore, just as reasonable as to say that a cart is accompanied by a horse. It interchanges completely cause and effect.

TRANSFORMATION OF INTRINSIC ENERGY INTO OTHER FORMS

One of the greatest if not the greatest problem for the engineer is the discovery of an economical method for transforming intrinsic energy into electrical energy and light. A glance at the methods now in use for effecting these transformations will make this clear.

The primary cell was, for a long time, the best means of converting intrinsic energy into electrical energy. The materials that gave the best results in the primary cell were, however. so expensive, that this means of obtaining electrical energy was never satisfactory, and was never feasible for general use in the industries.

The primary cell was practically supplanted by the dynamo and the secondary cell, and the great advances that have been made in the application of electricity to the industries we owe primarily to them. But this method of transforming intrinsic energy into electrical, still leaves much to be desired. The dynamo is usually driven by a steam engine, and the best steam engine is a horrible waster of intrinsic energy. When coal is burned in the furnace of a steam engine a part of its intrinsic energy is converted into heat. The amount of available intrinsic energy in carbon is the difference between the total intrinsic energy of carbon and the intrinsic energy of carbon dioxide—its highest oxidation product. Every chemical compound contains some intrinsic energy; therefore, in no case can all of the intrinsic energy present in the elements be converted into other forms of energy—in no case is all of the intrinsic energy of the elements available.

WASTEFUL ENERGY TRANSFORMATIONS

Of the heat energy produced in the furnace of the steam engine from the intrinsic energy of carbon, about 90% is lost. It is a good ordinary steam engine that has an "efficiency" of 8%, and an exceptional one with an efficiency of 10%. This means that only one-tenth of the heat produced in the furnace from the intrinsic energy of the carbon and of the oxygen is transformed in such an engine into work, and can be expended in driving a dynamo. Nine-tenths of the heat energy obtained in this chemical reaction from the intrinsic energy of the substances reacting is thus lost, at once, in the early stages of the transformation of intrinsic energy into electricity and light. Of the 6, 8 or at most, 10% of heat transformable into work in the steam engine, not much is lost in driving the dynamo and producing electrical energy; so that we may say that approximately one-fifteenth of the heat obtained in the furnace of the steam engine from the intrinsic energy of the substances taking part in the chemical reactions in the furnace, is transformed into electrical energy.

Think of the magnitude of this loss. It is simply distressing. But when we attempt to transform the electrical energy in question into light the figures are still more startling. If we use the ordinary carbon filament only about 2 or 2½% of the electricity is converted into light. This shows that of the total intrinsic energy of the coal converted into heat in the furnace of the steam engine used to drive the dynamo to produce the electricity which we convert in small part into light, only a fraction of 1% (0.25) is converted into light and the remainder is lost as heat. If we use some of the newer forms of filaments, such as the tungsten filament, we can increase the amount of light produced about twice. But even then we get only ½ of 1% of the available intrinsic energy of the coal that is burned as light.

Some of the arcs recently devised are less wasteful of electrical energy than even the tungsten filament, but in some of these, the question arises as to the effect on the human eye.

The importance of the problem in hand is obvious after a moment's reflection. He who devises a method for converting available intrinsic energy, even approximately quantitatively, into electricity, will be a benefactor to the human race. There are few problems whose solution would produce as great an effect upon the industries in general.

INTRINSIC ENERGY INTO HEAT

The reciprocal conversion of intrinsic energy into heat, and heat into intrinsic energy constitutes the subject matter of thermochemistry. That heat can be converted into intrinsic energy is demonstrated whenever we break a chemical compound down into its elements simply by raising the temperature. A part of the heat energy that disappears is converted into intrinsic energy, i.e., probably increases the velocities of the electrons within the atoms. The elements within the compounds have their intrinsic energies raised to a level where they are stable in the elementary state, and the compound breaks down into its elements.

If we wish to measure the difference between the amounts of intrinsic energy in the elements and the compound which they form, we measure the heat that is liberated when the compound is formed from the elements. This heat set free in the reaction is a measure of the intrinsic energy that has disappeared in the formation of the compound, provided that no light or electricity are produced, and no external work done as when a gas is formed. These factors must, of course, also be taken into account, since they owe their origin to the intrinsic energy that has disappeared.

Thermochemical measurements, then, enable us to determine the amount of intrinsic energy that has disappeared in any given chemical reaction, and it is the intrinsic energy that gives us the other forms that manifest themselves in chemical reactions. Such measurements are thus obviously fundamental for the engineer. If thermochemical data are desired the best can be found in Julius Thomsen's "Thermochemische Untersuchungen" and in Berthelot's "Etudes de Dynamique Chimique."

Rand Power Company

JOHANNESBURG CORRESPONDENCE

At the first annual meeting of the Rand Mines Power Supply Co., which is interested with the Victoria Falls & Transvaal Electrical Supply Co., it was stated that a profit of £32,000 was made despite minor troubles in starting up the large electrical generators and air compressors at Rocherville power station. They state that only one real difficulty which hampered operations occurred through "the failure of three large transformers, which our engineers inform us was entirely due to defective workmanship on the electrical windings." This is reassuring in view of rumors of other serious defects and the probable need of placing the transmission lines underground. They state "the plant generally has given an excellent account of itself, particularly the compressed-air scheme; the large rotary air compressors, which are the largest in the world, have been an unqualified success."

Allis-Chalmers Co.

Receivers were appointed, on Apr. 6, for Allis-Chalmers Co., the receivers being D. W. Call, president of the company, and Gen. Otto H. Falk, president of the Merchants' & Manufacturers' Association, of Milwaukee. While no statement to that effect could be obtained, the proceeding is probably intended to facilitate the early reorganization of the company, details of which have lately been published. The works will be operated by the receivers with no cessation of activity in any line. Irving H. Reynolds, chief engineer of the company, during a more profitable period of its operations, is the last of a number of men recently announced as returning to the company.

NEW PUBLICATIONS

THE NEW MADRID EARTHQUAKE. By Myron L. Fuller. Pp. 119, illus. Bull. 494, U. S. Geological Survey, Washington, D. C.

MECHANICAL STRESSES IN TRANSMISSION LINES. By A. Guell. Pp. 31, illus. Bull. No. 54, University of Illinois, Urbana, Ill.

WATER POWERS OF NORTH CAROLINA. Pp. 383, illus. Bull. No. 20, North Carolina Geological and Economic Survey, Raleigh.

WATER POWERS OF CANADA. By Leo G. Denis and Arthur V. White. 7x10, pp. 397, illus. Commission of Conservation, Ottawa, Canada.

MINING LAWS OF THE STATE OF MONTANA. Compiled from the Revised Codes of 1907 and Session Laws of 1909-1911. Pp. 106. State Inspector of Mines, Helena, Mont.

A GEOLOGIC RECONNAISSANCE OF THE ILIAMNA REGION, ALASKA. By G. C. Martin and F. J. Katz. Pp. 137, illus. Bull. No. 485, U. S. Geological Survey, Washington, D C.

RESULTS OF TRIANGULATION AND PRIMARY TRAVERSE FOR THE YEARS 1909 AND 1910. By R. B. Marshall. Pp. 392. Bull. 496, U. S. Geological Survey, Washington, D. C.

MINERAL RESOURCES OF THE UNITED STATES, 1910. PART I, METALS; PART II, NONMETALS. Pp. 796 and 1005, respectively. U. S. Geological Survey, Washington, D. C.

GEOLOGY AND COAL FIELDS OF THE LOWER MATANUSKA VALLEY, ALASKA. By G. C. Martin and F. J. Katz. Pp. 98, illus. Bull. No. 500, U. S. Geological Survey, Washington, D. C.

ANNUAL REPORT OF THE WEST VIRGINIA DEPARTMENT OF MINES FOR THE YEAR ENDING JUNE 30, 1910. Pp. 333, illus. John Laing, Chief of Department of Mines, Charleston, W. Va.

A RECONNAISANCE OF THE JARBIDGE, CONTACT, AND ELK MOUNTAIN MINING DISTRICTS, ELKO COUNTY, NEVADA. By F. C. Schrader. Pp. 170, illus. Bull. 497, U. S. Geological Survey, Washington, D. C.

THE MINING INDUSTRY IN NORTH CAROLINA DURING 1908, 1909 AND 1910. By Joseph Hyde Pratt and H. M. Berry. Pp. 134, illus. Economic Paper No. 23, North Carolina Geological and Economic Survey, Raleigh.

THE PHYSIOGRAPHY AND GEOLOGY OF THE COASTAL PLAIN PROVINCE OF VIRGINIA. By William B. Clark and Benjamin L. Miller. Pp. 274, illus. Bull. No. 4, Virginia Geological Survey, Charlottesville, Va. Includes Chapters on "The Lower Cretaceous," by Edward W. Berry, and "The Economic Geology," by Thomas Leonard Watson.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE WESTERN STATES AND TERRITORIES IN 1910. Mine Production, Advance Chapter from Mineral Resources of the U. S., 1910. By A. H. Brooks, C. N. Gerry, V. C. Heikes, C. W. Henderson, H. D. McCaskey and C. G. Yale. Pp. 308. U. S. Geological Survey, Washington, D. C.

ANWENDUNG PHYSIKALISCH CHEMISCHER THEORIEN AUF TECHNISCHE PROZESSE UND FABRIKATIONSMETHODEN. By Robert Kremann. Pp. 308, illus.; 9.60 marks. Wilhelm Knapp, Halle a. S., Germany.

The aim of this work, as the title implies, is to discuss the physical-chemical theories which underlie technical processes.

The more important matters discussed are: The two laws of the mechanical theory of heat; catalyzers and reaction velocity; special applications of the law of mass action, and the phase rule, in its various bearings on technical problems. The subjects incorporated in this book seem to be well discussed, and it will doubtless prove to be valuable to the engineer.

It does, however, seem to me to be unfortunate that the scope of the book is not more extended. Take, especially, electrochemical processes. These have come into the greatest prominence within the last few years. The principles which underlie these processes could have been treated more fully, and to advantage in this work. Again, the nature and significance of solutions for the industries, as well as for pure science, should, in my opinion, have been given more prominence.

These are, after all, only individual opinions, and we must usually respect that of the author, who has generally devoted far more thought to the subject than the reviewer.

H. C. JONES.

RECHERCHES PRATIQUE EXPLOITATION DES MINES D'OR (Practical Investigation and Development of Gold Mines). By Georges Proust. Pp. 110, paper; 2.75 francs. Gauthier-Villars, Paris.

This little manual is a popular outline of the more important features involved in prospecting and mining for gold. It begins with a sketch of the minerals constituting the rocks, so that the rocks themselves may be next described. Special stress is, of course, laid on those characteristically associated with gold. A brief summary of ore deposits follows. They are classified as regular and irregular in shape, and as primary and secondary in origin. Faults, veins and dikes receive a few pages.

The introduction being finished, gold itself is specially treated. The following topics are taken up: Ores, associates, shoots, veins and approved methods of attacking an orebody. Churn, calyx and diamond drills are described. Assaying, cupellation and crucible assays are explained to the novice. Operation is at last reached, the manner of the same being dependent, as M. Proust acutely remarks, upon the capitalist. The way in which the miner drills, blasts and blocks out his workings; the way in which the mill man treats his gold quartz with his "tables Wiffley," "his concentrateur Gilpin" and other familiar machines, will be interesting reading to those who long to win the yellow metal. An old friend, the cyanide process, masquerades as "le procédé Mac Arthur Forrest." At last, when the placers are reached, another old friend, "Le Long Tom," finds a paragraph beside the batea and the pan. In this portion even M. Proust cannot write without English—"sluices," "ditches," "flumes" and "bedrocks" are dotted throughout the French. A glossary of mining and mineralogical terms concludes the book. The subject of gold mining and milling is a large one to cover in 94 small pages. The treatment inevitably seems sketchy and fragmentary, but M. Proust has perhaps performed his difficult task as well as the conditions permitted.

AUTOBIOGRAPHY OF JOHN FRITZ. Pp. 327, illus.; $2. John Wiley & Sons, New York.

In commenting upon this book, noteworthy as the life-record of a most distinguished engineer and metallurgist, it seems to us best to begin with the words of its author, who says:

> In this short preface I wish to tell my friends who read this book how it was that I came to write it. My undertaking it came about wholly through the persistent urging of a number of old friends, who insisted on my writing out for them, in my own words, an account of my life struggles; and the publication of my autobiography before my death is again owing to the fact that, against my wishes, these good friends would not wait for it, but insisted on having it now. And so I have jotted down the record of my life, and it is given to you as I wrote it. You must not expect fine language nor eloquent periods, but only the honest record of the hard-working life of one who loves his country and his fellow men, and who has tried to serve both.

We are glad and the entire engineering profession will be glad that John Fritz's friends persuaded him to write this record of his life and work. He did not need to make any apology for literary deficiencies, because no criticism could possibly be offered on that ground, any more than upon Gen. Grant's plain unvarnished memoirs. The simple stories of their work by men who have really done things that are worth while are so rare that they are to be welcomed whether they come in purple and fine linen or just in greasy overalls. In truth John Fritz tells his story, particularly that of his boyhood days and the period of young manhood, in a way that may make the authors of some of the "best sellers" envious.

This is, of course, largely because he had a real story to tell, the story of a young boy brought up on the farm with but imperfect means of obtaining education, inheriting a mechanical instinct, learning how to do things by experience, growing up with the newly developing iron industry of Pennsylvania, and making himself an engineer of world-wide fame. John Fritz's story, especially up to the time when he left Cambria, crowned with success, in 1860, reads like a romance, and we think that anyone who once takes it up and falls under its fascination, must go on with it without interruption to the end.

We shall not undertake to moralize or preach from the story of John Fritz's life. We shall content ourselves with suggesting that all of our educators, who are directing modern engineering schools, ought to require their students to read this autobiography as a part of their course of instruction.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

J. Parke Channing has gone to Arizona.

Dr. James Douglas has gone to Arizona on a periodic trip of inspection.

Alexander Leggat, recently at Butte, Mont., has gone to Ulysses, Idaho.

H. R. Plate announces that after Apr. 28, his office as mining engineer will be at 14 Wall Street, New York.

A. W. Burgeon has returned from Mexico and is now at Placerville, Calif., at the Pacific and Poverty Point mines.

G. R. Empson has been chosen president of the Iron River Ore Co., Iron River, Mich., succeeding R. L. Hammond.

John Hays Hammond is to be at the head of a commission to go to Europe on behalf of the Panama-Pacific Exposition.

Emil Deister, formerly of the Deister Concentrator Co., is conducting tests of his slime-treating machine at the Miami mill.

Robert Linton, general manager of the Sierra Consolidated Mines Co., Ocampo, Chihuahua, Mexico, is at present at Los Angeles.

Prof. Robert H. Richards is in Denver, Colo., for a week's professional work. He will visit Rolla, Mo., and Hancock, Mich., on his return trip.

Marshall Haney, of Geer, Va., has been engaged for several weeks in examining manganese property in Virginia, and several large properties have been purchased on the strength of his reports.

Eugene F. Bradt, formerly chief engineer of the Pittsburgh & Lake Angeline Iron Co., has been at work recently on a newly opened property on the Vermilion Range, known as the Fargo mine.

Walter Harvey Weed announces that the firm of Weed & Probert having been dissolved, hereafter he will continue in practice as consulting engineer and mining geologist, with office at 42 Broadway, New York.

G. M. Richards has been appointed chief mining engineer for the Cie. des Chemins de Fer du Congo Supérieur aux Grands Lacs Africains. He left London, Mar. 25, for his headquarters, at Kasindi, Belgian Congo.

George Watkin Evans has resigned his position as chief of coal surveys for the Washington Geological Survey, and has opened an office in the Leary Building, Seattle, Wash., as consulting mining engineer and geologist.

J. T. B. Bogardus, president of the Abendroth & Root Manufacturing Co., builder of Root water-tube boilers and spiral-riveted pipe, has returned from an extended trip abroad in the interest of the export business of his company.

Manager F. P. Mills, of the Giroux Consolidated, in company with Mine Superintendent James Willoughby and Engineers A. J. Sale and Neil A. McGill, have been at Bingham, Utah, where they spent a week in studying the system of ore extraction in that camp.

Warren J. McLaughlin, Iron Mountain, Mich., until recently mining engineer at the Loretto mine, Menominee Range, which position he resigned to accept a similar post with M. A. Hanna & Co., Cleveland, has gone to the Trenton district of Ontario, to take up his new duties.

Wilbur E. Sanders is visiting R. C. Knox, superintendent of the Black Oak mine in Tuolumne County, Calif. Mr. Sanders is an authority on mine timbering; he is of the class of '88 Columbia School of Mines. He was for some time at Helena, Mont., and is now a resident of Pasadena, Calif.

O. R. Hamilton has resigned as engineer of the Spring Valley Iron Co., taking effect May 1. He will open an engineering office in Iron River, Mich. Mr. Hamilton will have associated with him E. L. Laing, who has been retained by the Davidson mine. The new firm will be known as Laing & Hamilton. Both of the engineers are graduates of the Michigan College of Mines.

Benjamin Guggenheim, president of the International Steam Pump Co., and formerly prominent in the management of the American Smelting & Refining Co., was a passenger on the lost "Titanic." At this writing it is uncertain whether he was saved or lost. Ernest Sjostedt, of Sault Ste. Marie, the well known metallurgist, was also a passenger, and the same uncertainty exists in his case.

The Council of the Iron & Steel Institute has this year decided to award the Andrew Carnegie gold medal to Dr. Paul Goerens, of Aachen, Germany. Dr. Goerens is a metallurgist, and is a member of the staff of the Royal Technical College at that city. He has made many contributions to scientific metallurgy, and in 1910 he was awarded one of the Carnegie scholarships of the Iron & Steel Institute to enable him to pursue his investigations on the influence of cold-working on the properties of iron and steel. The gold medal is now awarded to him in recognition of the highly meritorious character of his research work on this subject, which was published last year in Vol. III of the "Carnegie Scholarship Memoirs" of the institute.

Societies and Technical Schools

University of Idaho—Rush J. White, superintendent of the Federal Mining & Smelting Co., of Wallace, Idaho, addressed the Associated Miners, April 3. His talk was on milling practice and experiments carried on in some of his company's mills. The talk was representative of the character of progress along experimental lines in ore dressing in the Cœur d'Alenes.

University of Washington—The College of Mines of the University made its spring excursion for the mine inspection to Texada Island, B. C., from March 28 to April 6. The party consisted of 20 senior and junior students accompanied by Dean Milnor Roberts and Prof. Joseph Daniels. The objects of the trip were to study the deposits of iron, copper, gold and limestone, and to inspect the lime kilns, oil-burning smelter and mining equipment of the region. Headquarters camp was established at Van Anda, near the north end of the island.

American Peat Society—On April 9 four addresses—(1) "Fuel Conservation," by Dr. Joseph A. Holmes; (2) "Agricultural Possibilities of Muck Lands," by Prof. Geo. W. Cavanaugh, Ithaca, N. Y.; (3) "Peat Fuel is a Success in Europe. Why not in America?" Prof. Charles A. Davis, Peat Expert of Bureau of Mines; (4) Address by Prof. W. R. Beattie, of the Bureau of Plant Industry, Department of Agriculture—were delivered at the Chemists' Club, New York under the auspices of the New York Section, American Peat Society.

Columbia University, New York—The work of the summer school in assaying, formerly done in the Department of Chemistry, during the past year has been transferred to the Department of Metallurgy and is now a branch of that department. In giving this summer instruction in assaying it is intended to benefit young assayers who may happen to be in the vicinity and who desire to learn more about assaying from a theoretical standpoint. The future success of this course depends upon getting a sufficient number of outside men to attend it during the summer. The course lasts six weeks and is given under the direct supervision of Prof E. J. Hall, who has had charge of the Assay Department at Columbia for a number of years.

American Iron & Steel Institute—The second general meeting of the Institute will be held in New York, May 17 and 18. On Friday there will be three sessions, all at the Waldorf-Astoria hotel. In the forenoon, in addition to the address of the president, there will be papers and discussions on business topics. In the afternoon, the papers and discussions will be on scientific topics. In the evening the addresses will largely relate to welfare work in the iron and steel industry. In addition, there will be two addresses illustrated by moving pictures: one on "The Making of Big Guns at Bethlehem," and the other on "The Washing of Ores at Coleraine, Minnesota." Saturday is to be devoted to seeing New York, excursions of different kinds being planned.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Apr. 11—A plan has been submitted to the farmers providing for the complete resumption of copper smelting in Shasta County. The plan contemplates the payment of damages resulting from sulphur fumes, in such amounts as may be determined by a commission to be named by the parties interested. Naturally the management of the smelteries expects to solve the smoke problem and thus be exempt from the payment of damages. It is questionable if this result would be satisfactory to the farmers. In Calaveras County the Penn Mining Co. has practically completed the demonstration of the thiogen process, in operation at the smeltery at Campo Seco; there are some details of mechanical construction to be perfected which are not difficult. A committee of farmers and representatives of the boards of supervisors of the affected counties have expressed themselves as fairly satisfied with the demonstration recently made.

There is no present evidence of damage to vegetation from sulphur fumes in the vicinity of the smeltery, and it is doubtful if there has ever been any serious damage to the crops. This smeltery has been in operation for about 14 years, and there was no complaint from the farmers until the agitation in Shasta County had succeeded in closing three of the smelteries there. Recently complaints have been made that the fish in the Mokelumne River were being destroyed by drainage from the copper mines. When that charge was disproved the farmers concluded that the fish are victims of the tailings from the stamp mills. There is no question, however, that there has been damage done to vegetation by sulphur fumes in some of the copper-smelting districts, and that the agitation of the farmers has induced the experiments that have demonstrated the possibility of successfully neutralizing the smoke. But it is the opinion of men prominent in copper mining and smelting in California that the permanent settlement of the differences between the smelters and the farmers can best be accomplished by submitting the entire matter to the United States Bureau of Mines for determination. Until the matter is permanently settled the smelters are likely to be harrassed by suits whenever the farmers are disposed to complain.

The barren hillside in Mono County over which the Hydro-Electric company had obtained a permit to build a 3800-ft. pipeline has been saved to the forest reserve and posterity through the efforts of Gifford Pinchot and the action of Congress. The Hydro-Electric Co. supplies power to mines at Aurora, Lucky Boy, Rawhide, Fairview and Wonder. Nevada is particularly interested in the success of the power company and dependent upon it for the profitable operation of many mines situated near the California line. Mono County, California, is also largely dependent on the transportation of water across the hill that is called a forest reserve, but which is about on a par with the forest reserve in Shasta County that was used as an excuse for closing the Bully Hill smeltery. California has an abundance of this class of forests, and their conservation is a burden on the mining industry.

Butte

Apr. 10—At the Pennsylvania mine of the Anaconda company, work has again been started on the south crosscut at the 1800-ft. level. This crosscut was discontinued some time ago and a diamond-drill hole was driven from the face in a southerly direction. Several veins were cut and the drill was pulled about a month ago and the hole allowed to drain. A flow of over 200 gal. of water per min. was recorded at first, and this had to be hoisted by the Pennsylvania pumps in addition to the regular amount from the mine. The new pumps installed some time ago in anticipation of this event, easily took care of the increased amount however, and the sources supplying the drill hole are gradually being drained and at present only about half of the original amount is being pumped. The crosscut is not following the diamond-drill hole but is being driven parallel to it at a distance of about 10 ft.; in this way the work progresses more rapidly, as the workings are comparatively dry, the hole draining most of the water in the vicinity. The miners are able to do more work with greater ease in the dryer workings, as the water in conjunction with the heat, necessarily encountered at that depth, causes a humidity that is difficult and weakening to work in.

The Amazon-Montana Development Co., of Duluth, Minn., which has been developing a property at Amazon, 30 miles east of Butte, has canceled its lease on the mine and has taken over the Florence silver-lead mine at Neihart, southeast of Great Falls. The company has been reorganized under the name of the Florence Mining & Milling Co., and work on the new property has been commenced.

Denver

Apr. 11—The Colorado Grubstake & Mining Co. was organized last year and a working fund raised by voluntary contributions, the purpose of which was to send prospectors into the hills to search for and stake mining claims. The president of the Chamber of Commerce, as trustee, was to have half, and the prospector half of the claims so acquired. During last season 48 claims were staked and recorded, about 30 of which were adjudged worthy of development. But now it appears that inability to obtain working capital for the exploitation of these claims, is likely to cause the failure of the project.

It would do far more for the mining industry of the state if the absurdly high royalties exacted from leasers were reduced and more mines thrown open to the "tributer." Twenty per cent. on net smeltery returns is not an unusual royalty demanded, and from that upward. It is a good mine that pays 20% clean profit, but the leaser has to pay that to the owner, and make his own profit in addition, the result being that about 10% of them make wages and about one in a hundred makes a good profit from an unusually rich strike; this serves to inspire the others and keeps the game going on a limited scale, whereas if claim and mine owners would advertise for leasers at 10 and 15% royalties, with a small footage paid for dead work, the former would have their properties developed free of expense to themselves, more discoveries would be made and a greater output of ore furnished to the mills and smelteries.

In addition to the steel orders already chronicled in the columns of the JOURNAL, the Minnequa (Pueblo) plant of the Colorado Fuel & Iron Co. now has a contract with the Rock Island railroad for $300,000 worth of steel for improvements.

An interesting demonstration of mine rescue and first-aid work was given recently by the students of the State School of Mines at Golden, under Prof. J. C. Roberts of the U. S. Bureau of Mines. Rescue car No. 2 was there in charge of Mr. Roberts. The School of Mines tunnel was filled with powder fumes in which the men worked.

Salt Lake City

Apr. 11—A brief survey of the operations of the Tintic mines during the first three months of the year, shows that the majority have kept up past records or have exceeded them. Several new discoveries were made either late in 1911, or in the first quarter of 1912, and known orebodies opened satisfactorily. The Chief Consolidated with 30 cars for the first quarter of 1911 and 146 cars in 1912, shows a gain of 116 cars. At this mine, the present productive orebody was opened in December after almost a year's work, and the profits for February were nearly four times as great as those for the whole of 1911. New silver-lead and copper orebodies were opened in the Iron Blossom, which shipped 553 cars, exceeding the corresponding output of 1911 by 149 cars. The Mammoth increased production from 12 to 110 cars, and the Victoria opened new ore on the 1200, shipping 44 cars, as compared to 10. The Gold Chain, producing chiefly from above the 700, shipped 144 cars, as against 79, and the Beck Tunnel increased from three to 38 cars. The Grand Central, occupied with shaft sinking, mined 124 cars, as against 109. In the May Day, gold ore of shipping grade was opened on the 400, and lead ore of the same quality on the 1000-ft. level, shipments amounting to 56 cars, as compared to 34. The Eagle & Blue Bell opened a new orebody on the 1300, and shipped 72 cars, as compared to 10, most of the ore coming from below the 1000-ft. level. The Yankee shipped 92 cars of dump ore, from which development expenses were paid. The Centennial-Eureka leads with its remarkable steady output of 300 tons per day.

There are rumors of a consolidation of the Uncle Sam and the Richmond-Anaconda mines, at Tintic. The Richmond-Anaconda is being worked through the Uncle Sam, and development in the latter property is trending toward the Richmond-Anaconda line.

On Apr. 9, about 360 men, employed in the Boston Consolidated underground mine of the Utah Copper Co., struck for an increase of 50c., and this section of the mine has been closed down, awaiting settlement. The increase asked for is more than the average Bingham wage, and the men will probably return to work at the old rate in a few days.

Deadwood

Apr. 12—E. W. Walter, the new superintendent of the Black Hills Smelting Co., has been making an examination of the mines of the district for the purpose of ascertaining the probable kind and quantity of ore supply that may be expected at the plant. He has stated that copper ore from the Jungle mine, in the Custer Peak district, can be utilized to advantage. This mine is three miles from the railroad, with a good wagon road and down-hill haul. From the railroad station it will be a 7-mile haul to the smeltery. He is still in doubt as to the best procurable pyrite supply, but a large quantity is expected to be secured from the Gilt Edge Maid mine, near Galena. This ore will require concentrating, and a plant for handling that class of ores has been erected adjoining the smeltery. A large portion of the dry-ore supply will come from the Richmond mine, half a mile from the smeltery, where there is a large quantity of $7 to $10 ore ready to be mined.

At the annual meeting of the Deadwood Lead & Zinc Co., held in Deadwood, the following directors were elected: Aaron Dunn, president; P. M. Bonniwell, vice-president; George S. Jackson, secretary and treasurer; O. N. Brown and C. S. Ruth. The reports of the officers detailed tests made during the year in a search for a treatment method. The ore carries a heavy percentage of iron pyrite, about 10% zinc, a similar amount of lead, $3 in gold and 10 oz. silver.

Commercial use of power generated in the Homestake company's hydro-electric plant on Spearfish River, commenced on Apr. 11, when the first motors were started in the Amicus mill, the largest stamp mill of the company. During the morning the first motor, driving 10 stamps, was started, and by evening three motors were operating. Others will be hooked up as fast as possible until all of the stamps are electrically driven. The motor installation includes a 25-hp. motor for each battery of 10 stamps.

Toronto

Apr. 12—The Departments of Mines and Colonization of Quebec will send out three exploring expeditions this season. Professor Bancroft, of McGill University, will be in charge of a party, which will leave early in June, to examine the geology and mineral resources of the Abitibi region, south of the Grand Trunk Pacific railroad. Another party under Professor Dulieux, of the Polytechnic School of Montreal, will study the iron ores of the Lake St. John district, the Eastern townships, and the St. Jerome, Ottawa and Gatineau River regions. A colonization expedition will also be sent to Abitibi in charge of J. H. Valiquet, Inspector of Mines, who will establish colonization centers and open roads.

Cobalt

Apr. 12—The construction of the Elk Lake branch of the Temiskaming & Northern Ontario Ry. has been started, and 150 men are at work clearing and grading the right-of-way. It is expected that this will be finished about Sept. 1, when the commission will lay the steel and do the final ballasting. Trains should be running over the line by Jan. 1, 1913. While the road will give an impetus to mining operations in the Gowganda and Elk Lake sections, it is doubtful if the latter district will be benefited to any great extent. Prospecting has been carried on for several years and several properties have been opened, but as yet not one has reached the producing stage. The road, however, will pass through good agricultural land and will help in its development. Gowganda will benefit considerably in the matter of freight charges, which has been one of the greatest factors in holding back the country.

Porcupine

Apr. 12—The low water in the Mattagami River and the consequent shortage of power at the Sandy Falls plant are causing considerable uneasiness among the users of electrical energy supplied by the Sandy Falls power company. The dam is giving a good deal of trouble and is leaking badly in places. This power plant is operated by the same men who control the Hollinger mine, and the Hollinger management has recently ordered a 25-drill, steam-driven compressor for use on the property. Power costs in Porcupine are high, the lowest probably being between $125 and $150 per hp. year, and cheap electrical power would be a great boon to the camp. The plant at Waweatin Falls is to be rushed as rapidly as posible but it will be some-time before it is in efficient working order.

Jena

Apr. 8—Mention was previously made in the JOURNAL of a gas well having been struck at Neuengamme, on territory of the free city of Hamburg, which at the time attracted thousands of visitors to view the burning gas. Capitalists having been chary in taking hold of such a source of power and light, the Hamburg government has at last stepped in and purchased from the owner the land on which the well is situated, for $18,000. It is intended to pipe the gas to the Hamburg gas works and there to use it in admixture with the illuminating gas. The natural gas has the following composition: Methane, 91.6%; hydrogen, 2.3%, heavy carbureted hydrogen; 0.8%; oxygen, 0.7%; carbon dioxide, 0.2% and 4.4% nitrogen.

The gold discoveries in the Eifel Mountains, to which attention was first directed early in 1911, have now been sufficiently explored to show that they will not pay to work. Professor Klockmann, of Aix-la-Chapelle, pronounces them secondary deposits containing 0.05 to 1.5 grams of gold per cubic meter, which is equivalent to from 2½ to 76c. per cu.yd. At the time these discoveries were first reported, the deposits were referred to as reefs, and as having been encountered 8 ft. below surface. Later on it appeared that the discoveries were made in sand dunes.

The Mining News

The Current History of Mining

Alaska

Lon De Van—This mine, near Ketchikan, will probably install a reduction plant this summer. Drifting on the vein is being pushed. George J. Lonstorf, of Milwaukee, Wis., is president of the company.

Alaska-Mexican—During February the mill crushed 18,606 tons of ore, yielding $54,527 gross and net $18,136. Operating expenses were $32,332; construction, $4058; development, 552 ft. The ore averaged $2.96 per ton.

Alaska United—During February, the Ready Bullion and 700-ft. Claim mills crushed 35,784 tons of ore, yielding $90,260 gross and net $36,414. Operating expenses were $48,436; construction, $5410; development, 852 ft. The ore averaged $2.63 per ton at the Ready Bullion mill and $2.47 at the 700-ft. Claim.

FAIRBANKS DISTRICT

It is predicted that the placer cleanup of the Fairbanks district for the coming summer will total about $5,000,000. Encouraged by the richness and number of veins that are being found, the placer operators who have heretofore held aloof are now becoming enthusiastic "hard rock" men.

Hudsons Brothers—The new find on Esther Creek has widened to 4 ft., and some asays show more than $300 per ton.

Fredericks—The shaft is now approaching the 300-ft. level. The owners expect to install 10 stamps this summer.

Arizona

GILA COUNTY

Old Dominion—The March smeltery production was 2,412,000 lb. of copper, of which about 95% was derived from ores from the Old Dominion and United Globe properties, the rest coming from custom ores. The El Paso Foundry & Machine Co. will construct a separate flue and dust chamber for the company's converter plant. The capacity of the present concentrator will be increased 50% and the classification and metallurgy improved. Approximately 1200 are now on the payroll. With the higher price for copper, it is possible to mine ore of lower grade than formerly. The concreting of the Kingdon shaft has been completed for 305 ft. below the collar.

Southwestern Miami—This company is continuing its drilling operations, and reports its No. 2 and No. 3 holes as continuing in chalcocite-bearing schist. Hole No. 4 is 90 ft. deep in conglomerate. Hole No. 5, union hole, is 40 ft. deep in conglomerate. Hole No. 6 will be started soon, making four drills in operation, in addition to the one on the Barney group.

Barney—Churn-drill hole No. 2 is 480 ft. deep and is apparently getting out of the conglomerate into the schist formation, but the ground is still badly broken and drilling proceeds with difficulty. The sludge is heavily iron-stained.

South Live Oak—L. D. McClure, managing director, and H. E. Dunn, manager, are superintending work preparatory to exploring. About 15 men are employed in building a camp, constructing roads to drill-hole sites, putting in pipe lines, hauling supplies, etc. Five cars of machinery, tools and supplies are on the road, and it is expected that drilling will begin about May 1. It is proposed to drill the first hole near the south end of the property in the granite-porphyry formation, which is thought to be underlain with schist. The first payment on the property, of $12,500, will be made on Apr. 15. There are about $60,000 in the treasury with which to make the first payment on the property and to conduct churn-drilling operations during the coming year.

Manitou—The Cracker Jim shaft, at the Five Points mine, caved in last week, burying Henry Peryam, a miner, who was rescued alive and unhurt after four days and nights. The caving started near the bottom and worked upward; Peryam took refuge in a short crosscut near the bottom of the shaft and thus escaped death. Miners from the Old Dominion and Gibson mines assisted in the rescue, which was dangerous and difficult work on account of the constant caving of the ground, and the fact that the shaft timbering had to be supported by wire cables from the surface. The shaft has been abandoned and work at the property discontinued.

Miami—Experiments are being made with a roughing system in the sixth unit. Emil Deister, formerly of the Deister Concentrator Co., has erected one of his new six-decked, slime-treating machines below the first unit and is conducting tests.

PIMA COUNTY

Ostrich—This property, in the Arivoca district, is under bond to men represented by M. J. O'Brien, of Toronto, Ont. Negotiations for the Yellow Jacket, adjoining, are under way. T. J. Woodworth, of Toronto, recently examined the properties for the Canadian interests.

SANTA CRUZ COUNTY

Elephant's Head—This mine has been sold to Topeka, Kan., men, for $60,000 cash, by Louis Tremaine and Benjamin Daniels, former marshal of the Territory of Arizona. The money has been paid over to the bank, and will be paid to the former owners as soon as the title can be perfected. There is a large amount of milling ore developed in this mine. It is the intention of the buyers to do considerable development.

Three Stars—This claim has been leased from the Security Mining Co., by T. F. Gardner, and a force of men is now at work in the shaft. The ore is high-grade silver-bearing gray copper, and will be shipped to the smeltery.

Bradford—This claim, near the railroad in Sonoita Cañon, has been leased by the Ferry Estate to E. McFarland, formerly of Courtland. Bisbee men are interested in the undertaking. The ore developed by diamond-drill runs 18% copper.

YAVAPAI COUNTY

United Verde—A contract will be let soon to construct a standard-gage railroad, six miles long, from the 1000-ft. tunnel to the site of the new smeltery. The road may be continued through the valley to afford a market for the farmers.

California

AMADOR COUNTY

Lincoln Consolidated—The lower level of the Lincoln is being unwatered preparatory to extending the drift into the Wildman-Mahoney.

Central Eureka—The 7-ft. vein reported to have been disclosed in the south end of the mine was found in a crosscut to the east from the south drift. This is on the 2700-ft. level.

Plymouth Consolidated—Much of the timbering in the Pacific shaft has been found in fairly good preservation at a depth of 500 feet.

Hardenberg—Development by vertical shaft is progressing, though it is somewhat retarded by the large volume of water.

CALAVERAS COUNTY

Boire—The gravel deposit in this mine, at Railroad Flat, has been developed for a length of 160 ft., and to an average depth of 8 ft. The gravel is cemented and will require crushing. A 10-stamp mill is contemplated. Boire Brothers are owners.

Pacific Gas & Electric—The company has notified the mines using direct water power that there is likely to be less than normal supply of water unless used conservatively, and that it may be necessary to curtail the supply in June.

Penn—This company has installed the thiogen process for the neutralization of smeltery smoke at its copper mines, at Campo Seco. The boards of supervisors of Calaveras, Amador and San Joaquin Counties, and the farmers who have been complaining, sent representatives to witness the demonstration of the process, and expressed themselves as satisfied. Dr. Stewart W. Young, of Standford University, installed the process, and it is believed by him and others that it will successfully control the sulphur fumes. Donald Smith is metallurgist in charge.

Melones—A new electrical hoist will be installed on the 1100-ft. level. The old hoist is 25 hp. The new hoist is to be 250 hp., 450 r.p.m., driven by a 2200-volt General Electric motor. The capacity will be 1000 ft. per min. for hoisting loaded 70-cu.ft. skips. This hoisting station is about 5000 ft. in from the portal of the main tunnel. W. G. Devereux is manager and John Fulton is superintendent.

KERN COUNTY

King Solomon—Ernest Peden, a leaser at this mine, fell through the main shaft, Mar. 31, a distance of about 200 ft., and was instantly killed. There was some delay to the skip that was to carry the men to the surface, and Peden, with others, climbed the ladder.

NEVADA COUNTY

Hurst-Travis—A 5-ft. quartz vein has been disclosed in this gravel mine at Graniteville. Samuel Hurst and A. Travis are the owners.

PLACER COUNTY

Gavin—A 10-years' lease has been taken on this property, near Forest Hill, on the middle fork of American River, by Arthur W. Copps, of Oakland, who also has a 10-years' lease on the Cache Rock dredge and dredging land. The Gavin property will be worked by tunnel.

SIERRA COUNTY

Mountain—This mine, which was once a large producer, is reported to have been acquired by Denver men.

Phoenix—Good ore has been encountered, at this Sierra City mine, during the winter's development work, and it is being crushed in the mill on the property. Hamilton & Wise are operating the property under bond.

Gibraltar Consolidated Gold Mining Co.—This company has been formed to obtain and operate the Gibraltar mine, near Downieville. The directors are Jacob Kieffer, Peter Kieffer, T. J. Donovan, P. L. Carmichael and Adam Kieffer.

SISKIYOU COUNTY

Blue Ledge—There is a tentative agreement between Robert S. Towne, recent purchaser of this copper mine, and about 300 citizens of Medford, Ore., to construct a railroad from Medford across the state line to the Blue Ledge mine. It is reported that the citizens agree to subscribe $75,000 toward constructing the road.

TUOLUMNE COUNTY

Black Oak—The installation of the 75-ton, all-slimes cyanide plant, tube mill and 20-stamp mill has been completed, and was put in commission on Feb. 3. The plant is electrically driven. A Stromberg-Carlson minaphone will be installed on the 1500-ft. level. Other stations will also be connected by telephone. The stamps and tube-mill construction were installed by the Trent Engineering Co., of Reno. The installation of the cyanide plant was made by C. H. Urquhart. R. C. Knox, Tuolumne, is superintendent.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

Belleview Consolidated Mines & Power Co.—This company has been organized and will develop the Gold Dirt and Perigo mines, with the Pactolus and Rollinsville placers, the latter covering about 2500 acres. The lode mines have been worked since 1860 and are credited with a large production. Lately they have been worked entirely by leasers, and every pound of ore which could be obtained has been extracted. The new company will have to do a large amount of development to create ore reserves. The placers are to be tested by drilling this summer and if satisfactory a dredge will be installed. The president and manager of the company is Charles Knight and the directorate is composed of Denver men.

CRIPPLE CREEK DISTRICT

Blue Flag—It is stated that the March output averaged $2.50 per ton and that the mill is to be enlarged to a capacity of 3500 tons per month, under the direction of John Masson, metallurgist.

Clara D.—Lessees Meldrum & Co. have opened 4 ft. of good-grade mill ore in this mine on Gold Hill.

Midget Bonanza—This mine on Gold Hill has been leased to Owen Roberts, of Cripple Creek, who is also operating the El Paso Gold King. The erection of a 100-ton mill to treat the dump ore is contemplated.

Portland—President Frank Peck and the directors have decided to lease 25 acres of virgin ground belonging to the company. This land is over the hill from the main workings of the company, and on the north slope of Battle Mountain.

American Eagles—The March output of this Strattons Estate property was about 17 cars, and the grade is stated to have been from $60 to $100 per ton.

LAKE COUNTY—LEADVILLE

A good deal of development work is being done in the Mosquito Range, Birdseye and other outlying sections of the Leadville district. The Mosquito group of 14 claims is to be worked from the Park County side through the Mazie tunnel; the Killarney group on Corinne Mountain, owned by Leadville men, is being developed by a tunnel already in 150 ft., which will be driven to the London fault at a point 400 ft. below the surface; on the Birdseye side, the Anderson Consolidated tunnel has been driven all winter, and is now in 500 ft.; a mile north of the head of Birdseye, the Jupiter group of 14 claims is being developed by a tunnel which is already in 100 ft. The Yak tunnel breast is now in Vega territory and is close to the base of the Mosquito Range.

Resurrection No. 1—The work, which was stopped by the heavy snows, has been started again and with the better roads shipping has been resumed.

Lillian—Regular shipments of carbonate of zinc ore are being made from the Murcrary lease on this mine. The grade is holding well and development is being kept ahead of extraction.

Denver City—An electric hoist has been installed at this mine on Yankee Hill. As soon as the old workings have been cleaned out, exploration for zinc ore will be started.

Idaho

Hydraulic mines in Boise County will be worked this season by the following operators: Boise Basin Hydraulic & Power Co., Leary & Brogan Placer Co., and Thomas Hally, at Placerville; Hardwood Glenn Mining Co. and the Centerville Mining & Milling Co., on Grimes Creek; the White Quartz Mining Co., at Idaho City.

IDAHO COUNTY

Colonel Sellers—An unusually rich strike was made recently on this claim in the Elk City district, owned by Mrs. M. A. Parr, of Elk City. The oreshoot has so far been uncovered for 300 ft. The width varies from 3 to 14 ft. Seventy-four tons, run through the 3-stamp mill, yielded 800 oz. of amalgam, worth $4.50 per oz. The concentrates ran $581.60 per ton and tailings $16.35. The property lies about one mile north of the Buster mine, and about two miles from Elk City.

Michigan

Copper

Mass—A special stockholders' meeting will be held May 8 to vote on a proposition to sell a portion of the company's lands to a new company to be formed to develop the lands. The stockholders will be given the privilege of subscribing for the stock in the new company. This plan will replenish the treasury and give a working capital to conduct mining on a more extensive scale; also to make repairs at the mine and mill, and to develop the lands which it is believed carry the extensions of the Lake and Arcadian lodes.

Arcadian—At a depth of about 1085 ft. in No. 23 drill hole, which is sinking in the vicinity of Ripley, near Portage Lake, copper was encountered; the core showed the formation to be well mineralized and carried considerable heavy copper. This is the second formation that has been penetrated by this hole, the first having been reached at a depth of about 330 ft. and showing a formation about 25 ft. wide with copper.

Oneco—The shaft is nearing a depth of 1220 ft. from which depth the rich drill core was extracted some months ago; the shaft is expected to reach this depth about May 1. After this attention will be given to lateral openings and the lode will be fully explored.

Osceola Consolidated—The taking of depositions in the injunction proceedings restraining this company from holding its annual meeting, brought about by Charles M. Turner, was called on Apr. 10 at Houghton. W. J. Uren, formerly general mine superintendent of the Bigelow properties, and upon whose affidavits the injunction is sought, was called but refused to take the stand. His attorneys stated that he was willing to file further affidavits elaborating on anything further desired and that he would take the stand at the trial which is called for Apr. 16, at Lansing, before Judge Weist, but that he did not desire any preliminary hearing before a notary. The hearing was then discontinued.

Cliff—The report of this Calumet & Hecla subsidiary for 1911 shows: Exploration and development, $13,867; surface and construction work, $908; miscellaneous, $1228; total, $16,004; balance of assets, $75,756. The vertical exploratory shaft was 217 ft. deep at the end of the year. Drifts north and south at 205 ft. failed to disclose copper-bearing lodes. A crosscut is being driven from the north drift to cut the west lode.

Mohawk—During 1911, receipts from 12,091,056 lb. of copper sold at 12.63c. per lb. were $1,527,107. Expenses at the mine were $1,128,333; smelting and other expenses, $97,988; construction, $31,279; net profit, $269,506; surplus Dec. 31, $590,880, an increase of $94,506 over the previous year. Operations at the mine were satisfactory and the grade of the rock improved.

Indiana—Reports state that heavy copper in felsite has been encountered 28 ft. from the shaft in a crosscut at the 600-ft. level.

Naumkeag Copper Co—The following constitute the first board of directors: J. Parke Channing, J. H. Sussman, Adolph Lewisohn, Theodore L. Herman, Frank L. Van Orden, Charles J. Paine, Jr., and Irving J. Sturgis. The officers are: Mr. Channing, president; Samuel A. Lewisohn, vice-president; Mr. Sussman, secretary and treasurer. Mr. Van Orden will be in charge at the property.

Iron

American—It is reported that a concentrator will be erected this summer to treat the low-grade ore on this property, about 10 miles east of Ishpeming.

Mary Charlotte—The working force was reduced recently by suspending one of the three daily shifts. About 100 men are said to have been released. This action was caused by the prevailing low price for iron ore.

Minnesota

The shipping season from the Mesabi Range is said to have started a few days ago, when the Great Northern Ry. hauled ore to its Allouez docks.

Koochiching-Vermilion — Gold-bearing rock is reported to have been cut by this company in diamond drilling near Northome, a town on the Minnesota & International Ry., in the southwestern part of Koochiching County and about 75 miles northwest of Hibbing. Such discoveries have been made before, but no commercial operations have resulted.

Missouri

Newton County

Wentworth Land & Mining Co.—This company, owner of the Alice Dayton mine, has taken an option to purchase the fee of 160 acres of land near Wentworth, known as the old Gobbler tract. This tract was once one of the large producers of the district and large bodies of ore found by drilling at that time, have never been developed. The company intends to develop these deposits thoroughly and pumping machinery is now being installed to drain the ground.

Mocking Bird—The company recently installed a crusher and rolls and expects to increase the output to one car of concentrates per week. The jigs are operated by hand power.

Pierce City—This company, operating near the Alice Dayton, recently installed a pump and resumed sinking the shaft, which is in good ore at the 80-ft. level.

Montana

Butte District

Anaconda—The work of remodeling the hoisting engine at the Leonard mine for the use of compressed air is advancing satisfactorily, though it may be six weeks before operations are resumed. Leonard No. 1 shaft is being advanced from the 1800- to the 2000-ft. level; an air hoist is being installed on the 1800 to hoist ore from the 2000 to that level, where it will be transferred, by motor, to No. 2 shaft, and thence to surface. No. 2 shaft at present is 1800 ft. deep. The hoisting shaft of the West Colusa mine is also being sunk to the 2000-ft. level. The West Colusa was recently connected with the workings of the Mountain View mine on the 1200-ft. level by an east drift from the latter property. The air shaft at the Mountain View mine is now sinking about 180 ft. below the 1800. A station will be cut on the 2000-ft. level and a small pump installed to handle the water temporarily.

North Butte—Drifting on the Snowball vein is showing it to be an unbroken vein of good ore, and the North Crœsus vein is also showing well. A rich narrow vein of copper ore has been cut by the north crosscut on the 2400-ft. level. The crosscuts on the 2600- and 2800-ft. levels are being driven rapidly to intersect the Edith May and Jessie veins, which are expected to be cut soon.

Cascade County

Florence Mining & Milling Co.—This newly organized company has secured the Florence mine, at Neihart. The mine is said to have produced $300,000, but was closed down some years ago. It consists of five patented claims, developed by several tunnels and a 400-ft. shaft. The property contains a strong, well defined vein, having the appearance of a true fissure, in gray feldspar gneiss, also several stringers and small branch veins, the ore being the richest at the junction of these stringers and the main vein. The ore consists of ruby silver, silver glance and brittle silver, in conjunction with chalcopyrite and galena. On the bottom level the orebody has a length of 600 ft., with an average width of three feet.

Boston & Corbin—During 1911, the company spent $80,000 in development and $8000 in construction. Opening work included: Drifting and crosscutting, 2463 ft.; raising, 282 ft.; shaft-sinking, 356 ft. A 10,600-cu.ft. station was cut at 922 ft. depth. Ore was opened on the 7th, 9th and 12th levels. About 50,000 tons are said to have been added to reserves since July 31, 1911. Ore is being developed between the 7th and 12th levels at the rate of about 650 tons per day, says Manager Emerson. The present reserves are stated to justify the erection of a 300-

ton concentrator. Preliminary tests on the ore by J. M. Callow indicate that a simple treatment is required, and it is estimated that the cost of the 300-ton plant will be less than $100,000. President Amster says that the directors deem it advisable that further tests on the ore be made before a decision as to the plant is reached. The report shows a surplus of $311,951 on July 31, 1911, and $9300 current indebtedness.

LINCOLN COUNTY

Libby Placer Mining Co.—W. Hooten, superintendent, recently left Libby for the company's hydraulic plant, on Libby Creek. He took a force of men with him and will start work soon. Double shifts will be used, and the intention is to operate throughout the summer.

Nevada

CHURCHILL COUNTY

Nevada Hills—The mill at Fairview is expected to resume at capacity about Apr. 15. All necessary connections have been made underground for handling the ore. The company is completing a hotel for the use of its employees.

CLARK COUNTY

Marion—A crosscut to reach the vein at a depth of 300 ft. is being driven at this mine, north of the Fourth of July Mountains, in the Searchlight district.

Spokane—This Searchlight mine has opened ore in the Princess shaft at 300 ft., and the mill is expected to start soon. A. M. Jennings is in charge.

Searchlight—The only work on this mine is on the Dabu lease, under charge of Walter Wells.

New York-Searchlight—This company, doing development just north of Searchlight, has discontinued work without finding ore. J. M. Foote, of Newark, N. J., is president and W. W. Hurt is manager.

COMSTOCK LODE

Union Consolidated—Two feet of good ore have been cut in the east crosscut from the north drift on the 2500-ft. level of the mine. The vein strikes east of north, and dips 70° east, the fracture being about 5 ft. wide, with 2 ft. of fairly solid quartz. This formation may be the footwall of the east vein. As soon as an air connection is made with the west crosscut from the 2500 station of the joint Union and Sierra-Nevada winze, the vein will be explored.

Mexican—Returns on eight bars of bullion netted the company $17,101. The mill has been operating steadily on ore from the surface dumps. Stoping has been resumed in the mine and last week 36 tons of $59 ore were taken from the 2300-ft. level and 103 tons of $28 ore from the 2400-ft. level.

Ophir—The 2500-ft. level has been pumped out by the Pumping Association, and a clay dam constructed in the north drift, near the old joint Ophir and Mexican winze, where two of the new electric pumps are to be installed. The company shipped a bar of bullion last week, worth $6700, secured from the cleanup of the drop boxes at the Kinkead mill, it having accumulated during the last run of 2000 tons.

Ward—A flow of about 250 gal. per min., of hot water, is being secured from the 2450 level, and in a recent round of drill holes, water spouted from each hole at the face. The extent of the water channel has not yet been determined. The pumps are handling a considerable flow of water, and are working in good condition.

LYON COUNTY

Mason Valley—One furnace is in steady operation, and is treating considerably over 600 tons of ore per day. The original estimate for the furnace was 500 tons per day. Results are highly satisfactory and small independent mines are commencing to ship ore to the works in lots of from 70 to 150 tons.

Bluestone—W. B. Thompson, of New York, in company with several mining men of Salt Lake City, recently visited this mine, at Springton, owned by Capt. J. R. De Lamar, and idle for some time. It was reported that the purchase of the mine was contemplated, but we have been informed that such is not the case.

Nevada-Douglas—In March, the company shipped 8600 tons of ore to the Mason Valley smeltery, and 2300 tons during the first seven days in April. This is less than the amount called for by the contract, which is 10,000 tons per month. The ore runs from 3 to 7% copper, and carries little gold or silver.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended Apr. 14, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,300	16,169
Tonopah-Belmont	1,950	30,676
Montana-Tonopah	1,053	13,924
Tonopah Extension	1,043	13,010
West End	700	9,749
Midway		180
MacNamara	435	4,107
North Star	..	40
Totals	8,481	117,855
Estimated value	$212,025	

Mizpah Extension—Drifting is in progress on the 1000-ft. level, on 2 ft. of $40 ore, believed to be an eastern extension of one of the Belmont veins.

MacNamara—A body of high-grade ore has been opened on the 375-ft. level and is from 4 to 7 ft. wide. Work has been commenced on a vein on the 800-ft. level. 30 ft. wide, by stoping for a length of 10 ft., the ore averaging from $10 to $25 per ton. The company's mill is treating about 60 tons of ore per day.

Montana-Tonopah—The Shaft vein, opened above the first intermediate level, has been shown to continue to the 515-ft. level, 240 ft. on its dip. The new vein cut on the 565-ft. level is from 8 to 10 ft. wide, averaging over $100 per ton Another new vein cut on the 615-ft. level is 2 ft. wide and has been drifted on for 25 ft., averaging from $100 to $120 per ton. The mine now shows ore reserves sufficient to run the mill for two years.

West End—The production for March was worth $51,150, from milling ore, in addition to nearly 200 tons of high-grade ore shipped to smelteries. The mine has ore reserves equal to more than one year's milling and these are being increased. The company is free from debt and will soon commence work at the Ohio shaft, 1300 ft. west of its working shaft.

Tonopah Extension—The company is extending its western workings on the 500- and 600-ft. levels, on four shoots of ore assaying from $18 to $23 per ton, and from 3 to 10 ft. in width. Sinking of the new 3-compartment shaft, 400 ft. west of these workings, is making good progress. The mill is treating about 142 tons per day.

WHITE PINE COUNTY

Boston-Ely—Contracts have been let for diamond drilling. Underground work will also be done below the bottom or 1245-ft. level. Considerable drilling will be done before sinking is resumed. It is hoped to find commercial ore below the water level.

Nevada Consolidated — The fourth annual report of the state railroad commission gives the total cost of the road and equipment of the Nevada Northern Ry., as $3,072,017. This line has 140 miles of main line and the net revenue for the year ended June 30, 1911, was $778,377. The greater part of the revenue is derived from the transportation of ore, of which 2,902,789 tons were handled during the year from the mines at Copper Flat and Veteran, to McGill.

New Mexico

GRANT COUNTY

Oro Grande—It is reported that development work will be started on this group of claims. Some mining men are said to have become interested in the property and are furnishing the money for development.

Lucky Bill—Paul Larsh is shipping from 10 to 15 cars of ore per month from this mine to the El Paso smeltery. The lead contents are returning a profit and the vanadium is being held for future disposal. A car of 30,100 lb. of vanadium ore shipped to Europe averaged 7.19% V.O., which was better than the guarantee demanded. The price under which this shipment was made was 75c. per lb. f.o.b. Fierro, but this price has been reduced to $2.50 per lb. for actual metallic vanadium contents.

Chino—The third unit of the concentrator went into commission recently, marking the completion of the plant as originally designed. The machinery for the units to be installed, which will increase the capacity to 5000 tons per day, is on the ground and is being assembled

SOCORRO COUNTY

Ernestine—The bullion produced during the last 10 days of March was 8850 oz.; concentrates, 12,000 lb. The total output for the month was 22,640 oz. of bullion and 16½ tons of concentrates, from an ore treatment of 3200 tons. The tonnage last week was 660. All developments in the mine are showing up well, the 300 level west being in especially good ore.

Deadwood—The plant is in full operation again, the repairs to the engine having been completed. During the absence of power, considerable water accumulated in the lower levels of the mine, which is now being unwatered, the upper workings furnishing the mill with ore in the meantime. A fair tonnage of custom ore is also being handled.

Tri-Bullion—A new orebody has been found on the Nit property of this company. Little is known regarding its width or length, but the ore is reported to be practically free from lime, with a good zinc content, and but little lead or silver. A trial run on the ore has shown that a good grade of zinc concentrates can be obtained.

Mogollon Gold & Copper—A new working lease has been let on the Little Charlie mine, to Los Angeles men. It is probable the other holdings of this company will be operated by the same men.

Oaks—Leasers on the Pacific mine are taking out a good tonnage of mill ore, largely from development, which amounts to about 40 ft. per week.

Oregon

Lucky Touville—Work is to be resumed at this copper mine, with a larger crew. The ore shows good assays. Col. Frank Ray, Medford, is interested.

Gold Hill—This company has recently been organized at Portland, for the purpose of erecting a custom mill, at Gold Hill, for the treatment of the ores in that section.

South Dakota

BLACK HILLS DISTRICT

New Reliance—Thirty stamps are now dropping at this property, on Annie Creek, including the 10 stamps recently installed. Since warmer weather has come, cleanups are improving. W. H. Weigand is superintendent.

Black Hills Grub Staking Concern—This is a South Dakota corporation, recently organized at Deadwood, with $26,000 of common stock and $24,000 of preferred stock. Its purpose is the advancement of mining development in the Black Hills region, by grubstaking prospectors for yearly terms, and assisting owners of property in developing ground.

Tennessee

Tennessee Exploration Co.—This company has been incorporated to make explorations, by drilling and otherwise, for zinc ore on a large tract of land, near Knoxville. J. D. Upton, of Reading, Mass., is president.

Texas

American Iron & Steel Co.—This company has been organized with a capital of $300,000 to develop iron-ore properties in Marion County that supplied ore to local furnaces many years ago. W. F. McClurg, of St. Louis, Mo., is a stockholder as are also W. B. Ward and B. F. Sherell, of Jefferson, Tex., where the company's office is situated.

Utah

Utah Co.—The company has announced a bond issue of $10,000,000, unconditionally guaranteed by the United States Smelting, Refining & Mining Co. The funds will be used solely to finance interests in valuable coal properties in Utah, and the construction of a second railroad outlet to connect with the Union Pacific Railroad.

BEAVER COUNTY

Majestic—It is stated that shipments from the Harrington-Hickory mine will be resumed soon. A recent trial shipment ran 5.29% copper and 3 oz. in silver.

Utah United—The Knight interests have acquired a large share of the stock of this company, operating in the Beaver Lake district.

Red Warrior—Two cars were shipped recently. The ore discovered on the 500-ft. level is reported to be 4 ft. wide, and has been followed 20 feet.

Beaver Star—The property consists of five claims in the Star district, a short distance north of the Hoosier Boy. There is a good surface showing, and development will begin soon.

JUAB COUNTY

Tintic shipments for the week ended Apr. 5 were 172 cars.

Iron Blossom—The company is shipping about 2000 tons per week and the monthly avearge of earnings for the last quarter is about $75,000. There is said to be about $150,000 in the treasury.

Eureka Hill—A lease has been given on the Shoebridge mill dump belonging to this company and containing from 700 to 1000 tons of ore, from which a profit of $3 per ton is expected.

Scranton—At a depth of 15 ft. the winze, which was being sunk from the Del Monte tunnel through lead ore, cut 5 ft. of zinc ore, assaying about 34% zinc, and carrying no lead.

Grand Central—Operations suspended for a week for repairs have been resumed.

SALT LAKE COUNTY

Utah-Apex—Electric haulage will be installed in the Parvenue tunnel, the main haulage way. The equipment has been ordered. There are 70 leasers working in the upper levels, and in the Phœnix ground now owned by the Utah-Apex.

Yampa—It is reported that the property has been examined recently by engineers for the Utah Consolidated.

Utah Copper—The output of the Arthur mill is 700 tons per section per day. The annual stockholders' meeting will be held Apr. 26 in Jersey City, New Jersey.

Montana-Bingham—A streak of good copper ore, with some gold and silver, is reported to have been opened in the tunnel, which is in 700 ft., the face being 350 to 400 ft. from the surface. The projected length is 4000 ft.; it is being built for drain, transportation and development purposes, and will afford considerable depth to the Bingham Amalgamated, Congor, Fortuna and Starless.

Michigan-Utah—On the 900-ft. level, in the Utah Mines Coalition, an orebody has been followed for 300 ft. to the west from a winze, which has shown the ore to continue to greater depth. There is considerable ore broken down and awaiting better weather for shipment.

Washington

FERRY COUNTY

Anaconda Gold Mining & Reduction—This company has been organized at Spokane, with a capitalization of $2,000,000; it has bonded the Fraction, Lucky, Ida, Ruby, First Thought, Last Shot, Minnie and Josephine claims, in the Republic district, and development work will be started soon. Arthur L. Flagg, Spokane, has charge of the work.

Swamp King—This company, with claims near Orient, is considering an offer from a North Dakota company for the lease of the property. The company is now controlled by Spokane men.

Gold Cube—This company, C. O. Perry, Addy, manager, will install new equipment, including an air compressor and drills this season, at its property in Stevens County.

LINCOLN COUNTY

A gold-bearing vein was recently reported as having been cut in a well being sunk near the town of Reardan. Exploration is said to be under way by Spokane men. This is an agricultural section.

Canada

British Columbia

Granby—It is reported that work will start in May on the construction of a 2000-ton smeltery, at Granby Bay, Portland Canal district, the amount involved being about $1,000,000. A similar amount will also be expended on the development and equipment of the Hidden Creek mine. A surface tram will be used.

Ontario

Dispatches recently stated that iron ore has been found by diamond drilling near Fort Frances, at the western end of the province and just north of the international boundary.

Cameron Island—Preparations have been made to resume work at this mine in the Lake of the Woods district, which is already equipped with a complete plant and a 10-stamp mill. A syndicate of Toronto and Hamilton men have completed the necessary financial arrangements, and work will be done under the management of Fred Pfau.

Ontario-Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Apr. 12, and for the year to date, are:

	Week	Year
La Rose	63.10	902.30
Coniagas	120.15	546.35
O'Brien	....	199.78
Right of Way	....	110.34
Chambers-Ferland	....	96.00
McKinley-Darragh	34.54	789.11
Nipissing	40.20	473.12
Hudson Bay	30.54	218.40
Buffalo	....	294.21
Crown Reserve	....	149.11
Cobalt Townsite	55.50	320.31
City of Cobalt	....	113.14
Trethewey	....	147.06
Colonial	....	20.00
Kerr Lake	54.28	231.48
Cobalt Lake	....	136.01
Drummond	....	300.32
Temiskaming	38.40	260.37
Beaver	30.00	101.99
Wettlaufer	28.43	111.21
Provincial	....	22.22
Casey Cobalt	....	24.50
Totals	491.57	5,769.47

BULLION SHIPMENTS IN OUNCES

Mine	Week	Year to date
Nipissing	39,411.00	1,124,500.52
Trethewey	1,696.18	5,703.66

Nipissing—The sampling plant was destroyed by fire on Apr. 10, entailing a loss of $5000 covered by insurance. It is being rebuilt. March shipments were valued at $257,706, of which $230,305 represented bullion. Production for the month amounted to 386,978 ounces.

McKinley-Darragh—In drifting from a winze sunk 60 ft. below the 150-ft. level, a vein 2 to 3 in. wide, of 2500-oz. ore, was cut near the Princess line.

La Rose Consolidated—The annual report for 1911 shows a deficit of $5770. The combined subsidiary companies show a surplus of $642,086 compared to $596,408 for 1910. On Dec. 31, 1911, La Rose cash amounted to $1,277,805. Exploration work was satisfactory, but a well defined fault has been found to extend through the mine, west of which no ore was found.

Ontario-Porcupine

Pearl Lake—This company has closed down for lack of funds.

McIntyre—It is expected that an issue of treasury stock at $6.50 per share will be made soon. The par value of the stock is $5. The company will add 20 stamps and a tube mill to its present equipment to be ready by June 1, giving a total mill capacity of 160 tons per day.

Rea—All underground work has been stopped, pending the annual meeting of the company on Apr. 17, at Montreal, when complete reports of the results of operations will be presented by Manager Bergstrom.

Keora—A small steam plant is being installed on this property.

Hollinger Reserve—A compressor plant and steam hoist are to be installed on this property. When it is in operation, the main shaft will be continued to 200 feet.

Dome Lake—The company has decided to install a 10-stamp mill. The process to be adopted will be determined when test runs on the ore extracted have been made.

Dome Extension—The crosscut in the workings from shaft No. 4 is in 90 ft., of which 63 ft. are in quartz and schist. The first 27 ft. carry ore of milling grade.

Preston-East Dome — The financial statement submitted at the first annual meeting, Mar. 27, showed liabilities of $6500, and $55,010 cash on hand. The amount spent on development was $30,821. The loss by the fire of last July was $20,584. The engineer's report showed that the main shaft was down 115 ft., and that crosscutting had been commenced at the 100-ft. level and carried in 15 feet.

Bewick-Moreing—No. 1 camp, the last operated by this company, has been closed down, and it is understood that the company is retiring from the Porcupine field.

Hollinger—In hunting for No. 4 vein on the 200-ft. level, the vein was entirely passed through before it was observed to be No. 4. It was only found by erratic assays, taken along the walls of the crosscut, and it was finally necessary to wash down the walls of the crosscut in order to see where the ore came from. The crosscut is believed to have been driven through a fault plane standing at about 70°, so that the two sections of the vein were on either side.

Quebec

Bell—On Apr. 6, Pierre Leviner was killed, William Doyle fatally injured and Eugene Nadeau seriously injured by a premature explosion while the wires of an electric battery were being connected at this asbestos mine at Thedford.

Mexico

Jalisco

San Pedro Analco—This property, on the Santiago River, in the Hostotipaquillo district, is under investigation by Messrs. Brown and Onelos, engineers representing English interests, that are said to have an option on the property. The property is extensively developed and is equipped with a hydro-electric power installation. It has been idle for some time.

Mexico

El Oro—During March, the mill treated 21,300 tons of ore and 11,410 tons of tailings, yielding bullion, $172,120. Working expenses were $96,720; development, $22,110; permanent improvement, $1150; and $62,110 total profit.

Oaxaca

Conditions in the latter part of March were satisfactory in this state. The Houston mill is in course of erection, the machinery has been shipped for the Cubilete mill and the designs for the San Juan mill are being completed, after exhaustive metallurgical tests. The Santa Catarina mill has been repaired and enlarged and is now working.

Alvarado—The company at the end of March was still operating with no trouble. Mill tonnage is normal and of good grade. Pumping has not been interrupted. If cyanide can be obtained, operations will probably not be suspended.

South America

Brazil

New diamond fields are said to have been found on the Garzas River in the State of Goyaz.

Bolivia

Activity has been shown in the Huanuni tin-mining district. The interests of Peny and Duncan have been transferred to a native capitalist for a large amount, marking the end of boundary litigation.

Salvador

Monte Mayor Gold & Silver Mining Co.—This company has recently acquired properties in the Department of Morazan, about six miles from the San Sebastian mine and about eight miles from Sociedad. Machinery has been ordered and some has been received. The company expects to use the cyanide process. MN—

Africa

Transvaal

Gold production in the Transvaal in March made a new high record, reaching a total of 820,782 oz., or $16,965,564. This was 126,866 oz. more than in February. For the three months ended Mar. 31, the total was 1,937,920 oz. in 1911, and 2,373,649 oz.—or $49,063,325—in 1912; an increase of 435,729 oz. this year.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Apr. 17—The coal trade in the West seems to be gradually settling down into better shape, with the prospect that there will soon be a general resumption of mining. No further obstacles have arisen to the general settlement, and the prospect is that matters will resume their normal condition before long.

The seaboard bituminous trade is also approaching its normal position, though prices are unsettled, partly because of the anthracite troubles, and partly because of an increased demand for export.

The anthracite-labor question is still in the air. At the conference last week Mr. Baer offered a plan to submit the questions in dispute to arbitration by the surviving members of the Anthracite Strike Commission of 1902. This was rejected, and a committee of four operators and four miners was appointed to prepare a compromise, if possible. The miner and operator members have been at work separately and meet today in conference to compare their respective plans and then submit the result to the larger bodies of representatives. The result is uncertain, but there seems to be a rather sanguine feeling as to the probability of a settlement. The main trouble is over the recognition of the union.

German Coal Trade—Exports of fuel from Germany two months ended Feb. 29 were: Coal, 5,174,207; brown coal (lignite), 9485; coke, 797,266; briquettes, 415,186; total, 6,296,244 metric tons. Imports were: Coal, 1,401,587; brown coal, 1,162,821; coke, 91,663; briquettes, 33,362; total 2,699,435 metric tons.

Coal production of German Empire two months ended Feb. 29, metric tons:

	1911	1912	Changes
Coal	26,196,203	29,209,910	I. 3,013,707
Brown coal	12,138,748	13,371 957	I. 1,233,209
Total mined	38,334,951	42,581,867	I. 4,246,916
Coke made	4,227,013	4,611,648	I. 384,635
Briquets made	3,466,888	3,832,660	I. 365,772

Of the briquettes reported this year 2,966,806 tons were made from brown coal, or lignite.

Iron Trade Review

New York, Apr. 17—The iron and steel markets continue active for the most part, and new business continues to come in, with indications of a good spring trade.

In finished material almost all kinds of steel are in demand, and there are indications that buyers are disposed to fill up their stocks and take contracts further ahead. Bars seem to be wanted, while plates and structural steel continue to be called for. Several rail contracts are noted, including one of 100,000 tons for the Southern Pacific lines, of which 40,000 tons will go to the Ensley mills, 20,000 to Pueblo and the rest to Eastern mills. Car and railroad-bridge orders are also on the increase. Prices are gradually strengthening.

Pig iron has been a little less active, but there have been some large sales of bessemer and basic, with further inquiries pending. Foundry iron is not so strong, though there are many small sales. Pig-iron prices are firmer, but buyers seem to have successfully resisted any large advances.

The Steel Corporation's statement of unfilled tonnage on the books on Mar. 31 gives a total of 5,304,841 tons, a decrease of 140,359 tons from Feb. 29. This is not at all unfavorable, in view of the heavy operations in March.

Baltimore

Apr. 15—Exports for the week included 11,767,175 lb. castings, structural steel, miscellaneous iron and steel to Panama. Imports included 74 casks silicospiegel, 1730 tons ferromanganese and 100 tons spiegeleisen from Liverpool; 62 casks manganese ore from Hamburg; 2397 tons cupreous pyrites from Huelva, Spain; 22,565 tons iron ore from Cuba.

Birmingham

Apr. 15—Southern pig-iron manufacturers are selling their product right along for delivery during the third quarter of the year with some business being booked also for fourth-quarter delivery. The quotations are firm at $11 per ton, No. 2 foundry, as the basis. Some of the manufacturers are confident there will be a better price when the buying is on for last-quarter delivery. In addition to the 66,000 tons of iron sold just before the start of the present month, it is announced that an Eastern pipe concern has placed an order for 25,000 tons of iron with Southern furnace companies for delivery during the latter part of the year. A number of smaller orders have been placed.

The make in Alabama in March was nearly 150,000 tons against 138,000 tons in February. The two days' difference had something to do with this increase. The make in April should be equal to that of March at least, if not a little better as the weather conditions have been favorable.

The steel situation also is a little improved, though the plant of the Tennessee company at Ensley is not yet working on full time. Fabricated steel is in strong demand.

Charcoal iron shows no change; $22@22.50 is the price. The make is still limited.

Chicago

Apr. 16—Sales of pig iron continues large in comparison with those in previous weeks, but there is nothing as yet in the nature of a boom. The tendency of the melters is to buy more freely than for a long time. Both Southern and Northern irons are in demand to a degree that encourages sellers, who are asking more for last-half deliveries than the average buyer is willing to give; but the number of exceptional buyers, willing to take a chance and to buy on a strengthening market, seems to be increasing. As a whole, the market may be said to be notably stronger and to be acquiring still more strength.

Southern No. 2 pig iron holds to $10.50@11, Birmingham—$14.85@15.35, Chicago—on all except the most favorable sales to the seller, who makes a minimum price of $10.50—and Northern No. 2 brings $14.50 in general—a few sales perhaps being 25@50c. less—with Lake Superior charcoal quiet but firm at $16.50 minimum. These prices apply to second- and third-quarter business; for last-half requirements in general and for fourth-quarter the higher quotations obtain. In general, it may be said, the consumer of pig iron is buying more liberally and gradually extending the time of his deliveries; the seller is cautious and seeks a higher price on deliveries any considerable distance in the future, in the belief that the market is rising.

The market for iron and steel products seems to be stiffening generally. Structural material is active and strong. Bridge and building needs are large and increasing, for business throughout the West and Southwest, the price holding to 1.35c. for material under 15 in. The bar business is still ragged, with some business probably placed under the nominal minimum of 1.33c. quoted, but general conditions holding the market rather closely to that figure. Iron bars are not so active as steel bars, prices holding to 1.15@1.20c. Plates find increasing sales in view of strengthening railroad demands, at 1.35c. minimum on ¼-in. tank plates. Railroad supplies are quiet, but track fastenings continue in good demand and there are some inquiries that may result in good-sized orders for light rails. Sheets have a better sale and wire goods are active in consequence of farm needs. General business improves steadily, though slowly.

Cleveland

Apr. 15—Iron-ore sales have been large. A number of vessels have been chartered to carry ore from the head of the Lakes to Cleveland at 40c. net—that is, 40c. and the unloading charge, whatever that may be fixed at. Whether it will be 10 or 8c. seems uncertain.

Pig Iron—Sales have been large, but there seems to be little or no change in prices. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.90 for basic, $13.25@13.50 for No. 2 foundry and $12.50@12.75 for gray forge.

Finished Material—Sales are good, especially for bars, plates and structural steel. Quotations are now pretty firmly held at 1.15c. on bars and 1.20c. on shapes.

Philadelphia

Apr. 17—The heavy transactions in basic and bessemer in Western markets have reflected a stronger tone in this market in all lines of pig iron. Within a day or two inquiries for large lots have come from unexpected quarters, large consumers who recently have been quite liberal buyers. Large inquiries for both bessemer and basic are now before makers and transactions are practically assured. Iron for steel making is more active than any other kind and even foundry, which has been dragging for some time, is in good request. Several orders have been placed for low-grade iron for pipes. Forge iron is moving more freely. Inquiries from New England are quite liberal and the entire market has just put on spring activity. Quotations are: No. 2 X foundry, $15@15.25; gray forge, $14@14.50; basic, $14.50. Southern brands are selling pretty close to these figures.

Steel Billets—The increase of exports inquiries is stimulating domestic buyers, and quite a number of large concerns have hurried into the market and closed for good sized lots at prices stipulated a week or two ago. The outlook for rolling billets is especially good. Forging billets are being called for more freely than for months.

Bars—An advance has taken place in bars to 1.32½c. for refined, which is a minimum price and higher figures are paid for small lots. An influx of small orders during the past week has spread a feeling of hopefulness in the bar mills. The inquiries some of them have received for summer delivery are particularly encouraging.

Sheets—Sheets have advanced $1 or $2 a ton in large lots with a greater advance in small lots. Several good sized orders have been placed, deliveries extending over the summer. Corrugated leads other kinds in activity.

Tubes—Tubes are more active than they have been for months at recent discounts, and an upward tendency is manifest.

Plates—Car builders are active buyers to provide for recent and prospective contracts, and some heavy orders have been placed, in which deliveries have been specified to begin in some cases early in May. Some of the contracts extend into August. The shipbuilding interests have also closed for large lots of material.

Structural Material—Some business which has been hanging fire for two or three months has been finally placed, calling for deliveries of bridge steel. The distribution is mainly over the Atlantic slope, and not a little of the business is in small lots, for small bridges and for terminal railway work, as well as for building operations.

Steel Rails—The large orders for steel rails, which have recently been placed, have not done Eastern mills much good. There are inquiries on the market for moderate-sized lots to complete minor track laying.

Scrap—An active demand is maintained and nearly all concerns using scrap are buying liberally. Railroad is scarce and has been nominally advanced. A lot or two of steel carwheels have been picked up. Melting scrap is in short supply. Heavy cast scrap is being called for and supply is sufficient, but it commands 50c. a ton more.

Pittsburg

Apr. 16—Mills are showing such a disposition to advance finished-steel prices that it is perfectly apparent they are indifferent to booking additional tonnage at the moment. As a rule they have their output sold to July, and are advancing prices at this time in order to realize a better average on their shipments in the third quarter. Of course, a limited amount of tonnage is sold at advanced prices for early delivery, but as a rule buyers will not begin paying the advanced prices until third quarter.

The Carnegie Steel Co. has notified the trade that on Apr. 20 its price on steel bars will advance from 1.15c. to 1.20c. Meanwhile, it is willing to contract at 1.15c., with jobbers for the usual 90 days ahead and with manufacturing consumers to Oct. 1. Such buyers, however, are already fairly well covered for the periods mentioned. The periods mentioned are for filing specifications, deliveries following according to the condition of mill order books. The Republic company advanced its price to 1.20c. today.

Effective Apr. 11, the American Sheet & Tin Plate Co. advanced its minimum prices from 1.85c. to 1.95c. on black sheets, from 2.90c. to 3.00c, on galvanized sheets, from 1.35c. to 1.40c. on blue annealed, and from $2.50 to $2.55 on galvanized corrugated roofing. It had a few weeks earlier made advances on black and galvanized sheets. The market was standing practically at the company's prices before the advance, and the new prices do not become the market as independents are still selling at the old figures to an extent, but it is believed that within a short time the whole market will be up to the new basis.

On Thursday, Apr. 18, the American Sheet & Tin Plate Co. will inaugurate the practice of selling all corrugated, V-crimps and other formed roofing by the pound instead of by area. This is pursuant to a plan considered for several years, for the purpose of discouraging the practice of misrepresenting the gage. A great deal of material is sold lighter than the gage marked, and it is believed that the change to selling by weight will stop this. Other manufacturers will gradually fall in line. The company's price system is a very simple one, as for corrugated material there is added 5c. per 100 lb. to the price of the black, for gages 12-18, inclusive; 10c. for 19-24 and 15c. for 25-28. Thus No. 28 will be quoted at 2.10c. per lb., since 28-gage flat sheets are held at 1.95c. As a square of 28-gage painted should weigh 68 lb., this will make a price of $1.36 for a square, but the billing will be by the actual weight, and the buyer will have to compute how much weight is required to cover the desired area.

There seems to be a definite movement on the part of manufacturers of bars, plates and shapes to work the market up to a level of 1.20c. for bars and 1.30c. for plates and shapes. As soon as the market is well lined up on this basis of 1.20c. for bars, one or other of the mills will probably announce a similar advance in plates from 1.20 to 1.25c., and this will be kept up until both plates and shapes are on a 1.30c. basis.

The advancing tendency in prices is having such an effect upon the filing of specifications that the mills are very well filled, and there is no index as to the fundamental strength of the market, as buyers may easily specify for more material than they really need, when they see that they cannot replace it at their contract prices.

Pig Iron—The market has been slow in point of sales and inquiries, but prices are absolutely firm and the outlook is regarded as good by the merchant furnaces in operation. They are not, as a rule, anxious for any advances in price, as they fear this would bring in some of the idle furnaces and the market might eventually decline to a still lower level. The inquiry of the Andrews Steel Co., Newport, Ky., for 15,000 tons of basic iron, was mentioned in last report. The company has since bought 20,000 tons, for second-half delivery, but did not take any of it from Valley furnaces. It is understood the delivered price was not over $14.20, which would be equivalent to $12.40, Valley. The iron probably came from Columbus or Toledo furnaces. We quote: Bessemer, $14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; gray forge, $12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg, for early delivery, furnaces as a rule asking higher prices for delivery after July 1 next.

Ferromanganese—The English producers yesterday announced an advance of $2.50. No definite information was available in advance, but for some time past it has been thought that another advance was contemplated. Deliveries have been poor in the past few weeks, the furnaces having difficulty in getting material to seaboard, while vessel room was also hard to secure. As a result, prompt metal has been quite scarce, and has frequently brought $44 or $45 a ton, Baltimore, while as high as $46 was paid in one instance. On the other hand, it is stated on excellent authority that within a few days a sale of prompt metal was made at $41. We quote prompt delivery at $44@45, and forward delivery at $43.50, Baltimore. The price holds good for deliveries into next year.

Steel—The western Pennsylvania mills are practically all out of the market, being already oversold, and the market, such as it is, is made by one or two sellers at Youngstown. There are no free sellers anywhere, and it is a question what would have to be paid for either billets or sheet bars. We quote nominally $20 on billets and $21 on sheet bars, Pittsburg, though it is possible a close buyer might pick up a little tonnage at less. Rods are $25, Pittsburg.

Sheets—The market is firmer since the American Sheet & Tin Plate Co. advanced its minimum prices, effective last Thursday. Its minimum prices now are: Blue annealed, 10 gage, 1.40c.; black, 28 gage, 1.95c.; galvanized, 28 gage, $3; painted corrugated roofing, $1.35 per square; galvanized corrugated, $2.55. On Apr. 18, its prices on corrugated roofing will be 2.10c. per lb. on 28-gage painted and 3.15c. per lb. on 28-gage galvanized, as already explained. The independents have continued to firm up, by one low price after another being withdrawn, and we quote the market now as follows: Blue annealed, 1.35@1.40c.; black, 1.85@1.95c.; galvanized, 2.90@3 cents.

St. Louis

Apr. 15—More activity has developed in the market for pig iron and sales have been larger than for some time. Inquiries running over the second half of the year continue to come in. Prices are firmer. Southern No. 2 foundry is held at $10.50, Birmingham, or $14.25, St. Louis, while Northern No. 2 is quoted at $14.50@14.75 per ton.

Coke is in rather short supply, and is coming in slowly. Quotations are $5.10@5.20, St. Louis, for good foundry.

Business in finished iron and steel is improving, with more sales and prices a little firmer.

Iron Ore Trade

Heavy sales of Lake ore are reported from Cleveland. It is stated that from 8,000,000 to 10,000,000 tons have been sold or resold up to date; and that nearly 1,000,000 tons of the total have been taken by Eastern furnaces. Prices are as heretofore stated, except that some cuts have been made on ore sold to Eastern companies. Lake-vessel rates are prettty well settled at 40c. from Duluth or Superior to Lake Erie, plus the unloading charge. There is talk of fixing that charge at 10c., but protests have been made, and 8c. seems more probable. A heavier tonnage than 1911 is expected.

Foreign Iron Trade

German Iron Production—Pig-iron production in the German Empire in February was 1,319,827 metric tons, being 52,922 tons less than in January. For the two months ended Feb. 29 the total was, in metric tons:

	1911	1912	Changes	
Foundry iron	509,645	485,114	D.	24,531
Forge iron.........	97,414	90,084	D.	7,330
Steel pig...........	278,635	357,766	I.	79,131
Bessemer pig.....	57,601	55,991	D.	1,610
Thomas(basic)pig	1,556,554	1,703,621	I.	147,067
Total.......... ..	2,499,849	2,692,576	I.	192,727

The total increase was 7.7%. Steel pig includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys.

METAL MARKETS

New York, Apr. 17—The metal markets have been again comparatively quiet, but are generally strong, though business has been less active.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Feb. 1912.	$ 10,589,295	$ 2,937,274	Exp.	$7,652,021
" 1911..	424,733	5,805,844	Imp.	5,381,111
Year 1912..	12,504,497	8,078,517	Exp.	4,425,980
" 1911..	1,348,409	15,346,674	Imp.	13,998,265
Silver				
Feb. 1912..	5,121,776	3,780,477	Exp.	1,341,329
" 1911..	4,453,171	3,897,946	Exp.	555,225
Year 1912..	11,149,681	8,138,486	Exp.	3,011,195
" 1911..	10,104,247	7,449,372	Exp.	2,654,875

Exports from the port of New York, week ended Apr. 13: Gold, $350,100, largely to Argentine; silver, $706,589, mostly to London and Paris. Imports: Gold, $309,354; silver, $52,272; from Mexico, South America and Australia.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There is some talk of shipments of gold from Europe to New York, but none has yet been made. In New York some small amounts were shipped to Argentina.

Platinum—The market is quiet and nothing seems to move it. There has been some talk of lower prices, but it is not easy to see upon what such an expectation is based. Dealers quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal, up to 10% iridium.

Silver—The market remains steady with a slight upward tendency. There is no movement of any special significance to record.

SILVER AND STERLING EXCHANGE

Apr.	11	12	13	15	16	17
New York....	58⅝	58½	58⅝	58¾	58½	58⅞
London .. .	27	26$\frac{15}{16}$	27	26⅞	26$\frac{15}{16}$	27⅛
Sterling Ex..	4.8695	4.8690	4.8700	4.8700	4.8710	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to April 4, reported by Messrs. Pixley & Abell:

	1911	1912	Changes	
India	£2,724 200	£1,830,800	D.	£893,400
China	702,800	465,000	D	237,800
Total ...	£3,427,000	£2,295,800	D.	£1,131,200

India Council bills in London averaged 16.05d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

	Copper		Tin	Lead		Zinc	
Apr.	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
11	15⅞ @16	15 70 @15 80	43¼	4 20	@4 12½ 4 15	6.50 @6 70	6.35 @6 55
12	15⅞ @16	15 70 @15.80	43¼	4 20	4 12½ @4 15	6 50 @6 70	6 35 @6 55
13	15⅞ @16	15.70 @15.80	43¼	4 20	4 12½ @4 15	6 50 @6 70	6 35 @6 55
15	15⅞ @16	15 75 @15 85	43⅜	4 20	4 12½ @4 15	6.55 @6 75	6 40 @6 60
16	15⅞ @16	15 75 @15.85	43½	4 20	4 12½ @4 15	6.55 @6.75	6 40 @6.60
17	15⅞ @16	15 80 @15 85	43½	4 20	4 12½ @4 15	6 65 @6 75	6 50 @6 60

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Apr.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
11	$70\frac{7}{16}$	$71\frac{5}{16}$	75¼	197½	194¼	$16\frac{3}{16}$	25½
12	70⅜	71¼	75¼	197¼	194	$16\frac{3}{16}$	25¾
13	......	......	......	......	......	......	....
15	70⅜	71¼	75¼	197½	194⅛	16¼	25⅞
16	70⅝	71½	75¼	197½	194⅜	16¼	25⅞
17	$70\frac{5}{16}$	$71\frac{3}{16}$	75¼	197¾	194½	$16\frac{5}{16}$	25⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market has been rather dull during the week Apr. 11-18, but even the relatively small demand has resulted in a further stiffening of prices. There have been some reports of sales of electrolytic at concessions by second hands, but it is not believed that these amounted to much. All of the first hands have maintained their prices firmly at 16c., delivered, both for domestic and foreign shipment. One large seller raised its quotation to 16⅛c. on Apr. 16, but no business at the advance has yet been reported. The demand for copper during the week has been more from domestic than foreign sources; apparently the speculative interests abroad are taking care of business in that quarter.

Consumption both here and abroad continues excellent, and the European statistics for the first half of April showed a decrease, the visible supply being about 740 tons and the stocks 140 tons less than at the beginning of the month. Little has been done in Lake copper, which is quoted nominally at 15⅞@16c. Electrolytic copper is somewhat firmer, and at the close cakes, ingots and wirebars are quoted 15.80@15.85c. Casting copper is quoted nominally at 15½@15¾c. as an average for the week.

The London standard market has been fluctuating within narrow limits, and closes practically unchanged at £70 6s. 3d. for spot, and £71 3s. 9d. for three months. There have been considerable realizations by speculative holders, the offers being readily absorbed.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 17@17¼c. base, carload lots at mill.

Copper exports from New York for the week were 3568 long tons. Our special correspondent gives the exports from Baltimore at 1201 tons.

Visible stocks of copper in Europe, on Apr. 15, are reported as follows: Great Britain, 35,520; France, 6490; Rotterdam, 3050; Hamburg, 7600; afloat from Chile, 1930; afloat from Australia, 5500; total, 60,090 long tons, a decrease of 990 tons from the Mar. 31 report.

Tin—The market remained firm throughout the week, with but slight variations. A good deal of cheap tin was offered in this market, a liberal supply of spot tin being on hand and large shipments coming in. This was quickly taken advantage of by consumers, who also bought June and July deliveries. The market closes steady at £197 15s. for spot, and £194 10s. for three months in London, and about 43½c. for April tin in New York.

Lead—More business is reported at the last prices, 4.20c., New York, and 4.12½@4.15c., St. Louis.

In Europe, the market for lead is firmer, Spanish lead being quoted at £16 6s. 3d., and English 2s. 6d. higher.

Spelter—There has been more demand, both for early and for future shipment, and the market is firm and slightly higher at 6.50@6.60c., St. Louis, and 6.65@6.75c., New York, according to the delivery. There is still a wide spread in prices, and the sales at the higher prices are not heavy.

The London market is also somewhat firmer, good ordinaries being quoted at £25 17s. 6d., and specials at £26 2s. 6d. per ton.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quiet and unchanged at 7⅛c. per lb., New York.

On a specification by the U. S. government for 50,000 lb. of Bertha or Horse Head spelter, delivered in Washington, D. C., the New Jersey Zinc Co. last week made an offer at 8¼c. per pound.

Other Metals

Aluminum—Business is quite active and prices are firm at last quotations, 20@20½c. per lb. for No. 1 ingots, New York. A late London quotation is £62 per ton—equal to 13.33c. per lb.—for ingots.

Antimony—Business has been better than in recent weeks. Cookson's is a shade firmer at 8@8⅛c. per lb. Hallett's and U. S. are 7¾; while 6⅞@7c. is quoted for Hungarian, Chinese and other outside brands.

Quicksilver—The New York price has been reduced slightly and is now $41@42.50 per flask of 75 lb., with the usual advances for small quantities. Business is brisk at the decline. San Francisco, $41.50 for domestic orders and $39 for export. London price is £8 12s. 6d. per flask, with £8 7s. 6d. quoted from second hands.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 13—The high price of zinc sulphide ore was $58, the base, per ton of 60% zinc, $50@55.50. Zinc silicate sold at $25@28 per ton of 40% zinc. Average price, all grades of zinc, $50.30 per ton. A weaker lead-ore market, with $55 high, brought the average down to $53.70, a decline of $1.30 per ton.

Outputting conditions are more assuring, so far as the weather is concerned, but the water-soaked earth is proving very treacherous in many of the soft mines, and accidents seem to be frequent. So far there have been few serious ones. Producers attempt to use every precaution, but the break will generally occur in the least expected place. These conditions have always followed such a long

SHIPMENTS, WEEK ENDED APR. 13

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,123,760	......	1,589,290	$150,150
Joplin	1,617,930	......	276,570	51,150
Alba-Neck	1,234,080	130,000	95,030	39,060
Galena	740,120	......	152,330	22,610
Miami	465,960	......	258,050	17,225
Oronogo	580,430	......	59,000	15,795
Granby	331,100	450,150	13,450	13,465
Duenweg	401,810	130,000	39,190	13,400
Cave Springs	371 320	......	.....	10,395
Carl Junction	265,220	......	......	7,610
Spurgeon	61,140	131,200	109,680	6,410
Jackson	119,550	......	6,630	3,230
Wentworth	103,270	......	......	2,565
Carthage	87,370	......	.....	2,350
Lawton	......	......	62,610	1,490
Totals	10,503,060	841,350	2,671,780	$357,075
15 weeks	149,901,590	8,949,850	25,369,380	$4,361,721

Blende val., the week, $272,480; 15 weeks, $3,543,870
Calamine, the week, 12,855; 15 weeks, 127,85
Lead value, the week, 71,740; 15 weeks, 699,97

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41 85	$44.90	$40.55	$43.54	$55 68	$58.9
February	40 21	45 75	39 16	43 31	54 46	52.39
March	39 85	51.56	38.45	49.25	54 57	54.64
April	38 88	......	37 47	......	56 37	......
May	38.25	......	36 79	......	55 21	....
June	40.50	......	38.18	......	56 49	......
July	40 75	......	38 36	......	58 81	.....
August	42 50	.....	41 28	.....	60 74	. .
September	42 63	......	41 29	. ...	59 33	.....
October	42 38	.. ...	40 89	.....	54.72	.
November	45 40	......	43 25	. ...	57 19	.
December	44 13	. ....	40 76	. ..	62 03	.
Year	$41 15	......	$39.90	.....	$56 76	.....

NOTE: Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

wet spell as this spring, and cause some loss of time. This will be followed by bad air when the weather warms a little more, in such mines as are not provided with excellent ventilation. Still the output may be maintained around 5300 to 5500 tons.

Platteville, Wis., Apr. 13—The highest price paid this week for zinc ore was $55 per ton; the base price, 60% zinc, was $53@54. The base price paid for 80% lead ore was $53 per ton.

SHIPMENTS, WEEK ENDED APR. 13

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	1,026,300	....	....
Hazel Green	401,000	....	....
Galena	378,100	....	....
Benton	323,300	....	346,900
Platteville	224,400	....	100,000
Cuba City	195,000	174,530	....
Livingston	180,000	....	....
Rewey	84,000	....	....
Shullsburg	80,000	....	....
Linden	60,000	....	66,260
Total	2,952,100	174,530	513,160
Year to date	56,361,740	1,621,860	6,160,350

Shipped during week to separating plants, 1,726,950 lb. zinc ore.

Chemicals

New York, Apr. 17—The general market is unchanged and fairly active.

Copper Sulphate—Business is on a fair scale. Quotations are $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Demand still continues up to supply, perhaps in advance of it. For white arsenic $3.75@4 is quoted for spot, with $3.50@3.75 per 100 lb. for futures.

Nitrate of Soda—The market is active and rather strong, but quotations are unchanged at 2.40c. per lb. for spot, and 2.35@2.40c. for future positions.

Petroleum

The monthly report of the *Oil City Derrick* gives new oil wells completed in March as follows: Pennsylvania and West Virginia, 313; Lima-Indiana, 31; Kentucky, 19; Illinois, 54; Kansas and Oklahoma, 408; Texas and Louisiana, 96; total, 921. In all the divisions there were 921 wells completed, 80 more than in February. The new production was 44,902 bbl., an increase from the February report of 1377 bbl. There were 165 failures among the completed wells, and 78 gas wells, a total of 243, leaving 678 oil producers.

On the last day of March there were 503 rigs up and 1088 drilling wells, a total of 1591. This was an increase of 53 in rigs and 132 of wells drilling.

MINING STOCKS

New York, Apr. 17—On Apr. 11, the Exchange was active, but a little inclined to recessions on all but a few favorite stocks. The Curb did a good business and mining stocks generally were in favor. Copper shares were irregular, some advancing and others declining.

Apr. 12 there was rather a halting market, with many recessions in price. The industries were stronger than other stocks. On the Curb, sales were slower and the market inclined to be heavy. Prices were variable for copper stocks, but the general tendency was to lower quotations.

Apr. 13 the market opened rather heavily, but recovered tone later and closed fairly strong. The Curb did a fair business in mining stocks, chiefly coppers, which showed considerable strength.

Apr. 15 the market took an upward turn. The copper stocks listed on the Exchange all advanced and were in demand. Trading in mining stocks on the Curb increased and broadened out, almost all selling at advancing prices. The copper stocks especially sold at higher quotations.

Apr. 16 trading halted, not for any specific reason, apparently, except for a purely sentimental cause, the general gloom cast over the market by the "Titanic" disaster. There was little reaction, but slow trading. The Curb also was rather inactive and trading was quiet and irregular. Apr. 17 the market had not yet recovered its tone and trading was again on a smaller scale, and with few changes, either on the Exchange or the Curb.

Boston, Apr. 16—Another week of activity and strength has been witnessed in copper shares. The sharp advances in some specialties have been well maintained, while reactions have tended to strengthen the technical position of the general copper share list. Public interest is increasing in metal stocks as a big volume of business attests. Many specialties have made record prices on the current movement and still further optimism is encouraged by the strength maintained in the metal itself.

The most conspicuous advances during the week are those made in Granby and Tamarack. The former rose $12.75 to $56.50 and the latter $12 to $42, although all of the advances mentioned were not maintained in today's uneven market. The Granby has got an immense tonnage in sight and the Tamarack has reduced costs 3c. per lb. to a point where the present level of copper gives a good margin of profit. Some of the lesser stocks like Adventure, Indiana and New Arcadian have had sharp movements with a large amount of trading. Adventure is working in rich copper territory and Arcadian has encountered good ore at depth. Indiana has struck rich ore in the crosscut on the 600-ft. level.

Butte & Superior has attracted attention with a $2 advance to $33. The company has voted to offer 30,000 shares of new stock to holders of record Apr. 27 at $27.50 per share. The issue is underwritten. Ahmeek Mining has taken its 50,000 shares from the Curb and listed them on the Stock Exchange.

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Jan.	Feb.	March
Alaska shipments	3,701,010	....	4,987,916
Anaconda	26,350,000	27,450,000	25,900,000
Arizona, Ltd.	3,200,000	3,020,000	3,150,000
Copper Queen	6,748,264	6,046,860	7,197,121
Calumet & Ariz.	4,544,000	4,452,004	4,652,000
Detroit	1,941,970	2,068,370	2,246,238
East Butte	1,520,000	1,440,000	....
Mammoth	1,665,319	1,722,954	.....
Mason Valley	600,000	1,100,000	....
Nevada Con.	6,309,228	4,888,790	....
Old Dominion	2,044,000	2,039,000	....
Ray	2,475,945	2,140,000	....
Shannon	1,550,000	1,300,000	1,388,000
South Utah	189,678	283,838	299,000
United Verde*	2,000,000	2,250,000	....
Utah Copper Co.	8,156,612	8,612,739	....
Lake Superior*	17,500,000	19,000,000	19,750,000
Non-rep. mines*	8,400,000	8,000,000	8,400,000
Total production	98,896,026	....	....
Imports, bars, etc.	31,790,590	18,976,513	....
Total blister	130,686,616	....	....
Imp. in ore & matte	8,340,740	10,432,438	....
Total	139,027,356	....	....
Miami	2,235,647	2,475,996	....
Brit. Col. Cos.:			
British Col. Copper	538,190	860,003	....
Granby	1,607,558	1,773,496	....
Mexican Cos.:			
Boleo	2,315,040	2,204,720	2,424,800
Cananea	3,552,000	2,948,000	2,834,000
Moctezuma	2,732,867	2,687,712	2,446,731
Other Foreign:			
Cape Cop., S. Africa	784,000	786,440	725,760
Kyshtim, Russia	....	....	....
Spassky, Russia	795,200	649,600	....
Famatina, Argen.	172,480	....	....
Tilt Cove, Newf'd.	153,257	109,059	104,992
Exports from:			
Chile	8,064,000	6,720,000	3,584,000
Australia	7,056,000	7,164,000	8,064,000
Arrivals in Europe†	13,144,320	10,868,680	12,559,680

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
III, 1911	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	7[illegible]9,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566

VISIBLE STOCKS

	United States	Europe	Total
IV, 1911	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,281,643	154,851,200	221,[illegible],843
III	62,339,988	141,142,400	[illegible]
IV	62,367,557	136,819,200	199,[illegible],757

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month

Speculation in Mayflower and Old Colony has subsided somewhat, although prices are well maintained. The Fay management in Mayflower will be succeeded by the younger Mr. Paine.

Business on the Curb has been active and prices generally strong.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1	....	$0.006
Algomah, Mich	Jan. 22	....	1.00
Belcher, Nev	Apr. 8	Apr. 30	0 10
Best & Belcher, Nev	Mar. 19	Apr. 8	0.06
Black Jack, Utah,	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.50
Bullion, Nev	Apr. 30	May 20	0.05
Cedar-Talisman, Utah	Apr. 20	....	0.005
Con. Imperial, Nev	Apr. 30	May 23	0.01
Con. Virginia, Nev	Apr. 24	May 15	0.20
Crown Point, Nev	Mar. 28	Apr. 19	0.05
Ely Con., Nev	....	....	0.05
Gould & Curry, Nev	Apr. 19	May 10	0.06
Hale & Norcross, Nev	Apr. 12	May 3	0 05
Hancock, Mich	Mar. 28	....	1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
Lehi Tintic, Utah	Feb. 29	....	0.01½
Leonora, Utah	Apr. 15	Apr. 30	0.0125
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	....	1 005
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1	....	0.10
Sierra Nevada, Nev	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz.	Jan. 15	....	1.00
Union Con., Nev	May 9	May 31	0.15
Wabash, Utah	Mar. 19	Apr. 10	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	.....	24 483	24.595	......
May	53.870	53.308	.....	24.797	24.583	......
June	53.462	63 043	.....	24.651	24 486	......
July	54.150	52.630	.....	25.034	24.286	......
August	52.912	52 171	.....	24.428	24.082	......
September	53.295	52 440	.....	24.567	24.209	......
October	55.490	53 340	.....	25.596	24.594	......
November	55.635	55.719		25.680	25.649	......
December	54.428	54 905	.. ..	25 160	25.349	.....
Year	53 486	53.304		24 670	24 592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard.	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	14.094	12.680	14.337	55.600	62.760
February	12.256	14 081	12.611	14.329	54.974	62 893
March	12 139	14.698	12.447	14.868	54.704	66.884
April	12.019	.....	12.275	....	54.034	....
May	11.989	.....	12.214	....	54.313	....
June	12.385	.....	12 611	....	56.365	....
July	12 163	.....	12.720	.....	56 673	....
August	12 105	.....	12.634	.....	56 266	..
September	12 201	.....	12.508	.....	55 253	....
October	12 189	.....	12 370	.....	55.170	.
November	12 616	.....	12 769	.....	57.253	.
December	13 552		13 768	.....	62.068	
Year	12 376	.	12.634	.....	55 973	

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	.....
February	41 614	42 962	August	43 319	....
March	40 157	42.577	September	39 755	.
April	42 185		October	41 185	....
May	43.115	.	November	43 125	.
June	44 606	.....	December	44 655	...
			Av. Year	42 281	....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4.435	4 334	4.327	13 009	15.619
February	4 440	4.026	4 266	3 946	13 043	15 738
March	4.394	4.073	4 238	4.046	13 122	15.997
April	4 412	......	4 262	......	12.889	......
May	4.373	.....	4.223	......	12 984	....
June	4 435	......	4 292	......	13.260	....
July	4.499	......	4.397	......	13 530	.....
August	4 500	......	4 406	......	14.260	......
September	4 485	....	4 356	......	14 744	......
October	4 265	......	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	.....
December	4.450	......	4.332	......	15.648	.....
Year	4.420	.....	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26 642
February	6 518	6.499	5 368	6 349	23 276	26 661
March	5.563	6.626	5 413	6.476	23 016	26.048
April	5 399	......	5.249	....	23 743	......
May	5.348	......	5 198	......	24.376	......
June	5 520	......	5 370	.....	24.612	......
July	5 695	......	5 545	......	25.006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	......	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.161	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14 75	$14.00
February	15 90	15.03	14 50	13.28	14 81	14.01
March	15.90	14.95	14 65	13 66	14.96	14 10
April	15 90	......	14 65	......	15 00	..
May	15 90	.. ..	14 30	......	14.72	.
June	15.90	....	14 06	......	14.56	.....
July	15.90	......	14 03	......	14 53	.....
August	15 90	....	14 00	......	14 47	....
September	15 90	.. ...	13 57	......	14 40	....
October	15.43	......	13.44	......	14.34	.....
November	14.92	......	13.30	......	14 25	.....
December	15.15	......	13.10	......	13.90	.....
Year	$15 72	....	$13 94	....	$14.49	....

STOCK QUOTATIONS

COLO. SPRINGS Apr. 16	
Name of Comp.	Bid.
Acacia	‡.05½
Cripple Cr'k Con.	‡ 01¾
C. K. & N.	‡ 17⅛
Doctor Jack Pot	.06¼
Elkton Con	.66¼
El Paso	.80
Findlay	04
Gold Dollar	.14
Gold Sovereign	‡ 02¼
Isabella	.12¼
Jack Pot	.06
Jennie Sample	.04
Lexington	‡ 01
Moon Anchor	‡ 01
Old Gold	‡ 03½
Mary McKinney	.65
Pharmacist	‡.01¾
Portland	.90
Vindicator	.70
Work	‡.01

SALT LAKE Apr. 16	
Name of Comp.	Bid.
Beck Tunnel	15½
Black Jack	20
Cedar Talisman	02
Colorado Mining	.30
Columbus Con	21
Crown Point	04½
Daly-Judge	5.95
Grand Central	65
Iron Blossom	1 35
Little Bell	.35
Lower Mammoth	04
Mason Valley	12.00
May Day	.14
Nevada Hills	2.40
New York	06
Prince Con	1 70
Silver King Coal'n	1.70
Sioux Con	.03¼
Uncle Sam	.22
Yankee	.10

TORONTO Apr. 16

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7 25	Hollinger	12 15
Hudson Bay	‡70 00	Imperial	05
Temiskaming	40	Pearl Lake	10
Wettlaufer-Lor	62	Porcu. Gold	37
Apex	05	Porcu. Tisdale	.05
Central	5 56	Preston E. D.	.08
Crown Chartered	‡ 28	Rea	40
Dobie	40	Standard	04
Dome Exten	.61	Swastika	.23
Foley O'Brien	.31	West Dome	.38

SAN FRANCISCO Apr. 16

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.12	Belmont	10.20
Belcher	.99	Jim Butler	68
Best & Belcher	.19	MacNamara	.25
Caledonia	3.90	Midway	.35
Challenge Con	.30	Mont.-Tonopah	3.25
Chollar	.13	North Star	.28
Confidence	1.10	West End Con	2.17½
Con. Virginia	.70	Atlanta	.30
Crown Point	1.07½	Booth	15
Gould & Curry	12	C.O.D. Con	.11
Hale & Norcross	38	Comb. Frac	17
Mexican	3 50	Jumbo Extension	.47
Occidental	.68	Pitts.-Silver Peak	1.45
Ophir	1.37½	Silver Pick	.10
Overman	2.65	St. Ives	.33
Potosi	.12	Tramp Con	.02
Savage	27	Argonaut	2.26
Sierra Nevada	.40	Bunker Hill	‡5 50
Union Con	1.17½	Cent. Eureka	.70
Yellow Jacket	1.47½	So. Eureka	‡5.00

N. Y. EXCH. Apr. 16	
Name of Comp.	Clg.
Amalgamated	83⅝
Am. Agri. Chem	60½
Am.Sm.&Ref.,com	85½
Am.Sm.&Ref., pf.	107¾
Am.Sm. Sec., pf. B	86¾
Anaconda	43
Batopilas Min	2⅞
Bethlehem Steel pf	62¾
Chino	28⅞
Federal M. & S., pf.	43
Goldfield Con	4⅜
Great Nor., ore., ctf.	40⅜
Homestake	94
Miami Copper	26⅛
Nat'nal Lead, com.	57¾
National Lead, pf.	108
Nev. Consol	19¾
Pittsburg Coal, pf.	86⅞
Ray Con	19¾
Republic I&S, com.	23½
Republic I & S, pf.	78
Sloss Sheffi'd, com.	47
Sloss Sheffield, pf.	‡100
Tennessee Copper	41
Utah Copper	64
U. S. Steel, com	70⅝
U. S. Steel, pf.	112⅝
Va. Car. Chem	51⅜

N. Y. CURB Apr. 16	
Name of Comp.	Clg.
Barnes King	‡¼
Beaver Con	.43
Braden Copper	5⅜
B. C. Copper	5⅜
Buffalo Mines	‡1¾
Butte & Vipond	‡.53
Caledonia	70
Con. Ariz. Sm.	$\frac{9}{16}$
Davis-Daly	1¾
Diam'field-Daisy	11
Ely Con	$\frac{1}{16}$
Florence	.84
Giroux	5⅞
Gold Hill Con	‡¼
Greene Cananea	9¼
Greenwater	08
Guggen. Exp.	228
Inspiration Con	19½
Internat S. & R.	126
LaGrange Placer	‡2⅞
Kerr Lake	2$\frac{13}{16}$
La Rose	3⅝
McKinley-Dar-Sa.	1$\frac{11}{16}$
Min. Co. of A. new	3¼
Nev. Utah M. & S.	$\frac{1}{16}$
Nipissing Mines	8⅛
Ohio Copper	1⅝
Pacific Sm. & M.	$\frac{9}{32}$
Precious Metals	‡1⅜
Ray Central	2⅜
Red Warrior	‡1½
South Utah M. & S.	1⅛
Standard Oil (Old)	880
Stand'd Oil of N.J.	399
Stand'd Oil Subs.	508
Stewart	1⅛
Tonopah	8
Tonopah Ex	2$\frac{5}{32}$
Tri-Bullion	¾
Tularosa	1
United Cop., pfd.	15
Yukon Gold	3⅝

LONDON Apr. 17	
Name of Com.	Clg.
Camp Bird	£1 10s 6d
Dolores	1 10 0
El Oro	0 16 9
Esperanza	1 13 3
Mexico Mines	6 17 6
Oroville	0 4 6
Stratton's Ind.	0 3 1½
Tomboy	1 2 0

BOSTON EXCH. Apr. 16	
Name of Comp.	Clg.
Adventure	8⅝
Algomah	7⅛
Allouez	45½
Am. Zinc	26⅞
Ariz. Com., ctfs.	6
Bonanza	½
Boston & Corbin	7½
Butte & Balak.	4½
Calumet & Ariz	73½
Calumet & Hecla	487
Centennial	23½
Con. Mercur	‡ 07
Copper Range	65
Daly West	6¾
East Butte	14½
Franklin	15
Granby	56
Hancock	32½
Hedley Gold	17
Helvetia	1¼
Indiana	18½
Island Cr'k, com.	43½
Island Cr'k, pfd.	88
Isle Royale	28
Keweenaw	1$\frac{11}{16}$
Lake	46½
La Salle	6¼
Mass	8
Michigan	3
Mohawk	64¾
New Arcadian	6¼
New Idria Quick.	‡6⅞
North Butte	33¼
North Lake	7¼
Ojibway	5⅝
Old Dominion	53½
Osceola	115
Quincy	87
Shannon	15
Shattuck-Ariz	21
Superior	33⅝
Superior & Bost.	3¼
Tamarack	41
Trinity	7½
Tuolumne	3⅞
Union Mines	‡2¼
U. S. Smelting	39¼
U. S. Smelt'g, pf.	48¾
Utah Apex	2¾
Utah Con	14½
Victoria	5
Winona	6¾
Wolverine	113½
Wyandot	2½

BOSTON CURB Apr. 16	
Name of Comp.	Last
Ahmeek	‡285
Bingham Mines	3½
Boston Ely	2
Boswyocolo	03½
Butte Central	8⅜
Cactus	14
Calaveras	3 00
Chief Cons	1¼
Corbin	2⅜
Cortez	1$\frac{1}{16}$
Crown Reserve	3¼
First Nat. Cop.	3$\frac{5}{16}$
Majestic	.72
Mazatan	‡¾
Moneta Porc.	19
Nevada-Douglas.	4¾
New Baltic	4
Oneco	3⅜
Raven Copper	.40
Rhode Island Coal	10
San Antonio	‡3
S. W. Miami	8¾
South Lake	7½
Trethewey	.60
United Verde Ext.	.43
Vulture	‡5.00

‡Last quotation.

The Engineering and Mining Journal

Vol. 93. APRIL 27, 1912. No. 17

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. ROB'T MCKEAN, Treas.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N. W. 7.

WALTER RENTON INGALLS, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page
Editorials:
  The Slime Problem 821
  Baltic Mining Method 821
  Cyanidation of Concentrate 822
By the Way 823
Miami Copper Co. 824
Prospects of Copper 824
Correspondence and Discussion:
  Where Should the Primer Go? ....Mining Codes ....Safety Appliances in Inclines....A New Type of Gravity Plane....Nickel in the Zinc Assay 825
H. Forbes Julian 827
Benjamin Guggenheim 827
Ernst A. Sjöstedt 827
George W. Wick 827
Edgar J. Meyer 827
Yerington District, Nevada 828
U. S. Smelting Co. in Utah Coal Fields 828
California Oil Producers' Agency 828
Mining in Rhodesia 829
Steel Production in 1911 830
Amster Buys R. R. R. Mine, near Patagonia, Arizona...Josiah Bond 830
Details of Practical Mining:
  *Electric Heater for Air Line Drains....Alignment in Driving ....Pumps Work after Long Submergence....*A Guy Rope Tightener....*The V-Notch Weir.... Cement Gun Concrete at Panama .... Friction in Air Pipes .... A Cannon for Loosening Keys.... Sketching Board for Use Underground 831
Details of Metallurgical Practice:
  *Alaska Treadwell Amalgamation Table .... *Scraper for Loading Tailings....*Joplin Trommels..... 835
The Cost of Doing Things:
  Melting Gold Precipitates....Food Supplies for Miners .... Copper Queen Smelting Operations.... Michigan Iron Mining and Furnace Production....Cost of Mine Fires ....Data on Underground Mining ....Loss of Time from Accidents ....Unit Labor Costs in Brazil.... 837
*Cyaniding of Concentrate. E. M. Hamilton 839
Rio Plata Mining Co. 842
*Baltic Method of Mining—I. Claude T. Rice 843
*Modern Gold Dredge in Georgia. L. M. Richard 848
Zinc Smelting in Kansas and Oklahoma 849
*Pumping at a Brazilian Gold Mine.. 851
Ankylostomiasis in Cornwall 851
Effects of Mine Atmosphere on Miners ....W. Hanauer 852
Patents 853
Personal, Obituary and Societies.... 854
Editorial Correspondence 855
Mining News 857
Markets 863
  *Illustrated.

The Slime Problem

The greatest of all metallurgical problems at the present time is, we think, the slime problem. By this we have no reference to the cyanide process, wherein the treatment of slime is now well managed, but rather to that of ordinary gravity concentration by the medium of water. Many millions of tons of tailings, containing from 10 to 20 lb. of copper per ton, are discharged annually from our dressing works as irreclaimable waste. While our smelters are able to extract upward of 95% of the copper delivered to them, our millmen get only 65 to 70%, exceeding the higher figure in but occasional instances. In the treatment of lead and zinc ores, the conditions are similar.

In making these statements we have no intention of depreciating the accomplishment of the millmen. In fact their achievements have not lagged behind those of either miner or smelter. If they are extracting only two-thirds of the mineral of their ore, they are, nevertheless, getting that from ore that but 10 years ago was scarcely dreamed to be capable of yielding anything. In the treatment of most of the disseminated copper ore, it is necessary to start in with a reduction in size that formerly was unheard of, and by the time that regrinding has been done, the pulp has become nearly all slime and the proportion that passes a 200-mesh sieve is high. Yet the recognition of this brilliant success in ore treatment does not prevent us from experiencing an uncomfortable and unsatisfactory feeling, as we watch the streams running down the tail-races.

Every manager is thinking about this and is groping for some improved method. Elaboration of the roughing system of concentration, the trial of new kinds of tables, experimentation with centrifugal separators are some of the refinements that are being considered and tried. Incidentally there is being given much attention to the development of hydrometallurgical processes, meaning lixiviation and chemical precipitation of the metal, and it is not unlikely that something useful in that direction may be developed, for copper extraction, anyway.

Hydrometallurgical processes for copper extraction are no new thing, but they have survived only for the treatment of special kinds of ore, and at the present time are but of limited application. Barring the Bradley process at Anaconda, which is not yet in regular operation, the only concerns in the United States that are extracting copper by wet methods, so far as we are aware, are the Arizona Copper Co. and the Pennsylvania Salt Manufacturing Company.

We understand, however, that the introduction of certain hydrometallurgical processes is being seriously contemplated by some other companies.

Hydrometallurgical processes for copper extraction have never received the attention from the mechanical standpoint that they have deserved. It is possible that some old methods may be successfully rejuvenated by the same kind of mechanical development that has attended the cyanide process for gold and silver extraction, especially in the field of silver metallurgy, wherein this wet process became a wonderfully useful thing after the old hyposulphite process passed out of use. It is not unlikely that it will be some hydrometallurgical process to which we must look for the ultimate solution of the slime problem in the case of copper ore.

Baltic Mining Method

Considered in their essentials, the methods of mining employed at the various amygdaloid copper mines at Lake Superior do not differ greatly. This is also true of the operations on the conglomerate lodes. For each of these two formations, from which the copper production of the Lake district is obtained, a general method of underground working has been evolved during the last 50 years. With one exception, it has been found possible to apply these methods successfully throughout the district, with certain slight changes necessitated by conditions peculiar to the individual mines. This one exception is the Baltic mine, or rather, the Baltic, Champion and Trimountain mines of the Copper Range Consolidated Company.

When mining started at the three properties, the methods employed were those that had been used with success at other steep-dipping amygdaloid mines of the district. It was not long, however, before it was seen that these could not be applied with equal success at the mines in question. The reason for this was a peculiar combination of conditions and subsequent work has indicated that this combination obtains only in these three mines on this lode. To meet these conditions a method of mining was worked out by Mr. Denton and has resulted in giving the Copper Range Consolidated Co. an enviable position among the low-cost producers in the Lake Superior district. This method is generally known as the "Baltic method," and its distinctive features are: Mining on a waste filling; dry-wall drifts and mill holes; underground sorting, and mining of the level pillars by "caving." Some of the conditions which precluded the successful use of the plans first used were found eventually to be adapted admirably to the present method. The Baltic method as it is today was not, of course, worked out "over night."

Owing to the steep dip of the lode the open-stope method was impracticable; the great vertical distance between foot and hanging walls made it impossible to rig up a machine drill without a filling of some sort on which to work. Serious defects were soon discovered in the ore-filled method when it was applied to the Baltic lode. Compared to the other amygdaloid lodes, the ore in the Baltic is wider, the copper occurs more in pockets, and many of the latter are in the footwall. With the ore-filled method many of these pockets were lost and because of this and the bunchy occurrence of the copper in the lode, the grade of the rock hoisted was too low. These objections and the tendency of the rock to break in tabular form suitable for the building of dry walls, led to the adoption of the present method. The failure of the old system and the gradual evolution of the new one, are well described in a series of three articles by Claude T. Rice, the first of which appears elsewhere in this issue of the JOURNAL.

Cyanidation of Concentrate

The concentration of gold and silver ores has made possible the cyanidation of low-grade material in some districts where preliminary roasting or direct cyanidation had proved inadequate. In the process of concentration not only is a fair proportion of the precious metals removed but also much of the more refractory material which makes direct chemical treatment unprofitable.

Since the material removed as concentrate is usually in the form of sulphides, arsenides or tellurides, a preliminary roast may make the ore amenable to cyanidation, thus avoiding the necessity of concentration, and this system is used in some districts, but it is not applicable in others because of high fuel and operating costs. When low-grade sulphide ores are to be treated, excessive cyanide consumption is likely to be the drawback to direct cyanidation. Whether concentration or roasting, or a combination of both is the auxiliary method to use is a question that can be decided only according to individual circumstances.

When it comes to the treatment of the concentrate after removal from the pulp still further options are open to the operator. Formerly, the general procedure was to ship to the smelter and this method is still advantageous in many instances. This is especially true of mills so favorably situated with reference to the smelter that the bonus received for iron in the concentrate largely bears the burden of freight and treatment charges.

In recent years, however, the subject of treatment of the concentrate at the mill has received a good deal of attention, and striking examples of the feasibility of this practice are given in the Goldfield Consolidated, the Oriental Consolidated and the Alaska-Treadwell mills. Excessive freight rates on high-grade concentrates in at least two of these cases made it easy to decide in favor of cyanide treatment at the mill. The net saving by cyaniding the concentrate at the Alaska-Treadwell mill on Douglas Island, rather than shipping to the Tacoma smeltery, is given at $6.22 per ton.

Notwithstanding the favorable results obtained at these mills, this method is not capable of universal application as is well brought out by E. M. Hamilton in an article in this issue of the JOURNAL. Mr. Hamilton presents the factors to be considered in deciding the question of how best to handle concentrates from silver-gold ores, which should be an aid to operators having this situation to meet.

A very agreeable sentiment was created in the Lake Superior copper country last week by the voluntary action of the Calumet & Hecla in raising the wages of its men by 10%, which action was promptly followed by the Copper Range, Quincy and other companies. The leading interests have faith in the stability of the copper market at or near the present level, and as more money is being made, are disposed to share their good fortune with their employees, especially inasmuch as wages were reduced in 1907. The particularly gratifying feature of the advance at Lake Superior is that the Calumet & Hecla did not wait to be asked but acted upon its own initiative. The relations between this company and its employees are ideal in many respects and afford a model that may well be imitated elsewhere.

The continual steady drain of gold to India and the position of the reserves in that country has led the Indian government to consider seriously the substitution of a gold coinage for part of the silver rupees now in circulation. The present proposition is to coin 10-rupee gold pieces experimentally; and it is expected that they will be taken largely in place of the current silver.

The "Titanic" disaster took a heavy toll from the mining world, as an obituary page this week bears evidence. The list includes names well known in mining and metallurgy and in the iron and steel industry. Nearly all, apparently, had many years of usefulness before them, and all will be missed in their chosen professions.

There is considerable discussion already about the future disposition of the Great Northern ore lands, though over two years must elapse before the present leases terminate. It is said that the trustees have already received some tentative offers for part of the lands.

By the Way

Since the postal authorities have taken it upon themselves to protect defenceless card-indexed investors against the literary persuasions of stock swindlers, a new field of industry has opened itself to a class of sleek individuals who seek out the gullible in person, says the *Evening Post.* It is dangerous to swindle by mail, but if worthless stocks can be sold direct by personal solicitation, there is nobody to interfere. Thousands of men are now going about the country peddling mining and other stocks, like book agents.

All engineers have had experience with fabricated fancies of the uninformed, in which various ores are claimed to contain metals in excess of the amounts allowed by nature. In this connection the "explanation" of a Canadian "expert," who was caught in the act of submitting a piece of impure, coarsely crystalline pig iron as a sample of his alleged iron "find," is unique and heroic. On failing to find on the ground any body of "ore" of the grade and character of his exhibited sample, he justified himself by claiming that the "sample" which he had taken had happened to be from the exact spot where lightning had struck at some time, and thus created an actual fusion and concentration of the rock. His companions, needless to say, were also "struck" by the explanation, but not entirely satisfied by it.

If you can read the following letter fast enough, you may be interested in some of the mining propositions offered therein. It is presented in the original "Esperanto" text as typed by the vice-president and general manager of the ——— ——— Mining, Milling and Smelting Co., typists being scarcer in Nevada than in New York: "Maech Th 24, 1912. Dr Ser: I Sce Det Jo Are Lokin For Maineg Prapperty I Have All Moste Anything Det Jo Ere Loking Forr Ine Maining Det Jo kann Mensen I Heve Tventy Faive Klemes Joining Gold King Ann De IstsaidEscv Ruenes $5 To 10 Perr Tonn Wi Er Workien An Gold King Whi Hevv Ore Roenes From $100 To $5000 Perr Tonn Ikann Sened Sempeles Ef Rekvaier red De Groened Will Stend De Teste Atet Anytaiem Jo Woses to Loket Over I intent To Bild A Smelter Des Somar. Joors Troly, ——— ———."

The "Corner House," so frequently referred to in Rand mining matters, is now the sobriquet for the Central Mining Investment Corporation, Ltd. Originally it referred to the firm of H. Eckstein & Co., the Johannesburg representatives of the mining house of Wernher, Beit & Co. which was liquidated on Jan. 1, 1912. For years, the offices of its representatives, H. Eckstein & Co., in the house at the corner of Commissioner and Simmond streets, directed many of the Rand's leading mining enterprises, such of the older mines as City & Suburban, Crown Reef, Robinson, Ferreira, etc.; later they organized some of the chief mines of the first row of deep levels into the Rand Mines, Ltd., and other groups such as the Geldenhuis Estate, the Modderfonteins, Crown Mines, etc., constituting a list too extended to be mentioned here. The old corner house at Commissioner and Simmond streets has now been replaced by a modern office building known as the Corner House Building. The old Wernher-Beit properties and their operations are still discussed as the doings of "Corner House."

In the Florida phosphate fields, the removal of the overburden which occurs generally as a feature of the beds of phosphate rock is a matter of much concern to the engineers responsible for the cost-sheet results, and is hence a subject of frequent discussion. At a recent meeting in the field, the engineer was talking about "overburden," when Pat, the foreman, who had found in his particular deposit that the varying depth and irregular limestone floor was a matter of more operating concern, remarked that it wasn't the "over" burden that was bothering him, but the "under" burden. In this he spoke wiser than he knew, for it is the "under" burden of many a deposit of ore that has been the fatal obstacle to the engineering and financial success of an operation. In other words, orebodies do end in depth somewhere, and the locus of this ending is often the problem of problems as to the life and value of the mine.

The text this morning will be found in Matt. XV, 14; if all the surveyors are down in the mine and there isn't a Brunton pocket transit in the office with which to find it, it says: "And if the blind shall lead the blind, both shall fall into the ditch." William Barrett Ridgely, former comptroller of the currency, recounted recently in the Supreme Court in New York that one James Graham Allen, a promoter, represented that he owned certain mining rights at Holguin, Cuba, where the land contained deposits of gold in a quantity and of a quality suitable for commercial purposes. Mr. Ridgely says that Mr. Allen exhibited samples which indicated that the deposits were very rich and afterward took him over the land and pointed out a considerable acreage as the property in question. "He represented that the land was rich in placer gold," says Mr. Ridgely, according to the *Sun,* "and that there were veins rich in gold and conglomerate"—whatever sort of coin that may be. "He had had the land examined by mining experts," continued Mr. Ridgely; "the gold deposits surveyed and the ore analyzed; and further, warranted that the property would yield a minimum of $4 to $5 per ton pure gold over a broad area." As a result of these representations, Mr. Ridgely says he believed in them absolutely and since he was not a mining engineer, he could not determine the truth of the representations personally. Allen offered for $10,000 his allotment of 100,000 shares in a corporation formed to take over the property. This offer Mr. Ridgely accepted, giving $1000 in cash and nine notes for $1000 each. After $3000 had been paid, Mr. Ridgely decided to inspect the property and took along some mining engineers who reported that while traces of gold were found occasionally, the property as a whole did not have the value represented. The title, Mr. Ridgely says, was encumbered by previous contracts and he claims that in all he spent about $7000 before he found that he had been defrauded. Against Allen's suit to collect on the notes, Mr. Ridgely seeks to collect the $7000 expended in proving the property and the $3000 he paid for stock. In his answer to the counter claim, Mr. Allen naïvely says that he isn't a mining engineer either, and that the representations he made to Mr. Ridgely had been made to him previously and that he believed them to be true. The moral being that managing the coin of the realm is one thing, digging it another.

The investigation of the labor conditions at the mines and plants of the United States Steel Corporation, suggested last year by Charles M. Cabot, of Boston, did not reveal any serious abuses as had been intimated in the yellow journals. Mr. Cabot, however, will probably continue his agitation of the matter, but, with or without this agitation we shall all probably see the abolition of the 12-hr. day. As a matter of fact there are very few mines or metallurgical plants in this country today where the 12-hr. shift is worked. In a competitive industry like that of steel, it is impracticable for one company, even though it be the largest in the industry, to make a drastic change in the hours of labor without the coöperation of its competitors. The 12-hr. day is a relic of ancient agricultural conditions, and has no place in modern industry at least not in this country. It gives time to eat, sleep and work; any other entertainment except on "long-change" day—means robbing one's sleep. Modern industry maintains that it has increased the productive abilities of the individual and it should and will provide correspondingly increased hours of leisure. There are, however, instances here and there of the old system. One of the best we have heard recently was the case of the new farm hand on a North Dakota farm. When the farmer awakened the new hand at 3 a.m. he said, "You can get up now and go down to the oat field east of the barn and cut them oats. By the time you've finished, breakfast will be ready." "Are they wild oats?" inquired the new hand. "Wild? why no, they're tame oats." "Well, if they are tame oats, maybe I can slip up on 'em in daylight."

Miami Copper Co.

The report of the Miami Copper Co., operating in the Globe district of Arizona, for the year ended Dec. 31, 1911, shows a total of 445,036 tons of 2.48% Cu ore milled, and 20,065 tons of 40.36% concentrates produced, equivalent to 36.39 lb. of copper per ton of ore, or 73.37% mill extraction. From the concentrates were produced 15,385,783 lb. of fine copper. The cost of copper on board cars at Miami is shown in the accompanying table.

COSTS AT MIAMI, 1911

	Per Ton Ore	Per Lb. Cu.
Mining	$1.2134	$0.03500
Milling	0.6274	0.01810
General	0.1706	0.00492
	$2.0114	$0.05802

In order to protect the ore from admixture with waste, and to permit complete extraction of ore without leaving pillars behind, it was found necessary to mine the outer ore by square sets and slicing so as to protect the central mass by a mat of timber. As this outer ore contains oxidized copper which cannot be efficiently saved in milling, the extraction obtained is not considered as good as will be had later. Similarly, the cost of mining, $1.21 per ton, is not considered as good as will be attained after the top layer of ore is removed by the caving system.

Ore hoisted during the year amounted to 450,036 tons, derived as follows: Stock pile, 43,437 tons; mine development, 152,074; square-set and sub-level caving, 204,362; shrinkage-stope rooms, 50,163 tons. Before starting the mill, during 1911, 18,771 tons of ore were added to the stock pile, and at the end of the year there were 226,343 tons in the stock pile, and 5000 tons in the bins. The capping has already begun to cave over the ground extracted by square-set timbering.

The mill was started on Mar. 15, 1911, with one section, at the end of the year five sections were running, milling 2500 tons per day, and the equipment of the sixth section was complete except for the fine-grinding machinery.

During the year 22,888 ft. of drifts and 10,047 ft. of raises were driven. The work consisted chiefly of completing the 420-ft. tramming level and opening up the ground in the northwest portion of the orebody, the limits of which had been defined by churn drilling. Ore reserves are estimated at 18,232,000 tons, averaging 2.58% copper. Drilling has been discontinued except on the Red Spring claim, where new ore of commercial grade has been found.

Additional power-plant equipment is being provided for the increased tonnage of ore to be handled over the original estimates. A third 1000-kw. electric generator, a second air compressor of 4000 cu.ft. capacity, and a spare condenser are installed. The water supply consists of 2,000,000 gal. per day from the Old Dominion mine, while it is expected to draw from 500,000 to 1,000,000 gal. per day from driven wells.

Beside the expense, exclusive of general mining expense, of putting the concentrates on board cars at Miami, which on the 14,970,557 lb. of copper already sold is taken at 5.310c. per lb. copper, other expenses are shown as follows: General mining expense, 0.714; freight on concentrates, 0.629; smelting, refining and freight on pig copper, 2.326; selling expense (including freight and insurance on refined copper), 0.171; New York office expenses, 0.175; total, 9.325c. per lb., from which must be deducted 0.222c. for proceeds of silver and miscellaneous rentals, leaving a net charge of 9.103c. per lb. The copper sold at 13.03c. per pound.

BALANCE SHEET OF MIAMI COPPER CO., DEC. 31, 1911

Assets		
Mine property		$1,626,133.22
Development		1,285,420.64
Construction:		
Concentrator	.$1,516,488.91	
Power plant	629,432.93	
Miscellaneous equipment	5,451.54	
Mine buildings and improvement	70,228.09	
Dwelling houses	115,815.01	
Water development and pumping station.	350,215.52	
Shaft No. 4 equipment..................	120,550.89	
		2,808,182.89
Ore on hand (at estimated cost of mining)		232,410.11
Metals on hand less advances............		395,772.52
Sundry materials and supplies...		182,389.78
Unexpired insurance		1,202.83
Stock investment		20,459.05
Cash		85,670.68
Accounts receivable		4,028.14
		$6,641,669.86
Liabilities		
Capital stock:		
Issued 664,993 shares at $5..		$3,324,965.00
Bonds, 10-yr., 6% convertible..		1,415,000.00
Capital surplus:		
Premium on shares, less expense of issue..		1,009,999.98
Accounts payable:		
Pay roll and sundry bills................	$90,048.80	
Smelting and freight charges not due....	189,552.47	
Machinery and supplies	66,704.47	
Reserve for bullion tax...	16,875.43	
		363,181.17
Profit and loss account:		
Balance Jan. 1, 1911.....................	$38,920.33	
Transfer from profit and loss account for 1911...	489,603.38	
		528,523.71
		$6,641,669.86

As to finances, a condensed balance sheet is here given. The bonded indebtedness was reduced $18,000 in 1911 by conversion of bonds. While the cost of development has been debited to capital, development account has been credited with 31c. per ton of ore hoisted, which, if continued, is estimated to be sufficient to liquidate fully all past and future development costs.

Amber in Russia

Owing to the exhaustion of the amber deposits of Western Europe, recent investigations by Belgian engineers acquire great importance, says the *Russian Universal Technical Review*. The most important deposits seem to be in the Volhynia and Minsk governments, where it is widely distributed near Dombrovitsa in the Roona district, at Goryni, and near the village of Barashi in the Zhitomir district.

Prospects of Copper

At the recent annual meeting of the Rio Tinto Co., in London, Charles W. Fielding, chairman of the company, made the following statements regarding present copper conditions: "Regarding the future of copper, I will only say a few words, but these are very hopeful ones. The enormous stock of copper, which was accumulating during 1908 and 1909, reached its maximum in the middle of 1910, since which date the copper stocks of the world have been gradually decreasing, and today they are less than half of what they were 18 months ago. We can only conclude from this that such low prices as prevailed in 1910 and 1911 were unremunerative to a good many mine operators, and this, among other causes, makes us confident that in the years that are coming we are justified in hoping for copper values which will enable us to earn enhanced profits. The prospects, therefore, in regard to copper are very much better than when I had the pleasure of addressing you 12 months ago, and, while we do not think your interests would be best served if copper was ruling for a long period at an excessively high price, yet we feel sure that there is room for an additional rise in the price of copper before it will in any way restrict consumption, while the cost of producing copper at many mines would need considerably higher prices than those ruling in recent years to enable them to pay reasonable dividends to their shareholders and at the same time have any chance of amortizing their capital during the life of their orebodies."

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Where Should the Primer Go?

In reading Mr. Brown's article in the JOURNAL of Apr. 6, 1912, on the question of where should the primer go, there were two or three things which drew my attention. Mr. Brown said the custom of placing the primer near the bottom of the hole is practically universal among those miners engaged in machine drilling. That sounds strange to me. Of course, that is Mr. Brown's experience, and it may have been as wide as mine; but mine has been just the reverse of his in that respect.

I have had over 30 years' experience with machine drilling, and in 99 holes out of 100 the primer is the last stick that is put in the hole. I have worked as a miner for 20 years, and during that time I have put in thousands of primers but have never thought of putting the primer in the hole until the last; that is the practice in the Lake copper district. However, I do not think that powder burns in the hole sometimes because the primer is placed in the bottom of the hole. I believe there may be three other causes: The cap is not strong enough; the powder is inferior; or the powder is frozen.

I was much surprised when I read the amount of powder placed in the hole, instanced by Mr. Brown; that is, providing the sticks were of ordinary length, eight inches. I know some rock requires more powder than another, but I never knew of any rock that required more than these copper formations. In places where the lode is rich in either amygdaloid or conglomerate the native copper makes it difficult to break, but in such cases the hole is seldom more than half filled with powder, and ordinarily a six-foot hole would have no more than four or five sticks of 40 or 50% explosives. A hole that is overcharged does not break as well as one that is not so full.

Some figures on some work now being done in this district may be of interest. The rock, I believe, is a little stronger than the average to be found around here. We are sinking a 7x19-ft. shaft, which we are not crowding, but working as it should be worked. The mining is done on the day shift and the mucking at night. We have two of the best drills on the market and have two men on each drill. Each drill puts in about 40 ft. per shift, or six holes from six to seven feet deep each. It requires about 30 holes to take a sink and square in. We do not drill all of these holes before blasting, but blast on each shift, for by so doing we do better work. With two of these drills, 5½ shifts a week, we get from 60 to 65 holes drilled and make about 13 ft. per week. We used about four boxes of powder with 85 to 96 sticks in a box, an average of about 5½ sticks per hole, of 50% explosive.

JOSEPH HOSKING.

Osceola, Mich., April 5, 1912.

Inasmuch as I started the present discussion on the above topic, I trust I may be allowed a word in summing up now that a du Pont man has kindly entered the lists.

Mr. Gunsolus says (ENG. AND MIN. JOURN., Mar. 30, 1912): "As a rule, with the exception as noted, the primer cartridge should be placed in the bore hole last, or next to last, whether fuse and blasting cap are used or the charge is detonated by electric fuses." The exception noted is that some Colorado miners "use the method of placing the primer cartridge in the bottom of the bore hole" to avoid liability of the collar of the hole being knocked off and the primer, if on top, being thrown out, causing a missed hole. He says that gelatin dynamites are less liable to be deflagrated by side-spitting of the fuse and that it was in the use of gelatin that Mr. Anderson (ENG. AND MIN. JOURN., Feb. 3, 1912) recommended the use of the primer at the bottom of the hole. Therefore, my original query is answered.

The discussion, though interesting, has tended toward the acrimonious. Mr. Semple (ENG. AND MIN. JOURN., Mar. 2, 1912) says that the proper place for the primer, if electrically detonated, is at the bottom of the hole; Mr. Gunsolus says at the top. Mr. Semple says that when using ordinary fuse, "there is but one place for the primer, the top." Mr. Gunsolus would seem to agree with this rule. Mr. Brown says (ENG. AND MIN. JOURN., Mar. 16, 1912) "that is generally the worst possible place for it," using the knocking off of the collar as his argument in proof. Mr. Brown is evidently describing Colorado practice, which is specifically noted by both Mr. Gunsolus and Mr. Anderson as "Colorado practice," and it would seem from the present disputants, at least, that only a Colorado man upholds the practice.

We certainly cannot admit Mr. Brown's dictum that "The custom of placing the primer near the bottom of the hole is practically universal among those miners engaged in machine drilling," nor can I admit the finality of his argument that the holes must have been properly loaded because done by a "practical and experienced miner." Some of us who have mined less in Colorado, but more in the various other Western states, might contest the first assertion, and the practical and experienced miner often has a lot of theories that cost his company money, and one of his pet ones is about loading a hole.

There is one point against having the primer in the bottom which has not been brought out; that is, the very kick away from the bottom of the hole has a tendency to kick out of the hole some of the charge, especially in the poorly tamped holes that most miners consider sufficient. As for knocking off the collar and tearing out the primer, thus causing a misfire, I believe this would be almost irrefutable evidence that either the hole itself or the one that shot its collar off was too heavily loaded or was misplaced. Certainly the collar of a hole is no place for dynamite.

Perhaps the opinion of an expert in Mr. Gunsolus' position ought to be final, and it is, therefore, not without some feeling of temerity that I close with my humble opinion on this topic. T. A. Rickard says there is only one rule without an exception, and that is that "a man must be present when he is shaved." The French have a maxim, "There is no general rule, not even this one." Yet a Yankee is nothing if not positive, and I am convinced, as a result of experience, careful observation and diligent study, that the primer cartridge should always be placed last in drill holes, and wherever there is a valid argument against putting it there, there is a still stronger argument for doing so.

PERCY E. BARBOUR.

Candor, N. C., Apr. 8, 1912.

Mining Codes

Will you allow me space in the Discussion column to call the attention of mining engineers to the fact that the 1908 Bedford-McNeill code is entirely different from the early issues, and that I think engineers should state on their letter heads and in their advertisements the date as well as the name of the code being used. What is the reason for this change? Is it merely to allow the code companies to sell new codes to all the old users? Anyone who has tried to decode a cable message by the wrong code will fully endorse this suggestion.

R. A. BURR.

New York, Apr. 16, 1912.

Safety Appliances in Inclines

In regard to the subject of preventing accidents from runaway cages or skips in inclines, which Mr. Ives brought up some time ago, prevention against such accidents is provided at the Gagnon incline, at Butte, Mont., in exactly the same way that such occurrences are guarded against in hoisting with cages in vertical shafts.

The Gagnon incline has a dip, I believe, of about 70°. In it skips having a capacity of 2½ tons are used, while the men are hoisted through it on cages that are taken off and put on at the proper times. Riding during shift is on the skip itself, instead of on a top deck, as is characteristic of the practice in the vertical shafts, at Butte. The shaft is timbered with sets, and on these sets guide timbers are carried just as in the case of a vertical shaft. This close timbering is necessary, owing to the heavy ground that compels close timbering of vertical or incline shafts in the Butte district. Probably that is one reason that the safety catches were put on the cages and the skips at the Gagnon incline. The adding of the guide timbers was a small item of expense. Safety dogs of the cam pattern that is characteristic of cage construction in this country are provided on both the skips and the cages. These are operated by springs that are released by the relief of the pull on the draw-bar just as in the case of the cages and skips running in the vertical shafts. Farther explanations are unnecessary.

In regard to the protection against runaways in incline shafts that are not closely timbered, the most feasible solution appears to be the use of cam-shaped shoes, or, better, knife-like dogs to be thrown out either to grip, in the case of shoes, or to groove, in the case of dogs, the stringer on which the rails of the track are carried. I believe that a device operating on this principle, was designed by Charles Mason, for use on the inclines at the Baltic mine of the Copper Range Co., in Michigan, but it was never made. It is purely a matter of expense. There is no mechanical reason why dogs cannot be made that will stop the cage by coming in contact with the inside faces, or, for that matter, the outside faces of the rail stringers, only that the latter would require additional shaft area. In the case of the concrete stringers a timber would probably have to be imbedded in the side of the stringer for the dogs to groove; for the safety dog to work effectively should work on the grooving principle instead of the gripping principle that is used in most safety catches in the United States. A gripping dog comes on suddenly. It tries to grip and fails, if things be not just right; then tries again, the velocity of the cage increasing all the time. Finally the teeth of the cam catch and the guide is suddenly gripped, with the result that several sets of guides are torn out. On the other hand, with a knife- or a chisel-edge to the dog, grooving begins as soon as the dog comes in contact with the guide. This groove is rapidly but gradually deepened, with the result that the energy of the falling cage is gradually diminished, and the cage is quickly stopped before it has fallen any great distance—generally less than 8 ft. in the shafts where dogs working on this principle are used.

In the case of the safety dogs for use on inclines, it it necessary to arrange them as to shape, so that they will straddle the roller frames. This, though, is no great difficulty to overcome.

The matter of providing against runaways in inclines is simply a question of dollars and cents. It requires the installation of special apparatus at considerable expense. The mine manager would rather take the chances with runaways in his shaft than do this. Specially constructed stringers, securely anchored in place, would have to be used. No one as yet has seen fit to go to this expense, and therefore it is considered good practice in incline shafts not to use safety appliances on skips and man cars operating on inclines. On the other hand, safety dogs can be installed on cages and skips in vertical shafts with small expense, and so it early became the practice to put on the dogs, as the guides have to be there whether dogs are used or not. No one has the nerve or the niggardliness to leave them off when he thinks much of his reputation among mining men.

The same might also become characteristic of hoisting in inclines with the stringers for carrying the rails to serve as the pieces to be grooved in stopping the skip or man-car, were inclines characteristic of the mining practice in those Western states where the miners themselves have a chance to say something in the making of the laws under which mining shall be carried along. As it is, incline shafts are characteristic of districts where the companies have the say in the making of the laws under which the companies operate, or else, as in the case of California, the unions have only recently come into a position to have anything to say as to the mining laws in the state.

There is yet to be shown a single state where there is adequate provision in the laws for the safe operation of mines, unless directly or indirectly it was forced there by the unions or the desire to keep out union agitation, as in the case of Idaho, which, I believe, finally adopted the admirable set of laws proposed by R. N. Bell, when state mine inspector, which he, for several years, tried in vain to have enacted as laws.

It is a disgrace to the mining profession that the Gagnon incline is, I believe, the only incline in the United States, and probably the only one in the world, where safety appliances for catching a runaway cage or skip are used in an inclined shaft.

Further, I doubt if there is a single hoisting engine in the United States working in an inclined shaft that has any provision against overwind, any rope detaching device, or an automatic cutoff for the steam as the car approaches the surface, that are characteristic of good hoisting practice in vertical shafts, because they all cost money.

CLAUDE T. RICE

Flat River, Mo., Apr. 16, 1912.

A New Type of Gravity Plane

Mr. Smith's description of inclined planes in which the descending cars always move on one track and the ascending on the other, and in which, consequently, the tracks at the head of the plane can always have a slope in favor of the load and need no special arrangement to get the descending cars over the knuckle, will call attention to an excellent arrangement which seems, somehow, to have been generally overlooked. The plan was fully described, as applied to underground planes at Commentry, in an article by M. Comblat in *Comptes-Rendus Mensuel de l' Industrie Minerale,* 1896, p. 81, under the title: *Note sur le croisement des câbles dans les plans inclinés.* I have seen no other account.

At my suggestion a plane on Mr. Comblats plan was built at Cranberry, N. C., in 1904. It worked well and is still in use, I think.

For underground planes, to save room, Mr. Comblat recommends placing the brake-sheaves in a vertical position in the center line of the plane. As thus arranged the ropes are not crossed, but there is more or less sidewise pull on the cars on the upper half of the plane.

J. E. Johnson, Jr., applied a sheave in a reversible frame to cross the ropes at an outside plane at the mines at Glen Wilton, Va., several years ago. I have never seen this plane and do not know how nearly this frame resembled Mr. Smith's well studied design.

F. FIRMSTONE.

Easton, Penn., Apr. 13, 1912.

Nickel in the Zinc Assay

Does the presence of nickel affect the assay for zinc?

A. G. S.

[It is our experience that nickel affects the ferrocyanide assay for zinc seriously, making the apparent zinc content higher by an amount practically equal to the nickel present. As a consequence, it is necessary at some point in the assay to precipitate the zinc and nickel as sulphides and dissolve out the zinc sulphide with hydrochloric acid.—EDITOR.]

H. Forbes Julian

H. Forbes Julian, who was lost on the "Titanic," was a well known metallurgical engineer, a specialist in gold-ore treatment. He was a resident of Torquay, England, and was one of the authors of the valuable work, "Cyaniding Gold and Silver Ores." He was a pioneer in the South African goldfields, where, in 1887, he was one of the consulting engineers to the Johannesburg Pioneer Co., and erected a small plant to treat blanketings from the company's first stamp mill, by the cyanide process. This was the first cyanide mill in the Transvaal. In 1888 he erected a better plant at the Roodepoort United Main Reef mill, and successfully treated low-grade ores by the cyanide process, then in its infancy. About the same time he was making investigations in connection with the dissolution of gold ores by chlorine and also by cyanide under a high pressure of air, and subsequent precipitation by an electric current and by sodium amalgam, which resulted in some patent applications in South Africa. He was on his way to San Francisco to take up some special work in connection with the Butters Patent Vacuum Filter Co., Inc., with which he had been connected for some time.

Benjamin Guggenheim

Benjamin Guggenheim, who went down with the "Titanic," was born in Philadelphia in 1865, being one of the younger of the seven sons of Meyer Guggenheim, who have become so prominent in the mining and metallurgical industries. In the early '80s, Meyer Guggenheim became a part owner of the A. Y. & Minnie mine at Leadville, Colo., which turned out to be profitable, and in 1885 Benjamin, just out of school, was sent to it to begin his business career and to look after the interests of his father, being given a position in the office. During this period he became acquainted with general mining and smelting conditions, especially from the commercial standpoint, and in 1888 was interested by Edward Holden in the smelting business, and in turn interested his father and brothers in Philadelphia. This was the inception of the Philadelphia Smelting & Refining Co., which erected works at Pueblo, Colo. In a very short time the business passed wholly into the hands of the Guggenheim family, several members of which were sent to Pueblo to learn it. For two or three years the works were not very successful, but before long all of the difficulties were cured and the brilliant commercial career in this business, with which all are familiar, was inaugurated. The great success began in 1892, when the importation of Mexican lead ore having been checked by the McKinley tariff, the Guggenheims immediately appreciated the possibilities of smelting in Mexico and erected a plant at Monterey, which was later followed by one at Aguascalientes. Later a refining plant was erected at Perth Amboy, N. J., under Benjamin Guggenheim's superintendence. After the smelting interests were consolidated he retired from active work for a time, passing two years in Europe. Returning to this country, he entered into the mining-machinery business in 1903, organizing the Power & Mining Machinery Co., which built large works at Milwaukee. In 1906 this concern was merged with the International Steam Pump Co., in which Benjamin Guggenheim was successively a director, chairman of the executive committee and president. This continued his chief business interest, and the visit to Europe, from which he was returning, was made for the purpose of inspecting and extending the work done through its foreign agencies.

Ernst A. Sjostedt

Ernst A. Sjostedt, one of the victims of the "Titanic" disaster, was chief metallurgist of the Lake Superior Corporation, of Sault Ste. Marie, Ont., and was returning from a three months' visit to Europe in connection with the business of the company. Mr. Sjostedt was born in Sweden in 1852 and was a graduate of the Stockholm School of Mines. He came to America in 1876 and was engaged at the Bethlehem steel works and afterward became manager of several iron plants in the United States. For some years he was in business in Montreal as a consulting metallurgist, and in 1898 went to Sault Ste. Marie as an associate of F. H. Clergue in the establishment of the group of enterprises subsequently taken over by the Lake Superior Corporation, one of the most important of which was the manufacture of ferro-nickel steel. He built the reduction works and the water-gas plant at the Sault, and was recognized as one of the leading metallurgical authorities in Canada. He leaves a widow and one daughter.

George D. Wick

George D. Wick, of Youngstown, Ohio, was one of the passengers lost in the wreck of the "Titanic." He had been connected with the iron interests of the Mahoning Valley all his active life, succeeding his father, who was a well known iron master. Col. Wick was vice-president of the Union Iron & Steel Co., Youngstown, when it was sold to the National Steel Co., now part of the Carnegie Steel Co.'s works. He then became vice-president of the Republic Iron & Steel Co., with offices in Chicago, but after one year with James A. Campbell he founded the Youngstown Sheet & Tube Co., at Youngstown. Because of ill health he retired from the presidency of that company. Later he purchased control of the Carry Iron & Steel Co., at Cleveland, and about a year ago merged it with the Empire Iron & Steel Co., of Niles, Ohio. On the formation recently of the Brier Hill Steel Co., he sold out his interestss in the Empire company.

Edgar J. Meyer

Edgar J. Meyer, vice-president of the Braden Copper Co., and an engineer of ability and experience, was one of those who went down on the "Titanic." We hope later to publish an extended notice of his life.

Florence-Goldfield Mining Co.

The report of the Florence-Goldfield Mining Co. for the year ended Dec. 31, 1911, shows that the amount of development work accomplished was 11,699 ft. at a cost of $7.281 per foot.

The work above the 530-ft. level disclosed the fact that the lessees had stoped practically all the ore of shipping grade, but two orebodies of good milling grade are still being developed at present. Development below this level, up to this time, has shown no ore of commercial grade. However, the change of geological conditions at 950 ft., where the main shaft enters the dacite, is considered by H. B. Clapp, mine engineer, to be much more favorable for discovery of ore at depth, the productive orebodies to the north being in the dacite and latite flows.

During the year, 48,847 dry tons, averaging $6.10 per ton in gold, were treated in the mill, an extraction of 83.96% being obtained. In this period no concentrates were made, as by certain changes in operation the above extraction was accomplished by amalgamation and cyanidation. This not only resulted in lower operating costs but also eliminated the cost of freight and smelting charges on concentrates, which in 1910 cost the company $44,457. General Superintendent Dewey states that this saving more than offsets any slight loss that might have occurred from eliminating concentration.

The costs are given as follows: Mining, $1.242; development, $1.744; milling, $2.595; marketing, $0.047; general expense, $0.381; taxes, $0.080; total, $6.089 per ton.

On the evening of Dec. 2, a fire of unknown origin totally destroyed the mill and storehouse, together with the gallows frame at the main shaft and the timbering of the shaft to a depth of 35 ft. After deducting insurance of $83,500 the loss is reported as $212,481. All efforts are being exerted in developing and determining the extent and value of the orebodies before again building a mill

Yerington District, Nevada

Special Correspondence

The Yerington copper district, in Nevada, has taken on new life during the last few months. Work is being prosecuted on nearly all the prospects which show indication of being able to ship at least some ore; the larger properties are rushing development work and daily shipments are being made from the Nevada-Douglas Copper Co.'s mines, Mason Valley Mining Co.'s properties and the McConnell mine, as follows: From the Nevada-Douglas mine, 350 tons of 5½% copper ore per day; from the Mason Valley mines, between 350 and 375 tons per day, of approximately 4% copper ore, and from the McConnell, an average of 60 tons per day, of ore which contains 5% copper. Leasers are shipping an occasional car from the numerous open pits of the Empire Nevada property.

The Nevada-Douglas

The Nevada-Douglas Copper Co. is also shipping approximately 500 tons of crushed gypsum per week, to the plant of the Western Gypsum Co., at Reno, Nev. During the last month, a crushing plant has been installed at the gypsum quarry, where the rock, as it is taken from the quarry, is crushed to 3-in. size through an Ersham crusher and elevated in a bucket elevator to bins which load directly into cars. The equipment is electrically driven. The company is finding its new electric hoist entirely satisfactory and has installed and is now working a 50-hp. Gould triplex pump on the seventh level of the Ludwig mine. Development work is being rapidly extended on this level on the east and west veins. Chalcocite ore has been encountered and now forms a fair proportion of the shipments. Both faces of the south drifts on these two veins are advancing at the rate of 125 ft. per month. The drifts are large and are being laid with 16-lb. steel. No water is being encountered in these workings, aside from a small flow of 50 gal., struck near the shaft. Development work on the sixth level is also being advanced rapidly and at the south end of the sixth level, at a point approximately 700 ft. south of the incline shaft, a 2-compartment winze is being sunk to the seventh level. This winze is in good-grade ore and is being driven near the hanging wall of the vein, at the end of a 96-ft. crosscut, through mixed gossan, sulphide material. For the first 500 ft. this level was in sulphides, but the water level has been depressed so that, strictly speaking, this level is in the oxidized zone at the south end.

The McConnell Mine

The McConnell mine is shipping a sulphide and carbonate impregnated, garnetiferous lime from the old workings, most of the ore coming from near the surface. The work is in charge of O. H. Sonne and Samuel B. Elbert, owners. They are working a force of from 25 to 35 men, keeping development work ahead of extraction. They have a reasonable contract with the Mason Valley Mines Co.'s smeltery, at Thompson, 18 miles distant, and a low rate over the Nevada Copper Belt R.R. to that point. The ore is hauled by teams about 3½ miles down hill, over good roads to an elevated platform or bridge extending over the cars. The Mason Valley Mines Co. ships from its property to the smeltery, limestone and oxidized ores low in silica and sulphides. This ore is handled from the main chutes by electric locomotives and crushed and sent down to the railroad over an 8000-ft. bucket-tram line. There have been rumors of one of the large mines of this district taking over the Bluestone mine, but no transaction of this nature has been consummated to date.

Mason Valley Smeltery

The Mason Valley Mines Co.'s smeltery is running along smoothly, and is obtaining excellent results with low costs. The second furnace has not been blown in yet. The single furnace has smelted as high as 706 tons in 24 hours, but the furnace can run regularly on between 500 and 600 tons per 24 hours. This is satisfactory, considering the fact that the plant was built as an 800-ton smeltery, with both furnaces running continuously. A 40% matte is being produced. Considerable custom ore is being received from the Southern Nevada districts and satisfaction has been obtained by all who have thus far shipped. The Yerington Copper Co. is working a small force of men and adjoining properties have commenced operation. At Buckskin, the Kennedy Consolidated has recently completed its surface plant and is sinking and drifting. This property has attained a depth of 150 ft. and has exposed some good copper sulphides.

U. S. Smelting Co. in Utah Coal Fields

The United States Smelting, Refining & Mining Co. has acquired control of the Castle Valley Coal Co., Black Hawk Coal Co., and Consolidated Fuel Co., which own 11,226 acres of land in Utah, of which 7526 acres are coal lands. There are five seams of coal on this area. The lowest seam averages 16 ft., and development work has hitherto been confined almost entirely to this seam, which is estimated to contain 140,000,000 tons of mineable coal. The next higher seam is 12 ft. thick.

The fields are connected with the Denver & Rio Grande R.R. by a 23-mile line owned by the coal companies, but an 80-mile connection reaching the Union Pacific R.R. at Spanish Fork, via Huntington Cañon, will also be put in, as the Union Pacific reaches a wider market than does the Rio Grande.

These fields are now shipping 500,000 tons of coal per year, which sells at about $2 per ton at the mines, but the attempt will be made to bring these properties up to annual production of 2,000,000 or 3,000,000 tons in the near future.

As noted in the Journal of Apr. 20, 1912, p. 813, these properties are to be worked by the Utah Co., a Maine corporation, the stock of which will all be held by the United States Smelting, Refining & Mining Company.

California Oil Producers' Agency

San Francisco Correspondence

The first formal report made by the president of the California Oil Producers' Agency was submitted to the stockholders at a meeting in Bakersfield, on Apr. 10. The report showed that the agency had received from its members during the year past 15,000,388 bbl. of oil, and that 14,004,102 bbl. were sold at a price which netted 31.97c. per bbl. Practically all of the old contracts which will expire within a short time it is believed will be renewed at a rate which will give to the producers a higher net price than the price of the last year. There were 81 members in person and by proxy at the stockholders' meeting. Upon motion of M. L. Requa, 68 members of the old board of directors were reëlected. It was announced that the certificates for storage oil would be ready for distribution Apr. 20. L. P. St. Clair was reëlected president, this being his sixth term. The financial statement for the year ended Mar. 31, showed receipts and disbursements of $3,994,074. The total income for the year was $71,664. The total operating expenses and charges on account of depreciation was $58,113, leaving a net income for the year, $13,550. The cost for handling was $0.003706 per barrel.

The president's report showed contracts for the sale of oil to consumers, a total of 52,288,722 bbl. The actual requirements will probably reach 60%, or 31,373,233 bbl. Approximately 25% of this requirement will expire during the year 1912, and 70% during 1913. With renewals at better prices, the average net price to the producers will be materially increased. It is pointed out in the report that the discontinuance of storage charges under the proposed plan to certificate storage oil will also increase the net returns to the producers. This charge amounted to 3.93c. per bbl., or a total of $462,842 in 1911. There is a general feeling among oil men that there will be an advance in the price of oil at the well, and that the commercial consumption will increase. This condition, in addition to the progress being made in handling the water infiltration, has given the petroleum industry a very hopeful look, and the excess stocks are not at present such a bugbear as they were considered a year ago.

Mining in Rhodesia

Johannesburg Correspondence

The chairman of the Rhodesian Chamber of Mines has recently stated that the value of the ore reserves of 6,700,000 tons fully developed in the large mines of the country is £13,000,000, or sufficient to maintain the present output for five years. This is not including ore in the small mines, which at present contribute 25% of the output. This is satisfactory, but in some respects the outlook is not entirely encouraging.

Some Mines Disappointing at Depth

The Globe & Phœnix mine, which has paid nearly £1,000,000 in dividends and which has ore to the value of £1,300,000 developed, is not looking well in depth, the remarkable enrichment about the 17th level having apparently been bottomed. The Giant mine, another mainstay, is absolutely bottomed and is now exhausting its developed ore, and several other steady producers in the past have closed down or passed into the hands of tributors.

Several of the newer mines developed during the boom period are not coming up to expectations, so that the new and promising ventures will have to maintain rather than increase the output. Of the new mines the Shamva is now meeting with profitable ore on its third adit level 500 ft. below the outcrop and below the zone of oxidation with some secondary enrichment.

The Cam & Motor mine shows a lens of ore 100 ft. wide at the fifth level, of an average value of 40s. per ton. The Lonely mine continues to develop rich ore to the eighth level, though the treatment plant has never reached the estimated output of 4000 tons per month. This is due to shortage of labor and fuel, caused by cattle disease, which disorganized transport, and to the need of alterations to the boilers and additions to filter presses and tube mills.

Most of the lenses of ore met with in Rhodesian quartz reefs are from 30 to 100 ft. in length, frequently limited in depth and are not often numerous enough along a line of fissuring to warrant comprehensive development. Practically all gold-bearing outcrops were worked by the ancients to varying depths, but fortunately considerable quantities of lower-grade ore were left broken on the surface (Rhodesians term this rubble).

From 1904 on the small worker was in a particularly favorable position. The larger corporations formed when the country was first occupied had partially developed many old workings, and in some cases had equipped mines which they were unable to make pay with costs and methods then ruling. These were handed over to tributors who thus had much ore available and were able to make a large aggregate output and to make large profits. Central mills of 3 to 10 stamps were also erected to draw supplies from rubble deposits and old workings or short shoots, or portable Tremain mills were carted about.

It says much for the number of gold occurrences that these superficial mining operations have lasted for eight years, but at present nearly all the rubble deposits, which included float rock and detritus from outcrops, are exhausted and practically all of the ancient workings have been opened and are almost exhausted. In many districts the small worker is rapidly becoming extinct, and it is increasingly difficult to obtain a property that would in any way warrant development and the erection of a mill.

Favorable Prospecting Conditions

Much is expected by some from the discovery of virgin reefs and no doubt undiscovered orebodies do exist. Most orebodies, however, occur in a matrix of quartz and in the undulating and hilly country of most of the gold belts (which are schistose areas in the granite) the overburden is not heavy and a quartz reef usually appears or shows float rock at some point along its line of strike, so that these outcrops have mostly been tested by the ancient or modern prospector. There are indeed areas covered with overburden such as the Eiffel flats in the rich Gatooma district, in which valuable discoveries have been made, but the expense of prospecting unknown country by sinking pits and trenching is at present prohibitive.

Were agricultural operations to become extensive no doubt more chance discoveries would be made, but the impression given was that by far the greater bulk of the ore deposits are already found and worked and that the contribution by the small worker is bound to become smaller year by year. The Rhodesian small worker is a fine type of efficient worker who with the aid of his native laborers can attack exceedingly poor ore if there be wood and water available. A mine with a five-stamp mill run entirely by two or three white men can win fine profits from 20s. rock occurring in a reef of a stoping width; with a 10-stamp mill a small worker would not neglect a reef giving a return of 16s. per ton.

The Shamva mine owners hope to mine their large ore deposits in the Shamva hill and to crush in a 100-stamp mill for about 8s. per ton. The Wanderer mine at Selukwe has worked its opencut orebody at a still lower cost. It will be at once evident that little low-grade ore is being left for posterity and that Rhodesia is not going to deluge the world with that flood of gold which some so-called economists blame for all the ills of recent years and the perfectly natural rise in prices due to greater demand and reduced supply of most raw materials.

Duty on Manganese and Ferromanganese

Washington Correspondence

The Court of Customs Appeals has rendered a decision in the case of the Goldschmidt Thermit Co. *vs.* the United States in which it affirms the decision of the Board of General Appraisers making manganese dutiable at 20%. The merchandise involved in this case was imported under the tariff act of 1909; it consists of an alloy of iron and manganese. The importers invoiced the article as ferromanganese, and claimed assessment under that name at $2.50 per ton, according to the provisions of paragraph 118. The appraiser reported that the importation was commercially pure manganese metal, and upon this return the collector classified the same as metal unwrought, not specally provided for, dutiable at 20 per cent. *ad valorem* under paragraph 183 of the act.

The importers duly filed their protest, which was heard upon evidence by the Board of General Appraisers, and was overruled.

The single question at issue in the case is whether the importation is ferromanganese, dutiable at $2.50 per ton, or unwrought metal, not specially provided for, dutiable at 20 per cent. *ad valorem.*

At the hearing before the board the importers introduced evidence of a chemical analysis of the article, made at their instance, which gave the following contents: Manganese 93.92, silicon 1.56, iron 2.33, aluminum 1.58, carbon 0.10, unstated residue 0.51. On the other hand the government produced testimony of a chemical analysis made by the official chemist, which gave the following result, viz., manganese 96.80, iron 1.40, silicon 1.40, undetermined, carbon, etc., 0.40. The government also submitted evidence tending to prove that the term ferromanganese has a commercial signification which excludes any alloy having so high a percentage of manganese as that at bar. The importers on the other hand submitted no testimony in regard to commercial designation.

In rendering its verdict the court says:

"It seems clear from the definitions and the testimony in the case that the use which fixed and determined the meaning of the term ferromanganese was its use in the making of bessemer steel, and that this use is most effectively and economically subserved by an alloy containing about 80 per cent. manganese with approximately 5 per cent. carbon, and the residue iron. Such an alloy, therefore, became the standard, and the use of the term ferromanganese, without qualification, properly applied to this standard. It is, therefore, reasonable to believe that the word was used substantially in that sense in the tariff act, and this belief is strengthened by the fact that it is there found collocated with iron in pigs, iron kentledge, and spiegeleisen.

"The importation in this case contains a much greater percentage of manganese than that above indicated as the common standard, and a much less percentage of iron, while carbon hardly appears as a substantial component. . . . . It appears that manganese does not figure in commerce in a chemically pure form, but always in combination with other elements; and foreign additions so slight as those stated in the analyses are correctly regarded as mere incidental impurities. Such an article is therefore manganese, and not ferromanganese.

"In this view of the case the assessment made by the collector was correct, and the decision of the board sustaining the same is affirmed."

Steel Production in 1911

The American Iron & Steel Association reports that the production of all kinds of steel ingots and castings in 1911 amounted to 23,675,501 tons, against 26,094,919 tons in 1910, a decrease of 2,419,418 tons, or over 9.2%. The production in 1910 was the largest in the country's history. The year of next largest production was 1909. Of the total production last year 23,029,479 tons were ingots and 646,022 tons were castings, as compared with 25,154,087 tons of ingots and 940,832 tons of castings in 1910. The production of various kinds of steel for the two years was as follows, in long tons:

	1910	1911	Changes
Bessemer (acid)..	9,412,772	7,947,849	D.1,464,923
Acid openhearth..	1,212,180	912,718	D. 299,462
Basic openhearth..	15,292,329	14,685,932	D. 606,397
Crucible	122,303	97,653	D. 24,650
Electric........	52,141	29,105	D. 23,036
Miscellaneous	3,191	2,241	D. 950
Total....	26,094,919	23,675,501	D.2,419,418

While all kinds of steel showed decreases, the smallest proportional loss was in basic openhearth and most important in bessemer steel. As all of the bessemer steel made in this county is acid, the proportion of acid steel made in 1911 was 38, and of basic 62 per cent., against 41.4 and 58.6 per cent., respectively, in the previous year.

Twenty-two standard bessemer plants were at work in 1911 and 27 Tropenas plants were running in 1911. In addition 1 plant made steel by the Robert-bessemer process in 1911, and 23 plants made steel in 1911 by the Bookwalter, Bretaud and other modifications of the bessemer process. The openhearth steel ingots and castings made in 1911 were produced by 149 works in 23 states and the District of Columbia. In 1911 there were 28 idle openhearth steel plants. There were nine active electric steel plants last year.

Tonopah Belmont Report

During the fiscal year ended Feb. 29, 1912, the shareholders of the Tonopah Belmont Development Co. were paid four dividends of $375,000 each or a total of $1,500,000, which amount is equal to the par value of the capital stock of the company.

The mine produced 152,599 tons of wet ore from which 33,624 tons was sorted as waste. Of the total production of 115,563 tons of dry ore, 87,349 tons assaying $20.84 per ton were milled and 27,611 tons assaying $61.35 per ton were shipped to the smelters. The gold recovered amounted to 45,069 oz. which was sold for $886,971; the silver production was 4,535,762 oz. and was sold for $2,381,543. The total receipts amounted to $2,881,177 after deducting freight and treatment charges.

The ore treated in the mill contained 0.269 oz. gold and 28.26 oz. silver per ton. The total gold and silver in the ore milled was 23,470 oz. gold, of which 22,066 oz. was recovered, and 2,468,249 oz. silver, of which 2,259,651 oz. was recovered. The average recovery was 92.54% of the total value of the silver and gold. The total operating expense at the mine was $5.439 per ton of ore mined. Milling cost $3.879 per ton of ore milled.

At the end of the year the ore reserves consisted of 348,912 tons of positive ore, 247,907 tons of probable ore, and 109,263 tons of possible ore, a total of 706,082 tons, the value of which is not stated in the report. Development work was hindered by the high temperature, poor ventilation, and by the flow of water encountered below the 12th level. During the year, the Belmont shaft, the main working shaft of the property, was extended to a depth of 1465 ft. This shaft is to be equipped with self-dumping skips of 3 tons capacity to take the place of the double-deck eages now in use. The timbering of the shaft is in such condition that the immediate and complete retimbering from the surface to the 10th level has become necessary, and preparations for this work are now under way. During the cessation of hoisting operations through the Belmont shaft, the Desert Queen shaft will be used.

A new reduction plant of a capacity of 500 tons per day is under construction at the mine and will cost $435,000 when completed. Efforts are being made to obtain a sufficient tonnage of custom ore from other mines to justify the operation of the old mill after the new mill has been completed. Up to the end of the fiscal year, $292,304 had already been expended on this new mill.

Amster Buys R. R. R. Mine near Patagonia, Arizona

By Josiah Bond*

As reported in the Journal of Apr. 13, the R. R. R. copper mine, the property of R. R. Richardson and A. E. Crepin of Patagonia, Ariz., was sold to N. L. Amster, president of the Shannon Copper Co., representing the same interests that control that company. At that time the price was reported as $335,000. The mine was offered at that price but the buyers let their time for paying earnest money slip by with the result that other bidders came in, running up the price finally to $550,000, at which price the deal was closed, payments made and title passed.

At the time of the first offer the lower crosscut had penetrated 14 ft. of ore; at the time of final sale, 24 ft.; now there is in sight 40 ft. and the further wall not yet struck.

The ore is mostly glance, a little chalcopyrite coming in. The first 14 ft. average about 13.5% copper and it is thought that the latter part of the crosscut is richer than this, and that the whole 40 ft. will average 15%. The mine is about three miles from the railroad in the northern end of the Patagonia Range. The railroad company is now putting in a switch for the use of the buyers of the R. R. R. mine as they intend to do business in a large way having already ordered a compressed-air plant, machine drills, etc. William S. Sultan, a mining engineer of Globe, is consulting engineer.

This mine has had a long history beginning more than 25 years ago. Mr. Richardson secured an interest in the mine in 1896 and has since then done about $50,000 worth of work. The mine has been bonded several times, once to the late Colonel Greene of Cananea fame. A great deal of ore has been shipped from the upper levels, the present crosscut being 1000 ft. below the outcrop of the vein. This is the largest body of ore ever cut in a single straight working from the surface in Arizona. The present owners have refused several higher offers for their bargain. The sale and the continuous widening of the orebody has produced great excitement in the country and many other deals are pending.

The Chief group between the R. R. R. and the World's Fair silver mine has been bonded by William Powers and associates to Kansas City men for $50,000, the first payment to be made May 15. Work will commence in about 10 days. Gray Brothers, owning ground contiguous to the R. R. R. have optioned their group at $100,000 to one of the unsuccessful bidders on the R. R. R. mine.

---

*Mining engineer, Patagonia, Ariz.

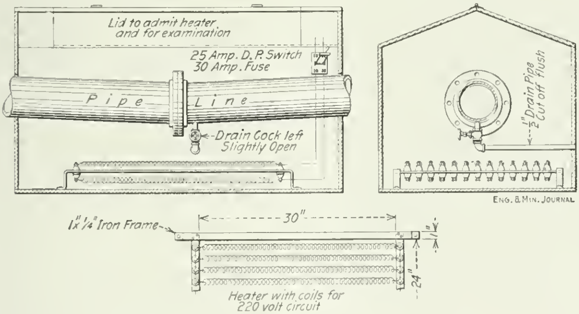
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Electric Heater for Air Line Drains

By G. C. Bateman*

When the Cobalt power companies first started to supply compressed air on a large scale to the mines, trouble was experienced in the winter by the water from the air collecting in the low parts of the pipe lines and freezing. In the pipe lines of the British Canadian Power Co., this difficulty was overcome by the use of an electric heater, designed by James Ruddick, the general superintendent for that company. The device consists of a heater which is placed in a small box built over the drain cocks in the pipe line. These drain cocks are placed wherever there is a drop in the line, so that the water will drain both ways to the cocks.



Electric Heater Used on Cobalt Air Mains

The heater, which is placed underneath the drain cock, is so designed that it fits snugly into the box, and a pipe leads from the cock to the outside of the box. This pipe is cut off flush with the box so that there is no danger of freezing on the outside. The frame of the heater is made of 1x¼-in. iron, and on this frame insulation knobs 1 in. in diameter and 1½ in. long are mounted back to back, as shown in the accompanying illustration, one bolt being sufficient for the two.

The coils are made by winding No. 14 galvanized-iron wire on a ⅞-in. rod, each coil consisting of 100 turns. The heater takes 220 volts, each coil being equivalent to 11 volts and 20 amperes. The coils are arranged so that there is at least an inch of space between them. There is a double-pole switch with 30-ampere fuses in each box and the wiring is mounted on cleats to prevent fire. Although the heater takes only 20 amperes the stronger fuses are used to take care of the current when starting, as the coils take more current when cold than when warm. The power required is 4 kw. for each heater.

The British Canadian Power Co. controls about 15 miles of pipe line between 6 and 10 in. in diameter, and several miles of smaller sizes. There are about 25 heaters in use, and since their installation no trouble from freezing has been experienced.

This device can be used advantageously wherever there is trouble from the freezing of surface lines, and as it is a simple device it can be built at the property. For pipes of smaller diameter than those mentioned, a heater of about half of the capacity of the one described can be used, in which case it would be necessary to have current at 110 volts, or less, and sufficient coils can be connected in series, to suit the voltage available. To increase or lower the voltage of the heater, it is only necessary to add or take out coils as the case may be. Should it be found that the heater does not warm up sufficiently, a coil or so can be cut out.

Alignment in Driving

The remark made in the article entitled "Maintaining Grade in Driving," published in the Journal of March 30, 1912, to the effect that in driving there is a tendency for the miners to advance with too much grade to the floor of the drift suggests another tendency often exhibited when driving on a vein that abruptly passes from relatively uniform rock into a sheeted zone or one wherein many nearly vertical fissure planes exist in close proximity.

Especially when the vein crosses or enters such a zone at an obtuse included angle the tendency for the miners to deflect the direction of the drift a little to one side is pronounced. Due to the way in which the breaking of the rock is influenced by the fissures or joints together with the tendency to advance slightly towards the direction of the joints, the drift in passing through such a zone is apt, when finished, to present a stepped in or jagged appearance.

This tendency must be guarded against or an unnecessary amount of ground must be broken and the drift may be continued out of the alignment desired.

Pumps Work after Long Submergence

By Charles Mentzel*

At the Cordova mines in Ontario there is a 400-ft. shaft in which the pumps were drowned and remained submerged for eight years. A few weeks ago it was decided to unwater the shaft which makes about 15,000 gal. per hour. On the 200-ft. level there is a 7½x4½x10-in. duplex pump of the Worthington type, which was built by the Northey Pump Co. of Toronto—no longer in business. The column pipes and air lines had not been touched in eight years and the water was within 20 ft. of the collar of the shaft. On giving it air, the pump immediately started and pumped 96 hr., then stopped. On reaching the 200-ft. level with a sinking-pump, it was found that a setscrew in a rocker-arm had slipped. After fixing this the pump worked as well as ever.

On the 300-ft. level there are two 5¼x3½x6-in. duplex pumps of the same type, lifting to a sump at the 200-ft. level; both discharges being connected to a 5-in. column pipe. Upon turning on the air at the 200-ft. level these pumps immediately began to work and are still pumping after continuous work for a week. On the 400-ft. level there is another pump lifting to the 300-ft. level and no doubt is entertained that on reaching the 300-ft. level and turning on the power, this pump will also do its duty. Under the conditions this work is remarkable.

---

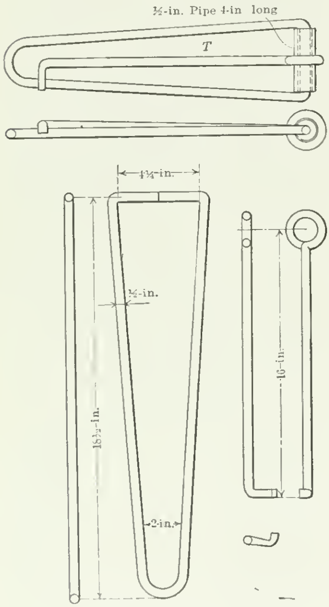
*Mining engineer, South Porcupine, Ont.

*Manager, Cordova Mines, Ltd., Cordova Mines, Ont.

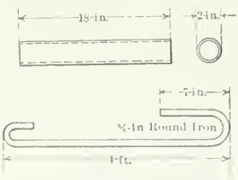
A Guy Rope Tightener

By Claude T. Rice

In the accompanying drawings are shown the details of a guy-rope tightening device which is used in the southwestern Missouri zinc district. The tightening device resembles a buckle in construction. It is made of ½-in. wrought iron, with a piece of pipe over the broad end of the buckle-shaped link so as to allow the tongue to rotate readily without much friction. This tightener is fastened to the anchor of ⅝-in. wrought iron after the guy rope has been secured to the tongue of the tightener.



Details of Guy Rope Tightener



Iron Parts of Concrete Anchorage.
Eng & Min. Journal

Guy-rope Tightener and Anchorages

By using the tongue as a lever, the guy line is wound around the broad end of the buckle until the proper tension has been obtained. Then the tongue is locked by hooking its end over the buckle part of the tightener. The iron parts for a concrete anchorage in which a pipe cross piece is used are also shown.

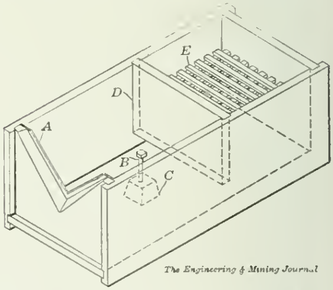
The V-Notch Weir

By E. H. Webster*

In the summer of 1909, the Republica mine in western Chihuahua was flooded, and underground operations were suspended for some months thereafter, production being maintained from ores and tailings which fortunately existed within easy reach on the surface. The mine was allowed to fill just before I assumed charge of the property. It had the reputation of making a large quantity of water, but I was unable to ascertain that any systematic measurement had been made of the flow, the estimates of the quantity pumped being based mainly on occasional observations of pump displacement and revolutions. On commencing the unwatering, in the following year, it appeared desirable to gage the flow, in order to check the performance of the sinking-pumps as well as to have some reliable data as to the volume to be handled in the event of a recurrence of the trouble. Conditions at the mine were such that in order to accomplish this it was necessary to provide some cheap, simple, and fairly accurate measuring device, rigged up from material on the ground, not easily deranged by unskilled labor, and which could be placed near the shaft collar and easily and frequently observed for the rate of flow.

The discharge from the pumps being variable and depending on the number of pumps in action from time to time, this point also had to be considered. Rectangular and Cippoletti (trapezoidal) weirs, on account of the relatively small quantity of water to be handled, hardly seemed to answer the purpose; Pitot and Venturi meters appeared too difficult of construction and application, and open to injury from rough treatment in the location selected, near the shaft; while the triangular or V-notch weir seemed to combine ease of application and observation with accuracy at all rates of flow. From an old box used in the mill for washing screens, I finally devised a measuring box on this principle, adapted from the notch box of an automatic English recorder, in wide use abroad and recently introduced into this country. This was placed conveniently near the shaft, and received the discharge from two 250-gal. sinkers.

In the accompanying sketch of this box, A is a thin iron plate, with a sharp-edged 90° V-notch, forming the essential part of the device; B is a lag-screw or bolt screwed into the base C, which is fastened to the floor of the measuring chamber about two-thirds of the distance from the notch to the baffle; D is the baffle board, which divides the box into receiving and measuring compartments, communicating at the bottom; E is a grating or screen in the receiving compartment, which breaks up the pump discharge and delivers a quiet flow to the measuring compartment. In setting this box, it must be carefully leveled transversely and longitudinally, to insure a perfectly horizontal position of the base of the notch and the floor of the box. When it is finally leveled and firmly secured, the lag-screw B must be adjusted on a dead level with the apex of the notch, in order to form the zero-point for the measurements to be made. It should be tested by running a quantity of water into the box, allowing it to discharge, and observing the water level. The grating E should be covered with a wire screen of suitable mesh, or a layer of small rock fragments sufficiently thick to break and diffuse the entering current, while not impeding the flow. The pump discharge should strike this compartment with as little force as is practicable under the circumstances. Care must be taken to see that the triangular crest is beveled thin, with the beveled side facing down stream; also that the end of the box is so arranged that the discharge from the crest is perfectly clear and free. When the box is properly set, a chip thrown into the measuring compartment near the rear will float in the quiet water indefinitely, unless brought quite close to the crest by some extraneous influence.



Weir for Gaging the Pumping of Mine Water

As a basis for determining the rate of flow, the height from the apex of the notch to the surface of the still water is measured. If these measurements are required with a considerable degree of accuracy, the usual hook gage, or some adaptation, must be attached to the box, for fine reading, but for the purpose in view, this was too refined and too liable to injury, and we decided on a rule, graduated in tenths of an inch, the rule being read at the surface of the water, and the rate of flow taken from the table herewith. Finally, the rates of flow corresponding to the individual tenths were added, and the rule was read direct in gallons per minute. The rule was a thin strip of dense wood, graduated in India ink and well coated with shellac afterward. No difficulty was experienced in reading it to the accuracy desired, but it will be noticed that even 0.05 in. means a considerable difference in flow as the height increases, and where conditions admit, the hook gage is preferable.

---

*Los Angeles, Calif.

The rule was hung at the side of the box, and observations were made at frequent intervals, the time and measurement being noted in each case. From these data the average rate of flow was calculated, as closely as the case demanded. In addition to giving this information, the weir was found useful in checking the condition of the sinking pumps. The heat in the cramped shaft was terrific, and the men were inclined to slight adjustments and repairs, but the Mexican pumpmen soon learned to read the rule, and became accustomed to watch the box for the pump duty, especially after adjusting packing, valves, etc., all hands being thus kept well informed as to the effect on the water lifted.

The box is shown as being equipped with a notch 8 in. in depth, and is hardly of the most suitable proportions. Possibly a better adjustment for this depth of notch would be, 4 ft. long, 2 ft. deep, and 2½ ft. wide. While the recording devices of the apparatus from which it is copied are patented, I do not know whether the weir box itself is or can be the subject of a patent; the notch itself, of course, is part of the common stock of engineering knowledge and available to all.

The table is calculated to the nearest tenth of a U. S. gal. per minute, and is based on the Thomson formula. Recent investigations at Glasgow gave coefficients varying somewhat, and slightly lower, but these figures were not available when the table was prepared.

The usefulness of a simple and accurate device of this kind is unquestioned. It is a safe assertion that a majority of mine pumps are working at much lower efficiency than their proper duty, and this is to be expected as usually no means of gaging the flow are provided, except an occasional revolution counter and the plunger displacement figures. In some cases the slip is estimated or guessed at more or less vaguely according to conditions and the personal equation of the men in charge, but generally it is not even considered. What this means under mining conditions, is shown by the statement of R. V. Norris, in an article "The Unwatering of Mines in the Anthracite Region," in the *Engineering Magazine* of October, 1907: "It has been notable that where water-hoisting has replaced a pumping plant the quantity of water previously figured on plunger displacement has invariably diminished to about 60% of that previously reported. The difference is accounted for partly in slip, and partly because proper allowance is rarely made for delays and low speeds in mine pumps, which until recently were rarely provided with counters."

Furthermore, even with pumping plants of larger capacity than the average mine plant, and working under infinitely more favorable conditions, matters seem to have been nearly as bad. In the *Municipal Journal and Engineer* of Dec. 16, 1908, a table of tests is given, covering 67 waterworks pumps in more than 30 American cities, the slip being determined by Pitot instruments of improved type. The slip ranged from 1 to 73.8%, and on the 67 pumps tested was distributed as follows:—1 to 5%, 19; 5 to 10%, 9; 10 to 20%, 14; 20 to 30%, 12; 30 to 40%, 5; 40 to 50%, 3; 50 to 60%, 2; 65, 2; 73.8%, 1. If this is the case with large waterworks pumps of good construction, operating under favorable conditions, and under the supervision and inspection of men appointed for their engineering qualifications, what would a similar testing of average mining plants show?

The installation of such weirs, either the simple form shown herein, or the perfected automatic recording form mentioned above, would greatly reduce the figures claimed by many mine managers and mechanics as representing the water being lifted at their plants. Further consideration of the weir figures would show the enormous waste of power in handling this water, and should stimulate investigation and effort to locate the responsibility for this waste, whether in the pumps themselves, in their condition and handling, in the condition of the boilers or power plant, or in the capabilities of the men in charge. This burden of responsibility may be distributed over all the elements indicated, or it may rest on only part of the system; but in order to fix it, some basis must be taken, and this basis is the accurate determination of the water actually issuing from the pump discharge.

Owing to its simplicity and portability, the V-notch weir should also be found useful in other departments of the mine wherever quantities of water or solution are handled; but wherever the expense is justified, the automatic continuous recording apparatus should accompany it. As regards mine pumping, due to the importance and cost of this department of mining, an accurate recording apparatus would seem to be a necessity, if any check at all is to be kept on the efficiency of the pumping plant and the cost per ton, million gallons, etc., of handling the water.

DISCHARGE OVER 90° V-NOTCH WEIR
IN U. S. GALLONS (231 CU.IN.) PER MINUTE

Head, Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	.....	0.007	0.04	0.11	0.23	0.40	0.64	0.94	1.3	1.8
1	2.3	2.9	3.6	4.4	5.3	6.3	7.4	8.6	9.9	11.4
2	12.9	14.6	16.4	18.4	20.4	22.6	24.9	27.2	30.0	32.8
3	35.7	38.7	41.9	45.3	48.8	52.5	56.3	60.3	64.4	68.8
4	73.2	77.9	82.7	87.8	93.0	98.3	103.9	109.6	115.5	121.7
5	128.0	134.4	141.1	148.0	155.1	162.4	169.9	177.8	185.4	193.5
6	201.8	210.4	219.1	228.0	237.2	246.6	256.2	266.0	276.0	286.3
7	296.8	307.5	318.4	329.6	341.0	352.6	364.5	376.6	388.9	401.5
8	414.4	427.4	440.7	454.3	468.1	482.2	496.5	511.0	525.8	540.9
9	556.2	571.8	587.7	603.7	620.1	636.7	653.6	670.8	688.2	705.9

Formula: U. S. gal. per min. $= 2.28904 \sqrt{H^5}$, where H equals head in inches; adapted from Trautwine's form of Thomson formula for flow in cu.ft. per sec. $= 0.0051 \sqrt{H^5}$.

Cement Gun Concrete at Panama

The coating of cement mortar applied by the pneumatic cement gun which was sent to the Isthmus of Panama a little less than a year ago for use in spraying the surface of certain rock faces in Culebra Cut, which disintegrated on exposure to air, was found, according to the *Canal Record*, not to prevent this disintegration. The concrete mixture sprayed on the smooth surfaces adhered uniformly, but was not sufficiently airtight to retard appreciably the progress of disintegration. The gun was used recently on the relocated line of the Panama R.R., in coating the surfaces of hand-laid revetment wall, made of hard Bas Obispo rock. In this case the concrete penetrated the interstices of the rocks as far as several feet and thus a firm hold was obtained. Using a mixture of 1 part of cement to 3 of sand for the inner coating, and of 1 part of cement to 2 of sand for the final surfaces, it was practicable to lay a smooth, strong coat from 2 to 3 in. thick, over an area of about 25 ft. square per day. The spraying was continuous. By the time the work had been carried from one end of the area under treatment to the other the first part was ready for another coat. In all, about 10,000 sq.ft. of revetment was treated. An opinion has been expressed to the effect that the failure of the cement coating at Culebra was due to the rock flaking off back of the surface.

Friction in Air Pipes*

By E. G. Harris†

The coefficients given in the accompanying tables were determined experimentally for use in calculating the friction of air in pipes by the formula

$$f = c\frac{l}{d^5}\frac{V^2}{r}$$

where f is the loss by friction in pounds per square inch; l, the length of pipe in feet; d, the diameter of the pipe in inches; V, the quantity of free air passing expressed in cubic feet per second; r, the ratio of compression in atmospheres, and c, the coefficient.

TABLE I. COEFFICIENTS FOR FRICTION IN AIR PIPES

Diameters in Inches		Coefficient c for	
Nominal	Actual	Actual Diameter	Nominal Diameter
½	0.63		
¾	0.82	0.110	0.069
1	1.07	0.100	0.071
1½	1.63	0.089	0.059
2	2.07	0.082	0.069
3	2.874	0.072	0.089
4	3.937	0.066	0.071
5	4.921	0.062	0.067
6	5.960	0.059	0.061
7		0.056	
8	7.874	0.053	0.059
10		0.050	
12	11.811	0.048	0.052

For the ¾- and ½-in. pipes, especially the latter, the results of the experiments were so irregular, erratic and conflicting, that the coefficients given in the tables for those sizes cannot be accepted as final. In light of these studies it is not probable that a satisfactory coefficient will ever be obtained for pipes less than one inch diameter, the reason being that in such pipes irregularities have relatively greater effect than in larger pipes. No doubt consistent results could have been obtained by using only pipes that had been "plugged and reamed" and selected fittings; but the results would not have been a safe guide for practice.

TABLE II. LENGTHS OF PIPE IN FEET OF RESISTANCE EQUAL TO THAT OF FITTINGS

Nominal Diameter of Pipe	90° Elbows	Unreamed Joints, Two Ends	Reamed Joints, Two Ends	Return Bends	Globe Valves
½	10	2 to 4	1	10.0	20
¾	7	2 to 4	1	7.0	25
1	5	2 to 4	1	5.0	40
1½	4	2 to 4	1	4.0	45
2	3	2 to 4	1	3.5	47

A number of experiments were made to determine the resistances of 50-ft. lengths of rubber-lined, armored hose, such as is used for connecting air tools with the supply of compressed air. These, given in Table III, include the resistance in a 50-ft. length with the metallic end couplings, where considerable contraction occurs; in ½-in. hose the end couplings are ¼ in. The excessive resistance in the ½-in. hose may have been due to these end contractions or to some other obstruction. It is a further illustration of the fact that reliable coefficients cannot be obtained for pipes of less than one inch diameter.

TABLE III. RESISTANCE OF AIR HOSE

Diameter, inches	½	¾	1	1½
Resistance in 50-ft. length	$950\frac{V^2}{r}$	$20\frac{V^2}{r}$	$4.5\frac{V^2}{r}$	$2.6\frac{V^2}{r}$

---

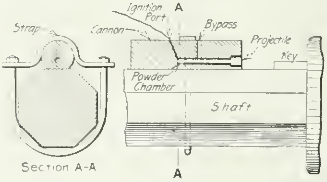
*Excerpt from a bulletin "Friction in Air Pipes," of the School of Mines and Metallurgy, University of Missouri.

†Professor of Civil Engineering, University of Missouri, Rolla, Mo.

A Cannon for Loosening Keys

When the drive pulley of a stamp-battery camshaft is keyed to the shaft by the ordinary type of key, trouble is often experienced when an attempt is made to remove the pulley, the key sticking so tightly as to make ineffectual all ordinary means of loosening it. For jarring loose all such keys a cannon described in *Power* may be used to advantage. This cannon was designed for loosening the keys that held the paddle-wheel of a river boat to the shaft.

A piece of 6-in. steel was planed flat on one side so that it could be clamped on the hexagonal paddle-wheel shaft. It was then bored with a 1½-in. hole to form the cannon bore. A steel projectile was then made to tightly fit the bore of the cannon. The hammer-shaped end protruding from the bore was hardened. A hole was bored into the cannon at a point where the projectile would pass it at the time it struck the key, the object of which was to relieve the pressure in the cannon without shooting the projectile out of the gun. A vent was bored into the powder chamber for an ignition port, and the igniting powder was fired by a piece of fuse. The construction and operation of the device is at once apparent upon inspection of the accompanying illustration.



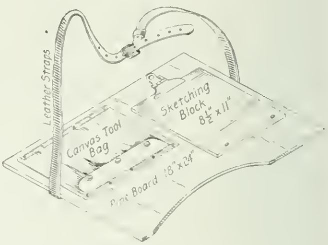
Cannon for Shooting Out Keys

This device should prove effectual in loosening rusted keys, but in using it all men should retire to a safe distance in order to avoid injury should the cannon burst.

In driving out tapered keys, or keys with a head, a special driving-out key is used, one end of which is headed to receive the impact of the projectile and the other end of which is small enough to enter the keyway and strike against the small end of the key to be driven out.

Sketching Board for Use Underground

The accompanying illustration shows a convenient sketching device for use of the mine surveyor's note taker. It consists of a small drawing board about 18x24 in. It is intended that when the board is in use it will be hung from the shoulders. For this purpose, writes R. B. Dale in the *American Machinist*, leather shoulder straps are attached on each side at a point a little beyond the center. When the device is not in use it may be allowed to hang vertically from the shoulders and the user is but little inconvenienced in moving or climbing about. The straps are adjustable as to length. The side of the board nearest the user is cut away slightly to conform to the natural form of the body.



A Convenient Sketching Device

The board is provided on the right with a sketching block or pad, which is securely held by means of a spring clip. Two small pegs at the lower end fit into corresponding holes in the block to prevent it from slipping about. It is intended that the sketches when completed may be removed from the block and inserted in a loose-leaf book cover.

On the left side the board is provided with a canvas tool bag which is fastened to the board by means of thin metal strips at each end. The canvas flap may be fastened down by means of straps and buckles or snap fasteners as desired. The bag is divided into compartments in which to keep tools, instruments and notebooks. It is thus seen that provision is made for the storage of a complete sketching equipment.

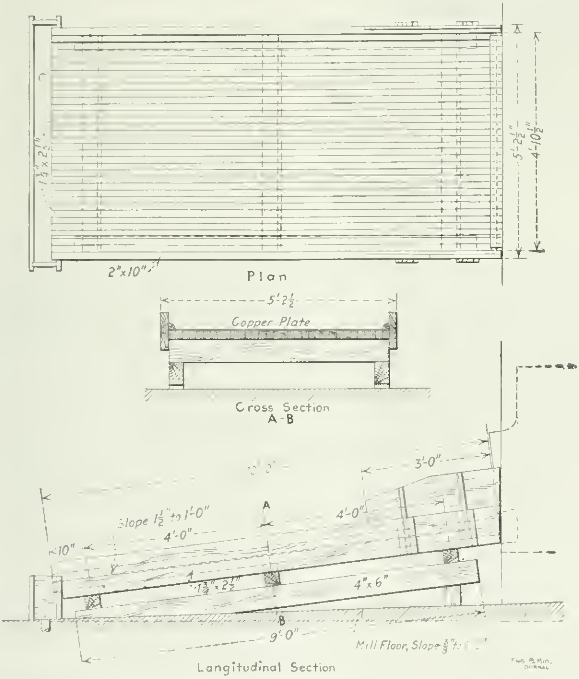
When taking measurements the board may be laid to one side if necessary in order that the draftsman may move freely about. A sheet of celluloid may be kept under the hand to protect the sketch from the dust and dirt.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Alaska-Treadwell Amalgamation Tables

The amalgamation table illustrated by the accompanying drawing is the standard design used in the five mills on Douglas Island controlled by the Alaska-Treadwell Gold Mining Co. and affiliated interests. One large copper plate is used for each battery of five stamps. As compared with the Homestake tables described in the JOURNAL of April 13, 1912, the Alaska-Treadwell table is wider, but shorter. The pulp from the tail-box at the lower end of the table is conveyed to the concentrators.



AMALGAMATION TABLES USED IN ALASKA-TREADWELL MILLS

The body of the table is made up of a number of 1¾x2½-in. squared timbers planed smooth on the sides to make a tight joint and on the upper surface upon which the copper plate is supported. These timbers are held tightly in place by the transverse timbers on the bottom. The copper plates are held in position by the rounded cleat on each side and at the upper end of the table.

The plates are dressed once per day, but if trouble from scouring, or from other causes is experienced, they are dressed as required. The operation is started by hanging up five stamps, first shutting off the feed so as to reduce the ore in the mortar to the level of the dies. The five stamps are then hung up, and a portable trough placed at the end of the plate, on the inside of the tail box. The plate is then brushed from the top toward the bottom with whisk brooms; it is then cleaned by rubbing with cloths saturated with a weak solution of cyanide. If quicksilver is required, it is now added and rubbed first with the cloth dampened with cyanide solution, and then brushed with whisk brooms at right angles to the flow of the pulp. The portable trough is then removed, some ore fed by hand into the mortar and the stamps dropped. The operation from start to finish takes on an average four minutes per plate. The present practice is to add very little quicksilver to the plates, except during the cleanup period which occurs once per month. During the remainder of the month the quicksilver is fed to the mortars, and the quantity so fed is sufficient to keep the plates in good condition.

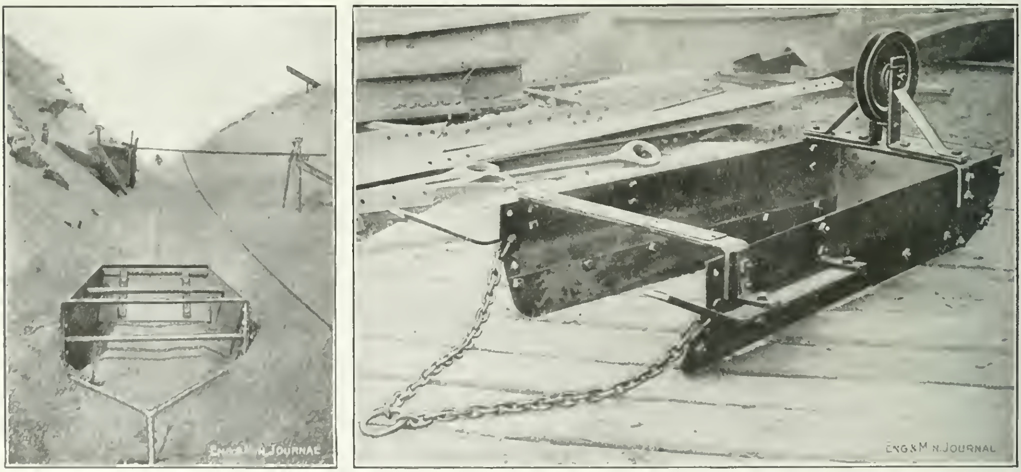
Scraper for Loading Tailings

The accompanying halftones show a type of scraper that is used in the Joplin district of Missouri for loading tailings into the bins of a tailings mill or into railroad cars. The scraper is hauled back and forward by a tail and haulage rope, operated by a two-drum engine. The scraper is made with two sides, held together by cross braces. The scraper shown in one of the illustrations is fitted with cross braces only at the top. These are flat bars that extend down on the outside of the side pieces or runners, as they might be called. In the scraper shown in the other illustration, tie-rods are used for bracing the runners, both near the top and near the bottom, with distance pieces of pipe over the bolts.

The principle of this scraper is simple. It has no bottom like an ordinary dirt scraper, for it does not carry its load, but scrapes it ahead. The back wall of the scraper is a hinged door that, when the scraper is moving forward, is prevented from swinging clear back by a cross rod near the bottom of the scraper. On the other hand, when the scraper is returning for its load, the door is free to swing, and so the scraper accumulates no load. In the scraper shown in use, no wearing plates or shoes are used on the runners, and there are no wings bolted to the side walls to regulate the distance that the scraper can sink into the tailings. These wings are not necessary to the efficient working of the scraper.

On the scraper shown with wings, there is also a sheave wheel at the back end. This is to go over the return rope; then, if the return rope is kept taut, the scraper can be made to cross hollows, if used in making fills, and also in dumping the load at the mill bin. Such a system of scraping the tailings into the mill is used at the Oronogo Circle tailings mill, as well as elsewhere in the Joplin district.

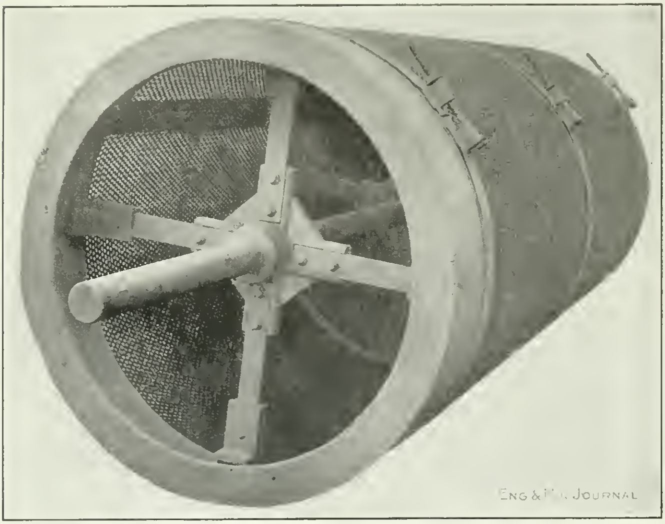
The dimensions of the scraper in use at the Oronogo Circle mine are: Length, 5 ft. 2 in.; width at front, 3 ft. 6 in.; width at rear, 2 ft. 10 in.; depth of sides, 14 in. The tie-rods are ¾-in. rods with 1-in. pipe over them for spreaders. There are two tie-rods at the top and two at the bottom, the rear one at the bottom being the one that the rear door rests against when pulling the load ahead. At the front and rear ends, the walls are reinforced, as well as tied together by the 3x½-in. straps that are riveted to the sides. The rear end of the scraper is beveled off at about the angle that the door assumes while the scraper is being pulled ahead with its load. The rear door is of sheet iron about ⅛ in. thick that is swung by two 2x½-in. straps from the upper rear tie-rod. These straps are riveted to the door 8 in. out from each side wall. The door is 17 in. deep and hangs about one inch down from the tie-rod. Both the two rear tie-rods, as well as the front tie-rod, by which the scraper is attached to the haulage rope, are seated in reinforcing straps.



Scrapers Used at Joplin for Loading Tailings

Joplin Trommels

The trommels used in the mills in the Joplin district of Missouri are shown in the accompanying halftone. Two sizes are used in the district, 48x96 in. and 36x96 in. The framework of both is the same except as to the diameter of the hood and the length of the arms of the spider. The arms are protected at the ends by castings that are fastened to the arms by a ¾-in. rivet. This protecting casting is made of two parts, a plate and the shoe. The plate is a casting with walls ⅝ in. thick that come half over the arms of the spider, which are pieces of 2½x½-in. iron, bent at the ends so as to fasten by two ¾-in. rivets to the hoops of the trommel, which are also made of 2½x½-in. iron. The shoe is of the same section as the plate in the shank part, but at the bottom is a projection at right angles, so as to cover the heads of the rivets that fasten the arms to the hoops. This is done because the ore going to these trommels is abrasive and hugs the bottom of the trommel. If these protectors were not used, the arms would wear away rapidly. As it is, the protectors can easily be replaced as they are worn out.



Joplin Trommel, Showing Design of Spider and Drawband

The spiders of the trommel are composite, being made of a hub casting, and the arms, that are riveted together by ¾-in. rivets. The hub is fastened to the shaft by a key and two setscrews, one of which comes over the key. On the hub are ribs for receiving the arms.

The trommel in the drawings is shown with the type of drawband used by J. A. Rogers in the trommels that he put on the market. The sockets for the drawband bolt are made by punching two slots through the drawbands to receive a U-clip 2½ in. wide and of No. 8 sheet gage. This clip goes over the drawbolt and clinches over backward, so that it cannot draw out of the slots as tension is put on the band. Moreover, as the drawbolt is tight against the band, this clip does not have the tendency to turn over that develops in those having cast-iron sockets for the drawbolts riveted to them.

The ore is fed into a cast-iron hood on the trommel. This hood is of the same diameter as the trommel and its walls are cast ½ in. thick. The side wall comes up 3½ in., and the wearing wall extends out from the side wall 10 in., so that the feed as it comes into the trommel drops on the hood casting and it takes the wear instead of the trommel screen.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Melting Gold Precipitates

Using a Faber du Faur tilting furnace with coke fuel, it requires at a certain mine 24 hours to melt approximately 700 lb. of gold precipitates and flux, including time required for changing broken crucibles and a remelt of bullion.

Crucible consumption: This depends upon the nature of the precipitate melted. It is possible for it to run as high as 1½ crucibles per 24 hours. From 1 to 1½ hours is the time usually consumed in dropping the fire, pulling out front of furnace, changing crucible and getting fire under way again.

Coke: It requires about 200 lb. of coke to get the furnace well packed after the wood necessary to start the fire has burned out. The coke consumed depends a great deal upon the regulation of the draft. If the fire is kept at a steady white heat, from 650 to 700 lb. of ordinary-grade coke is consumed per 24 hours.

Flux: Usually the flux used consists of 50 parts borax and 20 parts sand, to 100 parts of precipitates. In some cases a small amount of cyanide or niter is used and in other the greater part of the flux is composed of soda.

Grinding and Mixing: The time required for this operation depends upon the size of grinding barrel used. For a plant making about 400 lb. of dry precipitates per month and only using one melting furnace, a barrel 2½x3¼ ft. is often used. It requires about three hours to grind the precipitates, mix flux and sack 700 lb., which is the approximately total weight after flux has been added. This is with one man performing the work, and sacking from 10 to 15 lb. to a paper bag. Where one furnace is operated, one man can perform all the necessary work, except changing crucibles.

Food Supplies for Miners

Arthur A. Cole, mining engineer for the Temiskaming & Northern Ontario Ry., in his admirable report for 1911, gives the accompanying valuable data of the food supplies consumed by 3020 men in the Cobalt district in 1911, the figures having been supplied by the several mining companies of the district.

Mr. Cole also gives the accompanying data of the food supplies for 122 horses.

FOOD SUPPLIES FOR STABLES FOR MINES AT COBALT, 1911

Article	Quantity	Cost	Quantity per Horse per Year	Cost per Horse per Year	Quantity per Horse per Day	Cost per Horse per Day
Hay	991,250 lb.	$ 7,333	8,152 lb.	$ 60.11	22.27 lb.	$0 165
Oats	713,882 lb.	10,058	5,851 lb.	82.44	16.03 lb.	0 226
	....	$17,391	....	$142.55	....	$0 391

FOOD SUPPLIES FOR COBALT MINES, 1911

Article	Quantity	Cost	Quantity per Man per Year	Cost per Man per Year	Quantity per Man per Day	Cost per Man per Day
Flour	9,576 bags	$27,842	317 lb.	$9.22	0 87 lb.	$0 0253
Potatoes	18,918 bags	21,554	626 lb.	7.14	1 72 lb.	0.0196
Vegetables	....	21,520		7 12		0.0195
Cereals	....	3,290		1.09		0 0030
Cornstarch	....	688		0 23		0 0006
Biscuits	....	2,005		0.66		0.0018
Beef, veal, mutton, lamb	1,039,932 lb.	134,944	344 lb.	44.69	0.91 lb.	0 1224
Pork, ham and bacon	504,396 lb.	66,483	167 lb.	22.01	0 46 lb.	0 0603
Fowls	19,152 lb.	4,897	6 lb.	1.62	0.02 lb.	0 0044
Lard, etc	113,760 lb.	15,729	38 lb.	5.21	0.10 lb.	0 0143
Butter	211,518 lb.	54,890	70 lb.	18 18	0.19 lb	0 0199
Eggs	2,240,840 lb.	46,967	742 lb.	15.55	2.03 lb.	0 0426
Milk and cream	....	21,010		6.96		0 0190
Cheese	20,718 lb.	3,218	7 lb.	1.06	0 002 lb.	0 0029
Fruit, jams	....	60,556		20.05		0 0549
	....	$185,593	...	$160.79		$0 4405

Copper Queen Smelting Operations

During 1911 at Copper Queen smeltery at Douglas, Ariz., an average charge of 353 tons per blast furnace was treated per day. Of the total charge treated, exclusive of coke; 75.3% was ore; 0.3% was flux, and 24.4% other copper material. Of the various ores smelted, 73.7% was Copper Queen ore; 13.1% Moctezuma ore and concentrates; and 13.2% custom ore, etc. The coke consumption amounted to one ton of coke for every 8.76 tons of material in charge.

One ton of flue dust was recovered for every 17 tons of material in charge and coke consumed. Based upon the total contents of the ore as represented by the amounts recovered in bullion and contained in flue dust, the flue dust contained 13.6% of the copper; 8.7% of the silver, and 7.1% of the gold.

In the sampling works one sample was made for every 44.5 tons of ore sampled. In the laboratory, one determination was made for every 13.8 tons of charge, exclusive of coke.

Michigan Iron Mining and Furnace Production

The commissioner of mineral statistics for the state of Michigan gives data in his 1908 report from which some interesting unit costs can be obtained.

At the Hartford mine, Negaunee, 248 men were employed and 20 power drills used, producing 272,441 tons of soft, hematite ore; this is equal to 1100 tons per year per man or 13,622 tons per drill per year. For hoisting, 5½-ton skips were used and the production came mainly from the 650-, 750- and 825-ft. levels.

The Champion, one of the oldest iron mines in the Lake Superior region, produced 53,758 tons of ore, employing 120 men and operating 12 power drills, which is equivalent to 448 annual tons per man and 4480 tons per year for each drill. Mining was done by the underhand system and 4-ton skips used in hoisting.

At the Lake mine, of the Cleveland-Cliffs company, in Ishpeming, Mich., 272 men were employed and 10 power drills operated, producing 341,845 tons of ore. This gives an average of 1255 annual tons per man and 34,184 annual tons per power drill. During this time the mine was operated through a four-compartment, 10x16-ft. shaft, 450 ft. deep. The daily capacity of the mine was about 1850 tons. Skips were operated in balance and raised three tons per trip. All tramming was by electric haulage, dumping direct into skips. In 1907 this mine produced 556,573 tons of ore and used 930,846 ft. b.m. of timber underground, which is equivalent to 1.68 ft. per ton of ore produced.

At the Austin mine, Princeton, Mich., the production for 1908 was 197,411 tons of ore, 189 men were employed and five power drills operated, three of which were used in ore recovery. The annual tons per man on this basis is 1045, per power drill at the mines, 39,480 tons, and 59,470 tons per drill employed in ore extraction. The mine was operated through one shaft, 10 ft. 8 in. by 11 ft. 4 in., and 238 ft. deep. Skips carrying two tons to a trip were operated singly. The caving system was used for mining the ore.

The Chapin mine, near Iron Mountain, Mich., produced 450,177 tons, employing 368 men and operating about 50 power drills. This is equal to 1250 annual tons per man and 9003 tons per drill operated. The underground operations were conducted through two three-compartment shafts; one, 7x21 ft., 1418 ft. deep; and the other, 7x18 ft., 1525 ft. deep. The orebody consists of a series of lenses extending easterly and westerly 6100 ft. and varying from 50 to 150 ft. in width.

The Norrie mine on the Gogebic range employed 1057 men and operated 40 power drills, producing 917,543 tons of ore. This is approximately 868 annual tons per man and 22,938 tons per year per drill operated. Various systems of mining are used depending upon conditions. Electric trams were operated and dumped direct into skips.

Blast Furnaces

Eight blast furnaces were operated in the state during 1908, producing 142,744 tons of pig iron. At the Cleveland-Cliffs Iron Co.'s Pioneer furnace at Marquette an average of 244 annual tons of pig iron was produced per man employed and 412 tons at its Gladstone furnace, or an average of 326 annual tons per man for the two. The Lake Superior Iron & Chemical Co. secured 197 annual tons per man at its Boyne City furnace and 212 annual tons at the Elk Rapids furnace, or an average of 199 annual tons per man for the two.

The Antrim Iron Co., Mancelona, Mich., secured 228.8 annual tons per man, and the Mitchel-Diggins Iron Co., Cadillac, Mich., operating only three months produced 7949 tons, employing an average of 75 men.

Cost of Mine Fires

It has cost the Giroux Consolidated $34,521 to the end of December for repairing the damage done by the fire which started in the Giroux shaft at Ely, Nev., on Aug. 23, 1911. The distribution of cost was as follows: Putting out fire and getting ready to repair shaft, $6916; repairing shaft, stations, pockets, and drifts $11,847; bailing water and hoisting, $15,756. Two bailers were used, each held 7.3 tons or 1750 gal. of water. The rate of hoisting averaged as high as 1249 gal., or 5.21 tons of water per minute for a period of 24 hours. The depth of hoisting ranged between 1200 and 1400 feet.

During the year 1911 mine fires in the Holbrook division and the Lowell division of the Copper Queen mines in Arizona added 10.7c. per ton to the cost of extraction.

Data on Underground Mining

The data given in the accompanying tables were obtained from the records of a large mine in Nevada, where all mining is done underground. The development figures are based on records for 4354 ft. of work, including the usual proportion of raising generally necessary in opening new ground. All shifts are of eight hours' duration.

DEVELOPMENT DATA

	Per foot of advance
Average shifts of miners	0.655
Average shifts of shovelers and trammers	0.428
Pounds of dynamite	4.79
Number of blasting caps	2.74
Feet of fuse	17.45
Candles	4.28

During the same period the records for work in the stopes were:

STOPING DATA

	Per ton of ore stoped
Average shifts of miners	0.16
Average shifts of shovelers and trammers	0.095
Pounds of dynamite	0.446
Number of blasting caps	0.364
Feet of fuse	1.97
Candles	0.97

Based on the total tonnage of ore produced both from development and stoping for the same period, these figures are as follows:

MINING DATA

	Per ton of ore produced
Shifts of miners	0.271
Shifts of shovelers and trammers	0.169
Pounds of dynamite	1.46
Number of blasting caps	0.899
Feet of fuse	5.45
Candles	1.73

This would indicate that the underground workers handled 2.32 tons per man per shift, or a little more than 2 tons per man per shift, including all men employed about the mine. This average was later increased to about 3 tons per man. The number of candles used is dependent upon the distance to the working faces and draft. Approximately 14 tons of dry ore from stopes per shift of shovelers and trammers was the average at the time these records were made.

Loss of Time from Accidents

The accident report of the Copper Queen Consolidated for 1911 states that the average number of men employed underground was 1505 and that 282 were employed on surface around the mines, making a total average of 1787 men, not including ore dressing. Figuring on the basis of the average number of men employed, the report shows that by accident, 0.45% were killed; 4.65% were seriously injured, and 39.4% were slightly injured, making a total of 44.5% of all the men employed around the mines who met with accidents. These figures show that not considering the more important features of an accident, the loss of time must be reckoned as no small item, when considering the cost of accidents.

The average men employed, accidently injured, may seem high but as this figure must include every injury cared for by the hospital department, such as small cuts and bruises, it is not an exceptional record. Assuming that the average loss of time per man, slightly injured was one-half hour; and that those seriously injured were disabled for only 10 days each; the total loss of time was approximately 874 shifts, not including time lost due to fatal accidents.

Unit Labor Costs in Brazil

Some idea of the inefficiency of cheap labor can be gained by looking over the record of the Ouro Preto gold mines at Ouro Preto, Brazil. Practically all labor is native Brazilian, though various attempts have been made to import miners from Spain, but so far it has been impossible to get them to remain. In 1910 a system was introduced giving a bonus to men working underground who would work 24 days per month.

The average tonnage broken per man per month, based upon the men charged to stoping averaged 10.2 tons in 1909-10; 10.4 tons in 1908-9 and 11.3 tons in 1907-8. The 1910-11 report shows that the labor required per annual ton is all out of proportion to that required where efficient miners can be secured. The average number of men employed per day was as follows:

Administration, one man for every 6950 annual tons (2000 lb.) ore produced. Development, one man for every 1405 annual tons of ore, or only 40 ft. of advance work per year per man, of which only 2% was sinking. Stoping and tramming, one man for every 125 annual tons ore. Pumping, one man for every 3480 annual tons. Water course, one man for every 7720 annual tons. Mill, one man for every 590 tons ore milled. Cyanidation of concentrates, one man for every 360 tons concentrates treated annually. Cyanidation of sands, one man for every 9420 annual tons sands treated. Cyanidation of slimes, one man for every 2260 annual tons slimes treated. Hospital, one man for every 204 men employed.

Based upon the average number of men employed, 48.5% were treated at the hospital for slight injuries received in the mines.

The total men employed in developing, stoping, hoisting and pumping equaled one man for every 105 tons produced annually. The total in milling and cyanide department averages one man for every 485 annual tons. The rate of production per man employed in all departments is 81 tons per year. The total cost of production for 1911 is given as $6.07 per ton.

Cyaniding of Concentrate

By E. M. Hamilton*

Four methods of handling concentrate are possible: Do not remove from pulp; remove, regrind and return to pulp; remove and cyanide separately; remove and ship to smelter. Individual circumstances determine the best procedure. Cyanide consumption is an important factor; a regenerative method, adapted to ores high in silver, is suggested.

The cyaniding of concentrate has been attracting considerable attention during the last few years, and the present article offers for consideration some aspects of the subject drawn from my personal experience.

Gold Ores With High Silver Considered

At the outset it is necessary to be careful how one makes generalizations, because conditions are so often dissimilar when dealing with different ores. Someone, perhaps, writes that he has solved the problem of cyaniding concentrate; but what does it really mean? Merely that he has found a profitable method for treating the concentrate from some particular ore or group of ores.

The difficulties in this branch of cyaniding have a tendency to be fewer and less important in the case of gold ores than in that of ores containing a considerable amount of silver, and it is only the latter class that is considered here.

In dealing with concentrate there are four possible courses open to the metallurgist:

(1) He may disregard it entirely and allow it to take care of itself.

(2) He may remove it from the pulp for the purpose of regrinding it to a given fineness and then return it to receive treatment in the ordinary course.

(3) He may remove it and keep it apart for a separate cyanide treatment in a plant specially designed for it.

(4) He may remove it and ship it to a smelter.

Until recently the last has been the method most usually adopted. The best course to take, however, depends on a number of factors, such as the assay value of the material, the distance of of the mill from a railway and from the smelter, the cost of treatment at the mine, and the extraction that can be obtained.

With regard to the latter, a mere percentage figure, whether it be 95% or 99%, has no bearing on the question; the thing to be considered is the money equivalent of the precious metals which will have to be thrown away in the residue. In this connection, it is difficult to see what is to be gained by a treatment at the mine if there is enough left in the concentrate to make it worth shipping to a smelter after treatment, except in a case where the railway freights on high-grade material are prohibitive. But however that may be and leaving on one side such matters as disputes over settlements with the smelter, (a subject rather indefinite but which nevertheless gives rise to a certain amount of irritation) the choice must be made solely on the answer to the question, "Which method will leave the greatest net gain in dollars and cents?"

A few concrete examples are here given in illustration of the behavior of various gold and silver concentrates encountered in Mexico, as it affects this question, avoiding reference to those that consist largely of lead and zinc sulphides, and those that are essentially composed of manganese oxides carrying refractory silver.

First Concentrate Chiefly Pyrite

The concentrate at mill No. 1 is a simple one of about 75% pyrite and 25% silica; gold, $735 per ton; silver 202 oz. per ton. This had been shipped to the smelter for several years, but on extraction tests being made by fine grinding and cyaniding it was evident that it could be treated at the mine with profit over shipping. Accordingly plans were drawn up for a concentrate-treatment plant and part of the material ordered. In the meanwhile extraction tests were continued and certain results therefrom suggested to me that it might pay even better to leave the concentrate in the pulp to take care of itself. Careful experiments were then made as to the relative extraction made by the two methods, and though regrinding and separate cyaniding gave a much lower residue, yet, taking into account all the costs, there appeared a net gain of $5 per ton of concentrate by doing away with concentration.

In this particular case it happened that the gain in extraction by regrinding to pass 200 mesh was comparatively small and a sample of the concentrate taken direct from the vanners and agitated for 3 days with 0.5% cyanide solution yielded 96% of its gold and 97% of its silver. It may be mentioned in passing that at the mill in question separate sand and slime treatments were in operation and the aim in milling was to pulverize the ore to pass not finer than No. 80 sieve.

Copper in Second Concentrate

At mill No. 2 the concentrate was clean pyrite with 15% silica and 0.5% copper of which about 6 lb. per ton was soluble in cyanide solution. It assayed $72 in gold and 67 oz. in silver. This when ground to pass 200 mesh and treated by agitation yielded 87% of the precious-metal contents, with a cyanide consumption of 20 lb. NaCN per ton. An extraction 1% better could be obtained by grinding the 200-mesh material to an impalpable mud. About 50% of the sulphide content of the ore was saved on the vanners and the remainder went over into the pulp.

An examination of the pulp residues showed that the concentrate in the slime filter cake had as low an assay value as that which had been ground to pass 200 mesh and treated separately with twice the cyanide strength and for double the time, while the coarser concentrate found in the sand residue showed only $2 per ton higher. These figures were confirmed in the laboratory by mixing ground concentrate with slime pulp and calculating the extraction on the former by a comparison of the residue assay of the pulp with that of a parallel test without the addition of concentrate.

COMPARATIVE COSTS OF SHIPPING AND TREATING CONCENTRATE AT MILL NO. 2

Shipping	
Freight and treatment..........	$12.45
Loss on gold, 1.5% and 67c. per oz.	3.41
Loss on silver, 5% at 50c. per oz..	1.67
Representation at smeltery......	0.20
Sacks	0.75
	$18.48
Deduct, for excess of Fe.........	0.50
	$17.98
Treatment at the Mine	
Cyanide, 20 lb. NaCN at 18c.	$3.60
Precipitating, 61 oz. of bullion...	0.42
Melting, 61 oz. of bullion.........	0.42
Express on 61 oz. of bullion......	0.19
Loss in residue..................	13.50
	$18.43

The figures showed that a slightly better extraction was obtained on the concentrate when mixed with slime pulp and treated for 48 hr. with 0.2% cyanide solution than could be gotten by treating alone for 4 days with 0.5% solution. From this it was apparent that in the event of any cyaniding of concentrate being decided on, the method would probably not be by a separate treatment, but by circulating it through the tube mills and over the vanners in a closed circuit, until reground fine enough to pass with the ore pulp to the treatment tanks.

The assays of this concentrate are as follows: Head: gold $72; silver 67 oz.; value (silver at 50c.), $105.50. Residue:

---

*Metallurgist, care Mines Co. of America, 111 Broadway, New York.

gold, $9.10; silver, 8.80 oz.; value, $13.50. A comparison of costs, as between this method and shipping is given in the preceding table.

On the side of treatment no charge has been made for regrinding, because if returned to the general tube-mill system its presence would hardly be felt as an item of cost. Thus, there appears to be a difference of 45c. per ton in favor of shipping.

This being so, there remained the question whether concentration could profitably be eliminated entirely. Experiments were made on the same lines as before, working this time with concentrate taken direct from the vanners, without any regrinding. The result indicated that concentrate in this condition, if returned to the pulp and treated in the ordinary course, produced a residue of $19.18. This was much higher than when it was subjected to regrinding, but on the other hand the cost of concentration would be wiped out. A comparison between the alternatives of concentrating for shipment and abolishing concentration entirely, gave the following figures per ton of concentrate: Concentrating: Cost of concentration, $5.65; shipping charges and deductions as shown in the previous table, $17.98; total cost, $23.63. Not concentrating: NaCN consumption, 13 lb. at 18c., $2.34; precipitation, melting, and express on bullion contents, $1.33; loss in residue, $19.18; total, $22.85. This shows a loss of 78c. per ton on the side of concentration. The figures are so close, however, that we may say it is almost immaterial what course is pursued in the case of this concentrate.

CONCENTRATE TREATED PROFITABLY AT THIRD MILL

At mill No. 3 the concentrate is a clean pyrite with about 25% of silica. The assays follow: Head: gold, $1282; silver, 436 oz.; total, $1500. Residue: gold, $12.82; silver, 4.36 oz.; total, $15.

This material, when ground to pass 200 mesh and agitated with 0.5% cyanide solution for 5 days yielded 99% of its assay value, with a cyanide consumption of 54 lb. per ton.

A comparison between shipping and treating at the mine, showing costs per ton of concentrate, is given in the accompanying table.

In this instance the treatment at the mine indicated a considerable profit over shipment. It will be noted, however, that there is no charge made for redemption of plant, which would reduce the apparent profit to that extent.

The material at mill No. 4 was a pyritic concentrate carrying 30 to 40% silica and about 1% copper of which 12 lb. per ton was readily soluble in cyanide solution. The assays follow: Head: gold, $95; silver, 385 oz.; total, $287. Residue: gold, $1.55; silver, $4.98 oz.; total, $4.04.

This, when ground to pass 200 mesh and treated by agitation for 2 days gave an extraction of 98.5%, with a cyanide consumption of 90 lb. per ton.

COMPARATIVE COSTS OF SHIPPING AND TREATING AT MILL NO. 3

Shipping	
Freight and treatment	$51.00
Drying and sacking	4.00
Deductions in smelter settlement	50.00
	$105.00
Treatment at the Mine	
Grinding (estimated)	$1.00
Cyanide, 54 lb. KCN at 20c.	10.80
Treatment (estimated)	0.75
Precipitating and melting of resulting bullion	8.00
Shipping of resulting bullion	29.00
Loss in residue	15.00
	$64.55

Since taxes are included with other items on the "treatment" side, a tax charge has to be inserted on the "shipping" side also. In the other instances taxes are omitted from both sides, for the sake of simplicity. Here there is about $1 per ton shown to the advantage of treatment, but if we should write this amount off for redemption of plant the two sides would just about balance. The question of plant redemption will of course vary with the amount of concentrate made per month taken in conjunction with the estimated life of the mine.

COMPARATIVE COSTS OF THE TWO METHODS

Shipping	
Freight and treatment	$30.25
Drying, sacking and sacks	4.00
Assaying and sampling	1.00
Taxes	11.63
Smelter deductions	12.71
	$59.59
Treatment at the Mine	
Grinding (estimated)	$4.00
Cyanide, 90 lb. KCN at 17.5c.	15.75
Treatment (estimated)	0.75
Precipitation of 385 fine oz. at 1c.	3.85
Melting, at 1.2c. per oz.	4.62
Shipment charges, taxes, refining, etc., at 6.6c. per oz	25.41
Loss is residue	4.04
	$58.42

In the foregoing tables, where considerable variations occur in the costs for the same items at different mills, it is due to local circumstances such as distance from railway, mule trail or wagon road, steam or electric power, etc.

CYANIDE CONSUMPTION IMPORTANT

It will be plain from the instances given that the subject of cyaniding concentrate must be studied in reference to each individual case, but some general considerations are here offered which seem likely to have more than a merely local application.

Leaving on one side the first two examples, as not affording much scope for discussion, let us look at the last two. On the side of "treatment" the item that first attracts attention will probably be the consumption of cyanide. Cyaniding of concentrates which yield a really high extraction is, not infrequently, prohibitive commercially on account of the excessive expense of the cyanide used and a substantial reduction of the same would often turn a loss into a profit. Among the several sources of cyanide consumption one only will be considered in detail here, and that is, combination with the silver.

The dissolving of large quantities of silver necessarily means a considerable expenditure of cyanide and this is where gold concentrates have a great advantage over those that carry a large proportion of their assay value in the form of silver. In the case of the latter, when copper and soluble iron salts are inconsiderable, the silver usually constitutes the principal source of cyanide loss.

Whatever theory be assumed for the dissolution of silver sulphide in cyanide solution, the final result is the formation of $KAg(CN)_2$, where silver and the equivalent of potassium cyanide are combined in the proportion of approximately 108 parts by weight of silver to 130 parts of KCN, or 1 troy oz. of silver to 0.082 lb. of KCN. If, then, this combined cyanide could be changed into available cyanide by some such method as precipitation by an alkaline sulphide the value of the cyanide so recovered might have an important bearing on the question of shipping vs. cyaniding. It was with this end in view that I made the following experiments and though no opportunity has as yet presented itself of carrying them out on a working scale, they are here given as suggestions and starting points for other workers.

OXIDIZING IRON REDUCES CONSUMPTION

Taking the case of mill No. 3, with a concentrate assaying in gold $1282 and in silver 436 oz. the cyanide consumption is given as 54 lb. KCN per ton. This figure, however, was not arrived at all at once, the loss at the beginning of the experiments being over 100 lb., 50 lb. of which went to the formation of ferrocyanide. This was remedied by making up the charge with water instead of cyanide solution then making it strongly alkaline with lime and aerating by means of an air lift for 48 hr. before adding cyanide, the result being, presumably, to oxidize the ferrous hydrate to the ferric state, thus rendering it less susceptible to combination with the cyanide. Under the changed conditions the solution showed only traces of ferrocyanide.

After the treatment by this method of a sample assaying in gold $675 and in silver 440 oz., which gave a residue of gold, $6.40 and silver, 3.68 oz., the silver in the solution was precipitated with Na_2S, and the increase in free cyanide determined by titration. The total quantity of cyanide originally locked up in the solution (reduced to pounds per ton of concentrate) was then accounted for thus: KCN combined with gold (by calculation from the equation), 1.5 lb.; KCN actually regenerated by precipitation of the silver with Na_2S, as found by the difference in titration, 38 lb.; KCN combined as KCNS (by analysis), 8 lb.; total combined cyanide, 47.5 pounds.

The actual consumption shown was 53 lb. leaving 5.5 unaccounted for, probably representing oxidation products caused by the aeration. No copper was present and only traces of ferrocyanide.

For the extraction treatment the cyanide strength was maintained at 0.5% KCN, and the dilution at 5:1. No lead compound was added to the charge, and no zinc was present. The solution was not changed during treatment. The time of agitation was 4 days, and the combined extraction 99%. The cyanide theoretically needed for combination with the silver was according to equation, 35.8 lb. That the regeneration as shown by titration is greater than the amount theoretically called for is probably due to a slight over-titration and the multiplication of the error by five in reducing to terms per ton of concentrate.

Taking as a basis the equations,

$$Ag_2S + 4KCN = K_2S + 2KAg(CN)_2$$

$$K_2S + KCN + O + H_2O = KCNS + 2KOH$$

the amount of sulphocyanate theoretically required was 8.8 lb. per ton of concentrate, whereas the amount found by analysis is less than this by 0.8 pound.

Large Loss by Combination With Copper

Turning now to mill No. 4 with a concentrate assay of: Head: gold, $95, silver, 385 oz. Residue: gold, $1.55; silver, 4.18 oz. The cyanide consumption was 90 lb. per ton. The analysis of the solution showed: copper, 0.1%; sulphocyanate, (in terms of KCNS) 0.155%; ferrocyanide, trace.

The actual precipitation of the silver by sulphide was not made on this solution, but the amount theoretically recoverable according to the quantity of silver dissolved works out at 31 lb. per ton of concentrate. The ascertained cyanide losses therefore work out as follows: KCN combined with silver, 31.3 lb.; KCN combined as KCNS, 12.5 lb.; KCN combined with copper, 38.7 lb.; total, 82.5 lb. per ton of concentrate. The copper is calculated on the assumption that half is present as cuprous and the other half as cupric double cyanide. If the copper be assumed to be all in the cuprous state the figure for the combined cyanide would then be 25.8 lb. per ton.

In this instance the cyanide loss from other causes is largely in excess of that due to combination with the silver, so that a regeneration scheme which would recover only the latter cyanide would not show to such advantage here as it would in a case where the silver is the principal source of cyanide loss. Yet even here, when it is remembered that the cost of zinc precipitation is incidentally saved, the method would be well worth considering.

Under circumstances, however, such as those in mill No. 3, where a good profit is already shown on the side of treatment, a recovery of $6 or $7 worth of cyanide would be a welcome addition to the profit, so a few suggestions are given as to how this might be carried out on a working scale.

Regeneration by Precipitating Silver

In order to get a clean silver precipitate it would be necessary that treatment should be conducted with new solution each time so as to avoid the zinc which would be thrown down with it if stock solution were used, the treatment solution, after precipitation being added to the stock in the main plant.

It follows from this that the ratio of solution to concentrate should be as small as possible consistently with a good extraction, so as to avoid appreciably increasing the general stock in the main plant. I have found that with a ratio of 5:1 in the original agitation the maximum extraction can usually be obtained, without any change of wash, provided that the strength of free cyanide is kept up to the necessary point throughout the agitation.

Zinc Would Interfere

The difficulty of having to provide fresh solution for each charge might be overcome by precipitating the gold electrolytically instead of with zinc. In this case the same solution could be used over and over without fouling the precipitate of silver sulphide.

For agitation, an ordinary tank with mechanical stirrer and a small air-lift at the periphery for aerating, will usually be found much more convenient than a Pachuca, especially when the plan is to settle and decant. Not the least trouble is experienced concerning the sticking of the paddles if they are set sufficiently high above the bottom for the granular part of the charge to settle beneath them, the only other precaution necessary being to give a sufficient speed to the paddles so that they will pick up the charge again from the bottom. If these two points are observed devices for raising and lowering the paddles are quite unnecessary.

The most suitable filter would appear to be a horizontal vacuum filter, with sides 6 in. high, and arranged so that it might be tilted almost to the vertical for dumping the washed residue. A square or oblong table filter of this kind about 8x12 ft. would treat 500 lb. of concentrate at each charge, the pulp, solution, and water would be filtered to a finish in each case, and then the table would be tilted, the ledge on the lower side removed, and compressed air allowed to enter under the cake which would slide off towards the dump.

As soon, then, as treatment of the gold and silver is complete, the charge will be settled and decanted, the solution going to a special precipitating tank fitted with mechanical stirring gear. The thickened concentrate charge will then be stirred and sent to the vacuum filter to receive its washes, the original solution being added to that already decanted, and the wash (which might be plant stock solution) being run to the precipitation house of the main plant.

Sodium Sulphide the Precipitant

Returning now to the solution which was decanted from the finished agitation treatment, the agitator in the solution storage is set in motion, and a perforated box or basket hung therein containing commercial sodium sulphide. The solution is tested from time to time in a small flask with lead acetate, and sulphide is added to the tank little by little as it dissolves, until a faint coloration is seen on testing with the lead salt, indicating that soluble sulphide is in slight excess. At this point probably 98% of the silver will have come down; the remainder will not precipitate without a considerable excess of sulphide (varying as the strength of free cyanide present), and it would seem better to leave 1 or 2% of silver in than to be obliged to add lead compounds afterwards to remove the excess of sulphide and render the solution fit for re-use. If addition of sulphide is stopped when only traces of free sulphide are indicated the oxidation of the excess is so rapid that the mere fact of decanting from one tank to another is sufficient to remove all indications of it.

When precipitation has been carried to the desired point the agitator is stopped and the silver allowed to settle, and after decantation of the supernatant liquid, the precipitate is pumped into the cleanup press in the usual way. The product thus obtained is almost pure silver sulphide since copper and gold do not come down and zinc is absent unless dissolved out of the charge. It will be well to wash the cake in the press so as to remove the gold-bearing solution from the silver.

The solution decanted from the silver-precipitating tank is then treated by zinc dust or shavings, or by electrolysis, for the recovery of the gold, and in the first event run to the stock tanks of the main plant, or in the second, used for the next concentrate charge.

REFINING OF SILVER SULPHIDE

The silver sulphide thus obtained might be reduced with litharge in a test furnace and then cupelled, which would probably be the most satisfactory way usually. As an alternative, however, some experiments were made in direct crucible melting, and after a number of trials in assay crucibles with various fluxes, it was found that, on that scale at least, a simple reduction with charcoal was quite feasible, the only essential being to add sufficient fluxes to form a good slag bath for the reaction to take place in. The crucible that gave the best result had the following flux: Precipitate, 50 grams; charcoal, 10 grams; borax, 20 grams; soda, 40 grams; sand, 20 grams.

This may seem expensive, but as there is practically nothing to flux off the slag should not get fouled and could be used over and over again. The silver button from this melt was white and soft with not even a skin of matte on top, but it assayed only 964 fine, with traces of gold due to insufficient washing of the precipitate. The composition of the impurity was not determined, but it may have been only finely divided carbon held mechanically in the metal. It would seem that this method might be developed where cupellation does not commend itself.

The cost of sodium sulphide will vary greatly with the locality of the mine and difference in freight charges, but would be considerably cheaper than cyanide under any circumstances. The quantity necessary would be 0.3 lb. of pure sulphide, or about 0.5 lb. of commercial fused sulphide, to recover 1 lb. of cyanide. It must be remembered in this connection that the cost of zinc precipitation of the silver is saved, which in some plants amounts to 1c. gold per fine ounce of bullion, and which would more than pay the cost of the sulphide.

The process here outlined has been actually carried out by me on batches of 400 lb. of concentrate, with the results described, and would seem worthy of further development. When other cyanicides are not present this would remove the chief source of cyanide loss.

SOURCES OF CYANIDE LOSSES

Other possible losses may be due to: (1) copper; (2) zinc; (3) formation of ferrocyanide; (4) sulphocyanate. In the case of copper there seems little to be done, since it does not precipitate from cyanide solutions with a soluble sulphide. In some cases it might help to give a preliminary treatment with sulphuric or sulphurous acid and thus get rid of most of the soluble copper before cyaniding. Or it is possible that one of the methods involving an acid decomposition of the solution followed by a regeneration of the cyanide might be feasible on such high-grade solutions as we are discussing.

Regarding ferrocyanide, a method proposed in the early days of the Rand, and since put into practice by the Goldfield Consolidated, consists in treating the charge with dilute sulphuric acid previous to cyaniding, to remove the basic ferric sulphate which is a fruitful source of cyanide loss, but when the concentrate is taken direct from the tables without standing in the air in a moist state for oxidation changes to take place, I have seldom found any tendency to a formation of ferrocyanide. In the one instance given, (mill No. 3) the placing of the concentrate without delay in a strongly alkaline water wash, and the giving of a thorough aeration by agitation before adding cyanide, almost entirely removed this source of loss.

The sulphocyanate which is always formed to greater or less extent under these conditions can probably only be decomposed and regenerated by electrolysis, on some such lines as those proposed in the Clancy process. Where zinc is dissolved from the charge the cyanide so expended would be regenerated in the precipitation of the silver, with the production of a proportionately lower-grade silver precipitate.

In regard to the determination of sulphocyanate in solutions resulting from the treatment of concentrates such as those that have been described, the presence of silver and copper interferes to such an extent as to make impossible the methods commonly recommended. I have found, however, that by the simple expedient of agitating with excess of zinc dust to remove either or both of these metals if present, and then filtering, the usual methods when applied to the filtrate will give close checks on "made-up" solutions. To remove the silver an agitation with zinc dust for a few minutes only is needed, but to obtain complete elimination of the copper it is safer to give from ½ to 1 hour.

To find ferrocyanide the only reliable method seems to be that of evaporating with acids, and titration for iron, assuming that all the iron present was combined as ferrocyanide. (See Clennell, Chemistry of Cyanide Solutions.) In conclusion it may be said that if by one means or another the loss of cyanide could be reduced to a reasonable figure, one of the principal obstacles to the profitable cyaniding of concentrate would be removed.

A promising discovery of tin in a formation of quartz porphyry is reported to have been made at Colebrook on the west coast of Tasmania.

Rio Plata Mining Co.

The fourth annual report of the Rio Plata Mining Co., giving the results of operating its properties in the state of Chihuahua, Mexico, for the year ended Nov. 30, 1911, states that four dividends of 2% each were paid to stockholders, amounting in all to $149,554. The earnings for the year were $410,996, the expenses $194,050, the net profit $216,946. The earned surplus at the end of the year was $192,139, after deducting dividends. The total amount of $22,500 was written of for depreciation. Another 2% dividend was paid, Dec. 29, 1911, bringing the total dividends paid to that date to $327,018.

During the year 9452 tons of ore containing 35.7 oz. of silver per ton was mined. The cost of mining was $2.24 per ton. The cost of milling and concentrating 8775 tons of ore and of regrinding and cyaniding 25,831 tons of old tailings was $5.10 per ton. The following are the details of milling operations for the year.

Ore delivered at mill, 8775 tons; average assay, 35.7 oz. silver; total contents, 315,462 oz.; recovered in concentrates, 87,469 oz.; tailings from concentrators, 8693 tons; contents, 227,994 oz.; average assay, 26.2 oz. silver; treated by cyanide, 25,381 tons of tailings; contents, 871,428 oz.; recovered, 759,229 oz.; extraction, 87.2%; total cost per oz. of silver recovered, 17.8 cents.

The property, on account of its remote situation, was not inconvenienced by the revolutionary disturbances, but shortage of labor was experienced. The results of development work were not satisfactory, the work having been in ore too low-grade to mill. For these reasons the reduction works was closed in January, 1912, and work will not be resumed until the rainy season, which begins in July.

By reason of the extent of the low-grade ore, the unprofitable ground encountered during the year, and the unsatisfactory political situation in Mexico, the directors considered it advisable for the company to acquire a mine in the United States. Accordingly a majority of the issued capital stock, amounting in par value to $900,000, of the Trinity Consolidated Hydraulic Mining Co., was purchased.

This new placer property is in Trinity County, California. Its capital stock is $2,000,000, of which $625,000 in shares is on hand in the treasury. The authorized bond issue is $750,000, of which $603,000 in bonds is in the treasury. The Rio Plata company invested the sum of $60,000 in these stocks and bonds and also made a loan of $50,000 at 6% interest for a period of six months on collateral security.

Baltic Method of Mining—I

By Claude T. Rice

The method of mining used at the Baltic copper mine in Michigan was necessitated by conditions peculiar to the Baltic lode in Copper Range Consolidated ground. The system includes mining on a waste filling, built-up dry walls and mill holes, underground sorting, and the mining of level pillars by "caving."

The mines with a comparatively flat dip, in the Lake Superior copper district, generally use an open-stope method of mining, while those of steeper pitch, excepting the Copper Range Consolidated mines, use ore-filled stopes. At the Copper Range properties, however, the Baltic system of mining is used, in which the mill holes and the walls along the levels are made by building a dry wall from the poor rock, and in which the miners rig up in the stopes on a filling of poor rock. This method has been adopted after trying other methods, and experience has shown that along the Baltic lode, in the properties belonging to the Copper Range, waste filling must be used to mine at a profit.

Old Methods Employed First

The Baltic, Trimountain and Champion mines were worked first in a manner somewhat similar to the Atlantic mine nearby. Stulls were placed along the level, the upper end resting against the hanging wall, and the bottom end in the ore, thus allowing a triangular opening sufficient for level purposes. The stopes were filled with ore, on top of which the miners rigged their machines, the excess ore being drawn off through chutes placed between the stulls on the level, at intervals of from 25 to 30 ft. The ore ran to a sollar about 3 ft. high, from which it was shoveled into cars. This method was employed at the Trimountain and the Baltic and was the one first used at the Champion, but it was soon decided that it would be better at the Champion to leave a pillar of ore above the level to protect the drift, rather than to place stulls which were expensive and consumed much time in lowering from surface.

This method was shown to be an improvement over the first one, but there were reasons why any such ore-filled method could not succeed in these mines. To understand this it is necessary to understand also the ore occurrence, which I will describe with some detail.

View Showing Early Winter Conditions at Champion Copper Mine, Michigan

Manner of Occurrence

The Baltic, Trimountain and Champion mines extend along the Baltic lode for a distance of about four miles, with stretches of less promising but little prospected ground between. In this distance the Baltic lode makes a considerable bend to the south, shown by the fact that at the Baltic mine the strike is north 63° east, at the Trimountain, next, south, north 32° east, and at the Champion, next south, north 27° east. At all three properties the dip is approximately 70° northeast.

In some previous descriptions of the Baltic lode the mineralization has been ascribed to the fact that the ore occurs along a shear zone. It is true that there has been some fissuring of the lode parallel to the walls, but shearing has played a less important part than would be inferred from such a statement. In truth, the origin of the lode, in its essentials, seems to be similar to the other amygdaloid lodes of the district, being due to the mineralization of an amygdaloidal flow, more open than others nearby, owing to the shattering that it received during the folding that the flows underwent. I would attribute the manner of cooling as the reason for the localizing of this shattering, as numerous shrinkage veins were apparently developed; it was probably these jointings that made the flow the place of adjustment for the strains that were accumulating in that part of the Keweenawan series during the folding. In other words, the breaking-up of the lode, so as to offer a good channel for the mineralizing solution, was not due so much to a shearing action as to an opening of the flow along lines of weakness, the latter due to shrinkage from sudden cooling.

Ore Occurs in Patches

The ore in the Baltic lode, as in the other mineralized amygdaloids in the district, occurs in large irregular patches with stretches of poorer ground between. That these patches of poor ground should come in along the dip, just as at the surface they come in along the strike of the lode, is to be expected, and this is the history of the district. The Trimountain, after seven years of famine, appears to be entering a more promising ground under a poorer patch. Similar occurrences are not unknown; in the early life of the Quincy mine the lode on the ninth level was so poor that the mine was almost abandoned, and even on the Calumet & Hecla conglomerate, where the ore is more uniform in grade than in the amygdaloids, a great egg-shaped area of poor ground was found in the center of the Calumet & Hecla properties, and for a time was quite discouraging. In short, the ore occurs along the lodes in areas rather than in shoots. The grade of the ore is erratic in the interior of these irregular patches, and on the Baltic lode probably only about 60% of the area of such patches is of mineable grade.

Characteristics of Baltic Lode

A noteworthy difference of the Baltic lode, as developed in Copper Range ground, and as contrasted to other amygdaloids, appears to lie in the large proportion of copper that occurs in good-sized bunches. This coarse copper appears to one going through the different properties of the district, to be larger in proportion to the total copper content of the rock than in other mines where the ore is of similar grade.

The reason for this is, that the Baltic lode is broken more by jointings than are the other amygdaloids. The copper made off from these fractures by eating its way out into the mass of the basalt rather than by hunting for preëxisting cavities, such as vugs and amygdules, or small openings in a rock matrix made porous by alteration. These small cavities in the massive rock were not especially numerous, and there is a large portion of the lode's cross-section that is absolutely barren. Most of the copper can be seen, and underground sorting can be done to advantage, by making the picker follow the rule of throwing into the ore mills, all rock showing copper, even if only a particle. The rock in the Baltic lode shows a pronounced tendency to break along planes parallel to the walls, and it is due to this characteristic that the poor rock breaks into the tabular boulders so admirably adapted to the walling system than is used in protecting the workings. Further, it is because the rock is little altered that it stands so well when built into walls, not shelling off under pressure nor crumbling, as does the poorer rock from the Baltic lode in Superior ground. Probably the width of the ore in the three mines averages about 30 ft., being much wider than the usual amygdaloids, this being due doubtless to the shattering of the mass of the flow. Large pockets of rich ore are found characteristically along the foot of the flow.

Considerable fine copper occurs with the coarse, and the recoveries at the mill show that approximately 15% of the copper yield will pass a 40-mesh screen; by this is meant copper metal and not mineral, the latter being the name for concentrates in this district. This occurrence of fine and coarse copper is so characteristic that larger pieces of lode material, which do not show visible copper, are thrown aside as poor rock for filling. The pockets that are apt to occur along the foot wall, where the walls have been fractured, often greatly increase the width of the ore. The greatest widths of the ore are found where strong cross-fractures have allowed the solutions to penetrate a considerable distance into the walls of the lode, and in places the ore width is 75 ft. These foot-wall pockets are often separated from the main lode by bands of poor rock, and are found in breaking into the walls to obtain necessary filling for the stopes.

THE WEST VEIN

A vein, called locally the West vein, parallels the Baltic lode in the hanging wall at a variable distance of between 50 and 60 ft. in these three mines. This flow in many places is more amygdaloidal than the Baltic, but apparently has not been broken so much. In Baltic and Champion ground it has produced much copper, but apparently only near places where rich areas have been found in the main lode. Such mineralization is due to cross seams cutting the main lode at those points, thus permitting the solutions from the main lode to enter the other amygdaloid, and apparently it is only under such conditions that ore is found in the West vein. The stopes in the wide, rich portions of the main lode are those that are most short of filling, and it is at these points that ore is most likely to be found along the West lode and consequently crosscuts are generally driven to the latter amygdaloid. Since there is a possibility of finding ore at any point in the West vein, the practice, when poor rock from the main lode is insufficient, is to take a shallow slab off the foot in search for a pocket along that wall, and then to crosscut to the West lode.

WEST LODE BARREN AT TRIMOUNTAIN

The mining captains are inclined to believe that the filling which comes from the walls of the lode is paid for by the profits on the copper that is found in this way. In the Trimountain mine no copper has yet been found in the West lode, although the latter has been opened at many points. In that mine, therefore, no crosscutting to the West lode is done in the stopes, but the filling is obtained principally by slabbing off the foot wall, as it is there that unsuspected pockets of ore are most likely to be found. As regards the amount of copper found in the foot-wall pockets, the Baltic resembles the Osceola lode more than any of the others north of Portage Lake. In the Baltic mine there are small stretches of the lode that are much altered, and the walls here are quite weak and break readily when exposed. In general the walls of the stope stand well when not broken into; once broken into, the hanging wall is generally stronger in this respect than the foot wall. The wall rock of the lode drills generally with a redder sludge than the ore does, often beyond a soft wall of such red-drilling ground, pockets of good ore are found in both the foot and the hanging walls of the main lode.

COST OF BREAKING GROUND IN COPPER RANGE SHAFTS

Mine	Baltic				Champion	
Size of shaft	24x10 ft.		18½x10 ft.		20x8 ft.	
	Per Ft.	Per Ton	Per Ft.	Per Ton	Per Ft.	Per Ton
Dritling labor	$11.52	$0.576	$ 9.04	$0.586	$8.41	$0.632
Explosives	2.16	0.108	1.64	0.106	1.22	0.091
Total breaking costs	$13.68	$0.684	$10.68	$0.692	$9.63	$0.724

CHALCOCITE VEINLETS CHARACTERISTIC

The true veinlets of chalcocite, locally called copper ore, that are found along the Baltic lode are a noteworthy feature. Calcite generally occurs with the latter, and in places I measured solid chalcocite 2½ in. wide; it is said that occasionally veinlets of solid chalcocite 5 in. wide, have been found. The veinlets can often be traced for several hundred feet, running true with the vein until cut by some cross fracture; they are often used by the mine captains to find the lode, when the latter has been lost owing to a barren patch. The true significance of this chalcocite has not been shown, but the amount is quite appreciable as shown by the noticeable streaks on the tables at the mills. There seems to be less of it in the Trimountain than in either the Baltic or the Champion mines.

The Baltic lode is broken by cross fractures at many points, and these seem to be of two characters. Some apparently were prior to mineralization, for the ore solution made off along them into the West lode to form pockets; others have displaced the lode 20 to 30 ft. at places. Some other breaks seem to have had little effect in throwing the lode; on one side of them much copper is often found, possibly owing to the lode on that side having been broken more by fracturing, while on the other side there will be noticeably poorer rock. Fingers of good ore occasionally make off for considerable distances into the foot wall, but it seems that the hanging-wall branch, no matter what the relative size of the two at the point of dividing is, is always the real lode. Often in the stretches of poor ground that separates good patches of ore in the interior of the larger areas, it is quite difficult to determine what is really the lode; whenever a chalcocite veinlet can be found, however, all doubt is removed.

The direction of displacement varies greatly, and there is no rule to follow in finding the lode again. If the displacement has occurred in poor ground and there is no chalcocite or calcite veinlets, identification is not an easy matter. The ore in a stope will often make out over a poor stretch on a level, but the fact that poor ground has been found on one level is no reason for supposing that this will be the case on the level below in that part of the mine, for the poor rock generally occurs in patches bearing little relation to one another.

Owing to the fact that the mass of the lode is not badly altered, the ore itself stands much better than the walls. Considerable time is taken up in barring down the back before the miners are able to set up a machine because the copper rivets the ore together and holds the slabs up even when the latter have been cut off by a strong crack. Cross-seams of laumonite and calcite, cutting across the lode, are apparently less common along the Baltic than in the Kearsarge and Osceola lodes; for this reason the ore is less treacherous in the stopes, although none of the copper-country lodes are especially treacherous in this respect. It is generally either the hanging or the foot wall that slabs off. For this reason it is quite common in the Baltic mine to leave a slab of poor ore along the hanging wall to support the arch of ore in the stope. In fractured places along the lode the workings, in this way, can be made more safe than if the walls of the lode itself were exposed.

Difficulties in Stoping With Ore Fillings

The ore-filling method of stoping has proved quite satisfactory for mining lodes of high dip, such as the Isle Royale, Pewabic and Atlantic amygdaloids; in these the mineralization was confined more to the upper and more open part of the lode, the ore does not make off so much into the hanging wall, and the stoping widths are less. It can be easily seen upon consideration, however, that under the conditions found at the Baltic a method of ore-filled stopes was not destined to prove especially satisfactory. In fact the weaknesses of the old system soon became evident.

When the ore was drawn from the stopes after the latter had been carried up to the level pillar above, it became evident that there was still much ore left in the walls, notwithstanding that the pockets had been extracted as far as possible. This was due to the fact that the ore filling had to be carried close to the back in order to protect the walls from any slabbing tendency. Therefore, there was not much of the walls exposed for inspection after a breast of ore was broken down; and it was not until the stopes were being drawn that indications of many pockets appeared. A good many of these pockets along the foot wall were worked out while the ore was being drawn from the stopes, but it was a dangerous task for miners to work in a stope with a large breadth of unsafe hanging wall exposed above them. The walls slabbed off to some extent even when not cut into; once broken by mining out a pocket, this slabbing became more pronounced, rendering the securing of other pockets still more dangerous. It was also impossible to draw the ore from some of the stopes where the hanging wall was especially weak, and it was evident that some support to the walls was necessary. The main reason for abandoning the method of mining on a filling of ore, was that the grade coming from the mine was much lower than it should have been from the appearance of the lode in the different stopes. This was due partly to admixture of wall rock, but mainly because the mass of the lode, which itself was little mineralized, had to be drawn off from the good portions adjacent to the fractures. As a result the mines were soon making scarcely any profit, and a change was forced upon the company.

This change was made first at the Baltic property where F. W. Denton, the present manager of the Copper Range group of mines, was in charge. But even before the Champion and Trimountain mines came under his control, through a consolidation of the three properties, changes had been introduced at those mines also. Mining on a filling of ore in this lode, which was so admirably adapted to underground sorting, was proving disastrous at each property. It was decided to mine out the ore on a filling of waste, as this would also allow the pockets of ore, that made off into the walls, to be mined more safely.

Development of the Waste-filled System

At first the levels were protected with drift sets, and the ore was taken from the stopes through cribbed chutes. These were made in the form of a pig-sty 5 ft. square, from 7-ft. logs, each log being notched slightly on the upper side to receive the next log. These cribs were first placed about 35 ft. apart; when the distances became too great for loading the ore directly into the mill, wheelbarrows with flat platforms carried on handles swung from below the axle were used, in order to allow boulders of ore to be rolled on them easily. Because of the cost of maintaining the cribbed mills, the distance between them was soon increased to 50 ft., and the wheelbarrows were replaced by small cars running on a track.

Mining on a waste filling had not been in practice long when John Jolly, the present underground superintendent of the Copper Range mines, and then one of the under-captains at the Baltic, suggested that dry walls built out of poor rock be used to protect the levels. These stood well, and in the hope of decreasing the cost of maintaining the cribbed mill holes, it was decided finally also to try to build them from the larger pieces of poor rock. Before cribbed mill holes were done away with, their cost at the Baltic mine alone had increased until it was $1200 per month. These dry walls have been used ever since, as it was found that no more labor was required in building them than when the cribs were in use, owing to the great amount of constant repairs on the latter. Several savings were effected, including the cost of the timber, the elimination of the cost of getting the timbers underground, and the consequent decrease in the ore-hoisting capacity of the shaft.

The Baltic System of Mining

The final innovation was the mining of the pillar that formerly had been left in the higher dipping lodes, to protect the level, to support the walls and to hold back the waste that was later dumped into some of the stopes. It was this practice, locally called caving, that Mr. Denton devised, and it was this step which finally made the Baltic method complete. The carrying of the stope on a filling of waste, with dry wall drifts and mill holes, together with underground sorting and the mining of the level pillar by the system called caving, makes the Baltic method distinctive from other waste filling systems. Underground sorting resulted in a better grade of ore hoisted and sent to the mill, and the Baltic soon became one of the lowest cost mines at the Lake.

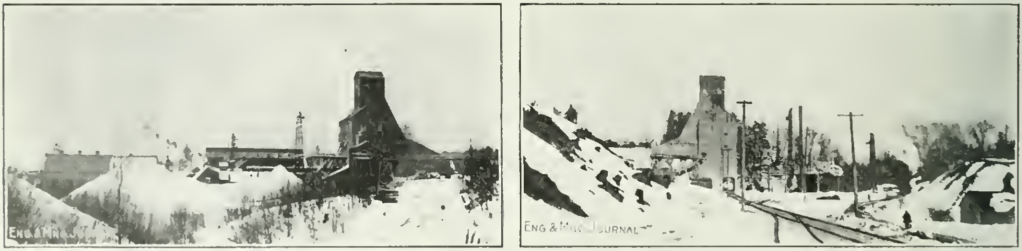
The three mines are opened with shafts sunk at approximately the dip of the lode, but some of them were started with too flat a dip and have gone into the hanging wall. This is true at the Champion and the Trimountain mine. At the Baltic the shafts are in the foot wall or the lode itself. In all cases the shaft is near the vein and at no place more than 30 ft. in either wall. It has not been thought wise to steepen the shaft now in the hanging wall, as other lodes in the district have been found to flatten appreciably with depth, and it might necessitate a second curve at a greater depth, thus possibly affecting the hoisting efficiency.

Arrangements of the Manways

The Champion shafts have their manways at the south end of the shaft; in the Baltic the manway is always placed in the center between the two skip roads, and at the Trimountain some of the shafts have the manway in the center and others at the end. In these steep shafts, dipping at about 70°, it is more convenient to have the manway in the center; it is easier to make repairs and to inspect the rollers, and it is also safer, as in case a skip jumps the track there is little danger of its causing a wreck in the other compartment. To facilitate working, it is important also to place the manway in the center of the steeper shafts; this is not so necessary in the flat shafts where a man can walk up and down.

Most of these shafts have to be sunk through considerable overburden, and one at the Trimountain went through 150 ft. of wet material. This was done by sinking a small one-compartment shaft near the site of the larger one. In cases where the shaft had to go through only a short thickness of overburden, this was done without great trouble by putting down a cribbed shaft much larger than the section of the incline shaft; after this a tight seal was put in at the solid rock, and either a concrete collar, or in still earlier days the cribbing for the regular shaft, was carried up, and dirt was filled in around the timbers as the shaft was raised.

Baltic shafts Nos. 3 and 4 have their manways in the center, 10 ft. wide, so as to give ample room for an auxiliary cage in that compartment, in addition to the pipes and ladderways, in case such procedure becomes desirable when the mine is deeper. In the other Baltic shaft the manway is only 4 ft. wide in the clear. In all the Baltic shafts the skip compartments are 6 ft. wide in the clear, as the skip tracks which are carried on wood stringers imbedded in a continuous stringer of concrete, are put in with standard gage, 4 ft. 8½ in. This makes the larger shaft 24x10 ft. in the clear, and the smaller ones 18½x10 ft. The Trimountain shafts are 20x7 ft., and at the Champion 20x8 ft., inside measurement. Regular shaft sets, carried by hangers from bearer sets, are used only where the ground is bad, and these shaft sets are planed from 12x12-in. timbers, the wall plates consisting of one piece. The stations are carried on 10x16-in. timbers. Where the shaft rock is good, only dividers of 10-in. flat timber are used, carried in hitches both in the foot and hanging. The practice at present at all the shafts, however, is to use concrete wherever the shaft walls are at all bad; the only timber that is now being placed in the shaft are the stringers that carry the rails of the skip roads in the concrete, and the casing planks between the manway and the skip compartment. Consequently the lower parts of the shafts are almost completely fireproof.



Shaft E and Shaft B, Champion Copper Mine, Michigan

Method of Sinking

The shafts have all been sunk by means of buckets and trolleys traveling on an overhead cable It is the practice to anchor the eye-bolt, to which the track cable is fastened, in the drill hole, with a wedge driven into a split in the bottom of the bolt; this is to prevent the eye-bolt from pulling out in case it should bend. At present the shafts are sunk in 200-ft. lifts. After this the concreting and the stringers for the permanent skip tracks are put in. In the shafts where the manway is only about 5 ft. wide, the hoist used in sinking, which in many instances is now an electric-driven, geared hoist instead of the usual air-driven puffer, has to be set up in back of the station of the top level of the lift, the station being enlarged for that purpose. However, in the Baltic shaft with the large manway compartment, the sinking hoist is set up in the manway itself. On nearing the station the bucket skids up a case-way, occupying the upper third of about one-half of the manway compartment. At the top the bucket swings back over the bins occupying the space under the bucket-way and is dumped into it; after this the rock is drawn from time to time, through a door in its side, into the skip and hoisted either to the surface or to the underground, poor-rock dump. This is better than the other method, in which the buckets must be dumped into a car and the rock stored on the level until a skip can be obtained. The shafts are sunk from 45 to 55 ft. per month according to the size of the shaft and the character of the ground. Whether the cut is taken at the end or in the center of the shaft depends partly upon the shape of the bottom and partly upon whether the manway is in the center or at one end of the shaft; it is the practice to try to take the cut or sink under the manway, whenever possible, so that the buckets can set in the sink when the shovelers are mucking out the dirt.

Two 2-man machines are used in the shaft, and the drilling and timbering is done on day shift, the shovelers cleaning out the shaft on night shift In the Trimountain shafts it takes from 30 to 35 holes to square a cut, and about 6½ ft. of advance are made at a square. Four holes are required in the cut row, and also in each of the rows for squaring up the ends of the shaft; in most of the other rows three holes are sufficient to bring the ground. The miners blast each shift and on night shift the shovelers, three or four in number according to the amount of rock broken, send up from 30 to 50 tons, as each shoveler will ordinarily clean up from 12 to 13 tons of rock in a 9-hr. shift. These shafts are dry and there is little water to contend with; what little there is goes up in the bucket with the rock.

Costs

In the Lake copper district it is the custom to keep only the cost of breaking the ground separately under the shaft-sinking account, and so I shall give those figures, which are accurate; but they cover only the actual cost of labor and supplies for breaking the rock in the shaft and do not cover the cost of mucking, hoisting, timbering and other such items. This holds true of all development statements made in company reports from Lake Superior copper mines unless otherwise specified, and the reader should remember this. The total cost of shaft-sinking is about $35 per ft. at these mines for a 20x8-ft. shaft, such as those at the Champion mine, taking in all expenses including the putting in of the concrete skipways. The actual breaking costs are given in an accompanying table.

Two Crosscuts to the Lode

The roof of the shaft would be greatly weakened if the ground at the station were broken out across the whole width of the shaft, especially those of the Baltic having the wide manway compartments; for this reason the practice was adopted at the Baltic of cutting out only in front of the skipways and of driving two crosscuts from the shaft to the lode, leaving a pillar between to help strengthen the roof of the shaft at the level stations. This seems to be good practice and has been adopted also at the Champion mine. The front of this pillar is strengthened with a column of concrete to keep it from shelling off where it overhangs the shaft; in the Champion mine, one of the pillars, all of which are left much narrower than at the Baltic because the manways are at the ends of the shaft, was crumbling away and the whole pillar was taken out and replaced with concrete.

Skips of two sizes are used in the different mines, the larger one holding five tons or two cars, and the smaller one 2½ tons or one car. The policy is to have small skips in the outside shafts and large ones in the central shafts, where most of the ore is hoisted. Where the large skips are used, the hoisting engines are practically all Nordbergs, having a double-cone drum with a diameter at the cylindrical portion of 18 ft. and a small diameter at the conical ends of 12½ feet.

No chairs or gates are used in the shaft, owing to the trouble that comes from their being broken through carelessness in letting the skip down on them. Moreover, it is better for the hoisting rope if the dumping is done with the load on the cable. In the case of the 5-ton skips and owing to the stretch of the cable, this requires that the skip be raised each time, as it would be dangerous to dump the second car with the skip much below the station; rock might be spilled into the shaft during the dumping. This is one of the dangers of dumping cars directly into the skip and is one reason that the manways are covered so carefully with a trap door at each level. In the mines with a flatter dip aprons are used to help in keeping the rock from being spilled during loading, but in some ways these are equally dangerous. A hood arrangement on the skip is being experimented with in models at the Copper Range mine, and it is hoped to develop a method of eliminating this danger.

Distance Between Shafts

The shafts are sunk quite near together because tramming is done almost entirely by hand. This is quite an advantage in the early life of the mine as it allows the property to be opened rapidly, thus enabling the management to see what really is in the ground; however, when it comes time to install the permanent equipment such as rock houses, hoisting equipment, etc., it seems time to abandon some of these shafts, for the surface equipment at a Lake Superior copper mine, taking in the cost of the rock house, boiler house and large, double-cone hoist, is heavy. There is, however, the advantage of the excellent ventilation which prevails through all the mines of this district, except where the latter are over a mile deep on the incline. There is little doubt that this is due mainly to the nearness of the shafts.

The maximum distance between shafts at the Baltic mine is 1170 ft., that being the distance between Nos. 2 and 3 shafts, while No. 4 shaft is only 900 ft. west from No. 3, and No. 5, 855 ft. from No. 4. The distance between C and D and between D and E shafts at the Champion is 1300 ft., and B shaft is about 1050 ft. from C. At the Trimountain the shafts are about 1000 ft. apart, and the policy has been begun of increasing the distance between shafts, as No. 1 shaft has been abandoned.

Electric Haulage

Electric haulage is being tried on three levels of the Baltic. While this is apparently resulting in some decrease in the tramming cost, it is hard for the management to ascertain the exact amount of the saving effected. The great advantage is the fact that a greater distance between shafts is permissible. At the Baltic where the electric haulage is used on the 17th, 18th and 19th levels and the ore is hauled to the two central shafts, the men running the trains work in two pairs, and they go up from one level to another. One man loads from a chute on each side of the shaft. When his cars are loaded a man goes to the station, gets the locomotive, which is always left there when not in use, pulls his train to the station, takes his empties to the mill and brings the motor back to the station again, while the other man is loading the cars of his train. No ore is hauled on night shifts, but instead the ore is allowed to accumulate in the mills on the levels where electric tramming is used. Ten 2½-ton cars are hauled in a train.

At the Quincy electric haulage has shown itself an economy, but at all the mines in the copper country there is the scattered condition of the working faces to contend with. As a result there is a comparatively small tonnage coming from each level at most of the mines. In a way this scattered working of the mine is obligatory in order to keep an even grade of ore going to the mill, for the grade of the ore in a stope is apt to change quite suddenly in a short distance, and the average can only be kept from fluctuating by scattering the machines in the hope of not having them get into low- or high-grade ground at the same time. Further, in order to keep reserves well ahead, in these mines where the grade of the ore is at the best only a shrewd guess, it is necessary to keep much more ground open than in the West, where the ore is in shoots, and the grade can be determined with some assurance. It is almost always necessary to have several machines on development work, and these would probably be scattered over four or five levels, so that it is next to impossible to concentrate the work on a few levels as in western practice.

Track Gage and Cars

The tracks on the motor levels have a gage of 2 ft. and are put in with a little grade, but on the other levels the grade is 3 in. in 100 ft., as the cars are fitted with Peteler axles and bearings and are self-oiling. These cars are long and low, as is characteristic of Lake Superior practice, and have one end open so that they can be raised up at one end, a brace put under them and the boulders rolled in. A rough wall of boulders is piled in at the end to hold back the fine dirt.

The distinctive features of the cars used in the Copper Range mines are the axles, which are fastened tightly to the truck so that a cradle has to be used to dump them, and the narrow gage of 2 ft. The low grade of 3 in. in 100 ft. can be used because of this narrow gage, the fact that the wheel base is only 24 in. and because the wheels are self-oiling. In hand-tramming the men work in pairs. In some shafts regular dumpers, generally three in a crew, but sometimes two, do the dumping, but in those shafts where less ore is being hoisted, the trammers do their own dumping. This tramming is done by the men working in the drifts and cutting out stopes on each level, and the men in the regular stopes do not have to come down to run their dirt.

At the shaft a side track about 60 ft. long, on which the empties can be stored, is put in, while on the electric-haulage levels at the Baltic, a double track is carried through the station and out a considerable distance to each side of the shaft. This extra track is used for the storage of empty cars. Turntables are put in on the track opposite each skipway at the station. These are not equipped with ball bearings, as is the case at some of the other mines, but instead the tables turn on a flat ring that is kept well greased. On the trolley levels the turntables are kept locked, but where hand tramming is used no catch is required to hold them in position.

A bell cord is used for all signaling to the engineer, although practically all the underground stations are equipped with a Carlson-Stromberg telephone, so that in case anything unusual is to be done the engineer can be told through the telephone.

(To be continued)

A Roman Iron Slag

The department of the Yonne, France, is said to be thickly dotted with Gallo-Roman slag piles. A sample from one of these, near the forest of Alliant, said to contain about 300,000 metric tons, ran as follows (*Echo des Mines*, Feb. 15, 1912): Fe, 46.69%; SiO_2, 27.44; Mn, 2.4; CaO, 0.30; S, 0.027; P, 0.072. No trace remains of the workings from which the ores were taken. These slag heaps have a present value as a flux for the limey ores of Lorraine.

Modern Gold Dredge in Georgia

By L. M. Richard*

Interest in the advancement of dredging and the application of modern dredges to the Georgia deposits in the old Dahlonega district is apparent in the completion and operation of a modern California-type dredge on the Chestatee River. This stream, in the past, has played an important part in the history of dredging in Georgia, and has been the scene of various endeavors with the smaller type of dipper dredge. It is reported that the first gold dredge erected in the United States was operated on this river, such names as F. G. Benham, Burch brothers, Captain D. Ingersoll and F. Jacquish being linked inseparably with dredging in this notable stream.

The geologic relationship of the section is not different, in any marked degree, from the general conditions existing in the upper auriferous belt of the Southern Appalachians. The rock formations, for the most part, are made up of schists and gneisses. The orebodies are composed of innumerable quartz stringers, termed by Becker[1] "stringer leads," and are closely allied with the schists. The small quartz seams are, with few exceptions, conformable to the schistose cleavage. It is these veins which have contributed the most gold which is found in the valley floors. The larger and thicker bodies of quartzite material to be found in the south rarely carry sufficient gold for treatment by milling.

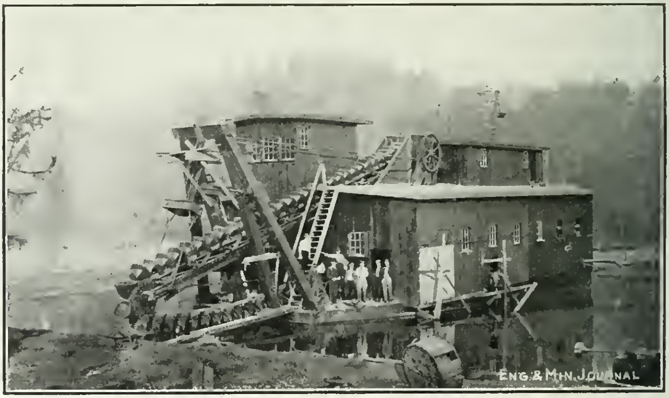
The region through which the Chestatee flows shows evidence of having been subjected for a long time to conditions favoring subaërial rock decay and denudation. The opportunity for deep cutting and further erosion and transportation of the decomposed mantle to the rock floor below is excellent on account of the climate and the excessive precipitation. For many miles the Chestatee cuts through this belt, and with its upper tributaries has been for over 75 years the natural and much used drainage medium for the placers.

Dredge on Chestatee River

About four miles southwest of the town of Dahlonega, Ga., on the Chestatee River, is a Bucyrus dredge, built to design for the Seawell Dredging Co. This is a 3-cu.ft. bucket-elevator, 70-bucket Bucyrus dredge, equipped with hopper, shaking-screen tables, belt conveyor and standard gold-saving tables. The dredge is electrically driven, the total power being 125 hp. The dredge has a maximum yardage capacity of 4000 cu.yd. per 24 hours.

The hull was built on the shore in a pond which was dug for the purpose and filled with water from a nearby stream. It is constructed of the best quality of Georgia pine, selected with care to serve the purpose. The gantries and housings are substantially made and the hull is extremely well braced to take care of all strains. The buckets are made of cast steel, to which are riveted the manganese-steel digging lips and the base for mounting on the chain. The digging ladder is of truss construction, made entirely of steel and well designed. All tumbler bearings are of manganese steel, as well as the bucket pins which have withstood severe usage.

The disintegration is done on two large suspended shaking tables being moved by eccentrics on the same shaft, thus avoiding the use of gears. This mode of disintegrating and separating the fine from the coarse gravel is found to be successful when the wash water is effectively applied. These shaking tables are 5½ ft. wide and have a combined length of 24 ft., with perforated-plate bottoms, the holes running in size from ⅜ to $\frac{7}{16}$ in., excepting the first section, which has bars instead of plate metal spaced ⅝ in. apart, running longitudinally with the screen at the lower end of the last section. These screens are run by a separate motor.



A 3-cu.ft. Bucyrus Dredge on Chestatee River, Georgia

The gold-saving device is fitted with boxes beneath the screens, which are riffle lined. The side riffles are each 32 ft. long and 3 ft. wide, fitted with Hungarian riffles, which have been found exceedingly simple and effective. The material, after passing over these side riffles, follows out into the tail sluice, which is covered with cocoa matting, on which is a covering of expanded metal. This sluice is 25 ft. long.

The tailing stacker carries a Robins belt conveyor 70 ft. long with a 26-in. belt. This is mounted on a truss, composed of I-beams. The belt is driven by a separate motor. The discharged wash gravel varies in size. The screens, swinging which, digging buckets and high- and low-pressure pumps are each separately and independently operated by motors. The electrical energy used on the boat is supplied by the Gainesville Railway & Power Co., from its hydro-electric plant at Newbridge, 4½ miles from the dredge. The initial current leaving the generating station is a three-phase alternating current of 12,000 volts, which is stepped down at the boat to 440 volts. From the transformer house on the shore the energy is taken on the boat by means of flexible weatherproof cables. Considerable line loss is encountered here even with the best of care.

Heavy Clay Overburden

The average yardage being treated per month at the time of my visit in October, 1911, was from 30,000 to 40,000 cu.yd. The capacity was materially cut down on account of a heavy overburden of stiff, red clay, which it was almost impossible to disintegrate and dissolve thoroughly. No disposition is made of the black sand, which amounts to approximately 1% of the total gravel removed. It carries gold ranging from $3 to $6 per ton. Zircon, rutile, ilmenite, monazite, garnet, spinel are some of the heavier materials accompanying the black sands. These are not saved.

Twelve transformers being built by the General Electric Co. are of interest on account of their size (*Elect. Rev.*, Feb. 17, 1912). They each occupy a floor space, 5x11 ft., and are 19 ft. high. They are 60-cycle, 3000-kw., for Δ-connection on a 140,000-volt transmission line; each contains 4000 gal. of oil, and they are to stand a test of 280,000 volts from the high-tension winding to all other parts.

---

*Mining engineer, 1663 Maryland Ave., St. Louis, Mo.

[1] Sixteenth Annual Report, U. S. Geol. Surv., 1895, p. 291.

Zinc Smelting in Kansas and Oklahoma

By A Smelter

An enumeration of the works in operation in the natural-gas fields, with brief descriptions of the equipment of each, and some remarks respecting their metallurgical practice and the subject of fuel supply.

The transition of the zinc smelting industry from the coal fields to the natural-gas fields, during the latter part of the '90's, marked an epoch in that branch of smelting, which up to that time had not taken its position among the other branches of smelting. It is now one of our most important arts in the making of metals.

Formerly zinc was almost universally smelted in the coal fields irrespective of the distance from the ore supplies, the cost of fuel far offsetting that of the cost of the freight on the ore, owing to such large quantities of the former being required. The zinc smelters west of the Mississippi River in many instances were given their coal (slack) free of charge; a small charge only was added to cover the cost of loading, screening, etc., which added to the freight made the cost very low. At this period there was no large demand for this class of fuel, and many coal companies were glad to offer inducements to smelteries, simply to get rid of it. With the introduction of machinery to handle this character of fuel for firing, etc. in large steam plants, it became to these coal companies a source of much revenue, rather than a loss.

The discovery of natural gas in Kansas came as a welcome source of the best fuel to be had for the heating of zinc furnaces, and it had the fine advantage of being near to both the zinc-ore fields of Missouri and the coal fields of southeastern Kansas where existed the large beds of the "dead" coal so necessary as reduction material in the smelting of zinc ores. The first smelters to take advantage of this cheap, and to them, new fuel, were some of the Lanyons, who built works at Iola that were subsequently taken over by the Lanyon Zinc Co.

Gas leases could then be obtained at Iola, for 10c. per acre a year and $100 per producing well. These first wells "came in" with an average of 8,000,000 cu.ft. per 24 hours, and with an average rock-pressure of 350 lb. Being inexperienced with this fuel and not realizing the shortness of its life the smelters did not take any steps to conserve the supply.

General Practice

Between 1897 and 1903 the following concerns operated in the Iola field: Lanyon Zinc Co., two plants; United Zinc & Chemical Co.; Prime Western Spelters Co.; and Cockerill Zinc Co. In speaking of the Iola field, or district, it is to be understood that this takes in not only Iola but also Gas City, East Iola and La Harpe. The furnaces erected were all of the Belgian type, Iola style, this being a long furnace, of three or four rows of retorts in height, with forced draft, the gas and air being introduced through the front of the furnace.

About this time the Lanyon Zinc Co. became involved in a suit with the patentees of the Brown roasting furnace, which suit lasted many months and was finally decided adversely to the Lanyon company, which then adopted the Zellweger furnace, now in general use by all the western zinc smelters, the Edgar Zinc Co. excepted, which continues to use the Brown furnace whereof it holds patent rights. Retorts were made by the auger machine and condensers by hand. The ores smelted were the soft Missouri sulphides and silicates, except that the United Zinc & Chemical Co. was even then using largely of western ore, making sulphuric acid as well as spelter. These works continued in constant operation during the years mentioned and were discontinued only when the gas supply began to fail.

The Cherryvale Works

S. C. Edgar, of the Glendale Zinc Co., operating zinc smelteries at St. Louis, Mo. for 28 years, realizing the immense advantages of natural gas, entered the field at Cherryvale, Kan., where today his company, the Edgar Zinc Co. has one of the best equipped zinc works in this country. This company has about 25,000 acres of gas lands and leases in a territory relatively free from competition. Mr. Edgar employed the late John C. Dods to erect his works, embodying many ideas gained during his long experience, these works now comprising 4800 retorts. Double circular Brown furnaces are employed for roasting. At this period it was generally believed that natural gas could not be used in a zinc furnace in any way but with forced draft (although natural-draft furnaces had previously been used in Indiana). After some experimentation Mr. Dods evolved a furnace that could be fired with gas at 4 oz. pressure and with natural draft. This furnace was not only economical of fuel but also yielded a higher percentage of metal extraction than any furnace previously erected in the gas fields. The Edgar furnaces are strongly built, having perhaps twice the material of the ordinary distillation furnace, and some of them have been fired for as long as five years without "dead-firing" for repairs. Being constructed with high combustion chambers and being otherwise arranged differently than the usual practice, coal or any other fuel may be used in the future without any change in the form of the furnace.

The Edgar furnaces are 5 rows high and 20 rows long, thus making 100 retorts per side, or 200 per furnace. They are built in these small units to enable them to be "dead-fired" at any time or to be repaired without shutting off a great number of retorts. Each building contains three of these furnaces having 200 retorts to a furnace, making 600 retorts to a building and there being eight such buildings in the plant, there is a total of 4800 retorts. The furnaces are separated from each other by about 14 ft. from end to end and all piping, etc. is independent for each furnace. Spelter is drawn by an original design of "draw-car" and "shield" combined, which is passed along the front of the furnace by means of a sprocket-gear attachment The ladle is of a capacity of about 350 lb. and when drawn full is moved along the front of the furnace to the end, where at right angles to the ladle track, the molds stand waiting on a movable track. One man does all the work of drawing and pouring and the great amount of exertion that used to attend this operation is eliminated.

The retorts are blown out by means of water as is now the usual western practice and the old residues are dropped into the cellar through the ash hole in front of furnace, being removed from the cellar in the usual manner.

Oil Used in Roasting Furnaces

The Edgar Zinc Co. is experimenting with oil as fuel and no doubt remains that when the gas is exhausted this plant will be operated by oil. The roasting furnaces are all of the Brown circular type, except that one now in construction is of the straight-line type, 270 ft. long and 14 ft. hearth wide, inside. The new furnace is connected with a 120-ft. Weiderholt reinforced tile chimney. All of the roasting furnaces are fired with oil, which has been found to effect a saving over gas, as all machine kilns for roasting zinc ores are large consumers of gas, using indeed more than the distillation furnaces. The results obtained as to sulphur driven off are better with oil than with gas, the oil seeming to give a more favorable heat. Less than 0.5% S is returned by these kilns from ores carrying an average of 4% S. By conserving the gas for use with the distillation furnaces only this company has assured itself of a long supply from its extensive holdings.

Mr. Edgar introduced into these works the first mechanical mixing house used in this industry in the United States. In this house all the charge is mixed the day before using, each furnace having its own bin wherein charge of any kind different from the others may be mixed without interfering with the other furnaces in the least. All of the material used is passed over scales and a very close record is kept of this work. A large concrete building houses all of the coal-grinding machinery, replacing the former building that was of wood construction, lately destroyed by fire. All bins in this building are of concrete.

The pottery contains a hydraulic retort press with a capacity of 250 retorts per day and pug mill of the same make as mill. The condenser building is separate from the pottery building proper and contains a Garrison-Whipple condenser machine, with the kilns adjacent to the building. All of the retort tempering kilns are situated between the distillation furnaces.

The entire plant is equipped with the Hunt system of trackage and cars, carts and mules being used for work only where track is not available. The ores smelted are Missouri sulphides and silicates, together with some high-grade Mexican carbonates.

Three Plants at Bartlesville

After the gas at Iola was exhausted for all practical purposes, the industry that had flourished there removed south into the vast gas fields of Oklahoma, the first plants being erected at Bartlesville, where are now the plants of the Bartlesville Zinc Co., two in number, and the plant of the National Zinc Co., a Beer-Sondheimer interest. The Bartlesville Zinc Co. has one plant containing 5184 retorts and the other 3456. These smelteries have Iola distillation furnaces, and Zellweger roasting furnaces. The pottery is equipped with a Mehler hydraulic retort press and the condensers are made by hand and also to some extent with the Vannata condenser machine. The ores mostly smelted are western with some Mexican carbonates and silicates. Gas is used for fuel in all departments.

The National Zinc Co. has Iola furnaces comprising 4256 retorts and Zellweger kilns. The pottery has an auger machine for making retorts; condensers are made by hand. This company has a very complete system of tempering the clay used in the manufacture of retorts and condensers by means of brick cells heated with steam which is a departure from the old way of letting the clay temper or "weather" in the open air. All power is electric, even to the cars used to transport materials in the yard, and is generated on the premises.

The three plants at Bartlesville obtain their supply of gas from the "Hogshooter" district, a wonderful field about 10 miles southeast of the town, which has produced more gas per acre than any other known territory. All own their own wells and have many thousand acres under lease in this district.

Dearing and Caney

Returning to Kansas we find at Dearing and Caney the two plants of the American Zinc, Lead & Smelting Co., the former having 3840 retorts and the latter 3648. The distillation furnaces are of the Iola construction; Zellweger kilns are used for roasting. The potteries are provided with a double hydraulic press, the invention of C. A. Wettengell, the mechanical engineer of this company, which is a great success, having two plungers instead of the usual one, thus being much faster than the Mehler machine. At Caney they have a Garrison-Whipple condenser mill in the condenser building. This company obtains almost all its ores (blende) from its mines at Carterville, Mo., unless the market justifies purchasing. It has a large gas field to draw from and is using the natural flow of the wells without the help of any pumps or compressors. Both plants are in full operation.

Altoona-Granby-Chanute

To the north of Dearing, about 18 miles, is the plant of the Altoona Zinc Co., an old Cockerill plant, but operated until the first of 1912 by the Beer-Sondheimer interest, now being operated by the bondholders that took over the Cockerill interests after the failure of the Cockerill Zinc Co. and organized as the Kansas Zinc Co. This plant smelts Mexican ores exclusively, having a bonded warehouse for that purpose, all ores being shipped in bond. Gas for fuel is supplied by the Portland Pipe Line Co. The pottery is equipped with an auger machine for the manufacture of retorts; condensers are made by hand. The roasting is done by Zellweger furnaces. The distillation furnaces are of the Iola style and comprise 3840 retorts.

The Granby Mining & Smelting Co. has a plant at Neodesha, Kan. of 3840 retorts, furnaces of Iola construction, Zellweger kilns for roasting. The pottery is equipped with a Garrison-Whipple condenser machine.

This company owns in fee and leases much valuable gas land and is constantly bringing in new wells. It also owns the largest amount of ore producing land of any one company or individual in the southwest Missouri zinc district. This company makes a specialty of high-grade spelter produced from silicate ore of high grade, free from lead. East of Neodesha, about 15 miles, at the town of Chanute, Kan. is the plant of the Chanute Zinc Co., consisting of 1280 retorts in furnaces on the style of the Edgar Zinc Co. Each furnace has 160 retorts, four rows high. The pottery is equipped with an auger machine for the manufacture of retorts; condensers are made by hand. The roasting furnaces are a modification of the Ropp, a form that was in considerable use before the Zellweger was introduced. This company owns its own gas, supplying other consumers in the vicinity, and smelts Missouri ore only.

Two Plants at Collinsville

At Collinsville, Okla., south of Bartlesville, there are two plants. The Tulsa Fuel & Manufacturing Co. has Iola furnaces comprising 3320 retorts, and Zellweger kilns. The pottery has an auger machine for manufacturing retorts. The condensers are made by hand and also by the Vannata machine. The Collinsville Zinc Co., as it is locally known, is a plant belonging to the same interests that own the Bartlesville Nos. 1 and 2 works and was constructed from one of the old Iola plants. It has 3200 retorts, Iola furnaces and Zellweger kilns. It is noteworthy for having in use the first Mehler hydraulic retort press imported to this country. This machine is in good shape even at this late date. The condenser building is equipped with a Garrison-Whipple condenser machine. All power is electrical, individual motors being used throughout the plant. The two plants at Collinsville get their gas from a field that has a large volume and a very high rock pressure. The ores smelted are mostly western; some Missouri ore is used, but not to any great extent.

Some General Remarks

All of the smelteries that I have described are in what is known as the "Mid-continent Oil and Gas Territory" and while much has been said and written regarding the diminishing gas supply of this territory I think that it will be many years before the supply is exhausted to such an extent that none will be available for smelting ore. It must be borne in mind that all of the smelteries are still using the natural flow of gas, conveying it through miles of pipe line, and they are not using pumps or compressors, except in one or two cases. Many wells that were drilled for oil have "come in" with gas and the persons owning them are very anxious for a market. The large companies supplying natural gas for domestic purposes are gradually withdrawing from the important centers owing to the many difficulties that it seems impossible to overcome in the transmission of this gas. All of the large fields, although drawn on heavily at the present writing, will furnish gas for many years to come, I think, if it be consumed only at home. Contrary to the general opinion, it does not take an immense quantity of gas to operate a zinc smeltery; not nearly as much as to operate a brickyard or a cement works. At the present time all of the plants that I have mentioned are in operation to their fullest capacity and many of them expanding. Regarded from all angles, no region is more advantageous for zinc smelting than this one, which has the grandest and cheapest fuel that is known, coal for reduction material at the very doors of the several works, and ability to export spelter via Galveston to Europe more cheaply than it can be shipped to New York by rail. The towns are pleasant to live in, having all the advantages of churches, schools and social intercourse. Labor is efficient and the men work steadily.

The smelteries are all in charge of men that have been "born" in the business. The zinc industry is of such a character that it seems that a man must have been associated most intimately with it in order to be successful as an operator.

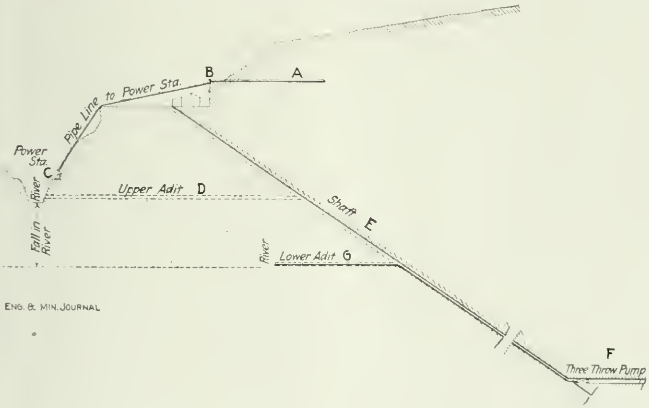
We hear of our wasteful methods as compared with European practice, but a trip through any of our works will disclose that we do not do so badly as supposed. Each has solved in his own way problems peculiar to his own case. While in all other metal smelting there is to a certain extent a universal practice or method, the zinc smelting industry is peculiarly an art and science of its own.

Pumping Plant at a Brazilian Gold Mine

A hydro-electric pumping plant has recently been installed by the Sandycroft Foundry Co., of Chester, England, at a Brazilian gold mine. The system is shown schematically in the accompanying illustration.

The collar of the incline *E*, is on the side of a hill, below which is a river. From the incline two adits, *D* and *G*, are driven to different points in the course of the stream.

Water is led to the power station at *C* from a small stream through a duct and pipe line, *A* and *B*, the tail water from the station being discharged into the river below. The power is brought into the shaft through the upper adit, *D*, and is thence conducted down the shaft, *E*, to the three-throw electric pump *F*. This pump draws the water from the level and pumps it to the lower adit *G*, through which it runs to the river.



PROFILE OF A HYDRO-ELECTRIC MINE PUMP INSTALLATION

The water delivered to the power station is under a head of 200 ft. and 282 cu.ft. per min. is discharged from the 16-in. pipe line. A double-vortex, inward-flow Gilkes turbine in the power house develops 80 b.hp. at 1000 r.p.m. and drives a three-phase generator, rated at 68 k.v.a., 500 v. and 50 cycles. An exciter giving 100 v. is also driven by belt from the turbine shaft. Each phase of the current is carried by a bare copper conductor hung in leather suspenders from porcelain insulators along the adit *D*, to a junction box from which point a 3-core insulated cable passes down the shaft to the pump.

The pump motor is a 50-b.hp. Sandycroft-Hunt "cascade"-type, having no slip-rings, rubbing contacts or brush gear. The motor drives a three-throw plunger pump mounted on the same bedplate, each plunger being 7 in. diameter and 12-in. stroke, running single acting at the rate of 53 s.p.m. The pump has a capacity of 250 gal. per min. against 450-ft. head, the efficiency being 75 to 80 per cent.

Ankylostomiasis in Cornwall

LONDON CORRESPONDENCE

Dr. E. A. Boycott, lecturer in pathology at Guy's Hospital, London, in giving evidence before the Royal Commission on Metalliferous Mines and Quarries, said that in 1902, every miner in Dolcoath suffered more or less from the disease. In 1903-04, the rate of infection was about the same, showing that the curative measures adopted were not as effective as anticipated. At this period there were very few men incapacitated.

In April, 1908, a special examination was made to discover how far the sanitary conditions introduced in 1904 had been successful. Eighty-nine persons were examined, mostly boys, and 76% were found infected, showing that there was still a danger from infection. In June, 1911, 62 miners were examined, and only 43, or 69%, gave positive results, showing a perceptible and beneficent decrease.

Further tests were made as to the time each affected miner worked, and the result may be tabulated as follows: Of 11 persons who worked less than one year, only four, or 36% were infected; in the case of 22 who had worked from one to three years, 19, or 86%, were infected; in the case of 17 examined, who had worked from four to six years, 13, or 76%, were infected; while in the case of 12, who had worked more than six years, 7, or 58%, were infected. It was hoped that the disease, after the precautionary measures which were adopted in 1904, would have shown a greater decrease; still, the results must not be regarded as disappointing.

At the Basset mines, 63 miners were examined, and 51% were infected; Botallack, 12%; South Crofty, 11; Trenwith, 8; Dolcoath, 69%. There was no evidence given to show that there had been an increase during the 10 years. The miners may carry the disease from one mine to another, as a miner may leave one mine and work in another without a medical examination.

Umber and sienna consist of silicates of iron and aluminum, containing varying proportions of manganic oxide. Zinc-lead is a white pigment (*Bull.* U. S. Geol. Survey) consisting apparently of a molecular combination of zinc oxide and lead sulphate, with small proportions of lead oxide, lead carbonate and zinc sulphate. It is prepared by sublimation from low-grade zinc-lead ore. The pigment is fine, amorphous and uniform in the size of its particles.

Effects of Mine Atmosphere on Miners

By W. Hanauer

Several years ago tests were carried out at the Institute of Hygiene in Breslau by Professor Reichenbach and Doctor Heymann to determine whether miners become acclimated to the unfavorable conditions in the mines. For this purpose measurements were taken of the body temperatures and the pulse of workers in the coal mines in the Saar district and upper Silesia, and of outside workers for comparison.

The air temperatures in the working places in the mines ranged from 57° to 75° F., the humidity in one case was found to be only 85%, but in all other cases above 90%. A great difference in the air current was found to exist between the galleries with column-supported and truss-supported roofs. In the former no measurable, and at the most only a noticeable movement of the air could be felt, although the air passages were large; in the latter an active ventilation was noticed. The miners' temperature was found to be 97.7° F. when they were resting above ground, and always over 98.6° F. in the mines.

Less Temperature Rise in Acclimated Miners

The high humidity was the determining influence, apart from which the temperature changes remained entirely without influence. The pulse rate varied considerably and gave no results of value. A continued high temperature was proved in all these mines where it was to be expected. An acclimatization to the mine conditions appears to obtain to this extent, that the body temperature does not increase so much as with unacclimated persons.

The effect of becoming accustomed to the results of continued high temperature is peculiar. Subjective sicknesses did not appear at all, and the capacity for work was not lowered; also objective illnesses could not be recognized. In spite of this it looks as if its continued influence finally has an unfavorable effect, for the total incapacity of the workers in the coal mines, where the humidity is greater than in other mines, begins at 45, nine years earlier than with other miners.

After Reichenbach and Heymann had shown by these tests that intense bodily activity in hot rooms favored the appearance of continued high temperatures, if the air at the same time was moist, and was not in motion, Doctors Liefermann and Klostermann of Halle made similar tests in the Burbach, Sollstadt, and Thiederhall salt mines, at the suggestion of the Halle mining commission. Detailed tests showed that the air in the workings was not particularly impure. The temperature varied between 70° and 84° F., and there was no measurable movement of the air. The humidity was low, varying from 40 to 50%. Measurements of the temperatures of 49 miners, between the ages of 20 and 40 showed that, in comparison with the conditions above ground, the average increase in temperature was 0.45° F. in the Burbach mine, and 0.72° F. in the Thiederhall. Although there was no movement of the air the increase in the body temperatures was small, apparently because of the low humidity. The dry hot air of the salt mines worked against the formation of a continued high humidity. No reasons were found for any unfavorable influence of these increases of temperature, or of the salt mine conditions at all, on the health of the miners.

Temperature in Deep Potash Mines

Recently tests were made, at the invitation of the Clausthal mining commission, in the deep potash mines in regard to the influence on the miners by Doctor Rosenthal of Göttingen. In the province of Hanover potash beds have been opened at a depth so great that temperatures have been reached not previously observed in Germany. The problem was to ascertain whether troubles were to be feared for the miners, and if so, how they could be provided against. Tests were made in four mines. In one, where the main level was 2985 ft. below the surface, temperatures from 84° to 86° F. were found. The humidity which was 80% above ground, ranged from 27 to 43%. High temperatures and great dryness of the air are characteristic of all the potash mines. At the working places further increases of 1.8° to 3.6° F. were found in the air temperatures, which Doctor Rosenthal thinks are due to the miners themselves, their lamps, and the splitting and cracking of the salt. A rapid movement of the air in the workings is favorable for the men, as it lowers the heat of their bodies by evaporation of the perspiration. In the main level, however, it feels cold, and may easily lead to health troubles. Measurements of the temperature, pulse, and respiration were made on the miners, Doctor Rosenthal, and his companions. In only single cases was the temperature as high as 100.4° F., and in general, extremely small differences were found from normal conditions. From the observations of the physicians of the miners' union no sicknesses arose through troubles of the heat regulations.

As the temperature of the workings is almost that of the mens' bodies, in some cases even more, the giving out of heat is equalized through radiation and conduction. On the other hand evaporation from the men's bodies is greatly increased by dry air, its movement, and the fact that it has free play on the unclothed upper part of their bodies. Free perspiration is helped by more than sufficient drinking. Alcoholic liquors cannot be carried into the mines, but weak coffee is furnished, partly free and partly at a low price, and is taken in large quantities. Doctor Rosenthal mentions that those who have been in the mines the longest drink the least.

The author of this article does not think it right that a temperature of 86° F. should be the only factor considered in fixing the working time in the mines at only six hours, the degree of humidity should also be taken into consideration. If potash beds at a greater depth than 3000 ft. come to be worked, which is by no means impossible, temperatures of 104° F. will probably be reached. In this case consideration should be given not only to a further shortening of the working time, but also to specially rapid movements of the air, and also cooling of the air through the installation of cooling machines at the bottom of the mine.

---

*Translated by G. B. Waterhouse from an article in Oest. Zeit. f. B. u. H.

California Oil Dividends

Including the preferred stock of Mexican Petroleum, Ltd., $825,842 was the amount paid by California oil companies as dividends during the month of March, says the San Francisco *Chronicle*. The dividend of $100,000 paid by the Amalgamated was an extra payment at the rate of $2 per share. Oil dividends of nearly a million in one month do not look as if the oil industry were in such bad condition after all. The following is the table:

Amalgamated	$2.00	$100,000
*Buick	0.04	127,254
Caribou	0.025	8,070
Central	0.015	15,400
Claremont	0.015	7,500
Columbia	0.01	9,992
Fullerton	0.05	30,000
Home	0.10	7,500
Homestake	0.01	1,000
*Mount Diablo	0.015	7,500
Monte Cristo	0.025	12,500
New Pennsylvania	0.005	2,500
Paraffine	0.01	3,000
Record	0.01	10,000
Rice Ranch	0.015	4,500
San Francisco-McKittrick	0.10	5,000
Sauer Dough	0.02	7,500
Section Twenty-five	0.25	10,000
Silver Tip	0.05	15,000
*State Consolidated	0.01	5,000
Traders	0.006	9,000
Union Oil	0.006	183,387
Union Provident	0.006	90,788
United Petroleum	0.006	48,451
Western Union	0.01	10,000
W. K.	0.03	15,000
Total California companies		$745,842
Mexican Pet., Ltd., pfd.	0.008	80,000
Total		$825,842

*Unlisted

There are other closely held dividend-paying stocks, which do not make their disbursements public.

Mining and Metallurgical Patents

A Classified List of New Inventions

A copy of the specification of any of these patents issued by the United States Patent Office will be mailed by "The Engineering and Mining Journal" upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COPPER

LEACHING—Process of Treating Copper Ores. Rudolf Gahl, Morenci, Ariz. (U. S. No. 1,021,768; Apr. 2, 1912.)

LEACHING—Process of Treating Ores. Rudolf Gahl, Morenci, Ariz. (U. S. No. 1,021,769; Apr. 2, 1912.)

PYRITIC SMELTING — Process of Smelting Sulphide Ores. August Haggenmiller, Tarica, Peru. (U. S. No. 1,021,096; Mar. 26, 1912.)

ROASTING—Improvements in or Relating to the Chloridizing Roasting of Ores. Helsingborgs Koppar Verks Aktiebolag, Helsingborg, Sweden. (Brit. No. 16,957 of 1911.)

GOLD AND SILVER

AMALGAMATING FLUME TABLE. Earl H. Tate, Los Angeles, Calif. (U. S. No. 1,021,277; Mar. 26, 1912.)

AMALGAMATION—Gold and Quicksilver Saving Apparatus. Louis Sachse, Los Angeles, Calif. (U. S. No. 1,022,110; Apr. 2, 1912.)

CYANIDES—Process of Producing Cyanides and Cyanamides. Carl Bosch and Alwin Mittasch, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany, a Corporation (U. S. No. 1,022,351; Apr. 2, 1912.)

CYANIDING—Leaching Solution for Extracting Metals from Ores. Jose Baxeres de Alzugaray, New York, N. Y., assignor to International Metallurgical Co., New York, N. Y. (U. S. No. 1,018,955; Feb. 27, 1912.)

CYANIDING—Apparatus for the Treatment of Ore. John Gross and Louis Cohen, Denver, Colo. (U. S. No. 1,021,248; Mar. 26, 1912.)

DREDGING — Spud-Operating Mechanism for Dredgers. John A. Johnson, Black Diamond, Calif. (U. S. No. 1,021,933; Apr. 2, 1912.)

PULP AGITATOR. Charles Claudius Hafer, Phoenix, Ariz. (U. S. No. 1,020,694; Mar. 19, 1912.)

IRON AND STEEL

BLAST-FURNACE CHARGING APPARATUS. Julian Kennedy, Pittsburg, Penn. (U. S. No. 1,021,534; Mar. 26, 1912.)

FERROMETALS—Process of Smelting Ores and Apparatus Therefor. Richard Fleming, Westfield, N. J. (U. S. No. 1,020,546; Mar. 19, 1912.)

PURIFYING—A Process of Purifying Iron and Steel. B. L. B. dit Reyer, Paris, France. (Brit. No. 6301 of 1911.)

LEAD, ZINC AND OTHER METALS

BORON—Method of Making Boron and Boron Alloys. Ezechiel Weinstraub, Lynn, Mass., assignor to General Electric Co. (U. S. No. 1,019,569; Mar. 5, 1912.)

LEAD and Method of Purifying and Improving the Same. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,020,514; Mar. 19, 1912.)

NICKEL and Method of Purifying and Improving the Same. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,020,513; Mar. 19, 1912.)

TIN and Method of Purifying and Improving the Same. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,020,515; Mar. 19, 1912.)

TITANIUM ALLOYS. A. J. Rossi, Niagara Falls, N. Y., assignor to Titanium Alloy Manufacturing Co., New York. (U. S. Nos. 1,019,526; 1,019,527, and 1,019,530; Mar. 5, 1912—U. S. Nos. 1,020,516 and 1,020,517; Mar. 19, 1912—U. S. Nos. 1,022,526; 1,022,595; 1,022,597; 1,022,598; 1,022,599; 1,022,600; 1,022,799; Apr. 9, 1912.)

ZINC and Method of Purifying and Improving the Same. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,020,512; Mar. 19, 1912.)

ZINC—Improvements in or Relating to Zinc Distillation. J. C. Moulden and H. W. Webster, Seaton Carew, Durham, Eng. (Brit. No. 5196 of 1911.)

MINING—GENERAL

BLASTING—Safety Fuse. Irvin E. Barricklow, Antioch, Calif. (U. S. No. 1,020,249; Mar. 12, 1912.)

BORE HOLES—Means for Straightening or Altering the Direction or Course of a Bore Hole. Frank George Seineke, Johannesburg, Transvaal. (U. S. No. 1,022,705; Apr. 9, 1912.)

CHUTE—Mining Apparatus. Elmo Finley Kellum, Don Luis, Ariz. (U. S. No. 1,020,649; Mar. 19, 1912.)

DRILL—Rock Drill. Charles H. Locher, Glasgow, Va. (U. S. No. 1,018,834; Feb. 27, 1912.)

DRILL FORGING AND SHARPENING MACHINE. Carl O. Borkman, Victor, Colo. (U. S. No. 1,022,925; Apr. 9, 1912.)

DRILLING—Drill-Hole Cleaning Attachment for Hammer Drills. Daniel S. Waugh, Denver, Colo., assignor to the Denver Rock Drill & Machinery Co., Denver, Colo. (U. S. No. 13,403; Apr. 9, 1912.)

DRILLS—Improvements Relating to Holders for Mining, Boring and Other Drills. R. Thomas and Owen Lewis, Clydach, near Swansea, Wales. (Brit. No. 2505 of 1911.)

DRILLS—Rotating and Feeding Mechanism for Drill Bars. Lester C. Hardsocg, Ottumwa, Iowa, assignor to Hardsocg Manufacturing Co., Ottumwa, Iowa. (U. S. No. 1,020,903; Mar. 19, 1912.)

FLUME—Metal Flume. Andrew J. Wiley, Boise, Idaho. (U. S. No. 1,019,870 and 1,019,871; Mar. 12, 1912.)

GAS—Mine-Protection System for Collecting and Removing Gas. James McGavin, Chicago, Ill. (U. S. No. 1,021,370; Mar. 26, 1912.)

HOISTING—Safety Apparatus for Supporting Mine Cages or the Like. Charles Dickie, Frederick Lambert and Richard Stables, Kimberley, South Africa. (U. S. No. 1,020,483; Mar. 19, 1912.)

LAMP—Miner's Lamp. Harry Becker, Baltimore, Md. (U. S. No. 1,019,748; Mar. 12, 1912.)

MINER'S CANDLESTICK. Antonio Viera, Ray, Ariz. (U. S. No. 1,020,332; Mar. 12, 1912.)

PROP for Mines. Otto Grünewald and Max Gorich, Ehrenfeld, near Cologne, Germany. (U. S. No. 1,021,249; Mar. 26, 1912.)

SHAFT LINING—Improvements in or Relating to the Construction of Shaft Lining. W. Breil, Essen-Ruhr, Germany. (Brit. No. 7100 of 1911.)

SIGNALING—Mine Signaling Device. John Rule, Jackson, Calif. (U. S. No. 1,023,040; Apr. 9, 1912.)

TUNNELING—Form for Tunnel Work. Edward G. Williams and Elmer H. Brown, Washington, D. C. (U. S. No. 1,017,029; Feb. 13, 1912.)

ORE DRESSING—GENERAL

CONCENTRATORS—Head Motion for Ore Concentrators. John F. Isbell, Salt Lake City, Utah, assignor to Galligher Machinery Co., Salt Lake City, Utah. (U. S. No. 1,019,650; Mar. 5, 1912.)

CRUSHING and Separating Fine Materials. Thomas A. Edison, Llewellyn Park, West Orange, N. J. (U. S. No. 13,382, reissue; Mar. 12, 1912.)

CRUSHING—Improvements in Stone-Breaking, Ore-Crushing and Other Like Machines. W. H. Baxter, Leeds, Eng. (Brit. No. 28,566 of 1911.)

ELECTROSTATIC SEPARATION — Process of Electrostatic Separation. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. (U. S. No. 1,020,063; Mar. 12, 1912.)

FLOTATION PROCESS—Art of Concentration of Mineral Substances. James M. Hyde, Basin, Mont. (U. S. No. 1,022,085; Apr. 2, 1912.)

PULVERIZING MILL. Walter A. Galland, Denver, Colo., assignor to John H. Elspass, Denver, Colo. (U. S. No. 1,021,981; Apr. 2, 1912.)

SLUDGE TABLE. O. W. Dunham, Joplin, Mo., assignor, by mesne assignments, to Braeckel Concentrator Co., Joplin, Mo. (U. S. No. 1,023,009; Apr. 9, 1912.)

METALLURGY—GENERAL

CHARGING — Mechanical Charging Mechanism for Smelting Furnaces and the Like. Irving L. Briggs, Newport, Del. (U. S. No. 1,022,654; Apr. 9; 1912.)

ELECTRIC FURNACE. Albert E. Greene, Pueblo, Colo. (U. S. No. 1,021,187; Mar. 26, 1912.)

ELECTROLYSIS of Metallic Solutions. Fernand Lacroix, Paris, France. (U. S. No. 1,019,969; Mar. 12, 1912.)

FIREBRICK—Process of Making Firebrick. Charles H. Jaxtheimer, New Wilmington, Penn. (U. S. No. 1,018,665; Feb. 27, 1912.)

FURNACE LINING—Fire-Brick Wall or Lining for Blast and Other Furnaces. Allan N. H. Strale, Chicago, Ill., assignor of one-half to Emanuel Block, Chicago, Ill. (U. S. No. 1,021,851; Apr. 2, 1912.)

LADLE CAR. William W. McKelvey, Youngstown, Ohio, assignor to William B. Pollock Co., Youngstown, Ohio. (U. S. No. 1,021,543; Mar. 26, 1912.)

REDUCTION — Improvement in and Relating to the Reduction of Ore. Sven Emil Sieruin, Hoganas, Sweden. (Brit. No. 1134 of 1911.)

REDUCTION — Improvement in the Method of and Apparatus for Reducing Ores of Volatile Metals. H. H. Hughes, Springfield, Mo. (Brit. No. 570 of 1911.)

ROASTING—An Improvement in Processes for Roasting Sulphide Ores. C. W. Renwick, Isabella, Tenn. (Brit. No. 1267 of 1911.)

ROASTING—Charging Apparatus for Mechanical Roasting Furnaces and the Like. Metallbank- und Metallurgische Gesellschaft Actiengesellschaft, Frankfurt-on-Main, Germany. (Brit. No. 19,314 of 1911.)

ROASTING — Process for Roasting Ores. Charles Gabrielli, Paris, France. (U. S. No. 1,018,609; Feb. 27, 1912.)

ROASTING AND SINTERING—Apparatus for Roasting and Sintering Ores. Arthur S. Dwight, New York, N. Y., assignor, by mesne assignments, to Dwight & Lloyd Metallurgical Co., Jersey City, N. J. (U. S. No. 1,021,509; Mar. 26, 1912.)

ROASTING FURNACE. T. D. Merton, Grove Mill, Watford, England, assignor of one-half to Harry MacKenzie Ridge, London, England. (U. S. No. 1,022,961; Apr. 9, 1912.)

ROASTING KILN—Recuperative Roasting Kiln. John Zellweger, St. Louis, Mo. (U. S. No. 1,017,839; Feb. 20, 1912.)

SCRAP METAL—Process of Melting Scrap Metal. Albert E. Greene, Chicago, Ill. (U. S. No. 1,018,418; Feb. 27, 1912.)

SINTERING—Metalliferous Ore Product. Arthur S. Dwight and Richard L. Lloyd, New York, N. Y., assignors, by mesne assignments, to Dwight & Lloyd Metallurgical Co., Jersey City, N. J. (U. S. No. 1,020,345, Mar. 12, 1912.)

SPOUT—Duplex Spout for Furnaces. George K. Hooper, Madison, N. J. (U. S. No. 1,016,013; Jan. 30, 1912.)

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Henry H. Armstead, of Guanajuato, Mexico, is in New York.

H. Kenyon Burch is at Globe, Ariz., where he is engaged on professional work.

C. Clerc, of Paris, France, is at present in Arizona, examining mines near Wickenburg.

J. M. Fitzgerald has been chosen president of the Davis Coal & Coke Co., of West Virginia.

F. M. Simonds, of Simonds & Burns, New York, is at present in Cuba on professional business.

W. R. Ingalls delivered the class-day address at Houghton, Mich., on Apr. 18, for the Michigan College of Mines.

R. B. Lamb has returned to Toronto from a visit to the Swastika and Porcupine properties, in which he is interested.

R. J. Wysor has been made chief chemist of the Bethlehem Steel Co., succeeding Robert C. Kresge, who recently resigned.

Hugh Poynter Bell, an English chemical engineer, is in Canada, making investigations in connection with the peat-fuel and natural-gas industries.

H. V. Winchell was in New York this week, returning to Minneapolis. He expects to be in New York again about the middle of May, and to sail for Europe.

Ricketts & Banks, mining, metallurgical and chemical engineers, announce that on and after May 1, their offices and laboratories will be in the Eighty Maiden Lane Building, New York.

L. D. Huntoon, B. Stoughton and A. H. Elliott have associated themselves for the general practice of mining, metallurgical and chemical engineering, with offices at 165 Broadway, New York.

Sir Robert A. Hadfield, Sheffield, England, has been elected a foreign member of the Royal Swedish Academy of Science, Stockholm, as "a token of its appreciation of his excellent work in metallurgy."

E. F. Lake has been placed in charge of the laboratory of the Perfection Spring Co., Cleveland, Ohio. Mr. Lake has recently been conducting a consulting metallurgical business. He was formerly steel editor of the *American Machinist*.

J. T. Haviland, of the U. S. Geological Survey, is making a complete survey of the middle fork of Feather River, starting at Bidwell Bar, Butte County, Calif., and going northerly toward the source of the stream, to determine the potential power possibilities of the streams.

J. B. Tyrrell, the well known geologist and mining engineer, is to lead the Ontario government expedition into the North to locate the five-mile strip which the province is to receive from the Dominion. Mr. Tyrrell's personal knowledge of the unopened lands of the Hudson Bay district will make his services of great value to the province. One or two surveyors and half a dozen Indians will probably compose the party. Although the route has not been settled, the party will probably proceed first to Winnipeg about the end of May, and thence by Lake Winnipeg to Port Nelson, much of the journey by canoe. At the mouth of the Nelson River, some time will be spent in locating the 10-mile strip, which Ontario will have as a terminus for the Temiskaming & Northern Ontario Ry., should it be decided to extend the line there. The party will then head for the south, and a larger part of the five months will be taken up in exploring the 50-mile stretch along Hudson Bay, anywhere in which the province has a right to choose its five-mile strip.

OBITUARY

H. W. Mussen, mining engineer, formerly of Toronto, Ont., died at Kiev, Russia, on Apr. 18, aged 38 years, as the result of an accident. He was a graduate of McGill University, Montreal, and had been following his profession in Russia for several years.

Horace J. Stevens died suddenly at Houghton, Mich., April 22, aged 48 years. He had been a resident of the Michigan mining country for many years. He was for some time editor of a daily paper at Ishpeming. About 10 years ago he begun the compilation of "Stevens" Copper Handbook" and has since continued its yearly publication, by which he became well known.

Ebenezer Rowland, one of the pioneer mining men of the Marquette Range, died recently at Boulder, Colo., where he had resided for some years. He was 81 years of age. He was born in England, but came to this country with his parents when three years of age. He was employed at a number of mines in the Lake Superior district and had charge of the Iron Cliffs furnace and sawmill and later was superintendent of the Barnum mine.

Thomas Edwards, well known as a mill manager and metallurgist and the designer of the Edwards roasting furnace, died at Melbourne, Victoria, early in February, aged 74 years. He was born in Cornwall and went to Australia when a boy. He was at different times connected with the Clunes United, the Mount Morgan and other important mines, and with the large treatment plant at Sebastopol, in the Ballarat district, which he founded. He was a large owner of mining property in Victoria.

Dr. Paul G. Freer died at Manila, P. I., Apr. 17, aged 50 years. He was born in Chicago, educated in that city and at the University of Munich. He was instructor at Tufts College a short time and professor of chemistry at the University of Michigan for 14 years. In 1903 he was made director of the government laboratories, in Washington, and in 1905 he went to Manila as director of the Philippine Bureau of Science. He was the author of several books on chemistry and of a number of valuable reports on the Philippines. He was a member of the American Chemical Society and of several foreign societies.

Samuel B. Ferguson died at Coulterville, Mariposa County, Calif., Apr. 6. He was born in Kentucky in 1832. He crossed the plains from Missouri to California in 1852, and had been actively engaged in mining operations in California, Nevada and Mexico until within recent years. Mr. Ferguson was instrumental in settling the miners' strike at Treasure City, Nev., in 1867. He controlled extensive operations in Bodie during the prosperous days of that camp and early in the history of the Comstock was employed as manager of the interests of James Fair, having under his supervision the Gould & Curry, Best & Belcher and Con-Virginia. He was for 35 years manager of the Cook mine in the Coulterville district in California.

Societies and Technical Schools

American Institute of Mining Engineers—The New York Section will hold a meeting at the Engineering Societies Building, New York, May 3, at which Prof. L. C. Graton and Joseph Murdock, both of Harvard University, will present views, illustrating "The Mineral Relations in Copper Sulphide Ores as Revealed by the Microscope." The deductions from this method of geological research will be exhibited graphically, and will be discussed orally by Profs. J. F. Kemp and William Campbell, of Columbia University.

Lehigh University—The class in Economic Geology, accompanied by Professors Miller and Eckfeldt, of the departments of Geology and Mining Engineering, have recently made week-end trips to several important mining districts of Pennsylvania and New Jersey. On Mar. 22 and 23, the concentrating plant of the Pennsylvania Steel Co., at Lebannon, and the magnetite mines of the Cornwall Ore Banks Co., at Cornwall, were visited; on Mar. 30, the class inspected the mines and furnaces of the Empire Steel & Iron Co., at Oxford Furnace, N. J.; and on Apr. 12 and 13, the class visited the mines and mill of the New Jersey Zinc Co., at Franklin Furnace.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Apr. 17—Plans have been arranged for a visit to the Penn Mining Co.'s smeltery, at Campo Seco, in Calaveras County, by representatives of the Department of Justice, the U. S. Bureau of Mines and some of the important smeltery interests of the country. The purpose will be to investigate the thiogen process, invented by Doctor Young, of Stanford University, and now in the experimental stage at the Penn smeltery. The Department of Justice will be represented by Ligon Johnson and Dr. L. D. Ricketts; the Bureau of Mines by Doctor Holmes and F. E. Cottrell. It is expected that the Amalgamated Copper Co., and the Balaklala will also be represented.

A company, recently formed, has taken over the patent on Doctor Young's process, and when it has been successfully and thoroughly demonstrated at the Penn smeltery, the process may be introduced at other smelteries, whose operations have been interrupted by farmers In California, it is fairly well known that the farmers have not been as badly hurt as their complaints have often indicated, but these complaints have been heard by the courts and a necessity for preventing a recurrence of the damage has been demanded by the bench. From the recent tests made at the Penn mine, there is some reason to believe that the thiogen process will be successful. Also, it has been fairly demonstrated at the Balaklala that the Cottrell system successfully accomplishes the neutralizing of the smoke, but the results did not reach a point to correspond with the demands of the court, so the smeltery was closed and the laboratory experiments continued. It is believed in California that both the Cottrell and Young processes will eventually prove as successful for eliminating the trouble as the baghouse in the Mammoth smeltery, at Kennett, Shasta County.

Butte

Apr. 17—Work has been started on the new branch line of the Chicago, Milwaukee & Puget Sound R.R. from Three Forks into the Radersburg mining district, and it is believed that trains will be running over it by autumn. This will mean much to Radersburg, as a number of properties there are shipping ore by wagon at considerable cost, and others are being developed to the shipping stage. It is also the intention to extend the line on into Helena.

A simple contrivance for doing away with the dust from hammer drills has been invented by Thomas Mitchell, foreman of the Leonard mine of the Anaconda company. Although used thus far only in test cases, it has proved satisfactory and it is likely that it will be installed in all the mines here, as the dust problem has long been a difficult one to contend with. Notwithstanding that many different devices for its elimination have been tried out, there has always been some factor causing their discontinuance, due to loss of time or an undue amount of care needed in their use. If Mr. Mitchell's invention is found to be suitable on a large scale, as it has been in the tests, it will probably be a great boon to the miners, as miners' consumption, caused by inhaling the pulverized rock from the machine drills, is one of the chief illnesses contracted by the men after they have spent a few years in the mines. The device, which is simple and can be manufactured at small cost, consists of four iron fingers attached to an iron ring, the fingers acting as a spring and arranged to fit into and to take a secure hold on the mouth of the drill hole. A canvas bag is attached to the ring and another short cylinder of canvas fits over the drill. The dust flows from the hole into the canvas receptacle instead of into the air, as formerly.

Denver

Apr. 18—The crude bitumen known as gilsonite, so named after Samuel Gilson, who discovered it, occurs in Uinta County, Utah, in the territory tributary to the survey line of the Moffat Road. It is found in vertical fissures in the sandstones, and these veins vary in width from 2 to 17 ft.; the late G. H. Eldridge, of the U. S. Geological Survey, gave the probable available tonnage as 30,000,000 tons, this estimate being made from the exposures on two sides, the surface outcrops and a "break off" in the country, or steep cliff, which showed the deposits to exist for about 200 ft. in depth. This hydrocarbon field has been practically controlled for years by the Barber Asphalt Paving Co., that built the Uintah Ry., from Mack, on the Rio Grande Western R.R., to Dragon, at the southernmost part of the deposits. One of the leading independent companies was the American Asphaltum Association, of St. Louis, of which Adolphus Busch is the chief owner. With the so called asphalt trust owning the railway and practically dominating the market, the independent companies obviously operated at a disadvantage, and now comes the report that the Barber Asphalt Paving Co. is to gain control of the St. Louis company, a $3,000,000 corporation being launched in Utah for that purpose. The 7% grades on the Uintah Ry. are to be reduced this year by a series of tunnels, and an extension of the line is projected to the veins a few miles further north, owned by the St. Louis company.

Salt Lake City

Apr. 18—Park City shipments for March amounted to 9625 tons, the principal shippers being the Silver King Coalition, the Daly West and the Daly-Judge.

According to the annual advance statement of the lead production for 1911, just issued by the U. S. Geological Survey, Utah ranks third in the list of lead-producing states, with an output of 55,198 tons.

The ninth remodeled section of the Arthur mill of the Utah Copper Co. has been put in operation, and the combined capacity of the two mills is 18,000 tons per day. The overburden is being removed as rapidly as possible, and by autumn it is expected that the waste will be so reduced as to bring about a further reduction in costs. It is reported to be the intention to accumulate as large a working capital as will be necessary for stripping operations and for the maintenance and improvement of the plant.

The U. S. Assay Office here, during March handled 6890 oz. of gold, worth $128,191, and 3446¼ oz. silver, worth $1792, the total being $129,983, and showing an increase of about $29,000 over the month preceding.

There is a movement on foot among Commercial Club members looking to the establishment of a bureau of mines as a part of the club organization. Funds for the maintenance of the bureau are to be obtained by subscription.

Construction has begun on the 35-mile wagon road between Green River station, on the Denver & Rio Grande R.R. and the San Rafael oil fields in Grand County, where increased activity is looked for during the spring and summer. The vanadium and uranium deposits are being developed.

Globe

Apr. 19—Norman C. Carmichael, general manager of the Arizona Copper Co., at Clifton, recently visited this district. He stated that 200 men are working on the grading for the new smeltery, at Clifton, and that the erection of the steel work should begin some time in July. He was further quoted as saying that from an economic standpoint the future of the Arizona Copper Co. looks bright, but that if the Kinney bill, now under consideration by the state legislature, at Phœnix, should be passed, it would mean a shutdown of the mines and the complete paralysis of the Clifton-Morenci district. The bill, as introduced, provides that it shall be unlawful to employ in mines, mills, smelteries, railroads, etc., "any person who cannot speak and understand the English language," and charges its enforcement to the state mine inspector and his deputies. The workmen of the Clifton-Morenci district are mostly Mexicans, and Mr. Carmichael says that it is impossisble to get white men to work and live in the climate and conditions obtaining in that district.

Deadwood

Apr. 18—Numerous signs indicate a season of prosperity for the Keystone-Hill City district, in Pennington County. D. Canfield and associates have spent the winter at the Golden Summit property, where they have opened a small shoot of rich ore, and when water is available they will start milling. The Colorado men, who have purchased the Forest City group, are planning extensive development to start soon. It is officially stated that shaft work will be resumed soon at the Dakota-Calumet copper property. Work is going forward at the Columbia mine, at Keystone, from which considerable smelting ore was shipped last year. A settlement of the litigation which has involved the J. R. property for several years seems to be in sight, and, if made, will result in an early resumption of work. The last mill run showed an encouraging grade of ore. In addition to these properties there are a number of others in early stages of development.

Cobalt

Apr. 19—The question of a commission of $50,000 for the sale of the Silver Cliff mine, in Cobalt, was tried recently in the assize court in Toronto, judgment being reserved. A syndicate, consisting of A. R. Peacock and associates, agreed to purchase the mine for $550,000 from the owners, the sale being negotiated by Dr. A. F. Crane and associates, who are the defendants in the present suit. It is claimed that the defendants induced the owners to make the price of the mine $550,000, returning $50,000 as commission for the sale. The purchasers, learning this condition, compelled the original owners to pay the $50,000 into court, instead of paying it to the defendants, and they are now suing to regain posession of this amount. They claim that the purchase price was represented as $550,000, whereas the $50,000 had really been added to enable the defendants to obtain a commission without their knowledge. The Silver Cliff mine has had an unfortunate history, having always been operated at a loss. It is understood that the property may be reopened soon.

Porcupine

Apr. 19—The Ontario government is preparing to send an exploring party to the new northern territory, recently added to the province. The expedition will be in charge of J. B. Tyrrell, of Toronto, and is expected to start about the latter part of May and to be absent about five months. In addition to exploring the resources of the territory the party will locate the 10-mile strip along the water front at the mouth of the Nelson River, which will form the terminus of the Temiskaming & Northern Ontario Ry.; it will also lay out the five-mile belt of land which has been granted by the Dominion to give the province access to Hudson Bay.

It is stated that a discovery of nickel ore has been made in the vicinity of Fredrickhouse River. As yet but little has been learned of the property, but it is to be tested by means of a diamond drill. The formation is the same as that in which the nickel ore occurs near Kelso. A shipment is to be made soon from the latter mine.

Mexico City

Apr. 15—The Americans in Mexico generally accepted the proclamation of warning issued by President Taft, in February, as an official intimation that intervention was soon to come and they proceeded to prepare accordingly; in the mining camps, particularly, many of the Americans acted at once on the specific suggestion that in case they were compelled to leave the country they could place their property in the hands of the American consular representatives. But the consuls had no instructions or directions in the matter and they generally declined to accept any special responsibility in the matter, much to the disappointment of the Americans who were greatly alarmed, and with reason, as to the safety of their property in the large districts more or less controlled by the rebels. There will certainly be a large list of claims for property losses made by Americans and American mining companies, and it is not known how vigorously the American government will interest itself in their adjustment.

Officials of one of the large steamship lines, running between New York and Mexican ports, recently stated that for some weeks past bookings from Mexico to New York, for Americans, had been unusually heavy, but that recently they have fallen off to nearly normal. This would indicate that Mexico is becoming pretty well depleted of its Americans.

A prominent member of the Chamber of Deputies is said to have stated recently, that undoubtedly that body will promptly approve Madero's request for a treasury loan of $10,000,000 gold, to enable the government to increase the army to 60,000. The government's war bills have been referred to the committees on War and Treasury and will be reported favorably within a few days, possibly with minor amendments.

London

Apr. 15—The Rand-mines scandal has been a drawback to the whole market in mining shares. It is doubtful if a serious recovery will take place soon, though the South African houses are doing their best to attract the public. The sad experience of the rubber and oil boom, combined with the strong attacks on the policy of the South African houses, at the recent disclosures of the faults made by the management of the East Rand Proprietary and further at the transactions of the Rhodesian trust companies, have strongly shaken the belief of the public that some profit may be left for the outsiders.

The last year showed in the mining market only few events which could be considered as proof of sound financial policy in mining matters. For years a boom in Rhodesians has been predicted, but it does not come off. The great expectations of the Katanga copper field have so far been a complete failure; years must elapse before cheap production can lead to a good return on the large sums invested in the companies of that district.

Russian mining securities have had a boom here, which was soon followed by a complete collapse. The hopes in that country were renewed last year, when John Hays Hammond was invited by the Russian minister and stayed some time in St. Petersburg; no results of his visit have become known. The feature in Russian mines of most interest is Lena Goldfields, which developed into a paying enterprise. The Orsk Goldfields may become another good Russian gold producer after the new American dredge commences steady work this spring. No other Anglo-Russian gold-mining enterprise has been a success, though much money has been provided to find good properties in the Urals and Siberia. A small concern, Russian Goldfields, Ltd., was brought out in March, in England, to dredge certain properties in the Urals. The prospectus spoke of a length of 20 miles of river rights, with an average width of 25 yd., and an approximate depth of gravel of 7½ ft.; the tests are said to have shown results averaging 85c. per cubic yard.

The Mining News

The Current History of Mining

Alaska

Alaska-Ebner—This company, formerly the California-Nevada Copper Co., has gone into a receivership because of default of bond coupons. A plan of agreement has been drawn up between Mortimer N. Buckner, Herman W. Hoops and Lucius G. Fisher, acting as a committee, and such holders of the first mortgage, 7% bonds as wish to become parties to the agreement. The company owns mines in California and near the Alaska-Treadwell in Alaska.

FAIRBANKS DISTRICT

H. J. Elmer passed through Fairbanks recently with 10 "double-enders" from Cordova, laden with repair parts for the big dredge he proposes to operate in the Circle district, on the Yukon. An early run is expected.

It is doubtful if Alaska has ever seen such a mild winter as has been experienced this year. The willows have been in bloom for three weeks. The breakup is looked for by May 1 instead of May 25. Placer operators are beginning preparations for early sluicing.

Garden Island—This mill recently finished the run on the ore taken from the Perault vein at the head of Pearl Creek and $40 per ton in free gold is the reported result. The vein is from 6 in. to 3 ft. wide.

Alaskan Exploration Co.—This company has been reorganized in London by G. G. Lemon and $500,000 have been paid into the treasury. Extra parts for the Lemon dredge are now on the way over the ice. In addition to extensive holdings on Fairbands Creek, the dredge company purchased the greater part of Twin and Pedro creeks last summer.

Arizona

COCHISE COUNTY

Calumet & Arizona—The company recently purchased the old tailings dump of the Commonwealth mine, from J. N. Kinney, for $15,000. The tailings are used for converter linings.

GILA COUNTY

Miami—One of the electric locomotives on the 420-ft. main haulage level, escaped control recently and ran into the cage compartment of the main shaft, falling 300 ft. to the bottom. Aside from the loss of the locomotive, the damage was slight. F. L. Ransome, of the U. S. Geological Survey, has been making an inspection of the underground workings.

Inspiration Consolidated—The diverting flume at the dam across Pinal Creek gave way recently and allowed the excavation and forms to fill with débris which is now being cleaned out. The test mill is running and the sinking of No. 2 shaft at the Live Oak mine will be resumed soon, the installation of the surface plant being nearly completed.

Southwestern Miami—Churn-drill hole No. 2 has been discontinued at a depth of 1240 ft. in the chalcocite zone. Commercial ore was disclosed in this hole but how much is not made public. Hole No. 3 is 710 ft. deep and in the chalcocite zone. Holes Nos. 4, 5 and 6 are 235, 200 and 75 ft. deep respectively and have not yet passed through the conglomerate. No. 7 will be started soon.

South Live Oak—The arrival of machinery is expected within 10 days. The camp consists of an office building, boarding house, bunkhouse and four dwellings. The first hole will be on the western extension of the Augustus claim, in the granite-porphyry.

Barney—Churn-drill hole No. 2 is 560 ft. deep in schist. Progress is slow, the ground being soft and clayey, caving considerably and causing the drill to stick; it is possible to drill only a few feet without driving the casing. Hole No. 3 is 200 ft. deep and in conglomerate.

Arizona Copper Co.—The company is increasing the capacity of the power-plant equipment for its mines at Clifton, Ariz., and has purchased new electrical machinery, including three 2500-kv.-a., turbo-generators, and nine 417-kv.-a. transformers. The apparatus will be installed by the General Electric Company.

PINAL COUNTY

Ray Consolidated—The annual report covering the 18 months ended Dec. 1, 1911, shows a net profit from operations of $147,545. Copper amounting to 14,935,447 lb. was sold at an average of 13.8c. per lb.; the average cost was 10.75c. At the end of the year the reserves totaled 77,314,470 tons of 2.17% ore. Among the expenses were $556,397 for mining, $405,166 for milling and $564,019 for freight treatment and refining.

SANTA CRUZ COUNTY

Augusta—This mine is being unwatered by intending purchasers. It has a good record of production, but has been closed for two years. The ore is a ferruginous copper ore.

Eureka—This mine will be reopened by B. F. Lindsley, manager of the Mansfield Mining Co. It is a part of the Prof. Blake group, at Salero Hill. Some ore, running several thousand ounces of silver per ton, has been shipped from this mine. There is supposed to be some of this ore still left, as well as a large amount of concentrating ore.

Viceroy—A new strike of good copper ore has been made in this mine, owned by Mr. Bach; this mine is the easterly extension of the Blaud.

Ivanhoe—James Johnson, superintendent, has closed for his company, negotiations with eastern men for this mine. The price is $225,000, but the terms have not yet been made public.

Pulaski—The owners of this mine, in Josephine Cañon, have made a discovery of concentrating ore, carrying copper, lead and silver. The ore is 4 ft. thick and is getting better with depth.

Black Hill—Ore is being taken out for shipment to the new Pioneer smeltery, at Tucson. This ore samples 7½% copper.

California

AMADOR COUNTY

South Jackson—An electric motor will be installed to operate the new hoist under construction. The results of prospecting are said to warrant extensive development.

Keystone—The new compressor has been installed and will be used for the air drills. Sinking will be commenced in the old shaft which has been reopened and unwatered to the 1200-ft. level. This is the first time the bottom of the shaft has been reached in 20 years.

Lincoln Consolidated—The water has been drained from the 1915-ft. level, which is the lowest in the Lincoln mine, and the south level will be extended through the Mahoney into the Wildman.

Original Amador—R. H. McGowan has withdrawn his suit against this company. The dismissal vindicates the officials of the company. The mine is being developed under the supervision of W. F. Deaner.

CALAVERAS COUNTY

Tulloch—High-grade ore has been disclosed at the 200-ft. level on the hanging wall of a vein about 40 ft. wide. A streak of this ore carries free gold and there are good indications of ore running above the average low grade ores of the district. The mine has been bonded to Judge Curtis, of Angels, who will proceed with the development. The property is near the Chapperal Hill mine, about 100 miles north of Melones. It was located about 20 years ago and was a large producer from pockets.

Lightner—It is reported that the old Lightner company and the Angels mines have settled their legal difficulties out of court. These differences bear no relation to the present owners and operators of the Lightner. The recent shutdown of the mill resulted from advancing the development beyond the talc.

North Star—The Dolling Co. has shut down the mill temporarily and developing is proceeding below the 400-ft. level. A quantity of good milling ore was procured but after getting into the talc intrusion was found not up to standard grade.

El Dorado County

Crane Gulch—This mine, near Placerville, has been sold to H. G. Jerrett, who will begin development soon.

Cora Dora—This mine, near Grizzly Flat, is being operated by Plumas County men. It has been idle for some time.

Inyo County

Skidoo—A suit is on trial at Los Angeles, in the U. S. court, in which William B. Gray, of Nevada, claims ownership of 10 fractional claims which have been operated as a part of the Skidoo mine. The Skidoo is one of the prosperous mines of Inyo County and the claims contested in this suit are said to be a valuable part of the holdings.

Kern County

Derby—The Standard drilled into a gas stratum at 488 ft. depth on this lease two miles east of Taft. The escaping gas cut the cable off, dropping the tools into the hole. Measurement showed the well to be making 65,000,000 ft. of gas per day. Two days following, the flow had been reduced to 41,000,000 ft. The existence of gas at this depth had not been known previously. This property lies at the south flank of the Buena Vista hills where a gas belt was encountered at 1600 ft. depth.

Mariposa County

Enterprise—A strike of good milling ore is reported from this mine near Hornitos.

Plumas County

Engle—An orebody 12 ft. wide was encountered while crosscutting to the hanging wall. The ore showed copper, gold and silver. The mine is in the Greenville district, near Taylorsville.

Rio Vista—This company is hauling in a large supply of material to the mine at Nelson Point. The old Franklin shaft will be unwatered to the gravel channel. E. P. Vandercook, of Oakland, is one of the owners.

San Bernardino

Another effort is being made to mine placer gold in Holcomb Valley. In the earlier days, gold was taken from this valley, but lack of water has prevented operations for several years. A preliminary survey was recently made for a pipe line. Harold Peck, of Los Angeles, conducted the survey for the water company, composed of residents of Long Beach and Oakland.

Trinity County

Globe—A stamp mill is completed for this mine, at Dedric. The Craig Mining Co., composed of Chicago and Canadian men, is the owner. James Hooper is superintendent.

Tuolumne County

Tarantula—The development work in this mine has reached sufficient depth to warrant drifting, and it is expected that the stamp mill will soon be in operation.

Mammoth—The Old Republican mine, reopened by this company, is now in operation, and the 20-stamp mill is in commission.

Colorado

Boulder County

Boulder Tungsten Production Co.—This company has been organized with J. G. Clark, of Boulder, as president, and it is stated that H. L. Barter & Co., of Chicago, have underwritten 700,000 shares of treasury stock. It is further stated that Mr. Clark is making preparations for mine machinery and a 50-ton mill.

Cripple Creek District

El Paso—The main shaft has been connected by a raise from the deep drainage tunnel, making the total depth of the shaft 1350 ft. It took 78 continuous days and nights to make the 350-ft. raise.

Golden Cycle—The 15th and 16th levels of the shaft, drained recently, are being cleaned out, and it is expected that shipping will begin soon. The shaft is 1650 ft. deep. The output of the mine is about eight cars per day of good-grade gold ore.

South Burns—Lessees operating this and the main Burns shafts, have paid, it is reported, $100 per day in royalties to the Acacia Gold Mining Co. The gross production is given at $25,000 for the last six months.

Progressive—This company, leasing the Chicken Hawk, Katinka, August Flower and Hobo claims of the Katinka company, is sinking the shaft to the 1050-ft. level, where laterals will be driven.

Happy Day—A new shaft is being sunk by lessees on this claim of the Alamo company, on Gold Hill.

Camilla—J. Morrison & Co., leasing the Camilla, on Guyot Hill, have installed heavy machinery and are driving east and west from the 1000-ft. level, to intersect the Doctor-Jack Pot and Work veins.

Jo Dandy—It is reported that in six months the dump of this mine, treated at the Kavanagh mill, has paid the lessees $3000, and enough additional to pay for the mill.

Lake County—Leadville

George Argall, manager of the Iron-Silver Mining Co., is secretary of an association that purposes pumping the water from the lower levels of the Leadville mines. Power is to be supplied by the Central Colorado Power Company.

Across-the-Ocean—Thomas Gilroy, superintendent, is working eight men and has 50 tons of ore in the bins ready to ship when the roads will permit hauling. The principal metal in the ore is gold.

Henrietta—The shaft on Carbonate Hill has been repaired and put in good working order and the usual tonnage of zinc ore is being hoisted.

Long & Derry—Work has been resumed at this old producer, and a new shaft is down 70 ft., with ore showing in the drift. Work is to be resumed in the old shaft, 300 ft. deep.

Chippewa—Two cars of ore are at the smeltery awaiting settlement. The ore is said to run about 3 oz. gold per ton with some silver and copper. It is operated by Green Brothers, lessees.

Adelaide—This old mine has been connected with the Yak tunnel by a lateral driven 2000 ft. from the tunnel level, and a raise to connect with the old shaft, 510 ft. below surface. Andrew Dyatt, manager, expects to produce 50 tons per day.

Ponsardin—The surface plant has been installed and the shaft is being repaired; when this is completed, shipments will commence.

Ouray County

Bachelor & Wedge—Lessees Kelleher and Lucas are reported to have shipped four cars of silver-lead ore, yielding respectively $179, $147 and $125 per ton, with returns from the fourth not yet received. Lessee Hartan, on the Bachelor, is also said to have shipped a car of ore which brought $1300, and Ryan Humphrey, on the Wedge, a $1000 car.

Kansas

Diplomat—This mine, at Galena, A. M. Gaines, manager, hoisted an average of over 1000 cans of ore from one shaft for the entire week, a total of 3215 tons.

Elinita—The mill of this company, at Galena, has been sold to O. W. Sparks, who will move it to Badger.

Kentucky

Coil—An explosion of gas in this company's mine, at Madisonville, on Apr. 21, killed five men, all that were in the mine.

Michigan

Copper

Franklin—Operations are being centered in No. 1 shaft in lateral openings between the 26th and 32nd levels and the shaft has reached the 33rd level where the lode will be opened by crosscutting. The rock going to the mill is running about 20 lb. mineral per ton. At the 23rd level a drift is being extended to connect with No. 3 shaft and when this shaft is reached it will be opened both by sinking and raising from this point. No. 3 shaft is now bottomed at the 16th level.

Adventure—Work has progressed through the copper-bearing lode that was encountered recently in the crosscutting from No. 5 shaft. The formation is about 30 ft. thick and is mineralized throughout. The identity of the formation has not been determined.

Houghton—This company is drifting at the 645-ft. level, and is opening uniform and mineralized ground on the main lode. Little work has been done on the West lode.

Oneco—Shaft-sinking has reached a depth of about 1180 ft.; some copper has been in evidence occasionally, but no lateral work has been done, other than station cutting every 100 ft. When the shaft is 1220 ft. deep, opening will be started at several points, and the formation, which revealed rich drill cores, will be explored.

Wyandot—The long exploratory crosscut is being continued eastward to the sandstone, and drifting has been started in both directions on No. 8 lode, which was highly mineralized at the point of intersection.

Calumet & Hecla—The company has announced a 10% increase in wages to all employees, subsidiary companies included, to take effect May 1. Other large producers in the district are expected to take similar action.

Copper Range—Following the example set by the Calumet & Hecla, the company has announced a 5% increase in wages.

Iron

Rogers—At this new Rogers-Brown mine, east of Iron River, the 11x16½-ft. shaft has been continued to the second level. At the first level, 330 ft. below the collar and 200 ft. in rock, a crosscut is being driven east to the orebody, which cuts across the property in a northeast direction, and a pump station cut on the first level just north of the shaft. The water is giving little trouble, only about 80 gal. per min. being pumped. Creosoted timbers have been used in the shaft. The contractors are starting to erect the steel and brick buildings. The foundations for the boilers are set and a concrete base has been completed for the steel smokestack, which will be self-supporting, 8 ft. inside diameter and 150 ft. high.

Huron Iron Mining Co.—The Groveland mine of this company, north of Iron Mountain, is closed down temporarily. Work continues at the McDonald exploration, at Crystal Falls.

Minnesota

Great Northern Ore—It is reported that after conferences in the East, D. M. Philbin, recently placed in charge of these properties, announced that arrangements will be made with independent operators on the Mesabi Range for the working of the Great Northern properties after the termination of the Steel Corporation's lease.

Missouri

Katy—This mine, at Thoms Station, sustained a bad cave in the old workings recently. It will not interfere with the working of the mine, as drifts were already cut around this portion.

Ray—This mine is on the land of the General Lead & Zinc Co., at Thoms Station, and is producing lead in chunks of 300 and 400 pounds.

Sycamore—The mine, on the Rex tract, at Joplin, has been purchased for $10,000, by T. F. Coyne, of Webb City.

Smithfield—This mill, at Webb City, has been purchased by Andrew McInturff, who will erect it on the Aylor tract.

Falls City—Pate & Poindexter will erect a 250-ton mill on their lease from the Falls City Co., west of Joplin.

Chicago-Lehigh—A. F. Dexter, of Chicago, has purchased the lease of Charles Wells, at Lehigh; he has drilled it thoroughly and will move the Culpepper mill from Webb City and erect it on the property.

Birthday—This company, at Spring City, will erect a mill on its land.

St. Francis County

The threatened strike in the disseminated lead belt has been eliminated by a general increase in wages, the underground men being advanced 25c. per 8-hr. shift and the surface labor 15c. The advance takes effect May 1, and will increase the pay rolls about $37,000 per month.

Montana

Butte District

Davis-Daly—The Colorado shaft has reached 1850-ft. depth, and will be advanced to the 2000-ft. level before a stop is made. At 1800 ft., a rich vein of zinc ore was intersected; it had a width of about 3 ft. where cut, and assayed 44% zinc. A vein was recently cut on the 1700-ft. level, averaging about 10% copper, and shipments of ore are being made from there regularly. By an arrangement with the Anaconda company, a crosscut is being driven from the Gagnon mine on the 2000-ft. level to develop the western end of the Davis-Daly property.

Ophir—On the 500-ft. level, an east drift recently intersected a cross fissure carrying good silver ore. Another drift on the south vein on the same level ran into an orebody some time ago, and about 100 ft. of drilling have disclosed ore carrying gold, copper and zinc. The contract for the erection of the steel work of the new concentrator has been let to the Colorado Iron Works, of Denver, and the Westinghouse company has been given the contract for the electrical equipment.

Beaverhead County

Butte & Vipond—Plans are being made to begin operations on a group of claims near the Hecla mine. This company was organized about a year ago by Butte and New York men, Thomas P. Manley, of Butte, being president. A crosscut will be driven south on the 200-ft. level, and it is expected to tap the vein within 250 ft. The company owns a mill site and will erect a mill when sufficient ore has been blocked out.

Fergus County

The camp of Kendall, where the North Moccasin mine is situated, is gradually being deserted, and the last of the mercantile establishments has been moved to the neighboring town of Hilger. The Kendall mine is the only one still operating there, and with but a fraction of the original force. The North Moccasin has become so tied up in litigation that it is probable that it will be idle for some time, though the Kendall company has repeatedly offered to take it over. With the reopening of this mine, the town will probably revive.

Jefferson County

Boston & Corbin—Negotiations have been closed for the sale of 10,000 shares of the company's stock at $8 per share, less a commission of 50c. per share. This is expected to provide $75,000 to construct a 200-ton concentrator. Stockholders on May 6 will vote on the matter.

Montana-States—The Montana-States Mining Corporation has been organized by Helena men, with a capitalization of $5,000,000, par $5, to develop a tract of nearly 700 acres of land, six miles east of Alhambra. The officers are: Robert A. Bell, of Helena, general manager; Henry C. Smith, justice of the supreme court, president; Dr. Rudolph Horsky, vice-president; Edward Horsky, secretary and treasurer; the main office is in Helena.

Lincoln County

Blacktail—This gold mine, in the West Fisher district, 35 miles from Libby, will be ready to operate June 1, according to Manager A. M. Balfour. The mill was damaged by a snowslide during the winter and this has delayed operations.

Nevada

COMSTOCK LODE

Mexican—A shipment of 1300 lb. of bullion was made last week, estimated to be worth $30,000. Stoping has been resumed, and the north ends of the stopes on the 2300- and 2400-ft. levels are now being opened. The recovery from these levels last week was 30 tons averaging $17.45 and 115 tons averaging $18.56.

Crown Point—Run No. 5 at the Yellow Jacket mill of 4400 tons, netted the company $22,000. Run No. 6 is now underway. Stoping contines on the 1400-ft. level, and the last week 628 mine cars of low-grade ore were extracted.

Ophir—The net smeltery returns on the cleanup from 2000 tons of ore milled at the Kinkead mill were $55,700. The company had a balance of $63,000 on hand in the treasury on Apr. 1, with all bills paid.

C. & C.—The three new centrifugal pumps have been grouted to their foundations on the new 2310 station, and the suction and discharge pipes and valves installed.

Union Consolidated—From the 2 ft. of quartz cut in the east crosscut, six mine cars of ore were saved, assaying $21.12 per ton. This streak will be followed when the crosscut is connected with the west crosscut from the joint Union and Sierra Nevada winze. In the Patton crosscut, a 2-ft. quartz vein has been found, giving assays of $12.90 per ton. This prospect will be developed.

HUMBOLDT COUNTY

The two producing mines in the Seven Troughs district produced about $300,000 worth of ore in 1911, a considerable portion of which is reported to have been profit. Ore reserves are said to be sufficient for some time yet.

Developments at the quicksilver properties in American Cañon, about 25 miles northeast of Lovelock, are reported to be satisfactory to the operators and some good specimens of massive cinnabar were recently exhibited as coming from Walker Brothers mine which is shipping regularly.

Boyer—This copper mine in the Table Mountains, in which Carpenter Brothers, of Denver, are interested, is planning to resume operations soon.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended Apr. 11, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,150	19,319
Tonopah Belmont	1,750	32,426
Montana Tonopah	1,053	11,977
Tonopah Extension	1,012	11,022
West End	600	10,319
Midway		180
MacNamara	390	4,197
North Star		40
Totals	7,955	125,810
Estimated value	$198,875	....

Tonopah-Belmont—During March, 8047 tons of ore were milled and 562 tons were shipped to the smeltery, with gross returns of $230,882; the net profit for the month was $146,628.

Montana-Tonopah—The orebodies continue to develop satisfactorily. On the 565-ft. level, the new vein is 22 ft. wide between walls; 8 ft. of this average $108 per ton, and the remainder from $30 to $35 per ton. On the 615-ft. level, another new vein is 3 ft. wide and averages $120 per ton. An important development is on the lowest level, where the Macdonald vein, 1000 ft. west of the main shaft, is being sunk on in trachyte, indicating new possibilities at depth in this section of the mine.

Tonopah Extension—The oreshoot on the 400-ft. level is from 5 to 20 ft. wide and about 90 ft. long; it has been opened up on the 500-ft., and due to the dip of the vein, this gives 180 ft. of "backs."

Tonopah Mining Co.—During the year ended Feb. 29, 1912, 174,685 tons of ore were milled and treated, averaging 0.286 oz. gold, and 26.05 oz. silver, or $19.97 per ton, or $2.01 per ton less than the average for the previous year. Since commencement of operations, opening work of all kinds, including 7278 ft. of core drilling has totaled 146,181 ft., or 27.68 miles.

WHITE PINE COUNTY

Giroux—Rich ore carrying chalcocite, native copper and cuprite, is reported to have been opened on the 90-ft. level of the Bunker Hill shaft.

Nevada Consolidated—During the 15 months ended Dec. 31, 1911, the net production of copper totaled 78,541,270 lb., at a cost, after providing for depreciation and all other charges, of 6.97c. per lb., as compared to 7.05c. for the year ended Sept. 30, 1910. The average price received for copper was 12½c. per lb. The reserves on Jan. 1, 1912, were 40,853,371 tons of 1.662% copper ore as compared with 40,360,823 tons of 1.70% on Oct. 1, 1910. The State Railroad Commission has served notice on the Nevada Northern Ry., owned by this company, that the entire schedule of freight and passenger tariffs are believed to be unreasonably high and will be investigated. As an illustration, the fare of $8 for 140 miles, from Ely to Cobre, is quoted.

Coppermines—The Gunn-Thompson interests, owning these mines in the Ely district, which have been idle for three years, have decided to resume operations. Arthur Smith is general manager and Henry Smith mine superintendent. The Minnesota mine separates the Butcher Boy claim of the Coppermines company from the Nevada Consolidated.

New Mexico

GRANT COUNTY

Cleveland—George H. Utter, owner of this group of claims, left for Denver recently, to purchase new machinery for his mill, eight miles north of Silver City. The present machinery has accomplished the purpose for which it was installed, that of demonstrating the practicability of concentrating the ores profitably. The plant will be replaced to meet commercial requirements. A new crusher and rolls will be installed, also some trommels and additional jigs. The plant will be made modern and will be operated for 24 hr. per day. During the last month three cars of concentrates were shipped to Oklahoma smelteries.

SOCORRO COUNTY

Ernestine—The first 10-day cleanup in April yielded 8470 oz. of gold and silver bullion and 10,000 lb. of high-grade concentrates; 742 tons of ore were treated during a recent week.

Oaks—A total of 35 ft. of development was done at the Pacific mine during the week, from which 42 tons of ore were packed to the Deadwood mill. Work continues in the main drainage and transportation tunnel.

Deep Down—The winze from the tunnel is being sunk with two shifts, in a good grade of mill ore.

Socorro—More than 5000 tons were treated in March. About 93% of the gross content of the ore is being recovered by concentration and cyanidation.

Treasure—Mine developments are satisfactory and stopes of good ore are being opened in what was formerly virgin ground. The mill on Whitewater Creek handles about 400 tons per week.

Johnson—Current work has disclosed good gold and silver ore and the extent of the orebody is now being determined.

Oklahoma

Prairie State—This company, at Hattonville, has bought a mill to erect on its property.

Chapman & Lennan—The Red Dog mill will be moved from Webb City, Mo., to the mine, at Hattonville.

Oregon

BAKER COUNTY

North Pole—Active development is going on in addition to stoping. The stamp mill is operating 30 of its 40 stamps, on satisfactory ore. Shipments of high-grade crude ore are also being made.

Red Boy—The 20-stamp mill is reported to be running on $13 ore. A tube mill is being installed.

Columbia—The mine continues to produce about 60 tons per day.

Ben Harrison—Work during the winter

is reported to have opened good orebodies, and it is said that the company will move a mill from an Arizona mine, and install it here this summer.

South Dakota

Black Hills District

Trojan—The cyanide plant is still operating one unit, but as the weather has improved, it is proposed to make an effort to start the other unit. This will give the plant a capacity of at least 300 tons per day. Considerable other work is planned, including the construction of a machine and repair shop. H. S. Vincent is general manager and Charles E. Ellis, formerly with the Mogul company, is mill superintendent.

Utah

Beaver County

Sheep Rock—It is the intention to resume operations at the 10-ton mill in May. The average milling ore runs $30 per ton, and the shipping ore between $100 and $200, chiefly in gold. Drifting is being done on the 60-, 100- and 110-ft. levels.

Juab County

Tintic shipments for the week ended Apr. 12 were 184 cars.

Opohongo—Shipments are being made at the rate of four cars per week, averaging $1000 per car. One car, shipped in March, brought $2874. The company has never levied an assessment.

Chief Consolidated—The March output amounted to 62 cars exceeding February by 10 cars. It is said that April shipments will be somewhat lower, but that the grade of the ore is satisfactory. The output for the first quarter of the year amounted to 146 cars. Conditions at the mine are encouraging, and there is a good surplus in the treasury.

May Day—Work is being done on the 700-ft. level in two faces of ore. Just below the 1000 ore has been opened, which is thought to be a continuation of the orebodies at present productive on the 400 and 700. The width of the ore, which is of good grade, is given as 6 ft., and the thickness as four feet.

Uncle Sam—Some ore is exposed in this property, which is more than making expenses.

Yankee—The mine has resumed its usual shipments of dump ore, as the condition of the roads has improved.

Iron Blossom—Shipments of 45 cars per week are being made, and the company is said to be earning about $75,000 per month. The ore, which is siliceous gold-silver ore, averages $10 per ton net. The electric hoisting machinery for No. 1 shaft has arrived in Tintic, and will be hauled to the mine in a few days. The new equipment will make it possible to undertake development on the 1900-ft. level and at greater depth.

Swansea—The oreshoot recently discovered on the 940-ft. level and later lost, is reported to have been reopened. It is stated that the company is contemplating taking an option on the adjoining property of the Picnic Mining Co. With 200 ft. of drifting from the Swansea a vein, in the past productive of rich ore on the surface of the Picnic, will probably be cut at a depth of 900 feet.

Emerald—The Opex equipment has been leased to this company and work continues through the Opex shaft.

Salt Lake County

Utah Metal—The tunnel, being driven to connect the Bingham and Tooele sides of the Oquirrh Range, has attained a length of approximately 8475 ft., being in 1075 ft. from the Bingham side and 7400 ft. from the Tooele side. The average progress is 60 ft. per week. The property comprises 3400 acres extending from Carr Fork in Bingham, over the Oquirrh Mountains into Tooele County The capitalization is 1,500,000 shares, $5 par value.

Bingham Mines—It is estimated that net earnings for the first quarter of 1912 will exceed $40,000. The March output of copper and lead ores from the Commercial and the Dalton & Lark amounted to 114 cars, and the February production to 121 cars. The Eagle & Blue Bell is shipping at the rate of about 24 cars per month.

Alta Consolidated—According to an official of the company there are 3000 sacks of high-grade ore ready for shipments, which are now to be made regularly.

Summit County

Park City shipments for the week ended Apr. 15 amounted to 4,859,020 pounds.

Thompson-Quincy—The raise, which is being driven from the 1600-ft. level for the limestone-quartzite contact, is up 300 ft., and shipping ore is reported in the top. The 1600-ft. level is the 1200 of the Daly West.

Daly West—Work is being done on the 900, with the limestone-quartzite contact in sight. Milling operations suspended owing to the freezing of the water supply, have not been resumed. Development continues at depth, and steady shipments of ore are being made. March shipments amounted to 2919 tons.

Virginia

Piedmont Manganese Corporation — Plans have been made to start work at this company's mine, eight miles east of Lynchburg, recently purchased by a syndicate headed by N. R. Livingston, of New York, and D. W. Myers, of Lynchburg. It is reported that the plant will cost about $300,000.

Canada

Ontario

Gould Consolidated—Vein 146 of the Nipissing has been cut on this property at the 100-ft. level. The lowering of Cart Lake has uncovered for surface prospecting a large area belonging to the company.

Mann—The returns from 15 tons of high-grade ore, shipped from this property at Gowganda a few weeks ago, were over $38,000, $6000 being about the expense of mining and marketing the ore.

Ontario-Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Apr. 19, and for the year to date, are:

	Week	Year
La Rose..	95.98	998.28
Coniagas.	.	546.35
O'Brien		199.78
Right of Way.		110.30
Chambers-Ferland.	33.60	129.60
McKinley-Darragh..	53.54	842.65
Nipissing .		473.12
Hudson Bay	31.48	249.88
Buffalo	28.17	322.38
Crown Reserve.		149.11
Cobalt Townsite.	..	320.31
City of Cobalt	32.70	145.84
Trethewey.	...	147.06
Colonial..	.	20.00
Kerr Lake.		231.48
Cobalt Lake		136.01
Drummond.		300.32
Temiskaming		260.37
Beaver. .		101.99
Wettlaufer		111.21
Provincial.		22.22
Casey Cobalt		24.50
Totals.. .	275.47	5,842.52

BULLION SHIPMENTS IN OUNCES

Mine	Week	Year to Date
Buffalo .	6,168.00	31,438.00
Kerr Lake	2,244.50	4,566.25
O'Brien. .	20,662.00	72,831.47
La Rose..	20,636.00	....
Temiskaming	2,522.50	56,833.00
Drummond .	1,198.70	....
Total.	53,231.70	.....

La Rose—During 1911, 3429 tons of ore containing 3,691,797 oz. of silver were produced at a cost of 19.2c. per oz. On Dec. 31, 1911, the ore reserves amounted to 4,250,861 oz. and the combined surplus was $1,551,420. The average price received for the year for silver was 53.55c. per ounce.

Nipissing—The report for the year ended Dec. 31, 1911, shows a total production of 5,197,042 oz. of silver at an average cost of 13.95c. per oz. On Jan. 1, 1912, the high-grade ore reserves exceeded in value those of 1910 by over $275,000, and total reserves were worth $4,572,000. About 270 acres remain unprospected.

Trethewey—Since its incorporation and up to Dec. 31, 1911, the company has earned net profits of $932,961, and has paid out $761,998 in dividends. During 1911, development work totaled 3071 ft., a large part of which is said to have been unprofitable but necessary crosscutting. The amount of ore placed in sight during the year is about equal to that mined, according to Charles A O'Connell, manager.

Right-of-Way—During 1911, the company mined $156,588 worth of ore and the year closed with a net profit of $59,030. Profit and loss account now amounts to $70,348. Since Jan. 1, the company has secured an option on a silver property in the Port Arthur district. The ore reserves are becoming worked out, but the dumps contain about 8000 tons of ore which are expected to run from 15 to 20 oz. per ton.

Ontario-Porcupine

During the last week two new mining companies having an aggregate capital of $2,000,000 were incorporated.

Porcupine Gold—The designs for the 100-ton mill are now ready and construction work will be started soon. A 3-ft. quartz vein apparently carrying good milling ore, has been found in crosscutting from No. 2 drift at the 100-ft. level.

Dome—This mill is getting an extraction of over 97%. The management plans to do 10,000 ft. of underground work in the next year. The working of the mill is regarded locally as demonstrating the fact that Porcupine ores can be handled by the free-milling process. Two cleanups per day are made.

Porcupine Lake—This property is being prospected with two diamond drills which are set up on the ice on Porcupine Lake.

Standard—The directors' report presented at the annual meeting in Montreal, Apr. 11, showed that the company was in debt and that operations had not disclosed any valuable orebodies. The directors were authorized to issue preferred shares, or adopt other means to raise funds for further development.

Hollinger—Some delay in the construction of the mill has been caused by legal proceedings in the United States against makers of parts of the machinery, on the ground of infringement of patents. The completion of the work before June 1 is not likely.

Swastika—The report for 1911 shows that $63,722 were spent on development and prospecting, and the year closed with a cash balance of $10,713. Total receipts were $149,272. Gold recoveries amounted to $4248 and gold bullion worth $3882 was on hand Dec. 31. R. B. Lamb, consulting engineer, states that during the latter part of 1912 the company should become self-sustaining.

Ontario-West Shining Tree

Dalton-Thomas—On this group of 15 claims, camp buildings have been erected and stripping done on the dike for 200 ft., some surface samples running $2.80 per ton.

Moore & McDonald—On this group of six claims, lying south of the Gosselin, a shaft sunk for 20 ft. shows free gold in places. The veins have been stripped on the surface showing a width of 35 ft. for a distance of 550 feet.

Gosselin—A shaft is down 40 ft. and veins have been traced to the surface and stripped for 700 ft., showing a width of 10 ft. with some free gold. Development will be pushed at the 50-ft. level. Diamond drills are on the way to the property.

Quebec

Robertson—The property of this asbestos company is being sold by the trustees for the benefit of the bondholders. The company's mines are near Thetford, in Quebec. Like many others, the results of competition and the lower prices have been felt keenly.

Mexico

Chihuahua

The following mines shut down in March: West Mexican, La Fe, Minas de Oro, Los Angeles and Cherokee Goldfields, Ltd.

Bazonopa—A discovery of free-milling gold ore was made recently in the vicinity of the Poche vein.

Sierra Piata—In March, work was still in progress at this mine, under charge of R. H. Allen.

Tepehuan Mexican Syndicate—The closing of this mine marks practically the cessation of all active mining operations in the vicinity of Sierra Madre.

Alvarado—The company is planning extensive development which will probably result in all the mines of the Presena group becoming one large mine. The ore will go to the Alvarado mill over the new aërial tramway.

Mexico

Esperanza—The Guggenheim Exploration Co. has disposed of its entire holdings in, and will sever all connection with, this company. The control will revert to London. During March the mill crushed 16,640 tons of ore. Gross receipts were $123,672; working expenses, $94,522; depreciation, $5000; other expenses, $1108; estimated profit, $21,734. Development work totaled 1352 ft. Additional drifting has been done north and south on the San Carlos vein, together with raising. The ore averages about 5 ft wide and over 1 oz. gold.

San Luis Potosi

Tiro General—This mine, at Charcas, is replacing a 15-km., narrow-gage railroad with track of standard gage. Ore shipments amount to about 200 tons per day, and about 1200 men are employed. S. F. Shaw is superintendent.

Sonora

Cananea Consolidated—The company recently placed an order for two Sterling boilers. The boilers will be equipped with superheaters.

Mesa Rica—This mine, 35 miles northeast of Sahuaripa, closed down recently and the Americans have left for the States.

Creston de Cobra—The company recently installed new machinery at this mine, 30 miles west of Hermosillo, including a 90-hp. Ingersoll-Rand compressor and five drills. A 50-ton concentrating plant is in course of erection. The main shaft has been sunk to 500 ft. and good ore is reported to have been found.

Newfoundland

Great Northern Copper Co.—This company has recently been merged with the Notre Dame Copper Co. and the Hodder Supply Co. These are Pittsburg companies with mines at Twillingate, Newfoundland.

South America

Chile

Braden—The company is producing over 700 tons of refined copper per month. The experimental plant being installed by the Mineral Separation Co., Ltd., is expected to be ready about June 1. It is understood that while the Separation company is installing this at its own expense, the Braden company agrees to use it if the recovery averages 85 per cent.

Peru

Caylloma—The company owning these silver mines has been reorganized as the Sociedad Explotadora de Caylloma Consolidada, with a capital of £100,000 in 400,000 shares of 5s. par. Good ore is reported to have been found in No. 5 level. In the Santa Cata shaft the electric pumps have been delivering over 90 tons of water per hour from the No. 6 level. Two similar pumps are *en route* from Europe. The railway and mill have been stopped temporarily and development of the San Cristobal lode to No. 8 level is being pushed. The Flor del Mundo drainage tunnel is being driven at the rate of 28 meters per month. This is expected to be increased to 40 meters with larger air drills. Alfred Fox, general manager, recently returned from Europe and is in charge at the property.

Asia

Chosen

Oriental—During February, 22,092 tons of ore were crushed, yielding $119,860 gross and net $45,936. Operating costs were $69,873; operating profit, $49,987, and $4050 were put back into improvements. The Kuk San Dong 40-stamp mill was hung up for the full month because of labor shortage.

Russia

Lena Goldfields—Dispatches state that 107 miners were killed and 80 wounded in a fight with Russian soldiers at the mines of this company at Irkutsk.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Apr. 24—The coal trade is still dependent almost entirely on labor conditions. A large proportion of the mines are still idle and trade suffers in consequence.

In the West the various districts conferences are gradually settling the new schedules and many mines are resuming or preparing to resume operations. Trade is rather slow, as many large consumers are still using stocks accumulated in anticipation of a suspension. With the new supplies coming into the market and the shipments from West Virginia and Kentucky, there is, apparently, sufficient coal to provide for present needs. Business is improving, however, and the prospect is for a good demand.

The seaboard bituminous trade is well supplied and is rather dull for the time being.

The anthracite wage conference still continues, the prospect being for the arrangement of a working compromise. No coal is being mined and the belief is that, even if a settlement is reached, it will be well on in May before the mines are reopened. Stocks are nearly exhausted and already there is a shortage of several sizes, both of domestic and steam coals. Another week or so will bring an urgent demand. Meantime the trade is altogether unsettled and uneasy.

Coastwise shipments of coal from chief Atlantic ports, two months ended Feb. 29, long tons:

	Anthracite	Bituminous	Total
New York	3,044,154	1,763,363	4,807,517
Philadelphia	319,294	529,078	848,372
Baltimore	36,461	514,674	551,135
Newport News	....	449,876	449,876
Norfolk	....	817,817	817,817
Total	3,399,909	4,074,808	7,474,717
Total, 1911	2,873,887	4,241,755	7,115,642

Increase this year in anthracite, 526,022; decrease in bituminous, 166,947; total increase, 359,075 tons, or 5%. Norfolk includes Sewells Point. New York covers all the harbor shipping ports, including barge deliveries to city and nearby wharves.

British Coal Trade—Exports of fuel from Great Britain, three months ended Mar. 31, long tons:

	1911	1912	Changes
Coal	15,201,352	12,473,072	D. 2,728,280
Coke	251,671	277,123	I. 25,452
Briquettes	425,246	373,332	D. 51,914
Total exports	15,878,269	13,123,527	D. 2,754,742
Steamer coal	4,701,509	4,051,302	D. 650,207
Total	20,579,778	17,174,829	D. 3,404,949

Imports of coal for the three months were 3341 tons in 1911, and 24,269 in 1912; increase, 20,928 tons.

Iron Trade Review

New York, Apr. 24—The iron and steel markets continue active, and the tendency to higher prices is becoming more marked, though the advances are small.

In finished material a heavy business has been done in bars by the agricultural machine makers. Their contracts have been generally closed on the base of 1.15c. Pittsburg, coming in before the recent advance to 1.20c. was made. In structural material a good business has been done; while plates are in demand, owing to the number of new orders for cars. Generally the mills are full and are showing no special anxiety for new orders.

In pig iron sales have been active. Basic pig seems to be in strong demand and many orders are reported. Foundry-iron sales are improving, and prices are a little better than they have been. Southern makers are seeking better prices for second-half deliveries. There is still much competition for good orders and this prevents any considerable advances. There is, however, undoubted firmness on the present basis.

The Bethlehem Steel Co. proposes to authorize an issue of $60,000,000 in first-mortgage 5% bonds, of which $15,000,000 are to be issued soon to pay for new work, improvements and additions to the plant.

Hearings are in progress before the Interstate Commerce Commission on the complaint filed by the Pittsburg Steel Co. and others, charging that the rates on iron ore from Lake Erie ports to the Pittsburg district are too high, and that they discriminate against the independent companies by reason of the ownership of railroads by the Steel Corporation.

Baltimore

Apr. 22—Exports for the week included 3,342,550 lb. rails and 265,758 lb. rail-joints to Tampico, Mexico. Imports included 6550 tons manganese ore from Bombay, India; 5550 tons pyrites from Huelva, Spain; 5900 tons iron ore from Cuba.

Birmingham

Apr. 22—The Southern pig-iron market is very strong, the sales being steady and the price firm with an indication of taking on an advance in the next week or so. Pig iron for delivery during the third quarter of the year is selling at $11 per ton, No. 2 foundry, while inquiries for iron for the last quarter are being answered with a 50c. advance on this price. There have been some sales made recently for delivery during the last of the second quarter of the year at $10.50. Some of the larger consumers have purchased quite freely. The make in Southern territory has not yet been improved, though this will be a necessity within the next 60 days if the demand continues.

Cast-iron pipe demands warrant a steady operation of plants and the output is large. The shipments are equal to the make right along. Charcoal iron is in fairly good demand with the make low. The price remains firm at $22@22.50. Scrap iron is in better demand also.

Chicago

Apr. 23—The pig-iron market continues quiet but strong. For last-half deliveries there has been a steady demand in the last week, with inquiries increasing and a number of large tonnage requirements under negotiation. The situation is better than it was a week ago, for nearly all sellers of pig iron. Southern No. 2 holds firmly to $10.50, with some sales made at $10.75, Birmingham, or $14.85 Chicago minimum price, the freight being $4.35. Northern No. 2 is quoted at $14 minimum at the furnaces, with sales up to $14.50. The demand is active for both Southern and Northern, the latter holding somewhat more steady because of the need of it in mixtures. Northern charcoal is also in very good demand, at $16.50, minimum.

In the finished products market both structural material and railroad supplies are in larger demand, though neither has anything of a boom. Railroad buying still lags generally. Bars are selling at uneven prices, but representatives of local mills assert that little business is being done from Pittsburg and that the nominal minimum of 1.33c. is being obtained. Plates are selling well; sheets and wire goods are in better demand than a week ago. Encouraging conditions are reported in almost every line, the bar sellers perhaps showing least optimism.

Cleveland

Apr. 22—Moderate sales of Lake ore are still being made, but the bulk of the business seems to be closed.

Pig Iron—A number of sales are reported and the market has been active. Some large lots of basic are reported sold at $12.50@12.75, but Valley furnaces hold at $13. Bessemer is $15.15; No. 2 foundry, $13@13.50; forge, $12.50@12.75, Cleveland delivery.

Finished Material—Some large contracts have been placed for bars and plates. Some of the bars were taken at 1.15c., but 1.20c. is now the general price. Sheets are active and firmer in price.

Philadelphia

Apr. 24—All grades of pig iron have been selling well during the week, mostly for early delivery, and consequently the transactions were generally for small lots. Low-grade iron has led in quantity and ready stocks are practically exhausted. Much business for low-grade iron now in sight will probably go southward, where already some very heavy transactions have been closed. The coal and coke situation has unsettled calculations of buyers and makers and the possibilities of a railroad strike have been an unsettling influence for the past week. Foundry irons are pretty well cleaned up for early delivery and makers are less anxious than a while ago to contract for third quarter. Forge irons are stronger than for a month, while basic and malleable are moving more freely. The outlook for pig is better than for some months and if two or three disturbing factors clear up it is believed that the heavier consumers will cautiously proceed to cover the probable requirements pretty well up to the close of this year. Sales of No. 2 X foundry are reported at $15@15.25 with Virginia iron selling from 50c. higher. Gray forge readily brings $14.50 and basic is strong at $15 per ton.

Steel Billets—A good deal of long-pending business in billets has been recently closed which puts the manufacturers in better position than for some months. Forging billets have become especially active. Rolling billets are $22.40@23.40, tidewater.

Bars—Bars are strong at 1.27c. minimum, delivered, with a moderate business in steel bars at 1.30c., at which a large business has been shoveled in, in anticipation of another advance.

Pipes and Tubes—Notable development has taken place in tubes and the current demand is well maintained.

Plates—The advance in steel plates has had a stimulating effect upon the market, especially in view of the probability that it is not the last advance. Steel plates are quoted 1.30@1.35c. The outlook is favorable for some heavy plate business.

Sheets—The sheet mills are rushing to the limit of capacity in most mills to clear their books for later business.

Structural Material—The week's orders are of moderate proportion. The quiet will be of short duration. There is enough business half through and which will be announced shortly, to send structural quotations after steel plate. Quotations 1.30@1.35c., tidewater.

Scrap—The scrap market continues active in nearly all kinds. Heavy melting steel, No. 1 railroad and heavy cast are taking the lead at practically the figures named by dealers.

Pittsburg

Apr. 23—The disposition of the steel mills to advance prices continues, and since last report the majority of mills have made advances in bars from 1.15 to 1.20c. and in plates and shapes from 1.20 to 1.25c. There is good reason to believe they will make a further advance in plates and shapes to 1.30c., and on this level they will likely rest, awaiting with such equanimity as they can command the development of third-quarter business. Buyers are heavily contracted to July 1, contracts permitting specifications to be filed up to that date, at prices generally ranging from 1.05 to 1.10c. for bars and from 1.10 to 1.15c. for plates and shapes. With prices so much above this level, specifications will naturally be heavy and buyers may specify little material on the new contracts. This might effect a lull in midsummer, but there are confident predictions that within the next 60 days the railroads will appear as large buyers, and this would save the situation.

Pig Iron—The market has been quiet and while in general the market shows a firm undertone, there was a sale of bessemer last week which disclosed an unaccountable weakness. The sale was 300 tons at $14.15, Valley, by one of the largest producers to a steel-casting interest in the Pittsburg district, when the market on all hands was admittedly $14.25. In the circumstances the sale attracted much attention. We quote: Bessemer, $14.15@14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; forge, $12.75, all f.o.b. Valley furnaces and 90c. higher delivered Pittsburg, for near-by delivery.

Ferromanganese—The market for forward delivery is firm at the advance of $2.50 reported last week, while small prompt lots are bringing still higher figures than formerly. The total turnover, however, in both prompt and forward, is relatively small. We quote forward at $43.50 and prompt at $45@48, f.o.b. Baltimore.

Steel—Very little steel is available and the market is at a standstill. Consumers are well covered to July 1, but in many cases are complaining of deliveries, while they cannot well eke out by purchases of prompt material as prevailing prices are so much above contract. We quote billets at $20 and sheet bars at $21, Pittsburg, but it is doubtful if much could be picked up at these figures. The market will probably soon open for third quarter, and $22 for sheet bars has been mentioned by one or two producers, but sheet mills do not see their way clear to pay the price as they are not realizing enough for their sheets. Rods are $25, Pittsburg, and very quiet.

Sheets—The market has advanced fully $1 a ton, by independents withdrawing their lowest price and thus getting the market nearer the minimum prices announced by the leading interest on Apr. 11. If any black sheets are available below 1.90c. the case is altogether exceptional, while the minimum of the leading interest is 1.95c. Galvanized sheets are similarly quotable at 2.90@3c., and blue annealed at 1.35@1.40c. We quote painted corrugated roofing at $1.35 per square and galvanized at $2.55. The leading interest's innovation, in quoting this material by the pound, has met with a very hearty reception and the practice is likely to become general. Its extras are 5c. per 100 lb. for corrugating, with an additional 15c. for painting gages 25 to 28 inclusive.

St. Louis

Apr. 22—The demand for pig iron seems to be better than at any time this year. Owing to the increased call, prices have been advancing, although very little business as yet has been done at the new figure. The iron trade on the whole is more optimistic and the demand for finished steel products is much better. Iron buyers seem a little more inclined to buy further ahead than heretofore; however, this is only a natural inclination on an advancing market. Southern No. 2 foundry is quoted at $10.75@11, Birmingham, or $14.50@14.75, St. Louis. The bulk of the demand is for Southern iron. Northern iron is being quoted at around $14.50 per ton.

Good foundry coke is bringing $5@5.15 per ton, St. Louis.

Iron Ore Trade

Sales of Lake ore continue, but rather slowly. Heavy chartering of vessels has been completed at 40c. from Duluth to Lake Erie, 35c. from Marquette and 25c. from Escanaba, these rates excluding the unloading charge.

The first train load of ore from the Mesabi arrived, Apr. 15, at the Great Northern docks, at Superior.

It is said that Spanish nonbessemer ore is now being offered to Eastern furnaces at 7c. per unit, delivered, notwithstanding the higher freights.

In the East, New Jersey and New York ores are selling on a basis of about 7c. per unit, delivered. Lake Champlain ores have been contracted for at 7¼@8c. per unit, on canal boats at Port Henry, according to grade. Newfoundland ores bring 7c. per unit on dock. The small quantity of Cuban ores sold on the open market brings the same price.

German Iron Ore—Imports of iron ore

in Germany, two months ended Feb. 29, 1,616,995 metric tons; exports, 362,245 tons. Imports of manganese ore were 50,451; exports, 1561 tons.

British Iron Ore—Imports of iron into Great Britain, three months ended Mar. 31, were 1,889,637 long tons in 1911, and 1,609,648 in 1912; decrease, 279,989 tons. Imports of manganese ore, 101,060 tons in 1911, and 69,552 in 1912; decrease, 31,508 tons.

Foreign Iron Trade

French Iron and Steel—The *Comité des Forges* reports production in France for the year ended Dec. 31 as below, in metric tons:

	1910	1921	Changes	
Pig iron	4,000,721	4,410,866	I.	410,145
Steel ingots	3,390,309	3,668,678	I.	278,369
Billets	1,597,803	1,696,635	I.	98,832
Bars and shapes	1,158,760	1,305,492	I.	146,731
Plates	406,291	462,681	I.	56,390
Rails	372,691	451,697	I.	79,006

The reports of finished iron and steel are not complete.

German Foreign Trade—Exports and imports of Germany, two months ended Feb. 29, metric tons:

	Exports	Imports	Excess	
Iron and steel	959,442	102,857	Exp.	856,585
Machinery	75,118	10,237	Exp.	64,881
Total	1,034,560	113,094	Exp.	921,466
Total, 1911	856,248	95,224	Exp.	761,004

Increase in exports this year, 178,312 tons; increase in imports, 17,850 tons.

Steel in Germany—Steel production in Germany in 1911 was: Acid, 571,254; basic, 14,308,665; crucible, 78,760; electric 60,654; total, 15,019,333 metric tons. This is an increase of 1,320,695 tons, or 9.6%, over the preceding year.

METAL MARKETS

New York, Apr. 24—The metal markets are generally strong still, but there have been no special movements during the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Mar. 1912	$ 7,453,589	$ 4,335,678	Exp.	$3,117,911
" 1911	505,615	4,119,063	Imp.	3,613,448
Year 1912	19,958,088	12,414,195	Exp.	7,543,893
" 1911	1,854,014	19,465,737	Imp.	17,611,723
Silver				
Mar 1912	5,806,307	3,711,734	Exp.	2,094,573
" 1911	5,896,795	3,197,409	Exp.	2,699,386
Year 1912	16,955,988	11,850,220	Exp.	5,105,768
" 1911	16,001,842	10,646,781	Exp.	5,355,061

Exports from the port of New York, week ended Apr. 20: Gold, $411,998, largely to Argentina; silver, $911,134, chiefly to London. Imports: Gold, $421,692; silver, $259,585, from Mexico and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Nothing further is said about exports from London to New York. The demand from India continues rather large, and South America is still taking some metal.

Gold in the United States April 1 is reported by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,028,432,369, in Treasury current balances, $172,841,816; in banks and circulation, $597,115,340; total, $1,798,389,525. Gold held against certificates includes bullion as well as coin.

Iridium—Prices are unchanged at $64 per oz. for pure metal, New York.

Platinum—While demand is only moderate, the metal continues immovable. Conditions do not favor any material change in prices at present. The Russian quotations are off a little, but this is thought to be only a temporary recession, due to local causes. Dealers quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal, up to 10% iridium.

Our Russian correspondent writes, under date of April 11 that the market is dull. The demand from abroad is insignificant. It is reported the inactivity of the market and the decrease of the prices on the local market are due to the sale below the market price of a large quantity of platinum by the Compagnie Industrielle de Platine, which controls about 80% of the platinum produced in Russia.

The prices remain nominal without change. The quotations are; at Ekaterinburg—9.90 rubles per zolotnik; in St. Petersburg—38,000 rubles per pood—equivalent to $37.22 and $37.24 per oz., respectively.

Silver—The market the last few days has been very active, silver having advanced today to 27⅞d., the highest point touched this year. The same price was recorded on Feb. 13, but with that exception silver has not been quoted so high since Nov. 6, 1907, when the official price was 28d. in London.

SILVER AND STERLING EXCHANGE

Apr.	18	19	20	22	23	24
New York	59¼	59⅜	59⅜	59⅜	59⅝	60½
London	27 5/16	27⅜	27 5/16	27 5/16	27 7/16	27⅞
Sterling Ex.	4.8720	4.8725	4.8730	4.8720	4.8720	4.8705

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Apr. 11, reported by Messrs. Pixley & Abell:

	1911	1912	Changes	
India	£2,831,400	£1,925,800	D.	£905,600
China	752,800	520,000	D	232,800
Total	£3,584,200	£2,445,800	D.	£1,138,400

India Council bills in London averaged 16.05d. per rupee for the week.

Coined silver in the United States April 1, as estimated by the Treasury Department: Dollars, $565,269,367; subsidiary silver, $165,073,658; total, $730,343,025. Of the dollars $487,163,000 are held in the Treasury against silver certificates outstanding.

Copper, Tin, Lead and Zinc

NEW YORK

	Copper		Tin	Lead		Zinc	
Apr.	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
18	15⅞ @16	15.75 @15.85	43⅝	4.20	4.10 @4.12½	6.65 @6.75	6.50 @6.60
19	15⅞ @16	15.70 @15.80	43⅞	4.20	4.10 @4.12½	6.65 @6.75	6.50 @6.60
20	15⅞ @16	15.70 @15.80	44	4.20	4.10 @4.12½	6.65 @6.75	6.50 @6.60
22	15⅞ @16	15.70 @15.75	44⅝	4.20	4.07½ @4.12½	6.65 @6.85	6.50 @6.70
23	15⅞ @16	15.70 @15.75	44¾	4.20	4.07½ @4.12½	6.65 @6.85	6.50 @6.70
24	15⅞ @16	15.70 @15.80	44¾	4.20	4.07½ @4.12½	6.65 @6.85	6.50 @6.70

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
Apr.	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
18	70¼	71⅛	75¼	198	194¾	16 3/16	25¾
19	70 3/16	71 1/16	75¼	199½	196½	16 5/16	25¾
20	......	......	......	......	......	..	....
22	69 13/16	70 13/16	75	203	199½	16 7/16	25¾
23	69¾	70⅝	74¾	203¾	200	16 9/16	25¾
24	70½	71⅜	75½	203½	200	16⅝	25¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market has been dull during the week of Apr. 18-24 and the operations of second hands have been dominant. The foreign demand has been filled by speculative resales at concessions, causing the market over there to fall rather below our parity and precluding export sales from here. In our own market there have also been speculative realizations in business amounting to several millions of pounds, and the actual consumptive demand having disappeared, temporarily at least, there has been a small decline in price, these sellers having been willing to accept lower prices than the principal agencies were asking. Although first hands have participated in this business to a certain extent, the position of the principal agencies has been reserved, the asked price of 16@16⅛c., delivered, usual terms, being generally maintained. Domestic consumers seem to be well covered for May and June and not yet disposed to contract for July. On the other hand, the producers claim to be well booked ahead. We have heard of some good buying of Lake copper at 15⅞@16c., and a small lot of a special brand is reported to have fetched 16¼c. At the close, Lake copper is quoted at 15⅞@16c., and electrolytic, in cakes, wirebars and ingots, at 15.70@15.80c. Casting copper is quoted nominally at 15½@15¾c. as the average for the week.

The market for standard copper declined under realization of speculative holdings to £69 15s. for spot and £70 12s. 6d. for three months on Tuesday. On Wednesday, the offerings being scant, the market reacted, and closes at £70 10s. for spot, and £71 7s. 6d. for three months.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire in 17@17⅛c. base, carload lots at mill.

Copper exports from New York for the week were 5149 long tons. Our special correspondent gives the exports from Baltimore at 75 tons.

Sales of Katanga copper at Antwerp are noted by *L'Echo des Mines*, of Mar. 25, being the first public sales of the metal. The Société Commercial Belge took 413,393 kg. at 154.25 fr. per 100 kg.; Osterrieth & Co. took two lots, 242,390 kg. and 295,149 kg., at 156.75 and 154.25 fr. per 100 kg., respectively. These prices are equivalent to 13.50c. and 13.72c. per lb. No allowance was made for copper containing cobalt.

Tin—The market has become very strong. The advance is not brought about by manipulation, but is due to the excellent statistical position of the metal. Buying on the part of consumers in this market has been satisfactory. The close is firm at £203 10s. for spot and £200 for three months in London, and about 44¾c. for April tin here.

Messrs. Robertson & Bense report the arrivals of tin ore and concentrates at Hamburg, Germany, in March, at 1077 tons; 1069 tons being from Bolivia and 8 tons from Southwest Africa.

Lead—The market is quiet. New York lead continues to be quoted at 4.20c., while lead at St. Louis is slightly easier at 4.07½@4.12½ cents.

The foreign market is very firm, and lead for early shipment continues scarce. Spanish lead is quoted at £16 12s. 6d., and English at 2s. 6d. higher.

Spelter—Consumers have not seemed disposed to contract for July spelter to any great extent, that delivery commanding about 6.50c., but there has been some demand for May and June and a fair tonnage for those months has been placed. Early deliveries have been liberally offered to consumers at about 6.65c. On the other hand the smelters do not seem disposed to press sales for the later deliveries. We quote at the close, 6.65@6.85c., New York, and 6.50@6.70c., St. Louis.

The foreign market is unchanged at £25 15s. for good ordinaries, and £26 for specials.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7⅛c. per lb., New York.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, three months ended Mar. 31, figures in long tons, except quicksilver, which is in pounds:

Metals	Imports	Exports	Excess	
Copper, long tons	36,537	15,208	Imp.	21,329
Copper, 1911....	36,424	20,240	Imp.	16,184
Tin, long tons....	12,874	14,543	Exp.	1,669
Tin, 1911........	10,786	12,948	Exp.	2,162
Lead, long tons..	52,925	11,544	Imp.	41,381
Lead, 1911......	52,897	15,325	Imp.	37,572
Spelter, l'g tons..	33,972	2,135	Imp.	31,837
Spelter, 1911....	31,129	2,463	Imp.	28,666
Quicksilver, lb...	1,471,960	667,625	Imp.	804,335
Quicksilver, '11	547,264	962,078	Exp.	414,814
Minor met's, tons	1,813	6,649	Exp.	4,836
Minor, 1911....	1,440	4,848	Exp.	3,408
Ores				
Tin ore and con.	7,562	....	Imp.	7 562
Tin ore, 1911...	7,438	....	Imp.	7,438
Pyrites..........	251,529	....	Imp.	251,729
Pyrites, 1911...	256,022	... ...	Imp.	256,022

Copper totals include metallic contents of ore and matte. Exports include reexports of foreign material. Miscellaneous metals include nickel, aluminum and the minor metals and alloys.

Other Metals

Aluminum—Business has been dull and sales small, chiefly on account of a strike which started in Cleveland and has extended to nearly all the works in the Central West which make aluminum into manufactured forms. Quotations are a shade weaker, at 20c. per lb. for No. 1 ingots, New York.

According to *L'Echo des Mines*, representatives of the American, French, Swiss and English producers of aluminum met recently in Paris to consider definite proposals for a basis of agreement as to prices and production—in other words for the reëstablishment of the old syndicate. Should the conference succeed in arranging for an advance, it would have little effect during 1912, since many large consumers have contracted for supplies for the year at present prices.

Antimony—Business has been quiet and prices are unchanged. Cookson's is 8@8⅛c. per lb.; Hallett's and U. S. are 7¾; while 6⅞@7c. is quoted for Hungarian, Chinese and other outside brands.

Quicksilver—Business has been good and the market is rather steadier. New York quotations are $41.50@42 per flask of 75 lb., while 60@62c. per lb. is charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. London price is £8 7s. 6d. quoted from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 20—The high price of zinc sulphide ore is $56, the base, per ton of 60% zinc, $50@53.50. The average price, all grades of zinc, $49.62. The high price of lead ore is $55, some ore selling on a base of $53 per ton of 80% lead. The average price, all grades of lead, $54.20 per ton.

Just at a time weather conditions seemed settled with favorable outlook for outputting, along came on Tuesday a slow, soaking rain of 36 hours, which the earth absorbed like a sponge. Again on Friday was another such rain for five hours. Tonight it is showers. The water-soaked earth is making the production of ore more hazardous, and is creating an in-

SHIPMENTS, WEEK ENDED APR. 20

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,174,930	......	661,630	$100,412
Joplin........	1,737,050	......	191,580	51,290
Alba-Neck....	1,175,610	44,090	52,520	34,950
Galena........	545,110	66,480	59,040	16,760
Miami........	633,930	......	63,460	15,340
Duenweg.....	477,960	128,250	44,950	15,000
Oronogo......	261,930	......	65,600	6,886
Jackson......	259,050	......	4,880	6,055
Spurgeon	120,410	187,500	......	5,760
Granby	......	336,610	6,560	4,995
Carl Junction	171,010	......	......	4,785
Lawton	122,910	......	57,390	4,620
Cave Springs.	128,140	......	14,690	3,855
Carthage	108,000	......	......	2,750
Springfield...	82,940	......	......	2,155
Quapaw......	64,000	......	......	1,470
Aurora......	44,000	......	......	1,000
Wentworth...	23,070	......	......	577
Totals.....	9,130,050	762,930	1,222,300	$278,660
16 weeks...	159,031,640	9,712,780	26,580,780	$4,640,381

Blende val., the week, $234,466; 16 weeks, $3,778,353
Calamine, the week, 11,158; 16 weeks, 139,015
Lead value, the week, 33,036; 16 weeks, 733,013

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January...	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February..	40.21	45.75	39.16	43.31	54.46	52.39
March.....	39.85	51.56	38.45	49.25	54.57	54.64
April.......	38.88	......	37.47	......	56.37	......
May.........	38.25	......	36.79	......	55.21	......
June.........	40.50	......	38.18	......	56.49	......
July.........	40.75		38.36	......	58.81	......
August......	42.50		41.28	......	60.74	......
September..	42.63	......	41.29	......	59.33	......
October.....	42.38	......	40.89	......	54.72	......
November...	45.40	......	43.25	......	57.19	......
December	44.13	......	40.76	......	62.03	......
Year.	$41.45	...	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

creased expense both in drainage and extra precaution against sliding ground. To these drawbacks was added a shortage of gas supply in portions of the district at intervals during the week. No unsold ore is reported in the bins, the stock being that portion of this week's output sold too late for loading. Lighter buying last and this week reduced this week's shipment to less than 5000 tons.

Platteville, Wis., Apr. 20—The highest price paid this week for zinc ore was $54.50; the base price of 60 per cent. zinc weakened from $53.50 to $52 at the week end. The base price paid for 80 per cent. lead ore was $53 per ton.

SHIPMENTS, WEEK ENDED APR. 20

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Galena	1,134,800	....	....
Mineral Point	708,200	....	....
Benton	535,610	....	512,000
Platteville	386,700	....	....
Hazel Green	346,800	....	....
Cuba City	312,690	87,670	127,300
Shullsburg	284,500	....	....
Livingston	220,000	60,000	....
Harker	84,200	....	....
Montfort	84,000	....	....
Highland	59,800	....	....
Linden	....	....	80,000
Total	4,157,300	147,670	719,300
Year to date	60,519,040	1,769,530	6,879,650

Shipped during week to separating plants, 1,484,390 lb. zinc ore.

New Caledonia Ores

Exports of ores from New Caledonia in January included 3321 tons nickel ore to Great Britain and 6705 tons chrome ore to New York.

Chemicals

New York, Apr. 24—The general markets are in good condition and show no material change from last week.

Copper Sulphate—Business is on a good scale. Quotations are $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Demand continues good and supplies are not plentiful. For white arsenic $3.75@4 is quoted for spot, with $3.50@3.75 per 100 lb. for futures.

Nitrate of Soda—The market is steady and quotations are unchanged at 2.40c. per lb. for spot, and 2.40c. also for future positions.

Petroleum

The Standard purchasing agencies have raised the buying prices of crude oil in the East from 3 to 5c. per bbl., according to grade. This is the first change since January.

Mining Stocks

New York, Apr. 24—On April 18 the Stock Exchange was rather depressed. The tendency was to reaction, but price changes were small. The increase in Amalgamated dividend to $1 had been so far discounted that the announcement had little effect. On the Curb trading in mining stocks was slow and scattered, with some fractional losses.

April 19 trading declined on the Exchange and the movement was inclined to be narrow. The exception was a sudden spurt in Bethlehem Steel, 21,300 shares common and 23,300 preferred being sold at advances of 3¼ and 7½, respectively. On the Curb trading was confined mainly to a few specialties, and mining stocks were neglected.

April 20 the Exchange was more active. Fluctuations, however, were small. Bethlehem Steel lost some of its advances of the preceding day. On the Curb mining stocks were in better demand and inclined to be firmer in price.

April 22 the Exchange opened rather weak, but grew firmer, with advances in a few stocks. Dealings were on a moderate scale. The Curb was disturbed by the failure of J. Thomas Reinhardt, who has been a prominent promoter and a heavy dealer in Porcupine stocks.

April 23 there was a general upward movement on the Exchange, especially in a few favorite stocks. The Curb also showed a good demand for mining stocks, but advances were not well distributed, being confined to a few of the copper stocks and one or two Cobalts. Porcupines were weak. The strength of the market continued on April 24, and sales were large.

Boston, Apr. 23—The persistent strength of copper is well reflected in the copper-share market. One of the strongest arguments in favor of the permanency of the advance is the voluntary increase of miners' wages by the leading Lake Superior copper mines. Many new high prices on the present movement have been recorded the past week and the market has been animated in spots. Brief resting spells have been taken which served to solidify the technical position of the market.

Activity has been largely in the Calumet & Hecla subsidiary companies and the so called Dow stocks, notably Indiana and North Lake. Indiana has risen $7.50 to $22.75 on positive strikes by diamond drill giving promising metal indications. It will be remembered that this stock sold up in the 40's a few years ago on diamond-drill operations. St. Mary's Mineral Land came in for a deal of attention today by reason of its activity. There had been no sales for some time until today, but knowledge that a large block of stock which had been hanging over the market for some time had been sold caused a sharp $6.50 advance to $61.50 per share.

Tamarack recorded an extensive rise of $17 to $51, although it has not retained all the advance. Tamarack, it is claimed, is in a position through lower operating costs to earn dividends. In addition it has a small capitalization. Ahmeek has duplicated its record price

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Jan.	Feb.	March
Alaska shipments	3,701,010	2,662,243	4,987,916
Anaconda	26,350,000	27,450,000	25,900,000
Arizona, Ltd	3,200,000	3,020,000	3,150 000
Copper Queen	6,748,264	6,046,860	7,197,121
Calumet & Ariz	4,544,000	4,452,004	4,652,000
Detroit	1,941,970	2,068,370	2,246,238
East Butte	1,520,000	1,440,000	....
Mammoth	1,665,319	1,722,954	1,939,310
Mason Valley	600,000	1,100,000	....
Nevada Con	6,309,228	4,888,790	6,380,000
Old Dominion	2,044,000	2,039,000	....
Ray	2,475,945	2,140,000	....
Shannon	1,550,000	1,300,000	1,388,000
South Utah	189,678	283,838	299,000
United Verde*	2,000,000	2,250,000	....
Utah Copper Co	8,156,612	8,612,739	8,160,000
Lake Superior*	17,500,000	19,000,000	19,750,000
Non-rep. mines*	8,400,000	8,000,000	8,400,000
Total production	98,896,026	98,476,798	....
Imports, bars, etc.	31,790,590	18,976,513	....
Total blister	130,686,616	117,453,311	....
Imp. in ore & matte	8,340,740	10,432,438	....
Total	139,027,356	127,885,749	....
Miami	2,235,647	2,475,996	....
Brit. Col. Cos.:			
British Col. Copper	538,190	860,003	....
Granby	1,607,558	1,773,496	1,882,673
Mexican Cos.:			
Boleo	2,315,040	2,204,720	2,424,800
Cananea	3,552,000	2,948,000	2,834,000
Moctezuma	2,732,867	2,687,712	2,446,731
Other Foreign:			
Cape Cop., S. Africa	784,000	786,440	725,760
Kyshtim, Russia	1,170,000	1,055,000	....
Spassky, Russia	795,200	649,600	....
Famatina, Argen.	172,480	....	....
Tilt Cove, Newf'd.	153,257	109,059	104,992
Exports from:			
Chile	8,064,000	6,720,000	3,584,000
Australia	7,056,000	7,164,000	8,064,000
Arrivals in Europe†	13,144,320	10,868,680	12,559,680

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
III, 1911	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460 519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,549
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I. 1912	119,337,753	62,343,901	80,167 904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566

VISIBLE STOCKS

	United States	Europe	Total
IV, 1911	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

of $300 made on the Curb just before it was taken over onto the Exchange.

Curb trading has been active and prices strong. Bohemia has given a good account of itself. The Porcupine issues suffered by the failure of one of the leading sponsors of these securities.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1	....	$0.005
Algomah, Mich	Jan. 22	....	1.00
Belcher, Nev	Apr. 8	Apr. 30	0.10
Black Jack, Utah	Feb. 6	....	0.01
Boston Ely, Nev	Jan. 18	....	0.50
Bullion, Nev	Apr. 30	May 20	0.05
Cedar-Talisman, Utah	Apr. 20	....	0.005
Con. Imperial, Nev	Apr. 30	May 23	0.01
Con. Virginia, Nev	Apr. 24	May 15	0.20
Ely Con., Nev	....	....	0.05
Federal Ely, Utah	May 8	June 8	0.01
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0.05
Hancock, Mich	Mar. 28	....	1.00
Houghton Copper, Mich	May 17	....	1.00
Julia, Nev	May 15	June 5	0.05
Kentuck, Nev	Feb. 29	Mar. 19	0.05
Lehi Tintic, Utah	Feb. 29	....	0.01½
Lower Mammoth, Utah	Mar. 16	....	0.01
Michigan Cop. & Gold, Utah	May 15	May 30	0.002½
New York Bonanza, Utah	May 8	....	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	....	1.005
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1	....	0.10
Southwestern Miami, Ariz	Jan. 15	....	1.00
Union Con., Nev	May 9	May 31	0.15
Utah Antimony, Utah	June 1	....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	.....	24.483	24.595	......
May	53.870	53.308	.....	24.797	24.583	......
June	53.462	53.043	.....	24.651	24.486	......
July	54.150	52.630	.....	25.034	24.286	......
August	52.912	52.171	.....	24.428	24.082	......
September	53.295	52.440	.....	24.567	24.209	......
October	55.490	53.340	...	25.596	24.594	......
November	55.635	55.719		25.680	25.649	......
December	54.428	54.905	.....	25.160	25.349	......
Year	53.486	53.304	.....	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	......	12.275	.	54.034	....
May	11.989	......	12.214	..	54.31.	.....
June	12.385	......	12.611		56.365	....
July	12.163	......	12.720	..	56.673	....
August	12.405	......	12.634	.	56.266	......
September	12.201	......	12.508	..	55.253	.....
October	12.189	....	12.370	....	55.170	....
November	12.616	.....	12.769	..	57.253	....
December	13.552	..	13.768	..	62.068	...
Year	12.376	.....	12.634	.	55.973	...

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	....
February	41.614	42.962	August	43.319	..
March	40.157	42.577	September	39.755	
April	42.185	.	October	41.185	
May	43.115	..	November	43.125	.
June	44.606	.	December	44.655	
			Av. Year	42.281	..

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	......	4.262	.....	12.889	.....
May	4.373	.....	4.223	......	12.984	..
June	4.435	.....	4.292	......	13.260	...
July	4.499	......	4.397	......	13.530	.....
August	4.500	......	4.406	......	14.260	.....
September	4.485	.....	4.356	......	14.744	......
October	4.265	.....	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	.....
December	4.450	......	4.332	......	15.648	.....
Year	4.420	......	4.286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	......	5.249	......	23.743	......
May	5.348	......	5.198	. .	24.375	......
June	5.520	......	5.370	.....	24.612	......
July	5.695	......	5.545	......	25.006	......
August	5.953	......	5.803	......	26.801	......
September	5.869	......	5.719	......	27.750	.....
October	6.102	......	5.951	......	27.256	.....
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	......	14.65	......	15.00	......
May	15.90	......	14.30	......	14.72	......
June	15.90	......	14.06	......	14.56	......
July	15.90	......	14.03	......	14.53	......
August	15.90	...	14.00	......	14.47	......
September	15.90	...	13.57	......	14.40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14.25	......
December	15.15	......	13.10	......	13.90	......
Year	$15.72	......	$13.94	.....	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Apr. 23

Name of Comp.	Bid.
Acacia	.05½
Cripple Cr'k Con.	.01½
C. K. & N.	18
Doctor Jack Pot	.06⅜
Elkton Con.	.67
El Paso	.78½
Findlay	.03½
Gold Dollar	.14½
Gold Sovereign	.02
Isabella	.12⅛
Jack Pot	.06
Jennie Sample	.06½
Lexington	01
Moon Anchor	01
Old Gold	03
Mary McKinney	.68¼
Pharmacist	.02
Portland	.90¾
Vindicator	.71¾
Work	.01

SALT LAKE Apr. 23

Name of Comp.	Bid.
Beck Tunnel	.15
Black Jack	20
Cedar Talisman	.02
Colorado Mining	.26
Columbus Con.	21
Crown Point	‡.04½
Daly-Judge	6.00
Grand Central	68
Iron Blossom	1.27½
Little Bell	42
Lower Mammoth	03½
Mason Valley	‡12.00
May Day	11½
Nevada Hills	2.31¼
New York	06
Prince Con	1.50
Silver King Coal'n	1.90
Sioux Con.	.03¾
Uncle Sam	.21
Yankee	.10

TORONTO Apr. 23

Name of Comp.	Bid	Name of Comp.	Bid
Conlagas	‡7.25	Hollinger	11.90
Hudson Bay	‡70.00	Imperial	04
Temiskaming	43	Pearl Lake	09
Wettlaufer-Lor.	62	Porcu. Gold	35
Apex	04	Porcu. Tisdale	04
Central	‡5.56	Preston E. D.	06
Crown Chartered	24	Rea	40
Dobie	‡.40	Standard	04
Dome Exten	.50	Swastika	22
Foley O'Brien	20	West Dome	.20

SAN FRANCISCO Apr. 23

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.20	Belmont	10.00
Belcher	.80	Jim Butler	68
Best & Belcher	.19	MacNamara	.24
Caledonia	3.25	Midway	.37
Challenge Con.	.25	Mont.-Tonopah	3.45
Chollar	.12	North Star	.25
Confidence	.93	West End Con.	2.10
Con. Virginia	.85	Atlanta	.29
Crown Point	.80	Booth	.12
Gould & Curry	11	C.O.D. Con.	.11
Hale & Norcross	32	Comb. Frac.	.16
Mexican	3.50	Jumbo Extension	.50
Occidental	68	Pitts.-Silver Peak	1.37½
Ophir	1.42½	Silver Pick	.10
Overman	2.22½	St. Ives	.33
Potosi	.08	Tramp Con.	.01
Savage	21	Argonaut	2.25
Sierra Nevada	.37	Bunker Hill	5.00
Union Con.	1.10	Cent. Eureka	82
Yellow Jacket	1.25	So. Eureka	‡5.00

N. Y. EXCH. Apr. 23

Name of Comp.	Clg.
Amalgamated	82¾
Am. Agri. Chem.	60
Am.Sm.&Ref.,com	85¼
Am. Sm. & Ref., pf.	108
Am. Sm. Sec., pf. B	87¼
Anaconda	42¾
Batopilas Min.	2¾
Bethlehem Steel pf	72¼
Chino	29¼
Federal M & S., pf.	43
Goldfield Con.	1⅜
Great Nor., ore., ctf.	41
Homestake	94
Miami Copper	25⅜
Nat'nal Lead, com.	57¾
National Lead, pf.	109
Nev. Consol.	19⅞
Pittsburg Coal, pf.	91
Ray Con.	19½
Republic I&S, com.	23⅞
Republic I & S, pf.	78½
Sloss Sheffi'd, com.	47
Sloss Sheffield, pf.	‡100
Tennessee Copper	41⅛
Utah Copper	63⅝
U. S. Steel, com	71⅝
U. S. Steel, pf.	112⅞
Va. Car. Chem.	50½

N. Y. CURB Apr. 23

Name of Comp.	Clg.
Barnes King	¼
Beaver Con	.44
Braden Copper	5⅜
B. C. Copper	5⅜
Buffalo Mines	‡1¼
Butte & Vipond	‡.53
Caledonia	70
Con. Ariz. Sm.	9/16
Davis-Daly	1⅝
Diam'field-Daisy	11
Ely Con.	1/16
Florence	.78
Giroux	5⅞
Gold Hill Con.	‡¼
Greene Cananea	9⅛
Greenwater	08
Guggen. Exp.	228
Inspiration Cop.	19⅜
Internat S. & R.	‡126
LaGrange Placer	‡2⅞
Kerr Lake	2¾
La Rose	3 11/16
McKinley-Dar-Sa.	1 11/16
Min. Co. of A. new	3
Nev. Utah M. & S.	1/16
Nipissing Mines	7⅞
Ohio Copper	1⅝
Pacific Sm. & M	¼
Precious Metals	‡1⅜
Ray Central	2 3/16
Red Warrior	‡1½
South Utah M. & S.	1
Standard Oil (Old)	880
Stand'd Oil of N. J.	385
Stand'd Oil Subs.	508
Stewart	1½
Tonopah	7⅛
Tonopah Ex.	2 1/16
Tri-Bullion	11/16
Tularosa	1/16
United Cop., pfd.	15
Yukon Gold	3½

LONDON Apr. 24

Name of Com.	Clg.
Camp Bird	£1 9s 6d
Dolores	1 10 0
El Oro	0 18 9
Esperanza	1 13 9
Mexico Mines	6 17 6
Oroville	0 4 6
Stratton's Ind.	0 3 1½
Tomboy	1 2 6

BOSTON EXCH. Apr. 23

Name of Comp.	Clg.
Adventure	9½
Ahmeek	300
Algomah	7⅝
Allouez	47½
Am. Zinc	27⅝
Ariz. Com., ctfs.	6
Bonanza	½
Boston & Corbin	8
Butte & Balak	4½
Calumet & Ariz	73½
Calumet & Hecla	494
Centennial	26½
Con. Mercur	.06
Copper Range	64
Daly West	6¾
East Butte	14⅜
Franklin	14½
Granby	57¼
Hancock	33⅜
Hedley Gold	17
Helvetia	1⅞
Indiana	22¼
Island Cr'k, com.	44
Island Cr'k, pfd.	88¼
Isle Royale	28½
Keweenaw	2
Lake	46½
La Salle	7⅜
Mass	8
Michigan	4½
Mohawk	65⅝
New Arcadian	5¼
New Idria Quick.	6⅞
North Butte	32½
North Lake	8½
Ojibway	5⅞
Old Dominion	55¾
Osceola	118
Quincy	88½
Shannon	14½
Shattuck-Ariz.	21
Superior	37
Superior & Bost.	3
Tamarack	46
Trinity	8
Tuolumne	3¾
Union Mines	3⅜
U. S. Smelting	39¼
U. S. Smelt'g, pf.	49
Utah Apex	2¾
Utah Con.	15
Victoria	4¾
Winona	6½
Wolverine	113¾
Wyandot	2½

BOSTON CURB Apr. 23

Name of Comp.	Last
Bingham Mines	3 7/16
Boston Ely	2¼
Boswyocolo	.03¼
Butte Central	7⅜
Cactus	.14
Calaveras	2⅜
Chief Cons	1½
Corbin	2½
Cortez	1
Crown Reserve	3⅛
First Nat. Cop.	3⅜
Majestic	.75
Mazatan	.60
Moneta Porc.	.15
Nevada-Douglas	4¼
New Baltic	3¾
Oneco	3¾
Raven Copper	.41
Rhode Island Coal	.10
San Antonio	‡3
S. W. Miami	9
South Lake	7½
Trethewey	.58
United Verde Ext.	.43
Vulture	‡5.00

‡Last quotation

The Engineering and Mining Journal

Vol. 93. MAY 4, 1912. No. 18

Issued Weekly by the
Hill Publishing Company
John A. Hill, Pres. Rob't McKean, Treas.
505 Pearl St., New York

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N. W. 7.

Walter Renton Ingalls, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 10,000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page
Editorials:
  Lime in Cyaniding ... 869
  Miners' Wages ... 869
  Steel Making in 1911 ... 870
By the Way ... 871
Correspondence and Discussion:
  Test for Vanadium....Where Should the Primer Go?....Research in Analytical Methods ... 872
Details of Practical Mining:
  *Cartridge for Tamping Dynamite....Corrosion-Resisting Steel....Strength of a Mine Dam....*Staple for Temporary Staging....*Kink for the Blueprint Cabinet....*Santa Rita Pressure Box....*Handling Drill Steel at Champion Mine....*Stacking Boulders....Placing Holes in Breast Stoping....Prospecting by Hydraulicking 879
Details of Metallurgical Practice:
  *Standpipe on a Mill Pump....*A Grizzly Crusher Feeder....Portable Crusher and Elevator....*A Valve Protector ... 883
*Thiogen Process Demonstration. L. H. Eddy 873
John Fritz ... 874
Chino Copper Co. ... 875
April Mining Dividends ... 875
Edgar J. Meyer ... 876
March Operations at Goldfield Consolidated ... 876
Horace J. Stevens ... 876
Witherbee-Sherman Dams Burst ... 876
Miami Copper Co. ... 877
*The Pioneer Smeltery, Arizona. A. L. Waters 877
Notes from Current Literature:
  Pure Nigerian Tin....Making Sodium Cyanide....Roasting Ores for Wet Processes....Separation of Iron from Manganese....Concentration and Leaching of Copper Ore....Determination of Lead, Nickel and Zinc as Oxalates....Tasmanian Hydro-Electric Development....Nickel in Norway....Asbestos in the Urals....Osmiridium in the Urals....Pyrite Mines of the World....Refining Metals with Titanium....Magnesia for Flooring....Strüverite in Perak.. 885
How the Metals Are Sold—Copper—I ... W. R. Ingalls 887
Geology of the Jarbidge District, Nevada ... 890
*Mines and Ores of Porcupine. Reginald E. Hore 891
Nevada Consolidated ... 895
*Improved Richards Pulsator Classifier ... 896
*Baltic Method of Mining—II. Claude T. Rice 897
Mining Index ... 903
Personal, Obituary and Societies ... 907
Editorial Correspondence ... 908
Mining News ... 910
Markets ... 915
*Illustrated.

Lime in Cyaniding

In the early days of cyaniding opinions were divided as to the best alkali to use as the neutralizing agent in the cyanide process. The two that have been most generally considered for commercial operations are caustic soda and lime. While caustic soda was for a time in favor, at present the use of lime for this purpose is practically universal.

A consideration of the reactions involved in the use of each of these reagents shows that theoretically 1 lb. of lime is as effective as 1.4 lb. of caustic soda. This fact taken in connection with the generally lower price of the former adequately accounts for the choice, especially since soda possesses no marked superiority in any branch of the process.

Having adopted lime as the substance to be employed, the cyanide operator still has some problems to solve in applying it to his particular needs. In deciding where to add the lime, the character of the ore is an important consideration. If the ore produces slime difficult to settle, it is essential, according to one investigator, that the alkali be added before water is applied in order to minimize the formation of colloids. The practice in many mills is to add the lime at the rolls, chilean mills or stamps in quantity sufficient to keep the alkalinity up to requirements. In other mills, further additions are made at sand and slime tanks to provide for acidity developed during the process. At one mill the lime is withheld until after the pulp leaves the concentrator to avoid the formation of crusts of lime on the tables.

There still seems to be a difference of opinion as to whether it is better to use the lime dry or as an emulsion or solution. Those advocating adding the lime dry state that by this method it goes slowly into solution and is thus available at successive stages in the process, whereas with lime as solution all the alkali is available at once, so that besides neutralizing the natural acidity of the ore it may enter into other and needless reactions. Exponents of the lime-solution method are positive that greater economy and higher efficiency are possible by its use. The fact that both of these systems are in use in the same district under supposedly similar conditions shows that the question is still an unsettled one.

The size of the particles of lime is of importance when added dry, because if it is too fine it goes rapidly into solution and if too coarse some of the lime may be discharged with the tailings without having exhausted its usefulness.

The method of adding the lime varies at different mills. Where automatic feeders are not deemed feasible it is common practice to place the responsibility of adding the lime upon the attendant of the crushing or grinding apparatus. The objection to this is that no matter how conscientious the mill man may be his chief aim naturally is to keep his machines up to capacity and, if work presses, what to him are secondary duties are likely to be neglected.

It is advisable to have the addition of lime under the control of the metallurgist or someone who appreciates the importance of this part of the process. In some mills the use of automatic devices makes such control possible and affords a means of avoiding irregularities by eliminating the human element. If the neutralizing branch of the cyanide process is as important as many think it is, the same care that is used in feeding zinc dust should be exercised in the use of lime.

Miners' Wages

It is reported that the miners of Butte have asked for an increase in wages to $4 per day and that conferences respecting this are being held with Mr. Ryan. It is surmised also that a similar demand is brewing at Bisbee and in other important copper-mining districts. Following the recent advance at Lake Superior, where wages have been restored to the level of 1906, it was to be expected that a similar action would be expected elsewhere. This is perfectly natural on the part of the miners, and their attitude is in no wise to be deprecated, but if it should prove that the recent advance in copper has been premature and overdone, the producers will have cause to regret their late enthusiasm. Restriction of consumption and increased cost of production are two of the consequences of intemperance in a commodity market.

Steel Making in 1911

The total production of steel in the United States, in 1911, as heretofore noted, was 23,675,501 long tons. This was 2,419,418 tons, or 9.2% less than in 1910, but only a little below the total of 1909, and was slightly above that of the boom years of 1907 and 1906. The last named fact indicates the increase in capacity in the past three years, since the make in a year considered to be one of comparative depression exceeded that of years when all our works were being forced to their full capacity.

The make of steel last year, as shown in the tables below, was again marked by an important increase in the proportion of openheath steel, and especially of basic steel. Another noteworthy fact is that the make of steel in 1911 exceeded that of pig iron by 46,157 tons. This is a condition never reported before in this or in any other large steelmaking country. In fact, it has happened only in one or two European countries—as in Italy—where one or two large works make steel from imported pig iron. The excess production of steel last year is explained by two facts well understood in the trade. One is that at the close of 1910 there were on hand unusually heavy stocks of pig iron, estimated at more than 2,000,000 tons, and that a considerable part of these stocks was used for conversion into steel in 1911. The other was that during a large part of the year there was an abundant and relatively cheap supply of steel scrap, which led to the use of an usually large proportion of scrap in the openhearth furnaces. This second fact is confirmed by the fact that the decrease in basic openhearth steel, as compared with 1910, was proportionally less than that in basic pig iron.

The division into acid and basic steel was as follows:

	Acid		Basic	
	Tons.	Per Ct.	Tons.	Per Ct.
Bessemer(conv'ter)	9,947 849	33.6	....	....
Openhearth........	912,718	3.9	14,685,932	62.0
Crucible, etc.......	129,002	0.5	....	....
Total...............	8,989,569	38.0	14,685,932	62.0

All our converter steel is made by the acid process, the basic converter not being in use in this country. It is assumed also that the small quantities of crucible and special steels made are acid steel. Basic steel is rapidly approaching the point where it will constitute two-thirds of our production. Over seven-eighths of the acid steel is made in the converter, and the proportion of acid openhearth metal does not increase. In 1910 it was 4.6% of the total. Comparing the converter and openhearth processes, we find that in 1911 converter steel was 33.6% of the total, while openhearth was 65.9%, special steels being 0.5% only. In 1910 openhearth was 63.2% of the total.

The growth of the openhearth process in recent years is strikingly shown in the following table, which gives the total steel production of the United States for 10 years past, in long tons:

	Converter	Openhearth	Crucible, etc.	Total
1902.	9,138,363	5,687,729	121,158	14,947,250
1903.	8,592,829	5,829,911	112,238	14,534,978
1904.	7,859,140	5,908,166	92,581	13,859,887
1905.	10,941,375	8,971,376	111,196	20,023,947
1906.	12,275,830	10,980,513	141,893	23,398,136
1907.	11,667,549	11,549,088	145,309	23,361,946
1908.	6,116,755	7,836,729	69,763	14,023,247
1909.	9,330,783	14,493,936	130,302	23,955,021
1910.	9,412,772	16,504,509	177,638	26,094,919
1911.	7,947,849	15,598,650	129,002	23,675,501

Comparing 1911 with 1902, we find that while the total make was 8,728,251 tons greater last year than it was 10 years ago, the quantity of converter steel was actually less by 1,190,514 tons, while the openhearth steel make was greater by 9,910,921 tons. The figures for crucible steel show little change.

COMPARISON OF U. S. AND GERMAN STEEL PRODUCTION

	United States		Germany	
	Tons	PerCt.	Tons	PerCt.
Acid converter...	7,947,849	33.6	187,359	1.3
Acid openhearth	912,718	3.9	383,895	2.6
Total acid.....	8,860,567	37.5	571,254	3.9
Basic converter..	....	.....	8,640,164	57.5
Basic openhe'rth	14,685,932	62.0	5,668,501	37.7
Total basic...	14,685,932	62.0	14,308,665	95.2
Crucible, etc.....	99,897	0.4	78,760	0.1
Electric..........	29,105	0.1	60,654	0 5
Total...........	23,675,501	100.0	15,019,333	100.0

The quantity of special steels in 1911 was made up of 97,653 tons crucible, 29,105 tons electric and 2244 tons made by various experimental and special processes.

It is of interest to compare the production of the two great steel-producing countries in 1911, with special reference to the processes used. The British figures are not yet available. The figures for the United States in the accompanying table are in long tons; for Germany in metric tons.

The production of basic steel in the two countries differed by only 377,267 tons, but over 60% of the German basic steel was made in the converter. Our excess of 7,556,168 tons over Germany last year was wholly in acid steel, which is less than 4% of the German make.

It appears from statements in the daily papers that the great potash deposit recently discovered in California by the U. S. Geological Survey is all privately owned. We suppose that it is a duty of the Geological Survey to assist the citizens of the country in the exploitation of their resources, i.e., if someone has got a diamond mine that he does not know about and the Geological Survey discovers it, certainly the owner ought to be told about it. There would be some excuse for the failure to recognize diamondiferous ground, but when a man or a company owns a potash lake and does not know it, there is something of a reflection upon his intelligence, not because he himself failed to recognize what he had, but because he neglected to obtain expert advice. The most interesting question will arise when the Geological Survey discovers some enormous deposit of potash or saltpeter in the public domain that has been withdrawn from entry. As to the potash discovery in California, we think it will be well to await some commercial report before waxing too enthusiastic.

The smelters' production of copper in the United States, plus imports of foreign blister copper and copper in ore and matte, was 127,885,749 lb. in February, against 139,027,356 lb. in January, a smaller importation of blister copper accounting for the decrease. The production reported by the refiners was 116,035,809 lb. in February and 119,337,753 lb. in January, the smelters' figures thus exhibiting a surplus of 31,539,543 lb. during the first two months of 1912.

By the Way

Besides other troubles due to the disturbed conditions in Mexico, the Mexican *Mining Journal* had the misfortune on Apr. 20 to lose its entire printing plant by fire. The publishers announce that the plant is being rebuilt and ask the indulgence of subscribers in the delay entailed in getting out the May issue which was in press at the time of the fire.

Apropos of racial peculiarities, the Welsh are not always without them. There were once two brothers worked in a copper smeltery who always arrived at the plant about 20 ft. apart. Inquiry revealed that they lived in adjoining houses, and the one in the farther house started first, knocking on his brother's door as he came by. The second then started but never would hurry to catch the first, nor would the first wait for his brother to catch up.

We do not often venture upon any prophecies respecting the monthly report of the Copper Producers' Association, but if we could make up our minds to break our rule, we should be inclined to forecast an increase in the stock during April. The thought has occurred to us, however, that inasmuch as the refiners are always doing the unexpected, the output of refined copper in April may shrink by 10 or 15 million pounds, wherefore we feel that after all we shall best refrain from prophesying.

Leading a more or less open-air life, mining engineers have not been worried so much by germs, etc., as some other professional men. Still, they have had to do with the ankylostomiasis worm and other strange animals. Now they are introduced to a new one by T. P. O'Conner, the well known apostle of home rule for Ireland. In his otherwise serious and literary paper, *T. P.'s Weekly*, he gravely retails the following story of a metal-eating worm: "A more feasible explanation of the disease which attacks old metal coins is suggested by the recent discovery by some Italian engineers of a microbe which feeds on iron. The discovery was made through the frequency with which railway accidents occurred in one particular portion of the railroad in a certain district. An examination of the rails was made, and the presence of severe corrosion was revealed. A rail was taken up and broken. It was then found to be hollow, and further examination showed the presence of a thin, gray, thread-like worm, about a third of an inch in length. A careful examination was made of the habits and appearance of this worm. Upon its head it carried two little glands filled with a corrosive secretion, which it ejected every few minutes on the iron. The ejection had the property of rendering the iron soft and spongy, when the worm at once proceeded to devour it." Rand mining magnates, writes a Johannesburg correspondent, are going to put an embargo on Italian imports. If the Italian worms are slick enough to evolve an acid that will digest steel rails, there is no knowing but that transplanted to new surroundings, they might start dissolving gold out of the banket ore. Or managers might be offering excuses for failing to keep the mills going, such as "worms in the stamp heads," or "No. 7 level stopes simply eaten out by the grubs," and almost anything might happen to the gold reserve, assuming that any mine were now bold enough to keep one in its family-skeleton closet.

In Prof. R. Pumpelly's book "Across America and Asia," published in 1870 and based in part on some very strenuous adventures in 1860-61 as engineer-in-charge at the Santa Rita mines near Tubac, south of Tucson, Ariz., is this paragraph: "The nearer an ancient mine may be to the heart of the Apache stronghold, the more massive the columns of silver left standing as supports at the time of abandonment. It is not strange, therefore, when we consider how easily our people are swindled in mining matters, that we find them lending a willing ear to these tales, and believing that in Arizona the hoofs of your horse throw up silver with the dust." That Professor Pumpelly's observations made nearly half a century ago have a decided resemblance to some present-day wisdom is in proof of the doctrine that human nature is very persistent in its characteristics.

Many young gold fields have started out brilliantly, but their careers have been blasted by wild extravagances, hot blasts of brokers' literature, gambling and other dissipations. No wonder the Rand became a great gold field. Consider the early advantages it enjoyed. Rev. David Russell, of Johannesburg, speaking before the Men and Religion Forward Movement, in New York, related some early experiences: "I was preaching at Pietermaritzburg when a man came in from the newly discovered gold fields. He told me there were two or three hundred miners without a preacher or church. . . . . He was eager that the diggers should hear the Gospel. I went, and shall never forget the first service in the public square, with two hundred miners clustered about. . . . . We had no place for an after meeting, but there was an unoccupied building, with a storeroom on one corner. There were no doors or windows and the place was to be a liquor warehouse. We got some planks and some boxes and made seats. Gen. Joubert, the Boer guerilla, who never was captured, was one of the audience. We held indoor meetings there for several days. The diggers learned the Gospel songs and we were told they rang through the valley for several miles. In 10 days the owner of the warehouse said we must get out, as his stock had arrived, but I got him to let us use the floor by guaranteeing him against the pilfering of goods. The digger men stacked cases of beer up in one end of the room, to provide seats much like your theater galleries. The platform was made of twelve big brandy cases—filled—and for the pulpit I set up two cases of gin, covered with my traveling rug. They told us there must be lots of spirits in our church. But the place was filled with eager men and that justified the occupation of the liquor warehouse."

The "dead miner" swindle, a variation of the "Spanish prison" scheme, has just come to grief. George W. Post, alias William A. Carter, pleaded guilty on Apr. 26 in the district court of New York to four indictments for having used the mail to defraud, and was sentenced to three years and six months and $11,000 fine. Post, who is a distinguished looking man of 65, used to work with E. A. Starkloff, alias Seaver or Sheldon. Their favorite plan, says the Times, was to write to the heirs of some person who had recently died in England, Germany or France, stating that a poor miner who had been assisted by the deceased had at last found a valuable mine and wished to reward his benefactor. Many who received these letters answered them and were then informed that by putting up a sum of money valuable mining rights could be obtained in Cripple Creek or some other well known district. Some of the victims sent money, and if cautious enough to come to this country, Post and Starkloff would send them home carefully guarding a trunk containing brass fillings, under the belief that it was virgin gold.

A London expert who was sent to report on a mine in Gilpin County, Colorado, tells the shareholders that "the positive ore developed amounts to 135,545 tons of an average assay value of $9.35 per ton. The probable ore amounts to 95,025 tons of an average assay value of $9.22 per ton. The ore expectant amounts to 220,082 tons of an average assay of $9.22 per ton." Note the 22c.! It is a well known fact that a metallurgist and mining engineer in that state, estimated to within a few cents per ton what it would cost to mill an 800,000-ton dump, and within a few dollars of how much profit per month he could extract in two years—and subsequently *did* it. But the other totally eclipses this—on paper—and knocks into a cocked hat the old adage "you cannot see an inch ahead of your pick's point." It simply shows what marvelous advance science is making in the art of mining when the value of 315,107 tons of "probable and expectant ore" can be given within a cent to the shareholders expectant.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Test for Vanadium

In the April issue of a contemporary of the JOURNAL, appears the following test for vanadium:

"A simple method of testing a mineral to determine whether or not it contains vanadium is to digest it with nitric acid and then add hydrogen peroxide to the resulting liquid. The formation of a brown color indicates the presence of vanadium."

I use a sulphuric-acid solution instead of nitric, and the addition of peroxide gives a wine color. If the substance is not readily attacked by sulphuric acid it may be put in solution by any other acids, evaporated to dryness and sulphuric acid added. I believe this test is more delicate.

B. A. STATZ.

Albuquerque, N. M., Apr. 16, 1912.

Where Should the Primer Go?

It would seem that such a question after being so thoroughly discussed would by this time be practically settled. However, none of the numerous articles that has appeared recently in the JOURNAL, has fully agreed with my experiences, nor has it given sufficient reasons for the views expressed and the conclusions reached by its writer.

Mr. Gunsolus states that no difference was noted, in experiments made by the du Pont company, whether the primer cartridge was placed first or last.

In my opinion the reason for no difference being noted lies in the fact that an excess of powder must have been used, enough in all probability, to break two holes of the kind loaded, as this is invariably the case in underground work, even when the loading is done by the most experienced men and in ground with which they are perfectly familiar. The rule that it is better to overload than to have a round fail is not a bad one.

Let whoever will, load two 10- or 12-ft. holes that have reasonably heavy burdens. Fill them to the brim with an inert explosive, such as a gelatin dynamite or one of the newer explosives of the non-nitroglycerine type. In one of them place the detonator in the bottom or near it, with the closed end pointing out; in the other place the detonator last, the business end always pointed toward the body of the powder. He will certainly see the difference in a case of this kind. Again, load any hole, or better, a number of holes, with an inert powder and place the primer last with the closed end of the cap pointed away from the body of the powder. In a great number of cases the cartridge containing the detonator will explode, leaving the rest of the powder in the hole, or will simply set fire to the main body of powder.

Place a long row of sticks of 40% gelatin dynamite end to end. Use 25 or 30 of them. Place an ordinary cap, say a Gold Medal (No. 4) in one end cartridge, pointed toward the string of powder. It depends upon the amount of paper between the cartridges, how closely in contact the powder is as to just how many of them will explode. It is safe to say that not more than half of them. Use a No. 6 cap and the detonation will carry farther. A No. 7 or a stronger cap will carry the detonating wave in proportion to its strength.

This means that a complete explosion of the powder is obtained only a limited distance from the initial point of detonation and that the greatest power is developed by the primer cartridge itself. Even though all the powder in a hole loaded to the muzzle may explode, the cartridge farthest from the cap exerts the least force. Not only this, but the primer is the first to explode, and in a long column this fact may make a material difference in some ground.

Detonation is a peculiar but now well known phenomenon and to go into the reasons *why* the primer cartridge exerts the most force and therefore should be placed where most needed, would take up too much space. It is nevertheless a fact, that when the primer is not placed near the bottom, the reason that the hole breaks at all is because the burden is so light that a complete explosion (the greatest force possible) is not necessary.

The fact that fuse running alongside of and in contact with powder is likely to set fire to it, even gelatin, cannot be gainsaid. This is the cause, to a considerable extent, of the excessive amount of smoke and nauseous gases given by the explosion of a round of holes loaded with nitroglycerine explosives. It is not the gas generated by the explosion but the volatilized unexploded nitroglycerine that causes the well known "powder headache." The question, then, resolves itself into: If you place the primer last you are not likely to get a complete explosion. If you place the primer in the bottom you are apt to burn the powder. And it is impracticable to place the primer any other place than in or near the bottom in a round of machine holes, in a mine drift or medium-sized tunnel, because of the fact that one hole will almost invariably cut off part of one or more of the others.

My experience in eight states and in more than 50 different mines compels the conclusion that there are few instances where it is at all safe to load a machine round with the primer last. In conclusion it may be well to state that if it were not for the presence of moisture in the holes from the water used in drilling, which, together with the paper covering, protects the powder from being ignited by the fuse, there would be a great many more burned holes, and it would have been necessary long ago to find different methods of drilling or loading, if not to invent an explosive that would not burn, or a fireproof fuse.

C. B. HANSON,
Field Engineer, Pennsylvania Trojan
Powder Co.

Allentown, Penn. Apr. 27, 1912.

Research in Analytical Methods

One is constantly struck with the beautiful results ordinarily reported in researches in analytical methods. It seems to make scarcely any difference how poor the method proves to be when applied in actual work, the original research usually shows 1.000 gram taken, and 0.999973 gram recovered, or similar figures.

Do many of the inventors of methods have the courage to ask fellow chemists or students to weigh out quantities of the element worked on, for them, the exact quantities to remain unknown until the analysis is finished, and only rough figures to be furnished them at first? In this way they would approach working conditions.

I fancy, if so, that there would be fewer reports that "the method far exceeds in accuracy any known method," and more to the effect "the method is fine theoretically, but no one can tell the end point"; "the amount of nickel must be approximately known before running this method," "we earnestly recommend this assay method as a short cut where no money is to be paid on the results." I certainly would like to hear from some of the research artists on this.

D. E. N. M.

St. Louis, Mo., Apr. 14, 1912.

Thiogen Process Demonstration

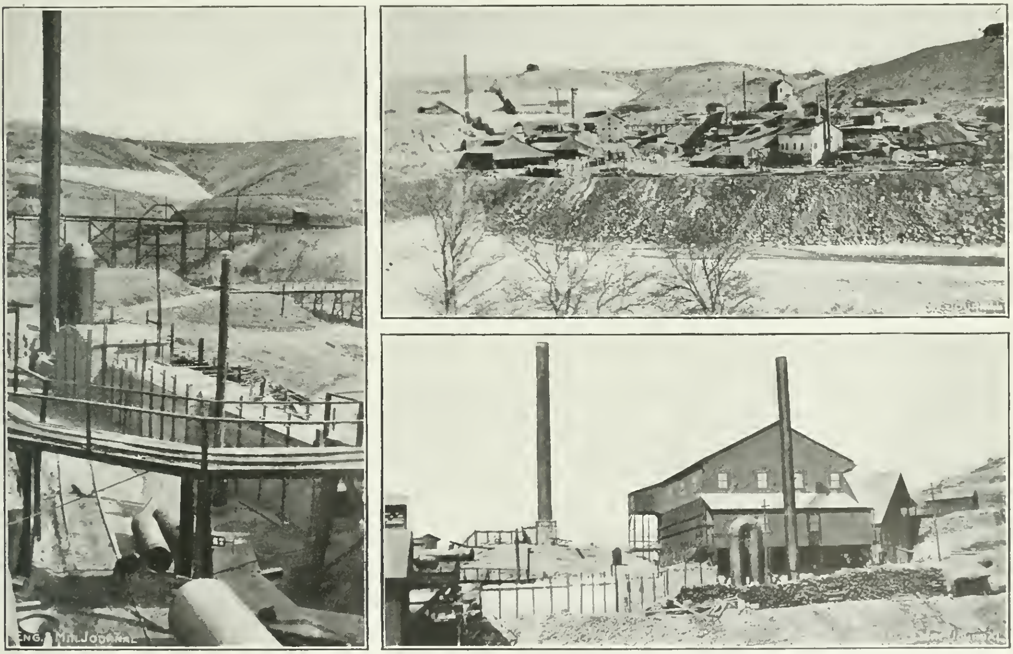
By L. H. Eddy

An application of the thiogen process of reducing to elemental sulphur, by means of hydrocarbons, the sulphur oxides in furnace gases. This is being accomplished in a small plant built for treating McDougal-roaster gases at the Penn smeltery at Campo Seco, California.

The object of the thiogen process, invented by Prof. Stewart W Young, of Stanford University, is to reduce the oxides of sulphur that are usually present in the gases given off by blast furnaces, reverberatories and roasters, to elemental sulphur in such a condition that most of it can be removed from the furnace gases before they are discharged into the atmosphere.

Satisfactory Results on McDougal Roaster Gases

Satisfactory progress is being made with the process, as applied to the Mc Dougal roasters at the smeltery of the Penn Mining Co., at Campo Seco, Calaveras County, Calif., where the amount of sulphur dioxide in the discharged gases has been reduced to as low as one part in 50,000. The gases from two 11½-ft. McDougal roasters have been treated in the experimental apparatus without forcing its capacity, although some trouble was experienced in obtaining perfect condensation, due to imperfect spraying devices. This seems to be the most important engineering problem remaining to be solved, and the apparatus is being remodeled in order to secure better results from the spray. The construction of the experimental plant is crude, as it was designed primarily for demonstrating the principle of the process and experimenting in order to gather sufficient data for guidance in the construction of a permanent plant.

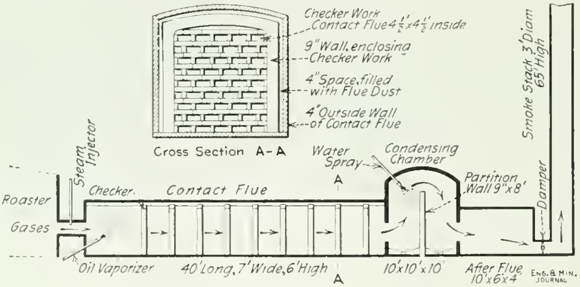


Thiogen Process Flues and General View, Penn Smeltery, Campo Seco, California

The plant comprises a brick flue 40 ft. long, about 6 ft. high and 7 ft. 4 in. wide, outside measurements; a condensing chamber 10 ft. high and 10 ft. square, and a second flue 10 ft. long, 6 ft. high, 4 ft. wide, extending to and connected with a smokestack 3x3x65 ft. high. The 40-ft. flue, into which the gases pass direct from the roasters, is provided with transverse panels, as shown in the accompanying sketches; these panels are of brick checkerwork 4½ ft. high, 4½ ft. wide, and 9 in. thick. The openings or flues in the checkerwork panels are filled with plaster of paris, to which sawdust has been added; the sawdust burns out, leaving the plaster of paris porous. This is the contact material. It may be cast in any desired shape, thin enough to be readily broken in small pieces and easily disposed in the open spaces in the checkerwork panels. This flue is connected to the roaster by an intake pipe about 2 ft. diameter, and to the condensing chamber by a 2½x2½-ft. outlet through the dividing wall. The condensing chamber is provided with a partition wall, parallel with the checkerwork panels of the flue, 8 ft. high and 9 in. thick. This chamber is connected to the second or after flue by a 2½x2½-ft. outlet through the dividing wall. The second flue is connected to the smoke-stack by a 2x2-ft. outlet.

Sulphur Oxides Reduced by Hydrocarbons

The operation of the plant is as simple as the process is interesting. The whole apparatus having been previously heated to a low red heat, the gases from the roasters are caused to pass through the intake pipe into the fore chamber of the main flue, which may be designated as the contact flue, where they mix with hydrocarbon vapors from the oil vaporizer inserted through the end wall of the flue just beneath the intake pipe. The gases then pass through the checkerwork panels, which contain the contact material. By the time the gases reach the condensing chamber they no longer contain appreciable quantities of sulphur dioxide or sulphur trioxide, these having been completely reduced to elemental sulphur. From this point the remaining operation consists in condensing the sulphur to solid or liquid form. The partition wall in the condensing chamber forms two compartments, through which the gases must pass; first through the compartment adjoining the contact flue, thence over the partition wall and through the compartment adjoining the second or after flue. The condensing chamber is provided with a water spray, inserted through the roof between the dividing wall of the chamber and the contact flue. Contact with the spray cools the gases below the condensing point of sulphur. The floors of the two compartments of the condensing chamber are inclined toward the center, thus providing drainage for the water.



Diacram of Thiogen Process Plant

The first trial indicated satisfactory reduction of the oxides of sulphur, the apparatus, however, worked under a negative pressure, and water soaked through the walls of the flue. To obviate this difficulty, a steam injector was introduced at the intake pipe, and a regulating damper placed in front of the smokestack. By the regulation of these two devices a slight pressure may be maintained in the apparatus. With the apparatus in this condition, the excellent results referred to were obtained. Sulphur has been obtained from traps in the condensing chamber in the form of rubber-like clots, and as milky sulphur emulsion with the excess water. It has also been condensed on iron pipes placed within the apparatus, and when so obtained is quite pure and crystallizes readily as the characteristic yellow sulphur. Considerable quantities have been carried by the draft out of the smokestack in the form of finely divided flowers of sulphur; quantities of this have also been collected

Brick Walls May Be Substituted for Checkerwork

The experimental stages of the process are almost completed, and it will soon be possible to proceed with more pretentious construction. Since my visit to the plant, Apr. 9, 1912, the engineers have made an experiment which may result in the substitution of solid brick baffles in the place of the checkerwork panels, although this has not yet been definitely decided. In the construction of the checkerwork panels, the faces of the structure are coated with plaster of paris, so that the contact is complete. It has been found that some flue dust accumulates in the after end of the contact flue. By the use of baffles coated with plaster of paris, the accumulation of flue dust descends to the bottom of the contact flue and may be more easily disposed of, but this is a detail of construction that affects the economy of operation and not the scientific principle upon which the operation is based. Another modification being considered by the engineers, relates to the character of the material used in the construction. Concrete and steel may be substituted for brick. In fact, there are various details to be considered in the construction of a permanent plant that could not have been clearly foreseen, except through the operation of the experimental plant.

The patents of the process are controlled by the Thiogen Co., a Delaware corporation, of which Charles R. Miller, of Wilmington, is president. H. G. McMahon, of San Francisco, is vice-president, and John T. Overbury, of San Francisco, is secretary and treasurer. These men, with Prof. Young and Hamilton Sanborne, are the owners of the patents. A. M. Hunt, of San Francisco, is consulting engineer, and Donald E. Fogg, formerly of the Peyton Chemical Co., is chief engineer.

According to the *Electrical World*, recent work at the University of Wisconsin resulted in determining the melting point of tungsten as 3002° C., and of tantalum as 2798° Centigrade.

John Fritz

In view of recent reports of his serious illness, the friends—and this means everyone—of John Fritz will be glad to learn that his condition has decidedly improved recently and that there is a fair prospect of his recovery. Probably the strongest elements counting for success in the struggle that our grand old friend has had, and is having, with sickness, are his indomitable nerve and pluck, and the great constitution with which nature endowed him, and which has been conserved by a temperate, well ordered life.

About two months ago his medical attendants found that it would be necessary to open a gathering on his chest which had been giving him much pain, and later, quite recently, on April 15, it was found essential to follow this with a much more serious operation for the removal of pus from gatherings that had formed on his breast and side. In his weakened condition Mr. Fritz naturally shrank from pain; at the first operation this was avoided by freezing the locality to be operated on. When Mr. Fritz heard the hissing of the jet used, he opened his eyes as he lay in bed, and turning to a friend by his bedside said: "That sound reminds me of my first Bessemer blow."

After the operation the surgeon said to him, "Now, Mr. Fritz, I'm going to tell you what I wouldn't have told you if you had refused to have the gathering opened. I was afraid that if we didn't open and drain it, the inner wall of the sac might prove weaker than the outer, and that it might break inward and do you serious injury." Mr. Fritz lay still for a few moments. Remember this was after quite a severe operation for a man in his weakened state—and then turning to the same friend, said: "That reminds me of Muggins. One time, years ago, a steamer blew up when lying at the Battery wharf in New York, and all the New York papers and local wiseacres spent weeks in speculating on the cause of the blow-up. Finally Muggins spoke up and said that it was his opinion that the boiler exploded because the inside pressure was greater than the outside pressure."

At the time of the second, or more severe, operation about two weeks ago, the same friend was by Mr. Fritz' bedside, and in urging him to have it performed said: "Remember, Mr. Fritz, the doctors are going to use laughing-gas (nitrous oxide) as an anesthetic, and you've often taken that when you've had teeth pulled, and you know that it will save you all suffering," "That's all right," Mr. Fritz replied, "but they shan't take out any of my teeth"—the joke being that he hasn't a tooth of his own left. Again being joked, at the time he was preparing for the operation, on his pretending to be ill, when only the day before he had sent out and bought a new horse, and had been taken to the window to see the horse go past, he said: "Yes, I paid $225 for that horse and I'm going to sell him after a while for $400. You see if I don't."

When a man of 90—his ninetieth birthday comes in August next—can joke thus when prostrate with illness, surely we may share the surgeon's confidence that one with a mental attitude such as these stories indicate, may well recover from his present prostration, and that the engineering profession may look forward to paying its tribute of loving respect to dear old Uncle John Fritz on his coming ninetieth birthday.

Loving friends are about him, and old friends are anxiously watching for his recovery. The above tidings come to us following a visit of Doctor Raymond's to Lehigh University, and a call on Mr. Fritz, on April 28, by Doctor Raymond and Doctor Drinker.

Chino Copper Co.

The report of the Chino Copper Co., operating mines at Santa Rita and a mill at Hurley, N. M., covers the period of 19 months ending Dec. 31, 1911. True operating was carried on in the last quarter of the year, during which 986,375 lb. of copper were produced, which sold at 13.3c. per lb. The expense of production per pound of copper was: Mining, 0.774c.; freight on ore, 0.461; milling, 5.391; treatment, refining and freight, 3.175; selling commission, 0.133; total, 9.934c. per pound.

Ore reserves on Dec. 31, 1911, are given as 55,000,000 tons, containing 2.24% of copper. It is estimated that of this amount, 32,000,000 tons can be mined by steam shovel, based on mining by this means to a depth of not over 200 ft. As it may be possible to mine by opencut to greater depths, this tonnage may be exceeded.

At Santa Rita, 2803 acres are held by the company, containing everything likely to be of value, or needed either for mining or surface uses. At Hurley, 7158 acres are held for mill site and water rights. The first section of the mill was started on Oct. 16, 1911, about 15 months after beginning construction work, the second about the end of December, the third on Apr. 1, 1912, and it is estimated the other two will both be running before Sept. 1, 1912. To date, $2,234,993 has been spent on account of the new mill.

Up to the end of 1911, about 2,000,000 cu.yd. of material had been removed, of which 1,700,000 was waste, the remainder was partly oxidized ore, most of which was stored, the remainder going to the concentrator, where a recovery of about 22 lb. of copper per ton of ore gave the production and costs mentioned above. The concentrates are sent to the smeltery, at El Paso.

April Mining Dividends

As compared with April, 1911, the mining dividends reported for April, 1912, are decidedly encouraging. United States mining companies paid $7,045,270, as compared with last year's $6,048,280; metallurgical and holding companies $3,656,358, as against $3,199,644 in 1911; and Canadian and Mexican companies $1,515,211, against $1,669,122 a year ago. The falling off in the last is, of course, accounted for by the troubles in Mexico. For instance, the Mines Co. of America, although it had a successful year and first quarter, considered it wise to take no present action on dividends, and San Toy failed to appear in this month's list. Among Canadian companies, the Standard Silver-Lead Mining Co. appears for the first time.

UNITED STATES MINING COMPANIES	Situation	Per Share	Total
Ahmeek	Mich.	$4 00	$200,000
Am. Zinc, Lead & S	U. S.	0.50	40,060
Anaconda, c.	Mont.	0 50	2,119,000
Ariz. Cop., pf. A	Ariz.	0.047	5,769
Bunker Hill Con., g.	Calif.	0.07½	15,000
Bunker Hill & Sull., l.s.	Ida.	0.15	49,050
Cente'ial-Eureka, l.s.g.	Utah	1.50	150,000
Copper Range, c	Mich.	0.50	192,093
Champion, c.	Mich.	1 00	100,000
Daly-Judge, s.l	Utah	0.15	45,000
Daly-West, s.l	Utah	0.30	54,000
Elkton, g	Colo.	0.01½	37,500
El Paso, g	Colo.	0.01	24,500
Frontier, z	Wis.	2.00	2,500
Golden Cycle, g.	Colo.	0.02	30,000
Goldfield Con., g.s.	Nev.	0.50	1,779,574
Hecla, l.s	Ida.	0.02	20,000
Homestake, g.	S.D.	0.50	109,200
Iron Blossom, s.l.g.	Utah	0.10	100,000
Mary McKinney, g.	Colo.	0.02	26,185
New Idria, g	Calif.	0.30	30,000
North Butte, c.	Mich.	0.40	164,000
Old Dom'ion M. & S. c	Ariz.	1.00	162,000
Opohongo, g.s.l	Utah	0 01	26,969
Pittsburg-Idaho, l	Ida.	0.04	32,120
Portland, g	Colo.	0.02	60,000
Stratton's Ind., g	Colo.	0.06	60,750
Tonopah-Belmont, g.s	Nev.	0.25	375,000
Tonopah-Mining, g.s.	Nev.	0.40	400,000
United Globe, c.	Ariz.	3.00	69,000
United Verde, c.	Ariz.	0 75	225,000
Wolverine, c	Mich.	5.00	300,000
Vindicator, g	Colo.	0.03	45,000
Wasp No. 2, g	S. D.	0.01	5,000

COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES	Situation	Per Share	Total
Am. Ag. Chem., pfd.	U. S.	$1.50	275,730
Am. Ag. Chem., com.	U. S.	1.00	171,141
Am Sm. Sec., pfd. A.	U. S.-	1 50	255,000
Am. Sm. Sec., pfd. B	Mex.	1.25	375,000
Central C. & C., com.	Mo.	1.50	76,875
Central C. & C., pfd	Mo.	1.25	23,437
Consol. Coal	Md.	1 50	299,148
Guggenheim Expl.	U. S.- Mex.	2.50	519,832
General Chem., pfd.	U. S.	1.50	150,000
Inter. S'm'k. Pow.,com.	Del.	0.50	90,000
Inter. S'm'k. Pow., pfd.	Del.	2.00	24,000
Island Creek Coal, pfd.	U. S.	1.50	75,000
Harbison Walker, pfd.	U. S.	1.50	144,000
National Carbon, com	U. S.	1.50	82,500
Old Dominion, c	Ariz.	0.75	219,933
Pittsburg Coal, pfd.	Penn.	1.25	371,262
Sloss-Sheffield, pfd	Ala.	1.75	117,250
Va.-Car. Chem., pfd.	U. S.	2.00	360,000
Vulcan Detinning, pfd.	N. J.- Ill.	1.75	26,250

CANADIAN, MEXICAN AND CENTRAL AMERICAN COMPANIES	Situation	Per Share	Total
Beaver, s	Ont.	$0.03	$59,989
Buffalo Mines, s	Ont.	0 05	50,000
Crown Reserve, s	Ont.	0.05	88,441
Domin. Coal, com.	N. S.	1 00	150,000
Kerr Lake, s	Ont.	0 25	
La Rose, s	Ont.	0 12½	187,300
McKinley-Darragh.,s	Ont.	0 10	224,769
Nipissing, s	Ont.	0 37½	450,000
Nova Scotia S&C., com.	N. S.	1 50	90,000
Nova Scotia S & C. pfd.	N. S.	2 00	20,600
Standard Silver-Lead	B. C.	0 01½	25,000
Tem. & Hud. Bay, s.	Ont	3 00	23,283
Temiskaming, s	Ont.	0 03	75,000
Wettlaufer-Lorrain, s.	Ont.	0.05	70,829

The rising price of copper for the last few months was reflected in the increased dividends of Ahmeek and Wolverine, both of which raised their rates $1, and in North Butte, which raised its rate from 30 to 40c. Anaconda's rate, for the present, remains unchanged.

The Cripple Creek district of Colorado made a good showing, as Elkton, El Paso, Golden Cycle, Stratton's Independence, Mary McKinney, Portland and Vindicator all contributed, paying $283,935, although premier honors among the gold-mining companies must go to Goldfield Consolidated. of Nevada, with its $1,779,574 quarterly disbursement. Nevada also can claim Tonopah-Belmont and Tonopah Mining with $775,000 for the same period.

United States mining companies making public reports, have paid $20,784,290 in dividends in the first four months of 1912. Mining, metallurgical and allied companies in North America report $54,998,011 for the same period. Judging by these figures, the "paralysis" of the mining industry so often heard of is of a singularly mild type.

Chronology of Mining

Apr. 1—Miners in Butte decided not to strike by vote of 4460 to 1121, an emphatic defeat of the radical element.—A gold bar of 160 oz. was deposited from the McIntyre mill in a Porcupine bank, being the first commercial product from the Porcupine district.—Miami Copper Co. declared initial dividend.—Inauguration of anthracite coal miners' strike in the United States.—Flume of the Wanapitae Power Co. at Sudbury, Ont., burst, depriving several nickel mines of power.

Apr. 2—Stockholders of Chino Copper Co., voted to increase capital stock by 100,000 shares.

Apr. 6—Leaders instructed the striking British coal miners to return to work.

Apr. 9—Announcement that the Guggenheim interests had acquired property in the Miami district in Arizona.

Apr. 10—Sampling plant of the Nipissing company destroyed by fire.

Apr. 18—Trouble at the Lena Goldfields workings at Irkutsk, Russia, resulted in the killing of 107 and injuring of 80 workmen by troops.

Apr. 21—An explosion of gas in the Coil coal mine at Madisonville, Ky., killed five men, all that were in the mine.

Apr. 23—Witherbee-Sherman dams at Witherbee, N. Y. washed out, entailing $45,000 loss.

Apr. 25—John D. Ryan, president of the Amalgamated company, announced that the company would spend $2,500,000 on reconstruction of the Great Falls smeltery.

Apr. 30—An explosion reported to have entombed 283 miners in the Hokkaido Coal Co.'s mine at Yubari, Japan.

Edgar J. Meyer

Edgar J. Meyer was born Jan. 13, 1884, at San Francisco, and after a preliminary education in that city came to New York, where he continued his schooling preparatory to entering Cornell University. At Cornell, he spent a year in the Academic Department, followed by four ears in the School of Engineering, and eceived the degree of M.E. from that nstitution in 1905. He was a member of the Zeta Psi fraternity. In addition o his regular course, he was keenly nterested in research work and made a particular study of gas engines. The result of his work in this direction brought him particular praise, and some of the heories he evolved in reference to the velocity of flame propagation of explosive mixtures were incorporated in the works prescribed in engineering courses.

After graduating from Cornell with honorable mention, Mr. Meyer entered he employ of the banking firm of Eugene Meyer, Jr. & Co., of New York, in which irm he subsequently became a partner o his brother who is the senior member. This firm has been and still is represented on the boards of certain of the argest mining enterprises both here and abroad. These interests required Mr. Meyer to spend considerable time in the field. At the time of his death he was vice-president and director of the Braden Copper Co. and was also active as an official of numerous other important corporations.

In the business and mining world, Mr. Meyer will be remembered as a close and careful student of values. He applied his scientific training with a great degree of sagacity to the consideration of problems of the mining industry as well as finance in general, and his combined ability as an engineer and business man was rapidly bringing him to the front. Mr. Meyer had especially close knowledge of the steel and copper business. The statistical study and analysis which he made in 1909 of the development and operation of the United States Steel Corporation, created much favorable comment. His conclusions in regard to the position of copper, drawn after a personal investigation in the important copper centers, were accepted as carrying much weight by those most vitally interested in the business, though at the time of his death he was but 28 years of age. Aside from his duties as an active member of a banking firm, he found time to interest himself in various other channels, having patented several automobile appliances and being also a member of the Technical Committee of the Aëro Club.

He met his death in the "Titanic" disaster, and in this catastrophe he distinguished himself in his endeavor to save the lives of others. According to the accounts of survivors, Mr. Meyer, after seeing his wife safe into one of the boats, remained and helped lower the last boat of women and children that left the ship. Mr. Meyer was married in 1910 to Miss Leila Saks, daughter of the late Andrew Saks, who, with a little girl of one year, survives him.

March Operations at Goldfield Consolidated

During March, the total production of the Goldfield Consolidated Mines Co. was 30,132 tons, containing $734,655, an average of $24.38 per ton; this was milled with an average extraction of $22.92 per ton, or 93.99%. The total net realization was $491,337, or $16.31 per ton. Development work totaled 2719 ft. for the month.

MARCH OPERATING COSTS AT GOLDFIELD CONSOLIDATED

Mining:		
Development	$0.80	
Stoping	2.55	
		$3.35
Transportation		0.08
Milling		2.11
Marketing		0.11
General expenses		0.49
Bullion tax		0.19
Construction		0.33
Total cost of operation		6.66
Miscellaneous earnings		0.05
Net cost per ton		$6.61

At the Clermont, the sill of the 428 stope between the third and fourth levels was extended and produced 53 tons of $26.45 ore. The 604 raise from the 1000-ft. level, and the stope being opened from the raise, produced 916 tons, averaging $56.34 per ton. The 700-M stope between the 1000- and the 1200-ft. levels produced 63 tons, averaging $45.47 per ton. At the Mohawk, the 111-M sill produced 524 tons of $15 ore. The 212-X crosscut, on the 350-ft. level, produced 53 tons, averaging $69.52 per ton. The 208-X intermediate, under the 111 sill, produced 30 tons, averaging $48.60 per ton. The 354 sill was extended and produced 198 tons of $74.40 ore. The 491 sill, under the old Mohawk-Jumbo lease workings, produced 436 tons of $17 ore.

At the Red Top, the 353 intermediate, between the second and third levels, was extended in ore and produced 151 tons, averaging $32.50 per ton. The 216-N raise from the second level produced 130 tons of $63 ore. The vertical raise from the 750-ft. level of the Hazel has holed to the bottom of the Laguna shaft, and is being squared out and the shaft timbered down to the bottom. The Hazel shaft surface plant will be dismantled, and all deeper development in this territory prosecuted through the Laguna shaft. In the Combination mine, superintendent Thorn states that an important discovery has been made between the fourth and fifth levels, in the Riley vein, about 300 ft. southeast of the shaft. The 311-P raise, from the fifth to the fourth level, produced 140 tons of ore, averaging $86.60 per ton. The upward extension of this orebody was cut in an intermediate between the second and third levels, where two hanging-wall crosscuts, 60 ft. apart, exposed 7 ft. of ore, which averaged $250 per ton. The 292-O sill was extended and produced 69 tons, averaging $25.60 per ton. The 328 sill produced 41 tons, averaging $20 per ton.

Horace J. Stevens

Horace Jared Stevens, whose death at Houghton, Mich., April 22, was briefly noted last week, was born in 1866, at Cattaraugus N. Y. He was educated in the common schools of his native town, where his father was, and is, a farmer. He taught school in his youth and at about the age of 18 went to Lake Superior, to Ishpeming, where his uncle, H. Olin Young, was engaged in the practice of the law. He found work at first in the mines and for five years was employed in various capacities at the old Beaufort mine. In 1889 he became a reporter in Ishpeming for the Marquette *Mining Journal*. While engaged in practical newspaper work he established in Ishpeming the Peninsula News Bureau, for the dissemination of mining and general news. About 1890 he removed to Houghton, where he continued in newspaper and correspondence work. For several years prior to 1900 he was assistant to the state commissioner of mineral statistics. In 1901 this work led him to begin the publication of his "Copper Handbook," which he enlarged from year to year and by which he became widely known. He was an extremely hard worker and prepared the successive volumes of the "Handbook" with very little assistance. He was one of the best known men in the copper country, and had a wide acquaintance among mining men everywhere. He leaves a widow and two children, one of them a student at the Michigan College of Mines.

Witherbee-Sherman Dams Burst

Press dispatches detailed the washing out, on Apr. 23, of three dams of the Witherbee-Sherman Co., at Witherbee, N. Y. These reports were largely exaggerated, the facts being substantially as follows: Due to severe winter and spring conditions, it is believed that water got under the concrete dam, built by the company about two years ago to create an artificial reservoir about a half mile long and several hundred yards wide. This dam went out, taking with it two smaller ones, and several bridges. The damage done to inhabitants' houses was slight or negligible, and no lives were lost. One of the company's power houses was partially flooded. The financial loss to the company amounted to about $45,000, and operations were suspended for 48 hours. The chief loss was that of about 1500 tons of coal, which is difficult and costly to bring to the property; this was washed away by the flood. The concrete dam was constructed to insure a constant supply of water for the compressors and it is stated that the company will probably be somewhat cramped for water this summer.

Miami Copper Company

Globe Correspondence

J. Parke Channing, vice-president and consulting engineer of the Miami Copper Co., is making a visit of inspection to the mine and speaks optimistically of its future.

"The 570-ft. level is looking remarkably good, the ore being opened by the development work now in progress containing fully as much copper per ton as the average for the orebody. I have never estimated more than 50 ft. of ore below this level, but I am confident that it will extend much deeper, and in time a crosscut will be driven from the main shaft on the 720-ft. level.

"Unexpected ore is being disclosed on the 420-ft. or present extraction level. It has been determined that on all the levels above, the orebody is limited on the north by an approximately east and west fault, but on the 420-ft. level a drift north through this fault has passed through clean ore for a distance of 100 feet.

"Seven shrinkage stopes are in different stages of operation above the 420-ft. level. One is completed and is full of broken ore; mining is being done in three, and three others are in the preparatory stage. After the stopes are finished and filled with broken ore, the pillars will be removed by top slicing, at the same time the ore will be drawn from the stopes so that the capping may settle evenly. Conditions may arise that will permit modifications of this method, such as blasting and weakening the pillars so that they will be crushed and then the ore from the stopes and pillars will be drawn together.

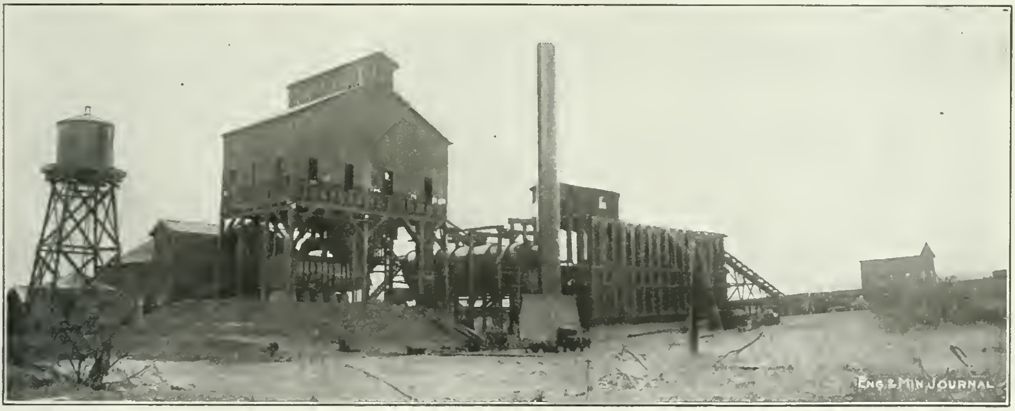
"The cost of mining for last year, as shown in the company's annual report, was $1.21 per ton. It might have been 40c. less if it had been the desire to mine wastefully and without regard to the safety of the men. The excessive cost was due to the large amount of square setting and top slicing done around the top and sides of the orebody for the purpose of forming a mat of timber between the capping and the ore. From many years' experience in similar large ore deposits, I can say unhesitatingly that it is absolutely impossible to mine the ore clean and with safety to the miners without placing a timber mat between the ore and the capping.

"Copper is being produced at the rate of a little less than 3,000,000 lb. per month, but it is hoped soon to bring production up to that figure. Excellent results are being obtained with the Deister tables in the mill, but some changes will be made in the crushing machinery. The Hardinge pebble mills have been demonstrated superior to chilean mills for fine grinding and probably will eventually replace them in all units. It is also probable that the rigid rolls used for the intermediate crushing will be gradually replaced in all units by heavy spring-rolls. The Traylor Engineering & Manufacturing Co. is building an unusually heavy set of spring rolls for use in the mill. They will be of the same size as the spring and rigid rolls now in use, 16x42 in., but the frame will be more massive and the construction throughout heavier. Seven Crocker-Wheeler 150-hp. motors have been ordered to replace the 100-hp. motors now used in driving the rolls. Hardinge ball mills have been tried, but have not thus far proved equal to rolls; the consumption of steel is apparently greater than with the rolls.

The Pioneer Smeltery, Arizona

By A. L. Waters*

The new smeltery of the Pioneer Smelting Co. will be blown in about May 1, 1912. It is situated at Corwin, Pima County, on the Twin Buttes railroad spur, 1½ miles west of Sahuarita station and 20 miles south of Tucson, Ariz. It is a custom plant at which ores from the Twin Buttes, Mineral Hill, Helvetia, Tip Top and many of the smaller mines of the district will be smelted. These ores are low grade, containing from 3 to 4½% copper with iron or garnet gangue and for the most part are nearly self fluxing None of the ore from any one property is entirely self fluxing, nor does any contain enough copper to be profitably shipped out of the district.



General View of the Pioneer Smeltery, Near Tucson, Ariz.

The Pioneer company owns the Plumed Knight mine adjoining the Mineral Hill property. It has been opened to a depth of 335 ft. The last 1000 tons shipped to the smeltery assayed: 20c. gold and 1.3 oz. silver per ton, 4.25% copper, 2.5% sulphur, 16.8% iron, 15% lime, 34.24% silica. From this mine 40 tons per day is being shipped to the smeltery, and the Twin Buttes company is shipping 50 tons per day; the ore contains silver and copper, is rich in iron and poor in silica. The Morning Glory mine at Patagonia is shipping 10 tons per day of ore containing 2 oz. silver, 2% copper, 43% sulphur,

---

*Managing director, Pioneer Smelting Co., Tucson, Ariz.

40% iron and 10% silica. The Gould mine, 12 miles west of Tucson, is controlled by the Pioneer company and is now being unwatered and prepared to ship 30 tons of ore per day which, judged by the production of 1907, is expected to contain 1 oz. silver, 3% copper, 20% sulphur, 24% iron, 14% lime and 23% silica.

Ore Hauled in Motor Trucks

The various mines are several miles from the railroad. The country is gently sloping tableland, running down from the foothills where the ores are found, to the center of the valleys where are the railroads. Several motor trucks have been tried in the vicinity of Tucson and all have been commercial failures. In spite of these discouraging examples, the management considered that the conditions under which the Pioneer plant was to be operated were more suitable and a 6½-ton capacity Saurer truck was acquired to haul ore from the Plumed Knight mine to the smeltery; the distance is 7.7 miles with a fall of 600 ft. There are two hills against the load coming down. Each hill is 300 ft. long and 8% grade. For a long distance there is a steady 3% down grade in favor of the load. The road packs hard and there are no rocks in it to cut the tires. Several small sand washes have been filled with soil that packs well. The truck makes the round trip in two hours; 20 minutes is required for loading and unloading. It travels 94 miles, or makes six trips per day, with two shifts of drivers and uses 18 to 20 gal. of gasoline costing 22c. and 1 gal. of oil at 56c. per gal. The rubber tires traveled 6000 miles and are believed to be good for 2000 miles more. The total cost, including 15% depreciation, interest on investment, insurance, repairs and replacements is 75c. per ton moved. The cost with teams would be from $1.50 to $2 per ton.

Ores are brought in by railroad, truck or teams and weighed on "Strait" scales, all parts of which are above ground and are easily accessible for inspection of the working parts. The ore is unloaded on a trestle 8 ft. above the level of the ground and 1/10 is taken in wheelbarrows to storage sample-bins. From these bins it is taken to the mill by a belt conveyor. The mill is small and simple, consisting of a 7x11-in., Dodge crusher, one elevator, a Vezin automatic sampler which delivers to 16x20-in. rolls; the last discharge the sample upon the cooing plates where the final cutting down is done by hand and the final pulp is ground by a Braun disk sample-grinder.

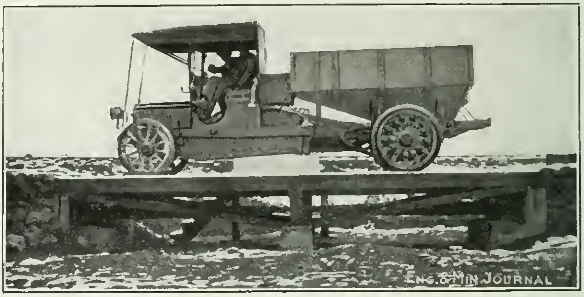
The plant is built on ground that has a general grade of 1 ft. per 100 and drops off 4 ft. per 100 directly in front of the blast furnace. Preliminary plans were drawn for a plant of 1500 tons daily capacity, including reverberatories and converters, and arranged so that the plant could be enlarged. The ores are bedded under the trestles and along the sides of the embankment and are also delivered by belt conveyor to the first unit of six bins, capable of holding 4000 tons of ore. After the ore mixture is made up, it is dumped into a hopper and when wanted is sent to the feed floor on a belt conveyor which discharges into a bin from which the furnace charge is fed through a swinging iron spout. By this method of feeding all the fine material is thrown to one side of the furnace, a distribution which has been found to be necessary in the type of furnace used.

Oil Engines Used

The prime movers are two 90-hp. De La Vergne crude-oil engines. While there is nothing novel about this type of power, it was looked upon with great suspicion by local mining men and is believed to be introduced for the first time at a copper smeltery. These engines drive the blowers, compressor, deep-well pump and the 55-kw. generator, which furnishes power for the sampling mill, belt conveyor, and lights. The engines are operating smoothly on 20° California crude oil with asphalt base. The oil costs $1.47 per bbl. of 42 gal. laid down at the engines. The engines are guaranteed to deliver one brake horsepower hour on 0.6 lb. of this oil and in preliminary tests delivered that power on 0.44 lb. The management estimates that these engines will be more economical by $47 per day than an oil-burning steam power plant of equal size; $40 for difference in cost of fuel and $7 for firemen and incidentals.

Crude Oil Used in Blast Furnace

The blast furnace was designed and built by the Colorado Iron Works Co. and is an application of the principles patented by the late John W. Nesmith, the founder and for many years the president of that company. The furnace is 106x42 in. at the tuyeres and is a modern, small, copper-matting, blast furnace except that a part of one side is removed and a crude-oil burning-chamber is attached. California crude oil will be used as smelting fuel except when the sulphur in the charge is sufficient to permit turning blast into the one set of tuyeres on one side of the furnace to aid in burning the hot sulphide ore. The combustion chamber really becomes a large hot-blast tuyere where oil is completely burned and driven into and through the column of ore in the furnace. Complete combustion before striking the ore prevents the formation of lampblack which would mix with the half-fused charge and make an infusible mass of balls which has stopped the career of many an experiment in blast-furnace smelting with oil. A 42-in. hexagonal oil-burning furnace was built and operated for many weeks in the yards of the Colorado Iron Works Co. and more than 900 tons of ores containing high percentages of magnetic iron and also alumina were successfully smelted in the furnace and the matte sold to the Golden smeltery. The first three weeks of those tests witnessed repeated freeze-ups and discouraging difficulties; during the succeeding two weeks less trouble was experienced and during the last two weeks the furnace ran smoother than an ordinary coke-burning furnace.



Saurer Truck Used at Pioneer Smeltery

California Oil in March

The net production of petroleum in all California fields in March was 6,923,908 bbl. In February, the total net production was 6,542,682 bbl., an increase for March of 381,226 in total production, but a decrease in daily average production from 225,609 for February to 223,352 for March. The shipments for March were 6,030,906 bbl.; a decline of 3128 in the total, and a decrease in the daily average of 13,528 bbl. Field consumption in March in all fields was 443,089 bbl. The stocks on hand at the end of March amounted to about 43,000,000 bbl., an increase over February of 900,000 barrels.

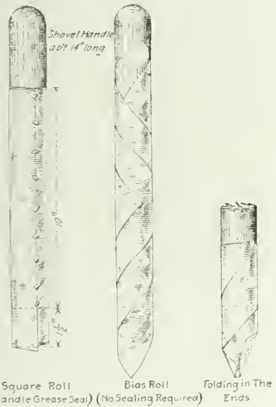
The record of field development showed 34 new rigs, 73 completed wells, 5464 active producing wells, 820 producing wells idle, 435 active drilling, 366 idle drilling, 21 abandoned.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Cartridges for Tamping Dynamite

The importance of tamping dynamite in drill holes, especially the lower grades, is rapidly becoming recognized in the mining practice of the United States. In many instances the powder companies furnish paper cartridges at small cost for incasing the tamping, and in some mines such casings are used. This, however, is not common practice. It has been stated that at one time there was a company, in the Joplin district, that made a practice of supplying the mines with cartridges filled with tamping.



Method of Making Tamping Cartridges

The general practice in the United States is to use fine material from the vein for tamping. This is far better than using no tamping at all, but the sharp pieces of rock that such material usually contains are liable to cut the fuse. In the copper mines of Lake Superior, the miners engaged in drilling and breaking work by contract and pay for the powder they use. They have an excellent method of making tamping cartridges. The tamping is clay sent down from surface that is moistened and mixed with fines from the lode, so that the mass is coherent when tightly packed.

The casing is made from ordinary newspaper, according to two methods, in one of which the newspaper is sealed with candle grease, while in the other no sealing is used. By either method a good cartridge is obtained, but the better method is that in which the paper of the casing is sealed with candle grease.

In both methods the newspaper, in single thicknesses, is wrapped tightly around a piece of old shovel-handle. When candle grease is used, the paper of the cartridge ends in a straight line running lengthwise with the piece of shovel-handle, about which it has been wrapped five or six times. The outside edge of the paper is sealed by dropping candle grease on it and pressing the paper together while the grease is hot. About 1 or 1½ in. of paper extends below the piece of shovel-handle. This is folded up and sealed back on itself by hammering it on a piece of wood after some candle grease has been dropped on it. The shovel handle is then removed, the cartridge filled with tamping, and the other end sealed in a similar way after the tamping has been compacted by tapping the bottom end of the cartridge lightly on a board. An accompanying drawing shows the method of making the cartridge. A cartridge that is rigid and strong results.

In the other system no candle grease or other sealing substance is used. The cartridge is not quite so strong; yet plenty good enough for the purpose. More paper has to be used, as the piece of newspaper is wrapped about the shovel-handle 8 or 10 times. The piece of newspaper is rolled around the shovel-handle so as to end in a double bias at about the middle of the cartridge. In this way side sealing of the cartridge is avoided. The lower end of the cartridge is sealed by folding the paper back upon itself and hammering it vigorously on a piece of board so as to mat it together. The seal is not good, but the cartridge can be removed, tamping put into it and compacted by tapping the bottom on a board. Then the top end is sealed by folding it in several times on itself and compacting the paper of the end by pounding it against a board, as in the case of the other end. Of course, this tapping and pounding cannot be done very vigorously. Such cartridges are strong enough to stand any ordinary usage in loading holes.

In drifting it is advisable to rig the cross-bar for the drills with the adjustable end always on the same side of the drift, then if the lifter on that side be always exploded last it will clear away the broken ground so that there will be plenty of room for the men to operate the jack-bars.

Corrosion-Resisting Steel

Press reports state that the testing department of the United States Steel Corporation has succeeded in its effort to obtain "an alloy steel that would successfully withstand tests with sulphuric acid, the chief enemy of tubing and sheets." Noncorrosive pipe or even pipe that is more resistant to acid mine waters than the present tubing will be greatly appreciated.

It may be worthy of noting in this connection that other steel companies have been giving this matter attention. The Inland Steel Co. is now putting on the market a grade of steel sheet known as "Vismera," of which the following is given as a typical analysis: Iron, 99.542; copper, 0.200%; manganese, 0.190; total metal alloys, 0.390. Carbon, 0.036; phosphorus, 0.004; sulphur, 0.018; silicon, nil; oxygen, 0.009; hydrogen, 0.001; aluminum, nal; total impurities, 0.068.

This company calls especial attention to the copper and manganese content, also to the low content of oxygen. It has long been known that a small percentage of copper, say, 0.25%, increases the resistance of the steel to corrosion, ordinary steel losing weight about three times as fast under sulphuric-acid test as the cupreous steel.

Strength of a Mine Dam

The total pressure exerted by water on a dam is found by multiplying the wetted area of the face of the dam, expressed in square feet, by 62½, the weight in pounds of one cubic foot of water, and this product by the vertical height of the surface of the water above the center of gravity of the wetted area, says *Coal Age*.

To calculate the required thickness of a dam, let

t = Thickness of dam (in.);
r = Shorter radius of dam (in.);
w = Width of opening or span (in.);
p = Pressure of water at dam (lb. per sq.in.);
S = Compressive strength of material (lb. per sq.in.)

For an arched dam

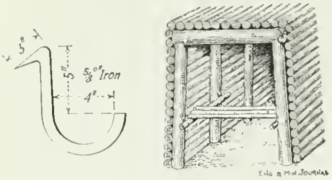
$$t = \frac{pw\sqrt{4r - 1}}{4S}$$

The shorter radius of the dam should be from ¼ to ½ greater than the clear span or width of opening. For practical reasons, it would not be advisable to build a dam less than 20 in. thick.

Staple for Temporary Staging

By B. M. Concklin*

In the accompanying sketch is shown a staple for supporting temporary staging, that is used in the mines of the Oliver Iron Mining Co. on the Mesabi Range.



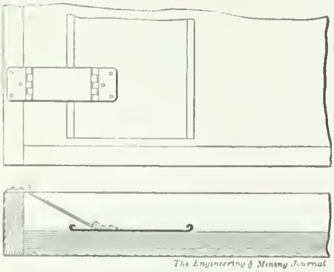
Staging Staple and Manner of Using It

One of these hooks is driven into each of the posts of two adjacent sets and on both sides of the drift. A pole is then laid in the two staples on each side of the drift and across these a platform of lagging is laid as shown in the illustration. The staples can be readily removed with a bar after the staging has served its purpose and has been removed.

Kink for the Blueprint Cabinet

When blueprints that have been much handled and folded are kept in flat drawers in cabinets, the edges are apt to project above the level of the edges of the drawer and become torn when the drawer is opened. Even unused prints are bulky and occupy much space if not weighted down.

The accompanying drawing shows a method of avoiding this trouble, used in the drafting rooms of the Calumet & Hecla Co. At the front end of the drawer a strip of heavy galvanized iron is fastened to the front of the drawer by three sets of double hinges. This weight is used only at the front end; it effectually prevents tearing the prints when the drawer is opened and holds them compactly in place.



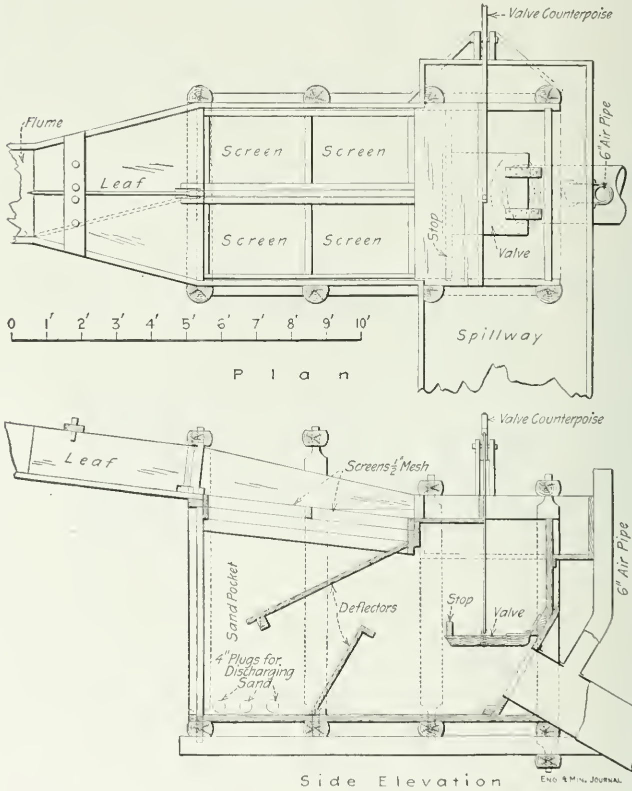
Hinged Weight for Blueprint Drawer

Santa Rita Pressure Box

By R. D. O. Johnson*

The pressure box shown in the accompanying illustration was devised by me and is used at the hydro-electric plant of the Santa Rita Mining Co. in the department of Antioquia, Colombia, South America. It is quite satisfactory in operation and so far as I know, there are some unusual features in the design.

Instead of being immersed in the water, as is usual and occupying a vertical or nearly vertical position, the screens are, for the greater part of their length, placed above the water level, and nearly horizontal. As shown in the illustration, the water is delivered to the screens in a direction parallel to their plane. This feature renders the screens much more efficient in as much as sticks, twigs and such elongated pieces of drift and rubbish strike the screens broadside, and are caught. It is my experience with screens placed in a vertical or nearly vertical position and that are submerged, that such rubbish, because of the eddying movement of the water, finally works its way through, unless the screen mesh is very small.



Pressure Box for Hydraulic Power Supply Pipe

The flat screens are easily cleaned, the accumulated rubbish being raked into the box at the lower end and then in to the spillway. To facilitate this operation the water may be shifted to one side by means of the leaf deflector, or hinged valve board on the apron between the box and the flume. To a certain extent the screens clear themselves automatically. With varying demands for water in the power house, the water level in the pressure box fluctuates. The rising water floats off a part of the accumulated rubbish and carries it out through the spillway.

By means of a deflecting apron made of 1-in. boards and placed under the screens, the direction of the flow of the water is reversed and passes towards the head of the box, thence towards the rear over a sand pocket made by a low, inclined partition running across the box. Three 4-in. holes on each side stopped by wooden plugs serve to discharge the sediment.

---

*Mining engineer, Bovey, Minn.

*Mining engineer, Apartado 110, Medellin, Colombia, S. A.

The mouth of the pipe is provided with a safety valve which in the event of a break in the pipe line, will be automatically closed by the strong current set up thus preventing further ingress of water. The valve is held open by means of a weighted lever.

The weights are so adjusted that the valve will not be closed by the current due to the draft of water in ordinary working. A stop prevents the valve being raised above a horizontal position.

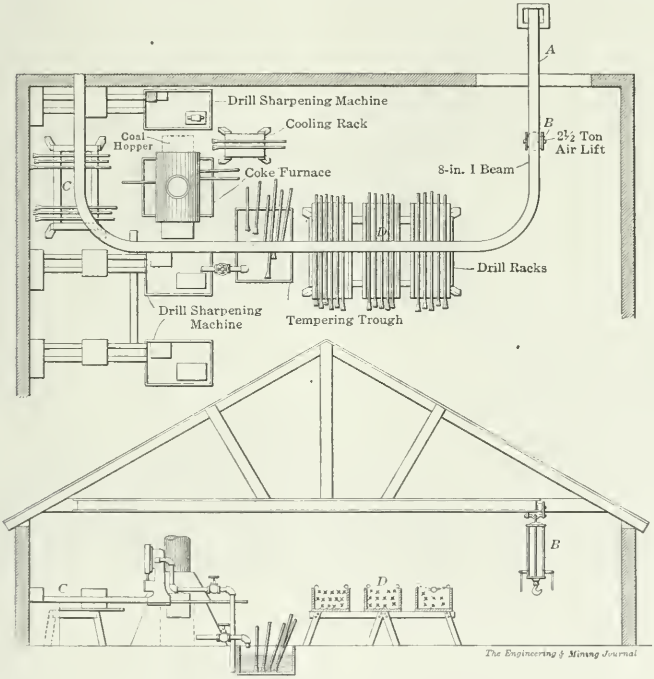
The 6-in. air pipe is a further safety device designed to admit freely a large volume of air upon the closing of the valve and thus to prevent the collapsing of the pressure pipe. The air pipe connects with the pressure pipe below the valve, extends above the water level of the box and is open to the air. The spillway is of sufficient size to carry the full discharge of the flume.

The following formula is recommended by *Power* for cement for steam and water pipes: Paris white, 2 lb.; litharge, 5 lb.; yellow ochre, ¼ lb.; and hemp cut up small, ¼ oz. Mix well with linseed oil to the consistency of putty and use at once. The materials can be mixed dry, and enough for immediate use can be made up with linseed oil. This cement will set under water.

Handling Drill Steel at Champion Mine

The best way of handling drill steel at a mine where there are several working shafts is often a serious question. There are several places at some mines where the steel is sharpened on being brought to the surface. At the larger mines it is generally better to sharpen the steel at some central place. The reason that the smaller mines favor the sharpening of the steel at each shaft is that the cost of gathering the steel is great unless the quantity is large.

This problem of gathering and handling the steel has been solved in a simple manner at the Champion mine of the Copper Range Company in Michigan. At this mine there are four working shafts from each of which steel is gathered. Shaft *B* sends up about 325 drills, shaft *C* 250, shaft *D* 200, and shaft *E* 180 drills per day. The drills are sent up loose on the cages, and at the surface are loaded directly into tank-steel boxes that are carried in the bed of a wagon in summer or sleigh in winter. These boxes are made in three pieces, a bottom and two hinged sides to which rings are fastened for receiving the hoops of the chains used to lift the boxes out of the wagon. While in the wagon the sides of the boxes are held up by the sides of the wagon or sleigh.



Drill Sharpening Plant at Champion Mine

In loading these drills they are sorted according to size so that they can be sharpened at the shop without any needless increase in the handling. Each shaft has its own wagon or sleigh. When it has been loaded with dull drills the team which does the hauling for the shafts comes for the wagon in the morning and hauls it to the blacksmith-shop with its load of drills. While the team goes after another load from another shaft, the drills are unloaded by means of an air lift attached to a trolley that travels on an I-beam carried in the frame of the shop.

Picking the boxes up with their load of drills at *A*, in the accompanying sketch by hooking chains into the rings on their sides, the 2½-ton air-lift *B* traveling on the overhead trolley takes its load to rack *C* in back of the heating furnace and on the same side as the drill sharpener so that the drills can be readily placed in the furnace. There the chains are unhooked from the box and the sides allowed to fall flat on the drill rack *C*. When all of the drills have been taken from the box during the progress of sharpening, the box is lifted with the air lift and taken over to rack *D* where it is put down between some pegs that will hold its sides up.

As fast as the drills are sharpened they are sent over to the other side of the heating furnace to be tempered. On the tempering side is a cooling rack where the drills are held for the proper color to come and then are plunged into the cooling tank which is at the side of rack *D*. From the cooling tanks the drills are put in the boxes resting on rack *D*, being placed in the boxes of the mine to which the drills belong. As soon as all the drills for one shaft have been tempered, the boxes are picked up by the traveling air lift, taken back and loaded into the wagon that is standing under the loading place. Then the drills are hauled back to the shaft, where the boys sort out the drills belonging to each machine by the numbers that are cut in their shanks and load them on the cage, those for one machine pointing up, those for the next machine on that level down, thus each machine gets back as many drills as were sent up.

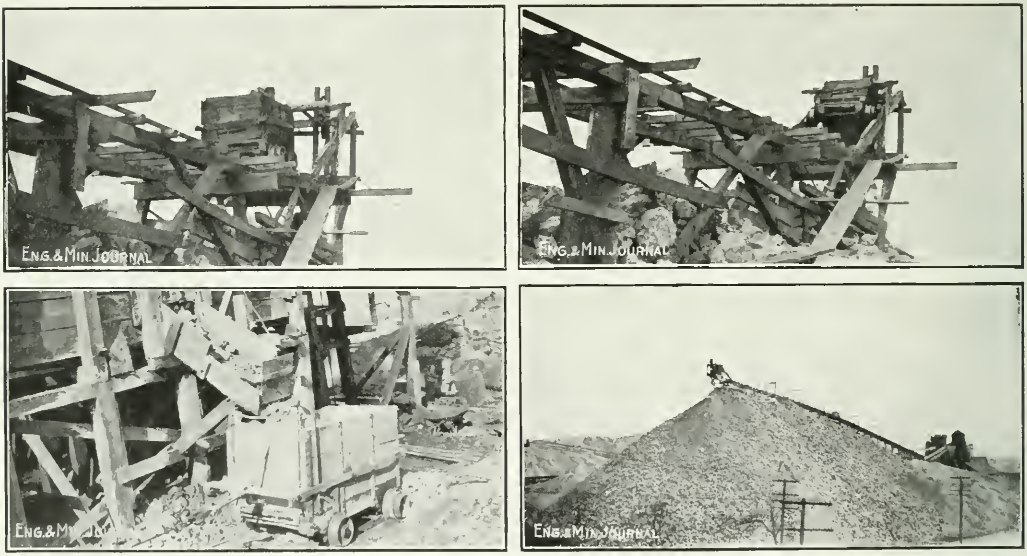
In this way the handling of the drills is reduced to a minimum, and yet all the advantages of central sharpening are retained for scattered shafts. The only investment other than would be required ordinarily is the providing of a wagon costing $50 or $60 to serve each shaft. The hauling is done by one of the teams that is maintained to do general hauling about the mine. This system of handling the steel has been in use for a long time at the Champion mine and is satisfactory.

Stacking Boulders

The boulders of waste that are sorted out of the Joplin ore at the grizzlies are usually loaded into a small car and trammed out on a trestle to the boulder pile near the shaft. At some mines it is not convenient to pile the boulders near the shaft and a long, high trestle is expensive to build. Moreover, on a flat site the boulder pile is rapidly extended if made only 40 or 50 ft. high. In some of the sheet-ground mines there is a layer of barren flint about 7 ft. thick that occurs between the upper and lower runs of ore. At mines where this flint is broken with the ore and is sorted out at the surface the boulder pile soon covers a large area.

At the Providence mine north of Webb City it is the practice to stack the boulders in the manner illustrated by the accompanying halftones. The same type of car is used for hauling the boulders as is used in transferring the ore from a bin at an auxiliary shaft to the mill hopper. In the illustrations the car shown at the loading chute is not the car actually used at the Providence mine, but is of the same type. The car is of the front-dumping type. The dumping device at the end of the trestle is made as shown in the illustrations. It is composed of two triangular frames tied together by cross-braces, the base of the frames serving as skids for sliding the frame along the top of the bents as the trestle is extended. The frame when in use is securely tied to several trestle bents. The sheave for the hoisting rope is carried on the frame so that the pull on the rope tends to hold the end timbers of the trestle from moving forward under the hammering it receives at the time of dumping. One of the top cross-braces which is securely bolted to the sill timbers of the frame serves to prevent overwinding, while blocks between the ends of this cross piece and the top legs of the dump also block the rear wheels, which follow the superstructure of the frame at the proper point to cause the dumping.

As the general view of the boulder pile shows, the trestle is extended upward at the outer end at a steep angle. When the pile is first started the trestle has to be extended frequently and the cost is therefore high, but as the pile is extended outward and upward the boulders can be piled to a greater height so that eventually extension of the trestle is necessary only at infrequent intervals.



BOULDER CARS, STACK AND TRESTLE AT PROVIDENCE MINE, JOPLIN MO.

At the Providence mine, ore is transferred from an auxiliary shaft to the mill hopper; therefore by using a hoist with two drums the same engine used in transferring of the ore can also be used to stack the boulders.

Placing Holes in Breast Stoping

By Harvey S. Brown*

In stopes 30 ft. or more in width, breast stoping usually leaves a stronger and safer back than back stoping by "upper" holes. In breast stoping, the manner of pointing the holes has a definite influence on the condition of the back. Holes drilled approximately at right angles to the breast; i.e., parallel with the general direction of the advance, shake the back the least and are, therefore, the most desirable. Holes drilled parallel to the breast cause loosening of the back, necessitating more barring down, with attendant delays. The work can easily be arranged so as to permit pointing all the holes at right angles to the breast.

Prospecting by Hydraulicking

A departure from the usual method of prospecting by trenching is to be made this summer on the property of the Nipissing Mining Co., at Cobalt, Ont. The hillsides will be cleared of drift by hydraulicking. The water will be pumped from a lake by a turbine pump direct connected to a motor that is guaranteed to raise 4800 gal. per min. against a head of 415 ft.; the pump will require 675 hp. It is expected that the hydraulic method will make it possible to discover the small veins that are often overlooked in trenching because of the difficulty of completely removing the drift and exposing a clean surface of rock.

It is not the intention, according to a recent report by Arthur A. Cole, engineer of the Temiskaming & Northern Ontario R.R. commission, to run all the tailings from the hydraulicking into the lake. A small area of ground will first be cleared and a careful examination made of the exposed rock surface, then the drift from a small area immediately above the first will be washed down, covering the surface that has been examined and exposing fresh ground for examination. In this manner the entire area to be prospected will be gone over.

---

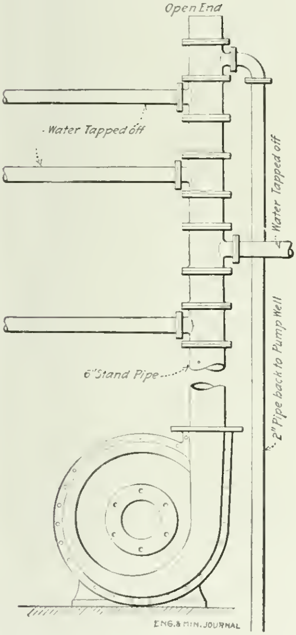
*Mining engineer, Victor, Colo.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Standpipe on a Mill Pump

In some of the mills at Joplin, Mo. the pressure on the hydraulic classifiers and on the water going to the jigs and tables is regulated by small supply tanks into which the mill pumps raise the water and from which it goes to the different devices throughout the mill. This system has its drawbacks because when suspending operations, the water has to be shut off by cocks which are usually in some unhandy place or else allowed to run until the supply tanks are empty with the result that the wells of the elevators become flooded. Morever in case the valves are closed time is lost in making adjustments to re-establish the desired flow. In winter during freezing weather trouble is experienced where tanks are used because the mill is operated but two 10-hr. shifts per day and while the mill is not in operation the water in the pipes may freeze solid.



CENTRIFUGAL MILL PUMP WITH STANDPIPE

To avoid the inconveniences experienced with the supply-tank system, J. G. Marcum, a mill designer of Joplin, Mo., uses a standpipe immediately above the pump and takes water from it at the heights corresponding to the pressures that he desires. The standpipe is about 6 in. diameter, but the size depends upon the quantity of the water required in the mill. The top end of the standpipe is open and is provided with a small pipe to convey any excess water overflowing at the top back to the pump-well or the suction end of the pump. The speed of the pump is regulated so that there is only a slight overflow yet enough to insure a constant pressure in the mains.

When it is desired to suspend milling it is only necessary to admit air to the pump and the pipes and valves are all drained of water so that they cannot freeze. In the morning it is only necessary to start the pump after shutting off the air.

Field Test for Phosphate

With ammonium molybdate and dilute nitric acid, satisfactory field tests of phosphate rock can be made. The ammonium molybdate crystals mixed with the powdered phosphate rock take on a distinctive yellow on application of the acid. This is a qualitative test only, as rock too low to be commercially available will respond to it.

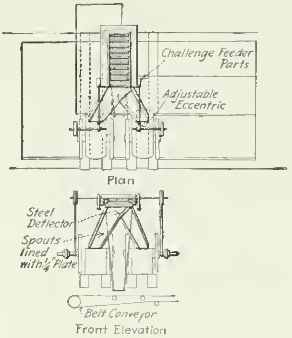
The Broken Hill South Silver Mining Co's. mill, New South Wales, producing a lead, zinc, and silver concentrate, consumes about 150 gal. of water per ton of ore. This includes all water used at the mine and the mill.

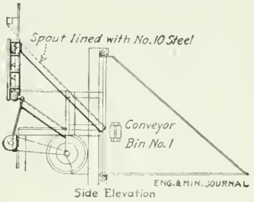
A Grizzly Crusher Feeder

BY S. A. WORCESTER*

The grizzly crusher-feeder illustrated by the accompanying drawings is used in a 60-stamp mill in which there are three ore bins, each supplying 20 stamps. In a former arrangement of the crusher floor there had been three crushers, one over each ore bin, and these were operated one at a time. The ore was delivered at the mill by a Bleichert tramway on which one man was employed in shifting buckets at the terminal and another in tramming the ore from the terminal to the crushers.

By removing the crusher over the ore bin farthest from the terminal and placing it at the side of the crusher over the nearest bin it is now possible to dispense with the trammer and use this crusher as a reserve. This enables the terminal operator to attend to the feeder and concentrates all the crushing at one point.





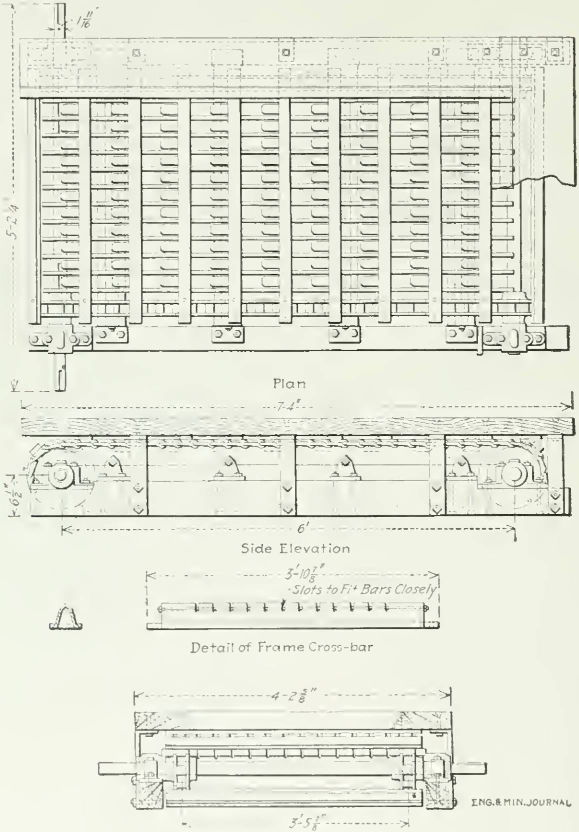
CRUSHERS WITH GRIZZLY FEEDER

As shown in Fig. 1, the ore from the crusher and the undersize from the grizzly drop directly down to the conveyor, which delivers by trippers or by end discharge to either of the farther bins. For delivering to the bin below the crushers, swinging deflectors, which are not shown in the illustration, are used. The grizzly feeder eliminating the shovelman, operates as follows: The terminal operator dumps the tramway bucket of a capacity of 800 lb. of ore on the horizontal grizzly, from which the rejections are slowly and positively raked over the end and into the spout leading into the crusher. The raking arrangement is similar to that of the chain-grate stoker used in boiler furnaces, and consists of two chains running over sprocket wheels and carrying a number of cross-bars provided with lifting fingers which travel below the upper surface of the grizzly and lift any ore which tends to hang between the bars.

---

*Mechanical engineer, Victor, Colo.

A deflector can be swung to direct the ore to the crusher which is in operation. The driving shaft of the feeder is given its slow, intermittent movement by a Challenge feeder friction device driven from an eccentric on a small countershaft driven from the crusher. The fines from the grizzly drop down the slope beneath to the conveyor or to the bin below. The rate of feed is regulated by adjusting the throw of the eccentrics. The sprocket chains are protected from dirt by a covering of planks. By the exercise of a little care in distributing the ore on the grizzly, the operator can easily avoid choking the crusher. The tapering section of the grizzly bars prevents any material from wedging below the top surface of the bars and the lifting fingers raise all material that tends to hang. The grizzly bars are firmly supported by substantial frame cross-bars to which they are secured by rods passing through the grizzly bars. The eccentrics, shafts, pulleys and pillow blocks were all taken from abandoned jigs, and the Challenge feeder parts were likewise on hand.



Enlargement of the Grizzly Feeder

Portable Crusher and Elevator

At many of the shallow mines in the Joplin district, the quantity of ore mined in the early life of a property is not sufficient to justify the erection of a mill, and many operators do not care to pay the charge of $1 per ton for hauling and milling the ore at a custom mill in the vicinity of the mine. This is particularly the case with ore that is called free milling, or ore from which little middlings is produced. Such ore is well adapted to treatment an hand jigs after undergoing coarse crushing. In such instances a portable crusher, driven by a traction steam engine or a gasoline engine, is used to crush the ore.

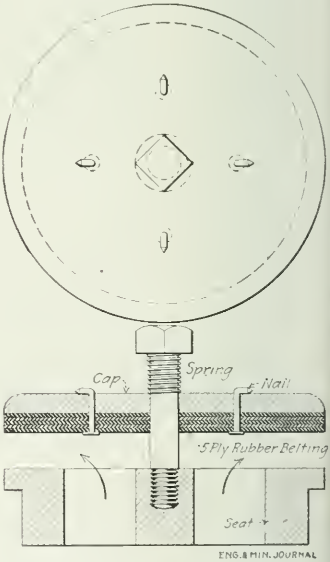
The apparatus consists of a four-wheel wagon, strongly built of structural steel and capable of withstanding the jar of the crusher. The crusher is mounted in the center of the wagon, and a wooden platform is provided at the jaw opening, upon which is piled the ore to be crushed as it comes from the mine.

At the rear end of the wagon, there is a bucket elevator for raising the crushed material, which is directed into the buckets by a hopper suspended below the crusher. This elevator is driven by a sprocket and chain, driven by a belt from the crusher. The angle of inclination of the elevator can be varied by a worm-wheel on the wagon, which engages a toothed quadrant rigidly fixed to the steel frame that supports the elevator bucket line and the upper and lower pulleys. This frame is pivotally mounted, so that the entire elevator structure can be revolved until it lies parallel to the body of the wagon and above the crusher, facilitating the moving of the crusher from one mine to another.

A Valve Protector

By Chester Steinem*

Lift valves, such as are used on the Deming and Gould pumps for pumping mill solutions, are usually subjected to severe wear, especially when operating on decanted solutions. A method of confining the wear to one easily replaceable part is shown in the accompanying sketch. At little expense ball valves may be altered so as to permit applying the same principle.



Pump Disks of Old Rubber Belting

A number of caps are kept on hand and these are pierced by four holes. Waste pieces of rubber belting are nailed and clinched to the caps and trimmed as shown. Punches, made of pipe ground to a cutting edge, would save time in punching. When a valve becomes worn, it is a simple matter to replace it.

---

*Mining engineer, Mogollon, N. M.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Pure Nigerian Tin

In the *Transactions* of the Faraday Society, Nov. 1911, p. 134, G. T. Holloway relates his experience with the little known Nigerian tin. He says in part:

"About 10 years ago, I received from Nigera some tin made by the natives from extremely pure alluvial tin ore, and smelted by them with wood charcoal under conditions where, although smelting was extremely crude, and the losses were heavy, the introduction of impurities was practically impossible. The tin was run by natives into straws or reeds, and the bars I had made from it formed the purest tin which I have ever examined. The highest grade tin which I had previously obtained and had used as a standard for analytical purposes, was found upon assay to be about 0.2 per cent. less pure than the Nigerian tin, in which I have been unable to find any impurity except a trace of iron.

Making Sodium Cyanide

Charles E. Acker's latest process for cyanide manufacture (U. S. pat. No. 1,019,002), embodies some rather novel features. A current of electricity is passed through an electrolyte of sodium and barium chlorides, using molten lead for the cathode. An alloy of sodium, barium and lead is formed, which is circulated through the apparatus by a centrifugal pump. In a so called reaction chamber, a large amount of finely divided charcoal is introduced, and a piston-shaped plunger is then lowered until slightly submerged.

Fuel oil is then introduced under pressure through this plunger, and is decomposed into hydrogen, which escapes, and carbon which, with some of the carbon of the charcoal, forms barium carbide. Nitrogen is then introduced through another pipe, which combines with the barium carbide to form barium cyanide. This is then decomposed by the sodium, regenerating the barium, and forming sodium cyanide.

$$Ba + 2C = BaC_2$$
$$BaC_2 + N_2 = Ba(CN)_2$$
$$Ba(CN)_2 + 2Na = Ba + 2NaCN$$

The sodium cyanide rises to the top of the bath, where it is drawn off from time to time. Owing to regeneration of the barium, it is only necessary to add sodium chloride to the electrolyte, except as some barium compound may be drawn off in the cyanide.

Roasting Ores for Wet Processes

For the effective preparation of roasted ores for leaching processes, a new process is given by Charles Gabrielli of Paris (U. S. pat. No. 1,018,609). In case pyrites, for instance, is being roasted, and the residue is to be leached for copper, a dead roast leaves part of the copper in insoluble form, and part of the iron in soluble shape, which then contaminates the leach.

Now, if to dead-roasted pyrites be added a quantity of green pyrites at a temperature between the decomposition temperatures of iron and of copper sulphate, a reaction will go on, between the raw and roasted pyrites, which will leave 90 to 100% of the copper soluble.

Or, in general, if the raw pyrite be added and the mixture kept at a temperature intermediate to the decomposition temperatures of the sulphates of two metals, that metal having the higher decomposition temperature for its sulphate will remain in soluble form. If the raw pyrite be added and the mixture kept at a temperature intermediate to the formation temperature of two metals, that sulphate having the lower formation temperature will remain in soluble state.

Separation of Iron from Manganese

If pyridine is added in slight excess to a neutral or slightly acid solution containing a mixture of iron and manganese, it is noticed that the iron is precipitated in the form of a hydrate, while the manganese remains in solution. It is thus possible (*Annal. de Chim. Anal.*) to separate rapidly 0.005 gram of manganese contained in 1 gram of iron.

One gram of pulverized ore is dissolved in warm concentrated hydrochloric acid, and is evaporated nearly to dryness to render the silica insoluble; this last operation is repeated two or three times, then water is added and the solution filtered. To the filtrate is added soda or potash until only slightly acid; the volume is made up to 200 cc., and sufficient pyridine is added to precipitate the whole of the iron. After boiling for 10 min., the mixture is filtered, and washed first with a strong solution of pyridine, and then with boiling water. In this way the iron remains on the filter while the manganese is in solution. When there is a large amount of manganese, the precipitated iron should be redissolved and then precipitated again in the usual manner.

Pyridine has no influence on lead or silver. At the same time it is advisable to separate these metals when found, then boil the solution in order to oxidize before adding the reagent. In the case where zinc occurs in the precipitate, it is necessary to reprecipitate with chloride of ammonia to separate zinc from iron.

Concentration and Leaching of Copper Ores

It is the idea of the recent patent of Rudolf Gahl (U. S. pat. No. 1,021,768) to crush copper-bearing ores to such a point that the separation of the mineral and the gangue is assured, without at all attempting to prevent sliming. The crushed ore is then concentrated and the tailings leached with ferric sulphate. It is stated that ores which in their natural state require leaching with hot concentrated solutions are, after removal of the concentrate, amenable to cold dilute leaching solutions.

The patent carries suggestions for manufacturing the original ferric-sulphate solution from mine waters, etc., and also describes various modifications, the addition of salt, chlorine or other reagents to the leach, or the production of a sand and a slime in the dressing so that one or the other may be discarded without leaching. The copper is precipitated from solution by scrap iron, and the ferrous-sulphate solution regenerated in any of the usual ways.

Determination of Lead, Nickel and Zinc as Oxalates

H. L. Ward has shown (*Amer. Journ Sci.*, April, 1912) that lead may be precipitated by the addition of ammonium oxalate to a lead-nitrate solution, which contains enough acetic acid to break up the double oxalate of lead and ammonium formed. Glacial acetic acid should make up one-half the volume of the solution. The lead can also be precipitated readily by adding crystallized oxalic acid to a boiling solution of lead nitrate. Here again, the solution should contain about 50% of glacial acetic acid. The lead can then be determined by titration with permanganate.

Classen recommends precipitation of nickel as oxalate (*Zeitsch. Anal. Chem.*, XVI, 470), by breaking up the soluble nickel-potassium oxalate with a large amount of acetic acid. In order to obtain a filterable product, the acetic acid must be run slowly into the boiling solution of double salt. The nickel oxalate thus obtained occludes much potassium oxalate and cannot be titrated. On ignition to oxide, large errors are also found, but the oxide can be washed free of potassium carbonate and the results are then reliable. By adding oxalic acid to nickel solutions, and then adding acetic acid after cooling, the nickel oxalate will come down fairly pure, although with small amounts of nickel it is necessary to heat to start precipitation. However, in attempting to titrate with permanganate, the green of the nickel masks the complementary permanganate pink. If cobalt be added to a slight pinkish tinge, the results are much better, but in general the procedure is unsatisfactory.

Zinc oxalate can be obtained using the precautions noted with nickel, but Classen's method gives a precipitate contaminated with potassium oxalate. The pure zinc-oxalate precipitate, not giving colored salts, may be titrated with permanganate.

Tasmanian Hydro-Electric Development

The right to utilize the Ouse and Shannon Rivers for hydro-electric power, and to conserve the waters of the Great Lakes for the same purpose, was granted the Hydro-Electric Power & Metallurgical Co., in 1909. Meteorological records show a rainfall sufficient, it is estimated, for generating 85,000 hp. under the 1000-ft. head available. The present installation, the headworks of which are now nearing completion (*Min. Journ.*, Apr. 13, 1912), will provide for 9000 hp. in the power house; weirs for 40,000 hp.; channels for 20,000 hp., and transmission lines for 20,000 hp. It is expected that cheap power will greatly stimulate mining in Tasmania.

Nickel in Norway

The production of nickel in Norway seems to be progressing, says *Echo des Mines*, Apr. 18, 1912. In 1911 the Evje company produced about 25,200 metric tons of ore. The smeltery treated 24,000 tons from the mine at Flaa, 2480 from the mines at Faœ (a separate company), 2070 tons of ore imported from Greece, and about 120 tons of matte from France. The metal content of the matte produced was: 418.5 tons of nickel, and 185 tons of copper. The company employs about 250 workers.

The old mines at Ringerike are being reopened and the ore will be smelted at the mines to matte, which will later be sent to the Christiansand nickel refinery. The Christiansand nickel refinery employs about 100 laborers, and workers on the Hybinette system. In 1911 it produced 285 tons of electrolytic nickel, and 80 of copper. This works is now being extended to produce 600 tons of nickel and 300 tons of copper per year.

Asbestos in the Urals

The production of asbestos in the Urals in 1911 showed an increase of 9,761,945 lb. over 1910, says *Viestnik Finanssoff*. The total production was 34,236,518 lb., which includes the production from the following mines: Baron Girard de Sukanton, 11,584,236 lb.; Poklieffsky-Kosiel, 11,104,974; P. O. Korieff's Successors, 7,124,407; Russo-Italian Co., 2,396,318; and N. V. Muchanoff & Co., 1,966,584 lb. The Poklieffsky-Kosiel company showed the greatest increase, the Korieff company a slight decrease. Productions of recent years have been: 1907, 19,607,462 lb.; 1908, 23,935,673; 1909, 29,390,237; 1910, 24,474,573; 1911, 34,236,518 pounds.

Osmiridium in the Urals

A report on the production of osmiridium in the Urals (*Min. Journ.*, Mar. 9, 1912) says that this mixture of the metals is found nowhere else in Russia, and even there is rare. It is usually found with gold in the Miassk deposits, Orenburg government, and in the Kyshtim deposits, western Ekaterinburg, but last year the only district which yielded osmiridium was the Miassk estate. The decline of the osmiridium industry may be followed from the accompanying table.

OSMIRIDIUM PRODUCTION IN THE URALS

Year	Troy Oz.
1902	144.7
1903	144.7
1904	156.5
1905	107.1
1906	44.8
1907	69.0
1908	54.4
1909	56.6
1910	52.2
1911	1.7
Total, 10 years	834.7

Pyrite Mines of the World

The chief commercial pyrite deposits of the world are given as follows by the *American Fertilizer*, Mar. 23, 1912:

The mines of Virginia, Georgia and a few other states, producing about 200,000 tons annually, of which the Arminius mine, of Virginia, produces about half; the provinces of eastern Canada, and Ontario and Quebec; the mines of Röres and Sulitelma in Norway, the former producing 20,000 tons for export, the latter 35,000 tons for export, per annum; Brosso, Italy, 25,000 tons per annum; the immense deposits of Sain-Bel, France, east of the Brevenne, producing annually about 325,000 tons of high-grade ore; in Germany, several important deposits, of which the output is all taken by German works, two mines at Meggen produce about 150,000 tons annually; most important of all, the mines of Spain and Portugal.

Of the deposits of the Spanish peninsula, those known as the Huelva are the most important, lying in the Spanish province of Huelva, and the Portuguese province of Alemtejo, between Rio Tinto and San Domingo. These deposits cover a zone from 12 to 20 miles wide by 120 miles long. The San Domingo, La Zarza, and Tharsis mines lie near the middle of this zone. These mines have been worked since the time of the Phœnicians, and the available deposits are now estimated at about 1,000,000,000 tons.

Spanish ore sells at about 13c. per unit of sulphur. Freights are estimated at about $2.74 per ton from Spain to the United States, and wharfage at about 45c. per ton.

Refining Metals with Titanium

The uses of titanium to purify metals or alloys, such as zinc, lead, aluminum or jeweller's alloys, is the subject of recent patents granted to A. J. Rossi (covered respectively by U. S. pat. Nos. 1,020,514; 1,020,512; 1,019,531; 1,022,600). The method of using titanium as a purifier is preferably to add a rich alloy of the metal to be purified, and titanium, say 10 to 12% Ti, in an amount equivalent only a trifle over the theoretical amount of titanium necessary to combine with the impurities present. Carbon, nitrogen and oxygen are the elements most easily taken up by the titanium. Jeweller's alloys are preferably made with copper previously purified by titanium. The purification of aluminum by this means seems to mark a decided step in the metallurgy of that element.

Magnesia for Floorings

It is stated that in Germany flooring for public and office buildings is being made from a mixture of magnesia and sawdust, wet with magnesium-chloride solution (*Daily Cons. and Trade Reports*, Aug. 7, 1911; Apr. 17, 1912). The mixtures are not patented, but the manufacturers keep them secret.

Whereas the magnesia flooring was first used as a base for linoleum, it has been found possible to give the mixture a good color, and a fine marble-like finish, in which case it costs about $1.34 per sq.m. It is stated to be crack-free, warm under foot, elastic, and sound- and waterproof.

Struverite in Perak

Some strüverite was recently found in the Kuala Kangsar district, Perak, Federated Malay States, which, on analysis, gave: TiO_2, 45.74; Ta_2O_5, 35.96; Nb_2O_5, 6.90; FeO, 8.27; SnO_2, 2.67 (*Chem. Trade Journ.*, Mar. 23, 1912). The only constituent likely to be of present value is tantalum.

How the Metals Are Sold—Copper—I

By W. R. Ingalls

An account of the customs and practices obtaining in the marketing of an important metal and the conditions that determine them.

The interest of the miner and the metallurgist extends to the production and disposal of the refined metals. In their subsequent utilization by the drawers of wire, rollers of sheet, etc., he usually has no concern. The last step of interest to him, and this is of vital interest, is consequently the sale of the refined metals. The details of the selling, the methods and conditions thereof, and in short all that pertains to the marketing are not, however, well understood. There have been, in the JOURNAL, many articles upon this subject, but even in such a matter as selling metals there are changes in practice and therefore this present series of articles will not be wholly a repetition of what has been said previously. It is not my intention to touch upon the selling of iron and steel, or of many of the minor metals, such as antimony, nickel, etc., but rather to confine myself to copper, lead, zinc and tin, with brief references to aluminum and quicksilver. I shall begin with copper as the metal of superior interest.

I shall not enter far into the subject of statistics. It will be sufficient to remark that at present the world's production of new copper is about 2000 million pounds per annum, whereof about 1450 million is the product of American refineries. The predominance of America in the world's market is therefore self-evident. This predominance is emphasized if it be further stated that of the remaining output a considerable portion is consumed in the respective countries of production, e.g., this is the case of Russia, and is not competitive.

Besides the new copper there is a considerable production from scrap and junk, which to all intents and purposes is equivalent to new copper. In the United States this production amounts to about 60 million pounds per annum.[1] It appears therefore that the total production of copper in the United States is fully 1500 million pounds per annum, the disposal of which implies the selling of an average of five million pounds per day of business. It is evident from these figures that transactions in the copper market must go on all the time and that in the dealings of first hands they must be of high order of magnitude. In the business from this standpoint the carload is representative merely of retail trading; one hundred thousand pounds is a relatively trifling unit; a million-pound lot is only ordinary in periods of activity; and transfers of much larger blocks are common. Transactions to the amount of 30,000,000 lb. per week only dispose of the current production, without allowance for resales. When the market is classed as dull, a weekly business to the amount of many millions of pounds is likely to be done, but less than the average. Business has to be upward of 30,000,000 lb. per week to be pronounced brisk.

KINDS OF COPPER

Copper is marketed in four principal kinds, viz.: 1, Lake; 2, electrolytic; 3, pig; 4, casting. Lake and electrolytic are marketed in three principal forms, viz., cakes, wirebars and ingots. Pig copper, as its name implies, is sold in pigs, while casting generally goes in the form of ingot. Cakes are commonly rectangular slabs of the metal; rarely discs. Cakes are used chiefly by the rollers and spinners. Wirebars are long bars, of square cross-section, tapering at one end to facilitate passage through the rolls of the wire mills. Ingots are the well known pigs that are partially divided into two or three sections, which is to facilitate the breaking of them for introduction into melting pots. Ingot copper is in fact used chiefly by the makers of castings and alloys, brass being the most important of the latter. Besides the ordinary ingots there are also what are called "ingot bars," weighing 60 to 90 lb., which are divided by three to five notches.

Cakes and wirebars as furnished by the several refiners are generally of about the same size and shape, but there are some manufacturers who require special shapes and often pay a premium for them. Sales of copper at a fancy price are occasionally reported in the newspapers and heralded as marking an advance in the market, whereas in fact they represent merely some purchase of copper in a special shape and perhaps also of a special brand.

LAKE COPPER

As its name indicates, Lake copper is produced by the mines of Lake Superior, and indeed it is produced only by them. Formerly it was relatively of much more importance than it is now, but during the last 20 years electrolytic has displaced it as the kind of metal of superior importance although in certain ways it still retains the premier position. Electrolytic is, however, now conceded to be superior to Lake in conductivity and equally good in some other respects. Lake copper is superior in the combination of high conductivity with high toughness, but in the main it holds the esteem that wins for it a premium in the market to a hoary prejudice on the part of some manufacturers who continue to demand it because they always have, because it has proved good, and because they don't want to take chances in trying anything else. Given two lots of the same metal cast in different molds, one with an old, well-known name and the other with a new one and some melters will report different results. Such absurdity is gradually disappearing with the introduction of the chemist into the brass works and other factories.

Lake copper is marketed as three distinct kinds, viz., special brands (Calumet & Hecla and Quincy); prime Lake (Tamarack, Osceola, Wolverine, etc., including the electrolytic Lake refined by the Calumet & Hecla at Buffalo); and arsenical (Copper Range, Isle Royale, etc.) These brands command different prices, the specials generally realizing a little higher and the arsenical a little lower price than the good, ordinary Lake copper. However, this is not always the case. At some times the arsenical copper sells on a par with first-class casting, but there have been times when a demand for copper high in arsenic has brought for it a price superior to prime Lake copper.[2] Similarly there have been times, especially during periods of decline in the market, when the best grades of Lake copper have been sold on the same terms as electrolytic. In general, however, prime Lake copper commands about 0.25c. per lb. more than electrolytic, basis New York, but not so much on basis of delivery. Further on I shall dwell more in detail upon this subject. Lately the

---

[1] Statistics of the recovery of copper from scrap and junk are conflicting and confusing unless they be carefully defined. Most manufacturers of copper have scrap and trimmings, which they remelt or return to the refiners for remelting. Manifestly such copper should be excluded from statistics because it has never been used. The correct view of the secondary recovery of copper is, in my opinion, confined to what is obtained from the reworking of old material; i.e., material that has been used, collected, and restored to the market in the form of ingot, etc., thus becoming to all intents and purposes new copper, with which it is in fact competitive. Such recovery is practiced not only by smelters who make it their special business, but also by the refiners whose chief business is the treatment of virgin copper.

[2] The arsenical Lake copper constitutes a class by itself, having a distinct market. It cannot be used in place of prime lake, nor of electrolytic, but finds employment either as casting copper or rolling copper. For the latter purpose it is in good demand, owing to the high tensile strength of the sheet made from it.

Calumet & Hecla has been making a differential of ¼c. per lb. between its Torch Lake and Buffalo copper.

ELECTROLYTIC COPPER

The production of electrolytic copper now amounts to about 80% of the total American production, and 70 to 75% of the world's production. Because of its excellence and the magnitude of its supply it occupies the leading place in the copper business. When the price for copper is referred to without qualification the common understanding nowadays is that the price for electrolytic copper is meant.

The electrolytic copper produced by the several refineries is substantially uniform in quality. Certain brands, e.g., B.E.R. and N.L.S., have at times enjoyed a little preference and indeed have commanded a small premium, but at present no material differences are recognized and the respective agencies compete upon an equal basis. The standard specifications, approved Feb. 18, 1910, provide that all wirebar and cake copper shall have a purity of at least 99.9%, silver being counted as copper, and an electrical resistivity not greater than 0.15535 international ohm per meter-gram at 20° C. The specifications of the American Society for Testing Materials adopted in 1911 are as follows:

> (3) The copper in all shapes shall have a purity of at least 99.880% as determined by electrolytic assay, silver being counted as copper. All wirebars shall have a conductivity of at least 98.5% (annealed); all ingots and ingot bars shall have a conductivity of at least 97.5% (annealed), excepting only arsenical copper, which shall have a conductivity of not less than 90% (annealed). Cakes, slabs and billets shall come under the ingot classification, except when specified for electrical use at time of purchase, in which case wirebar classification shall apply. The annealed copper standard, or resistance of a meter-gram of standard annealed copper at 20° C., shall be considered as 0.15302 international ohm The percentage conductivity for the purposes of this specification shall be calculated by dividing the resistivity of the annealed copper standard by the resistivity of the sample at 20° Centigrade.
>
> (4) Wirebars, cakes, slabs and billets shall be substantially free from shrink holes, cold sets, pits, sloppy edges, concave tops and similar defects in set or casting. This clause shall not apply to ingots or ingot bars, in which case physical defects are of no consequence.
>
> (5) Five per cent. variation in weight or ¼ in. variation in any dimension from the refiner's published list or purchaser's specified size shall be considered good delivery; provided, however, that wirebars may vary in length 1% from the listed or specified length, and cakes 3% from the listed or specified size in any dimension greater than 8 in. The weight of ingot and ingot-bar copper shall not exceed that specified by more than 10%, but otherwise its variation is not important.

These specifications do not take into consideration the so-called casting copper used for the purpose of alloying with other metals to produce cast shapes.

BRANDS OF COPPER

A list of the important brands of copper in the American market is as follows:

American Smelting & Refining Co.	P A
American Smelters Securities Co.	BER, BCW,† Tacoma
Anaconda Copper Mining Co.	M A
Arizona Copper Co.	A C C†
Balbach Smelting & Refining Co.	Bb† N B C
Calumet & Hecla Mining Co.	C & H M Co.
Copper Range	C R
Nichols Copper Co.	N L S, R M C
Phelps, Dodge & Co.	C*Q, P D C†
Quincy Mining Co.	Q M Co.
Raritan Copper Works	N E C
Tamarack & Osceola	T M Co.
Tennessee Copper Co.	T C C†
U. S. Metals Refining Co.	D R W

†Casting.

SMELTING AND REFINING

The smelting of Lake copper is a relatively simple process as is also the refining, which is done in the same works. These works are near the mines in Michigan, except the plant of the Calumet & Hecla at Buffalo, N. Y., and from them the copper goes directly to the manufacturers. The C. & H. works, at Buffalo comprise an electrolytic refinery in which some of the more argentiferous copper is refined. The copper so refined continues to be classed as Lake copper. At the Dollar Bay smeltery a proportion of Montana cathodes used to be melted with the Lake copper, the product going into the market as "Lake."

The refiners who rework scrap and junk, producing casting copper, employ reverberatory furnaces, the refining process being simple.

All of the other producers of copper turn out a first product known as pig or blister copper, this being the crude metal poured from the bessemer converters. Nearly all of the producers have converter plants, but a few ship their product as matte to other converters. The refiners receive a small proportion of their crude copper in the form of anodes, some of which is not strictly blister copper.

The bulk of the blister copper goes to the electrolytic refiners, it being necessary both to eliminate impurities and to extract its gold and silver content. Some of it, however, is non-argentiferous and sufficiently pure as it comes from the converters to be used as casting copper after a simple furnace refining. Such copper is marketed as pig or bessemer copper and to a large extent is exported. The product of the Arizona Copper Co., Detroit Copper Co. and Tennessee Copper Co. is of this class. Some of it contains enough silver to be near the dividing line and goes directly into consumption or to electrolytic refining according to commercial conditions, sometimes one way, sometimes the other. At present only the ACC copper is sold as pig. The product of the Detroit Copper Co. is marketed as PDC (casting) and that of the Tennessee Copper Co. is either marketed as casting or is electrolytically refined.

The first marketable product of the electrolytic refiners is cathode copper, i.e., the refined metal in large, rough, electrolytically deposited plates coming from the tanks. The cathodes go generally to melting furnaces wherein the process of refining is completed and whence the copper is cast as cakes, wirebars, or ingots, but there are some buyers of cathodes who do the rest of the process in their own works. Much less cathode copper is sold now than formerly. The major part of what is disposed of in this form goes to Europe. The cathode allowance for export is variable, ranging from 5 to 10s. per 2240 lb. (0.054 to 0.108 per lb.). In shipping copper in this way heavy losses in weight (0.25 to 0.75%) occur, owing to the brittleness of the plates and the rough handling in loading and unloading.

ELECTROLYTIC REFINERIES

The following is a list of the electrolytic copper refineries of the United States, together with their situation and a statement of their capacity at the end of 1911:

Works	Location	Capacity, Pounds
Nichols	Laurel Hill, N. Y.	330,000,000
Raritan	Perth Amboy, N. J.	330,000,000
Baltimore	Canton, Md.	288,000,000
A. S. & R. Co	Perth Amboy, N. J.	180,000,000
U. S.	Chrome, N. J.	180,000,000
Balbach	Newark, N. J.	48,000,000
Anaconda	Great Falls, Mont.	65,000,000
Tacoma	Tacoma, Wash.	28,000,000
C. & H. Min. Co	Buffalo, N. Y.	55,000,000
Total		1,494,000,000

THE SELLING AGENCIES

A few of the producers sell directly their copper and handle no other copper. This is the practice of the Quincy, Miami, Mohawk and Wolverine companies; also of some of the smaller Lake companies. Other companies sell their own copper and also act as agents for other producers. Thus, the Calumet & Hecla sells the product of the other Lake companies in which it is a stockholder. The Anaconda Copper Mining Co., through the United Metals Selling Co., sells the Cananea, Copper Range and Highland Boy copper. Phelps, Dodge & Co. sells the Calumet & Arizona. The American Smelting and Refining Co. sells the Utah, Nevada, Ray, Chino and Tennessee copper. These concerns sell their outside copper on commission, the rate now being commonly 1%. The American Metal Co. and L. Vogelstein & Co. act both as agents and as traders. The one large producer, Calumet & Hecla, and the five agencies that have been mentioned sell about 80% of the total American copper product. Beer, Sondheimer & Co., E. P. Earle, and one or two other concerns handle relatively small quantities.

These concerns constitute the "first hands." Besides them there are numerous dealers who conduct a speculative or distributive business, or a combination of both. Their supplies, barring what comes from the scrap and junk smelters, are of course obtained from the producers and agencies, either by purchase or by representation. Virgin copper has been known to be delivered against sales through unusual channels. As to the purely speculative business, reference will be made in a subsequent section of this article.

INTERNATIONAL RELATIONS

Approximately one-half of the production of American refineries is consumed in the United States; the other half is exported to Europe. Copper moves freely from one country to another, there being no import duties except into Russia and perhaps some minor countries. These conditions create an international market for copper, i.e., the American and European price is in general the same, allowing for freight differentials. The principal nominal markets are New York and London; the only other public market that comes into consideration is Hamburg. In importance Hamburg is decidedly inferior to London, to which in the main it conforms.

In New York the dealings are wholly in refined copper; in London they are both in refined sorts and in what is known as "standard" under a form of contract determined by the metal exchange which classifies and rates most of the commercial kinds of copper. Transactions upon the London Metal Exchange are conducted under systematized rules and the open market that is thus established is the focus of extensive speculation, which is no more confined to London itself than are the transactions on the New York stock exchange confined to Wall Street. Both of these places are simply the points of execution of orders emanating from all parts of the world. Thus, many of the speculative movements executed in the London copper market originate from orders cabled from New York and several American houses are prepared to conduct such business, in which public interest upon certain occasions has been openly invited, just as it might be invited to participate in speculation in cotton or wheat.

In view of these connections it is obvious that while the London and New York copper markets may temporarily exhibit a disparity, such a condition can not long exist, generally for not more than a few days, inasmuch as disparity immediately opens the way to profitable arbitrage business. If "standard" at London rises above the New York parity the American agencies may sell contracts and deliver their refined copper against them. On the other hand, if "standard" falls below the parity they may cause their refined copper to move at concessions and cover their sales by purchases of "standard" in London. There are frequently triangular and even quadrangular or more complicated transactions, such as occurred several years ago when China was playing an interesting part in the copper market. The details of these are often too abstruse to be understood by anyone except the traders who make it their business. The number of houses in a position to conduct arbitrage business is in fact small.

A consideration of the nature of this international business makes it manifest that the American and European markets must stand at the same level during most of the time. A movement may start in London or New York; if the start be in London it may be specifically inspired from New York; and a general change in level may be anticipated on one side or the other, which is why New York watches London so carefully, and vice-versa, but natural conditions prevent any disparity from being of anything but temporary character.

NEW YORK A BASING POINT

While New York is the great market for copper and while the price for copper in New York is the commonly accepted basis, a great deal of the copper sold, perhaps the major part, never physically enters New York. The electrolytic refineries, with a few exceptions, are situated on branches of the bay of New York, four of them being in the State of New Jersey and only the Nichols works in New York. This, however, is merely a technical distinction, three of the large New Jersey refineries being separated from the municipality of New York only by a narrow body of water. At the refineries the copper is loaded on lighters by which the copper is taken to the steamship docks for export or to the railway docks for transhipment to interior domestic places. In a few cases direct delivery to manufacturers can be made by lighters and to some extent the copper is shipped directly from the refineries in railway cars. The greatest manufacture of copper is on the Atlantic Coast, and especially in the Naugatuck valley in Connecticut. There are important isolated centers, such as Trenton, N. J., Rome, N. Y. and Detroit, Mich. The copper that goes westward from New York has to stand a back freight through the longitude that it has already traversed in coming eastward as blister copper. Not so with the electrolytic copper coming from Tacoma and Great Falls or the Lake copper from Michigan. When copper is delivered from western refineries to western manufacturing points it is a common practice of the Lake producers to settle on the basis of the New York price with freight allowance. In the case of the electrolytic producers conditions are more complicated because of the trade custom respecting delivery.

PRICE BASES

The price for copper is quoted to buyers in a variety of ways, whereof the more important are as follows: New York, cash; delivered, 30 days time for payment; delivered, cash; delivered, cash, less 0.5% discount; f.o.b. dock, New York (for export); delivered in Europe, c. i. f. (cost, insurance and freight). Formerly copper was sold on a strictly cash basis. At present the custom of granting time prevails in the domestic business, the larger part of the copper being sold on terms that include delivery at the buyer's works (the seller paying the freight), allowing 30 days (after arrival of the copper) for payment; and discounting the bill for cash. This is the meaning of the common, commercial phrase "delivered, 30 days." The custom of quoting copper in this way is now so general that the explanatory phrase is commonly omitted, which makes it necessary to employ an explanatory phrase when the basis be different. If it be said in the trade that the price of electrolytic copper is 14c. it is understood what that means, but outside of the trade such an understanding does not generally exist. The net, cash price, basis New York, is of course a very different thing from the price delivered, 30 days. In the foreign business the c. i. f. basis is also one of delivery, the seller landing the copper at some European port.

The practice of selling copper to domestic manufacturers[1] on the delivery and time basis was, I believe, inaugurated in the '90s. Lake copper was naturally delivered to them directly from the West and in introducing the then new kind of copper—electrolytic—coming from the West via New York it was reasonable to offer it to the manufacturer on terms that relieved him of a study of freight rates. The innovation of time allowance against the old cash basis was inspired doubtless by competitive reasons and coincided with the elimination of the middleman (broker), the rise of the great agencies possessing large financial resources, and the direct dealing with manufacturers whose credit was good and well known. Losses through bad accounts in the copper business as now conducted are almost an unknown occurrence.

---

[1] Throughout this article I refer to the "manufacturer" rather than the "consumer." The real consumer rarely enters directly into relations with the refiner. The latter sells to the manufacturer of wire, etc., who is simply a middleman one step further in advance. There are, however, some large users of wire, such as the General Electric Co. and Western Electric Co., which buy wire bars and have them drawn on toll or contract, but even they are not the ultimate consumers.

The granting of time on copper bills is of course a concession to the buyer, because the latter gains and the seller loses interest on the money, although this is not figured by some producers in their accounts. They reckon a sale as a sale irrespective of when they receive their money, but the interest on the money involved in the transaction accrues to some one, nevertheless, and is recognized in the discounting of bills for cash.

The time allowance is not a commendable practice or to the best interest of the business. At certain times it has been abused. In shipping to Connecticut the refiner in New York figures upon financing the consignment for about 45 days, the time while the copper is in transit being about 15 days. The buyer may take advantage of the agreement by delaying the receipt, i.e., delaying weighing in or entry upon his books, from which he begins to count his 30 days, and the seller is impotent, being anxious to avoid giving offense, especially when competition is keen.

(To be concluded)

Geology of the Jarbidge District, Nevada*

The Jarbidge district is in the northern part of Elko County, Nevada, near the Idaho state line on the north and about 60 miles from the Utah state line on the east. The district comprises an area about 14 miles square; it lies in rugged mountains that range in elevation from 5500 to 11,000 ft. The nearest railroad stations are Rogerson, in Idaho, 50 miles to the north, on a spur of the Minidoka & Southwestern branch of the Oregon Short Line, and Deeth, in Nevada, 55 miles to the south on the Southern Pacific and Western Pacific railroads.

The district lies in an area of folded and tilted, principally Paleozoic sedimentary rocks, cut by granular intrusives and flooded by Tertiary lavas. The rock groups of the region, beginning with the oldest, are Paleozoic sedimentaries, post-Paleozoic intrusives, early Tertiary and late Tertiary lavas, Tertiary sedimentaries and Quaternary deposits. With reference to the mineral deposits the early Tertiary lavas are the most important.

Veins Formed in Fissures in Older Rhyolites

The intrusion and deformation of the Paleozoic sediments by stocks and dikes of granite and their erosion was followed by the eruption of Tertiary volcanic lavas that more or less completely flooded the region. Among these lavas rhyolite is the most abundant and widely distributed. At or soon after eruption, the older rhyolites were fissured mainly by crustal movement attended by faulting. The fissures thus produced are now occupied by the gold-bearing quartz veins of the district, and a few of them by rhyolite dikes.

The faults, including the vein fissures, seem to be mostly normal, and occur roughly in two groups; the west group, mainly in the west slope of the Crater Range and along the Jarbidge River, and the east or Crater group, mainly in the upper east slope of the Crater Range. The faults of the west group strike northwestward and dip steeply to the east; those of the east group strike more nearly north and dip steeply to the west against the dip of the west group. The rocks are cut by rhyolite dikes that were probably derived from the same magma as the intruded rocks.

The younger rhyolites were poured out from essentially the same vents as the old lavas. In places they are gently folded and slightly faulted, but compared to the older flows they have not been much deformed.

Two Periods of Mineralization

The district shows at least two distinct periods of mineralization. The deposits occur in two sharply contrasted groups that differ considerably in age; the early occurring in or associated with the sedimentary and early granular intrusive rocks, and the late, in the rhyolite. The early, Cretaceous (?) deposits are said to occur chiefly as tabular fissure veins, containing gold, silver, copper and lead in quartz gangue. They occur mostly near the contact of the Paleozoic quartzite and limestone, and the granular intrusives; both classes of these rocks are cut by the veins. These deposits have not yet been extensively developed.

The most important are the later deposits which occur as tabular, gold-bearing quartz fissure veins or lodes in the rhyolite. They are in general well defined and contain angular inclusions of rhyolite, sedimentary rocks and seams of clay. The veins, about 40 in number, range from 1 to 20 ft. in width, from less than 1000 ft. to several miles in length, outcrop prominently, rising in places to more than 60 ft. above the surrounding surface, and show a vertical range in some individual cases of nearly 2000 feet.

Two Systems of Veins

The veins consist in general of two main systems or groups which gradually diverge northward, but which are not everywhere sharply differentiated, and converge downward. They occupy chiefly normal fault fissures. The west system comprises the wider and more important deposits, and the most prominent outcrops. The most important of these deposits are concentrated in a belt about a mile wide and three miles long. They contain more brecciated material and the walls are more irregular than the east system.

The inconspicuous outcrops of the east system show a vertical range of more than 4000 ft. They appear to occur mostly at geological horizons nearly 2000 ft. higher than the western veins. They are narrower, one to four feet, and more persistent horizontally, some being said to have a length of three miles. There is also a subordinate cross system of veins, striking almost at right angles to the two main systems.

Characteristics of the Veins

The veins are composed of characteristically laminated pseudomorphic milk-white quartz-andularia gangue, usually stained reddish brown to black or yellow in the outcrops and surface workings. The minerals in the deposits are chiefly andularia, apatite, argentite, calcite, chalcedony, chlorite, epidote, fluorite, gold, gold-silver alloy, hematite, kaolin, limonite, manganese oxide, marcasite, muscovite, opaline silica, orthoclase, pyrite, quartz, sericite, silver and talc.

Both the croppings and the gangue in the veins show free gold, the principal metal, which may be obtained by panning. Good ore usually yields a long streak of bright gold in the pan. The silver occurs chiefly as argentite. The quantity of silver is usually small, amounting to only 2 oz. per ton of ore, but in some cases as much as 90 oz. has been reported. While plates, specks and blebs of gold are often seen, most of the gold is finely divided and invisible. In most of the veins it is concentrated in streaks or pay shoots. The grade of the ore ranges from low to very high, the shipping ore from some veins assaying $600 to $1000 per ton. A sample from the Bluster vein over a width of 5 ft. assayed $60 per ton. It is, however, too early to form any idea of the average value of the ore of the district.

While on the whole the gold appears to favor the quartz portion of the gangue where quartz is plentiful, in many places it seems to occur independently of both quartz and andularia. The gold of the western veins is high grade; that of the Bluster mine has a deep yellow color and assays $20 or more per oz. In the eastern veins the gold is light colored, contains much silver alloy, and assays about $12 per ounce.

Weston Normal Cell

The technical committee, appointed by the International Committee on Electrical Units and Standards, has reported through S. W. Stratton, of the U. S. Bureau of Standards, that the electromotive force of the Weston normal cell should be considered 1.1083 volts at 20° C. This may be changed by a few parts in 100,000 when the committee finally reports on the final specifications for the silver voltameter.

---

*Abstract from Bull. 497, U. S. Geological Survey.

Mines and Ores of Porcupine

By Reginald E. Hore*

The gold occurs free, or intergrown with pyrite, in quartz veins. The country rock is gray sericite-quartz-carbonate schist, conglomerate, slate or ferrodolomite, generally containing pyrite. At the Hollinger, galena and sphalerite are considered good indications of rich gold ore. Mill tests show that good extraction is possible by combined amalgamation and cyanidation.

In the summer of 1909 prospectors working in the vicinity of Porcupine Lake, 360 miles north of Toronto, 100 miles northwest of Cobalt, and 25 miles west of the Ontario government railroad, found a number of promising gold-quartz deposits. During the following winter machinery was taken in to explore the properties and two of them, now known as the Dome and the Hollinger, were proved to be exceedingly valuable. On many other properties, notably the Miller-Middleton, Vipond, Rea and McIntyre, promising finds were made.

THE DOME MINE

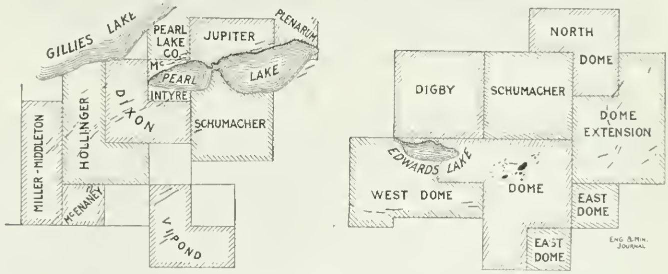
The Dome Mines, Ltd., owns 240 acres, six mining claims, in Tisdale township. On one of the claims, two large masses of gold-bearing quartz are exposed, and near the large masses are numerous smaller masses and veins. The country rocks are gray schists, conglomerate and slate.

Near the quartz, almost all the rocks are impregnated with carbonates. The schist is composed largely of sericite, carbonates and quartz with smaller amounts of chlorite and magnetite. It commonly contains near the quartz numerous striated cubes of pyrite. The conglomerate has a matrix of fine quartz, sericite, quartz and carbonates with a few large grains of quartz and feldspar. The pebbles are chiefly light-colored altered quartz-porphyry.

The quartz in several places shows coarse gold, especially in parts near the wall rock or inclosed masses of rock. Most of the gold is in parts of the quartz that have been crushed. Apparently the quartz was originally made up largely of grains 0.5 to 1 mm. in diameter; but much of it is now in grains 0.02 to 0.05 mm. in diameter which have been formed by granulation of the larger grains. The quartz contains numerous fluid inclusions and shows strain shadows. Most of the visible gold is inclosed by quartz. Some is wholly or partly inclosed in calcite. or other carbonates. Some is intricately intergrown with pyrite. In the quartz are numerous crystals of pyrite and the gold is commonly near the pyrite; but in several sections examined microscopically only a small proportion is actually intergrown with it. Minute streaks and patches of sericite and carbonate are common and much of the visible gold is among the granulated quartz near these minerals.

Mill tests have shown that most of the gold can be readily recovered by amalgamation if the ore is finely ground. By grinding to pass 90% through a 200-mesh screen, 84% of the gold was recovered by amalgamation. Sands from the stamps will therefore be recrushed in tube mills. The ore was found to be particularly free from cyanicides and the tailings can therefore be profitably treated by cyanide.

During 1911 surface prospecting at the Dome resulted in some important discoveries. One vein uncovered northeast of the larger quartz mass shows remarkable patches of coarse gold and has become known as the "Golden Stairway." A shaft is now being sunk to explore this vein. In excavating for the mill site other quartz veins showing much coarse gold were encountered. A large number of diamond-drill holes have been bored with satisfactory results.



TWO IMPORTANT VEIN SYSTEMS OF THE PORCUPINE DISTRICT

THE HOLLINGER MINE

The Hollinger Gold Mines Co. owns 160 acres, four mining claims, in Tisdale township. The property is part of the original holdings of the Timmins-McMartin-Dunlap syndicate, which owns the Miller-Middleton claims on the west and the Dixon claims on the east of the Hollinger, as well as the controlling interest in this company.

The orebodies are in the form of quartz veins running across the claims in a northeasterly direction. There are several approximately parallel veins forming a vein system. The vein system is part of a larger fissured zone which extends across the Miller-Middleton, Hollinger. Dixon and McIntyre, claims.

The wall rock is for the most part a finely crystalline gray schistose rock composed largely of sericite, carbonates and quartz. It contains numerous larger clear ragged grains of quartz occasionally in groups but usually in isolated grains. It is likely that some of these quartz grains were originally phenocrysts in the rock. Pyrite is a characteristic constituent generally occurring in well formed crystals. The rock is now almost entirely made up of secondary minerals; but was probably originally a quartz-porphyry. It was apparently acted upon by solutions carrying a large amount of carbonates, and by replacement has been almost completely changed. By pressure it has been made markedly schistose.

The quartz is much like that at the Dome, full of liquid inclusions and by strain shadows and granulation giving evidence of subjection to great pressure. The associated minerals are commonly pyrite, sericite and carbonates. Galena, sphalerite and chalcopyrite occur in small amounts. Recently scheelite has been found in the quartz. It has been found by P. A. Robbins that galena, and to a lesser degree sphalerite, is an indication of rich gold content. Mr. Robbins states that the schist walls of the vein do not usually carry profitable ore, except where contiguous to rich sections of the vein, and in such cases the schist seems to be more or less silicified, pointing to the silica-bearing solutions as having provided the gold. This observation at the Hollinger is probably true also of most of the other deposits. There are cases where the gold is not so limited to the quartz veins, but schist or ferrodolomite carrying gold are commonly impregnated with quartz in minute veinlets. Mr. Robbins has found the main vein to be an unbroken oreshoot over 1000 ft. long and from 2 to 20 ft. thick. The thick lenses have proved the richer.

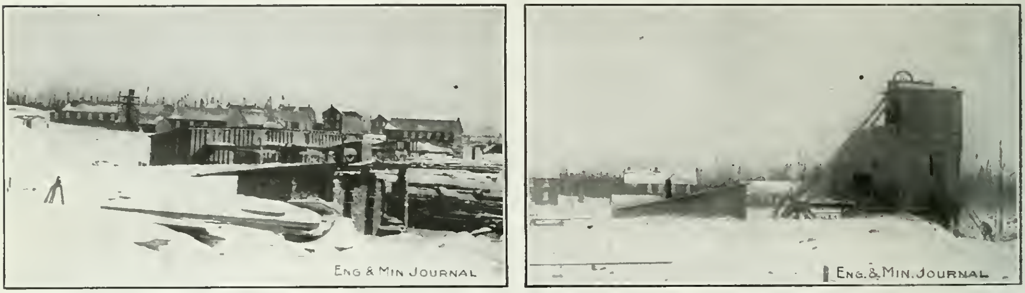
Mill tests made by A. G. Kirby have proved the ore to be in many respects similar to that at the Dome. By fine grinding a large percentage of the gold is

---

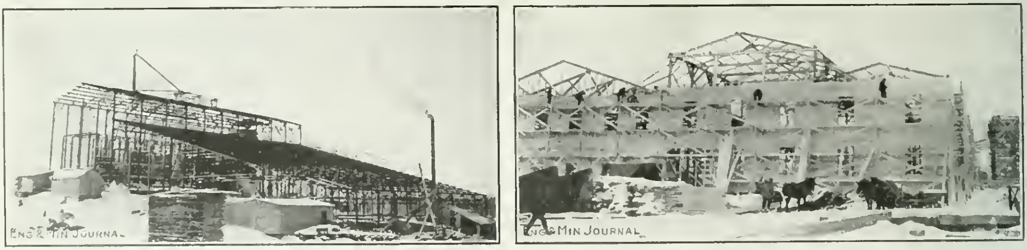
*Mining Geologist, Houghton, Mich.

Miller-Middleton Gold-quartz Vein

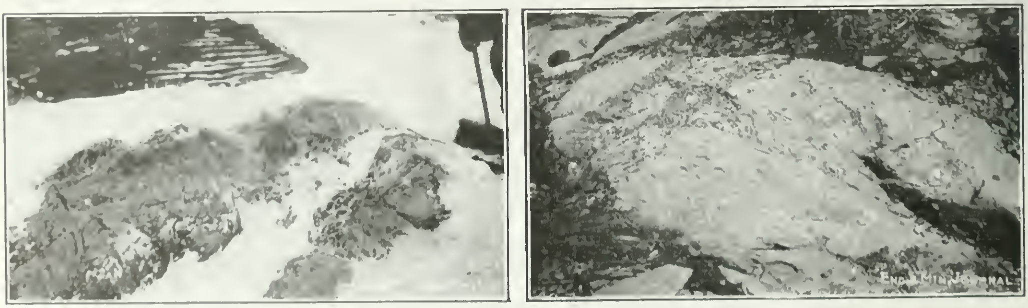
Nodular Masses of Quartz in Gray Schists, Hollinger Mine



Brick Camp Buildings and Golden Stairway Shaft at Dome Mine, Porcupine



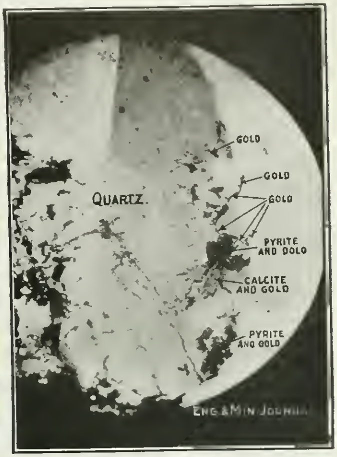
Dome and Hollinger Mills in December, 1911, Showing Different Types of Construction



The Golden Stairway Vein and Conglomerate at Dome Mine, Porcupine readily recovered by amalgamation and the remainder is practically all recovered by cyanide treatment. The process decided upon is: Coarse grinding, stamping in cyanide solution, tube milling, concentration followed by amalgamation of concentrates and cyanide treatment of both gangue and concentrate residues.

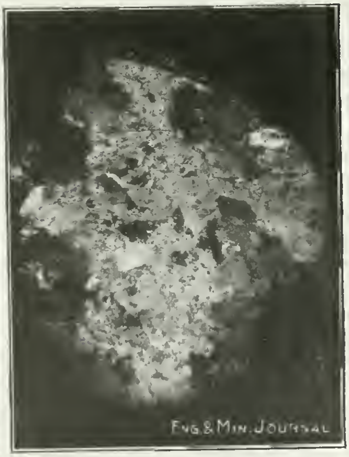
Sericite Schist Wall Rock at Hollinger

Quartz Veinlet in Pyritic Ferrodolomite, Rea Mine



Native Gold and Pyrite in Quartz, Dome Mine

Quartz Veinlet Separated from Ferrodolomite by Carbonates, Rea Mine



Granulated Quartz Characteristic of Gold-bearing Portion, Dome Mine

Gold Quartz Showing a Pyrite Crystal. Taken from Near Contact with Gray Schist at Dome

The mill tests and microscopic examination of the ores from Dome and Hollinger mines agree very well. The ores are comparatively free from minerals that might be expected to consume much cyanide and the tests confirm the observation. The visible gold is generally closely associated with pyrite and the tests indicate that the exceedingly fine gold is in similar association. Much of the visible gold while near the pyrite is not in actual contact with it but inclosed entirely by quartz and ready amalgamation of such gold is to be expected. Some of the visible gold is entangled in pyrite so that it would only be caught on the plates after fine crushing. Some of the gold seen only with the aid of the microscope is in minute particles completely inclosed in pyrite and would not likely be saved without treatment by cyanide or some other solution. The tests indicate that the gold which is not visible is probably present in the same form as the visible gold, the difference being simply one of magnitude.

The Vipond Mine

The Porcupine Gold Mines Co. owns 360 acres in Tisdale township, and 80 acres in Mountjoy township. The Vipond group of three claims, southeast of the Hollinger.

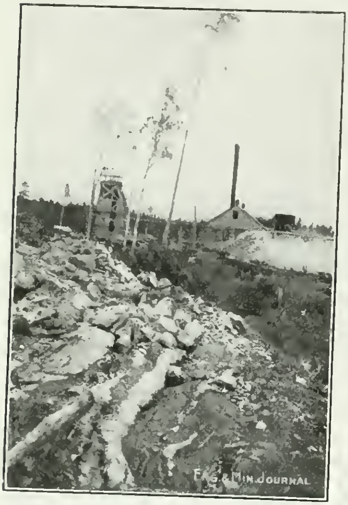
There are two rich quartz veins about 100 ft. apart. One vein showing 4 to 6 ft. of quartz, mineralized schist and ferrodolomite is said, by H. P. Davis[1], to average at surface $30 per ton for a length of 600 ft. At the 100-ft. level the assays are said to average $23.10 per ton for a stoping width of 42 in., and a length of 320 ft. The second vein at surface

---

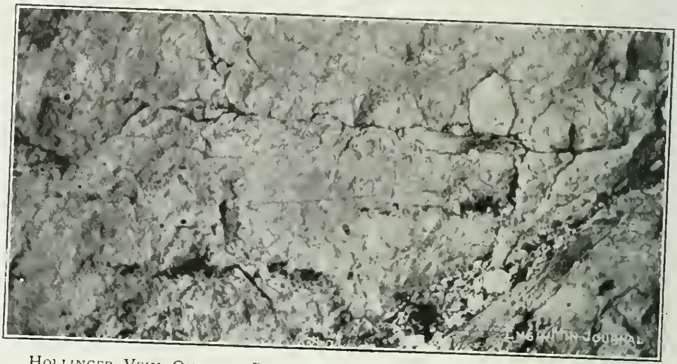
[1] Can. Min. Journ., Nov. 1, 1911.

McIntyre Mine, Porcupine, with Pearl Lake at Left

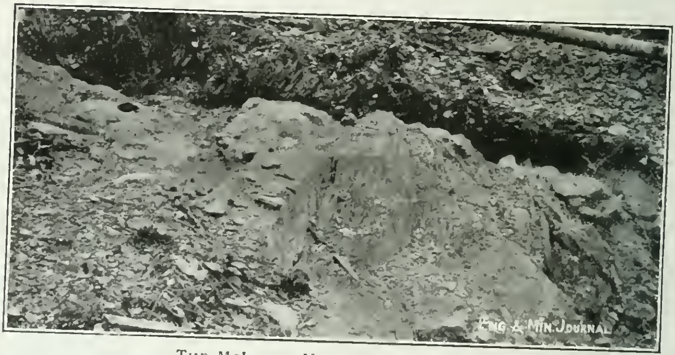
The Dome Extension Mine, Porcupine



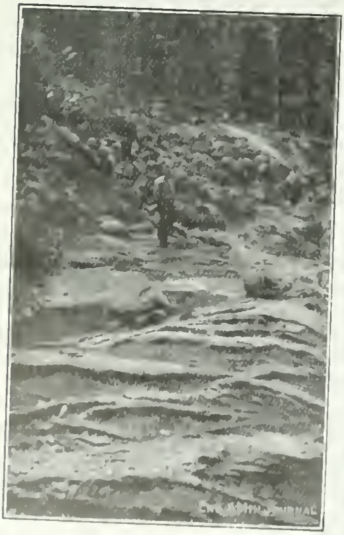
White Quartz in Gray Sericite-quartz-Carbonate Schist, Hollinger Mine



Hollinger Vein Quartz. Pyrite and Gold Usually Occur with Dark Minerals in Fractures



The McIntyre Vein in Gray Schists



Quartz Vein Standing in Relief from Ferrodolomite, West Dome Mine

Quartz Veinlets in Ferrodolomite at West Dome Mine, Porcupine showed a rich oreshoot 12 in. thick. Where cut at the 100-ft. level it showed 15 ft. of ore averaging $11.20 per ton. A mill with a capacity of about 100 tons per day is in process of erection.

THE REA MINE

The Rea Consolidated Gold Mines Co. owns 320 acres in Tisdale township. What is known as the main vein was discovered in May, 1910. The vein was stripped for 205 ft. and sampled every 5 ft. for a width of 42 in. The assays showed an average of $23.05 per ton. The average thickness at the surface is 6 feet.

The vein has a clear-cut boundary with the hanging-wall rock. The latter is a ferrodolomite which at the surface is rusty-weathered, and for a few feet disintegrated. Pyrite crystals are abundant. The carbonate grades off into a dark altered igneous rock impregnated with rusty-weathered ferrodolomite. The more altered parts are chiefly made up of chlorite and ferrodolomite with small amounts of quartz, sericite and black iron oxides. Parts of the rock show remnants of altered feldspars, some of which are apparently plagioclases ranging from oligoclase to andesine. The abundant chlorite scales and magnetite grains indicate that the rock originally contained a considerable percentage of ferromagnesian silicates; but there are none such now remaining. This chlorite-ferrodolomite rock is probably a fine-grained feldspathic igneous rock, most likely an acidic andesite or porphyrite, which has been permeated with and altered by solutions containing alkaline carbonates.

The quartz is milky white and vitreous. At the surface it shows rusty patches due to the alteration of contained crystals of pyrite and particles of ferrodolomite. As in nearly all the veins of the district there is little evidence of weathering a few feet below the surface. Numerous particles of coarse gold are visible, and one portion 12 in. wide along the north wall is for several feet remarkably rich. The wall is slickensided and vertically grooved. It is coated with an exceedingly thin greenish layer in which are numerous particles of coarse gold. In the quartz there are many minute dark streaks and much of the gold is found near these. The streaks are apparently secondary minerals which have filled in small crevices.

The quartz, like that at the Dome, Hollinger and Vipond has abundant fluid inclusions, and shows strain shadows and granulated particles. Small patches of ferrodolomite are scattered among the quartz grains. Two microscopically examined sections showing no gold are largely made up of coarse quartz grains 0.3 to 1 mm. in diameter with some carbonate. A section showing gold has much of the quartz in the form of fine grains, which have evidently been formed by the crushing of coarse grains. Tourmaline in brownish crystalline aggregates is common. Pyrite is abundant in the quartz and in the wall rocks.

In the latter part of 1910 development work was begun by two shafts 100 ft. apart. A shot-drill cut quartz showing coarse gold at a depth of 228 ft. From the eastern shaft at the 200-ft. level a crosscut was run to the vein, which was found to average for 200 ft. over $18 per ton. The vein where cut was 3 ft. thick. A section 110 ft. long, according to Mr. Rea[2], averaged $23.12. At the 300-ft. level the vein was found to be 38 ft. wide. A few samples were assayed and showed low gold content. Arrangements for more thorough sampling have recently been made and are now being carried out, and the shaft has been sunk to the 400-ft. level.

THE McINTYRE MINE

The McIntyre-Porcupine Mines Co. owns 148 acres, including claims adjoining Pearl and Gillies Lakes and a large portion of the bed of Pearl Lake. Prospecting in 1910 resulted in the uncovering of a number of quartz veins, two of which showed, in places, spectacular coarse gold. The wall rocks are gray schists made up largely of sericite, carbonates and quartz. The schists have probably been produced by the metamorphism of quartz-porphyry. The surface exposures show the rocks to be in places twisted, bent and broken. Faults displace the veins.

Five shafts have been sunk and good ore found in several veins. Some rich ore was encountered in workings at the 200-ft. level. Several holes were bored by shot and diamond drills, and ore found at depth under the lake. Development work has been pushed ahead rapidly and a 10-stamp mill has been started.

OTHER PROPERTIES

In the vicinity of the Hollinger and McIntyre the prospecting done during 1911 on several properties resulted satisfactorily. The Miller-Middleton, Dixon, Pearl Lake, Schumacher, Plenarum and McEnaney all found ore and have a reasonable chance of becoming profitable mines. The Miller-Middleton has an especially good surface showing. Drilling on the Pearl Lake property shows ore at a depth of about 1180 ft. Several of these properties have cut ore at a depth of about 100 ft. and some at 200 ft. The shafts as a rule do not follow the veins and no ore has been blocked out. The information that has been obtained, however, makes it appear likely that in addition to the known ore at the Hollinger and McIntyre there is a large amount of ore on the other properties in the gray-schist area in which the quartz veins on the McEnaney, Miller-Middleton, Hollinger, Dixon, McIntyre, Pearl Lake, Jupiter, Schumacher and Plenarum properties occur.

On the prospects in the vicinity of the Dome mine the development work done so far has not resulted as well as was expected. The Dome itself has exceeded expectations; but the surrounding mines have not yet developed any large orebodies. There are several good surface showings and further exploration may result in some good discoveries. In the northeast part of Tisdale township, the Crown Chartered, Dobie and Scottish Ontario have some good ore but no quantity of it is blocked out.

Nevada Consolidated

The fiscal year of the Nevada Consolidated Copper Co. has been made to coincide with the calendar year, so that the last report covers a period of 15 months, ended Jan. 1, 1912. The ore reserves on Jan. 1, 1912, are 40,853,371 tons of 1.622% copper, as against 40,360,823 tons of 1.70% on Oct. 1, 1910. The production for the 15 months was 78,541,270 lb. of copper, which was delivered on the Atlantic seaboard, after allowing credits and also providing for depreciation and all other charges, at a cost of 6.97c. per lb. of fine copper. The selling price was 12½c. per pound.

The most important changes during the year were the substitution of California oil for coal at the Steptoe plant, and the trial of basic brick in the Steptoe converters, which led to the decision to replace the ordinary converters with the Peirce-Smith shells. The Veteran mine of the Cumberland Ely Copper Co., was reopened in December, 1911, after having been idle since July, 1909, owing to a strike of the miners.

Fifty-one churn-drill holes, aggregating 17,185 ft., were put down. Hole No. 76, in the Eureka pit, was carried down to a total depth of 680 ft., to see whether the 0.4% Cu rock was the original primary ore or a local deposit. The former is believed to be the case. During the 15 months, 3,249,140 cu.yd. of overburden has been removed, while up to Jan. 1, 1912, a total of 6,038,683 cu.yd. has been removed, and it is estimated that 12,649,000 cu.yd. remain to be removed. The average thickness of profitable ore in the various sections is as follows: Eureka, 190 ft.; Hecla, 280.3 ft.; Liberty, 193.3 ft. The average thickness of direct capping is: Eureka, 87.1 ft.; Hecla, 101.4 ft.; Liberty, 154.7 ft. Including proportion of New York expenses, the mining costs have been 15.7c. per dry ton, to which is added 15c. per ton on the Eureka orebody, and 22c. per ton on the Liberty orebody to cover stripping. Stripping costs have been reduced to 36.30c. per cubic yard.

During the year siliceous carbonate ore, to the extent of 205,795 dry tons, averaging 2.91% copper, was mined, of which

---

[2] Can. Min. Journ., Jan. 1, 1912.

39,235 tons were crushed and delivered to the smeltery, and 166,560 tons put in storage to supply future needs of the converters and reverberatories. The cost of mining these carbonate ores has been 74.40c. per ton.

In the concentrator, results have been as follows: 3,338,242 tons of 1.80% Cu were concentrated 11.34: 1. The original silver and gold assays were 0.079 and 0.013 oz. per ton. Recoveries were: Cu, 67.59%; Ag, 45.92%; Au, 57.72%. The average copper in the concentrates is 13.80%, and the recovery of gold and silver 17.35c. per ton of the original ore.

Improved Richards Pulsator Classifier

The experience gained from the numerous installations of the Richards pulsator classifier has enabled the manufacturer within the last few years to improve its construction. All valves and gates are eliminated, and six spouts one to each compartment are provided, and for the great majority of ores to be classified these spouts are all situated on the same horizontal line. Altogether 19 parts requiring adjustment were eliminated, 13 of such parts being actually removed from the machine.

As a result of these changes only one adjustment is necessary to put the classifier in operation, namely, opening the main water-supply valve to the proper degree. Moreover, this simplified machine is now claimed to operate without change in adjustment, as well at one-tenth capacity as at full capacity, and to adapt itself automatically to sudden changes in amount of feed.

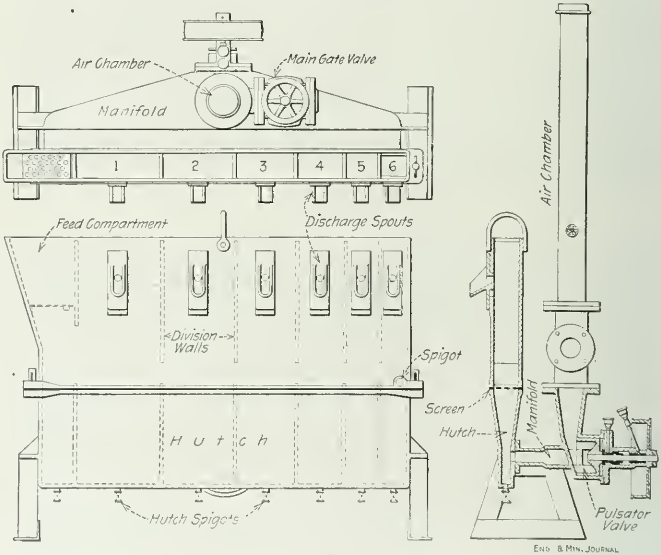
The type of classifier described herewith is known as the inverted type, for the reason that the slime is delivered from the first compartment, whereas in the common form of hydraulic classifier the coarsest pulp is delivered from the first compartment. The Richards classifier thus inverts the order of grading the pulp.

Referring to the accompanying engraving, it will be observed that the size of the classifying compartments varies from the largest at the feed end to the smallest at the opposite end of the classifier. The dimensions of each to give the desired capacity and proper gradation are a matter of calculation.

Hydraulic water enters the main gate valve at a pressure not to exceed 20 ft head, passes through the pulsator valve, by which the pulsating effect which characterizes the machine is obtained, thence up to the screen and out of the discharge box. The water from the pulsator valve is distributed equally to each compartment by the manifold. Therefore, the amount of water flowing upward through the screen of each compartment is equal, but as the area of each compartment varies, there are six different velocities of ascending pulsating columns of water, that near the feed end being the lowest velocity and that at the opposite end being the highest.

The division walls above the screen do not reach down to the screen by about 4 in., except for a small section about ¾ in. high directly above the screen for pressing the screen and gaskets down tight on to the division walls beneath. The screen serves only to support the bed of ore and has no part in the classification other than distributing the flow of water uniformly throughout the area of each compartment.

The ore pulp enters the feed compartment, passes down to the screen and flows along the screen to the 4-in. opening. In its progress it is subjected in succession to the six different rising pulsating currents, the first compartment having the slowest current lifts out only the finest slime and carries it up to the discharge spout. The last compartment, having the fastest current lifts the heaviest particles.



Richards Improved Pulsator Classifier

Coarse mineral particles too heavy to rise with the current in the sixth compartment may be drawn out through the spigot provided in the sixth compartment just above the screen. It is stated that almost invariably the discharge from this spigot is excellent and clean concentrate. Particles of free minerals smaller than the openings in the screen will settle into the hutches, or compartments below the screen, where they may be drawn off by the spigot shown. A further claim is that when properly adjusted, the Richards pulsator classifier will discharge all the slime in the ore from the first two discharge spouts, the balance of the product discharged being absolutely free from slime. The Richards classifier occupies comparatively little space. The 170-ton capacity machine, giving six classified products, requires a floor space of only 3x5 ft. and weighs only 1600 lb. The mill head or height required is only 10 in. from the bottom of the feed launder to the bottom of discharge spouts.

Beaver Consolidated Mines

The report of the Beaver Consolidated Mines, Ltd., for the year ended Feb. 29, 1912, shows that at its mine in the Cobalt district development work to the extent of 3515 ft. was done. The mine now has eight levels, and the main shaft is down 548 ft. The main shaft is to be sunk to 600 ft., where a station will be cut.

The year's production was 750,950 oz. of silver obtained from the following shipments: 199.22 tons of ore averaging 3320.2 oz.; 365.73 tons averaging 244.72 oz. The average price received was 54.7c. per oz.; the average cost of marketing, 3.37c. per oz.; the total average cost, 19.85c. per oz. Dividends, representing 8½% on the capitalization and amounting to nearly $170,000, were distributed.

A 50-ton concentrator to treat the dump and the low-grade ore from the mine was started on Feb. 22, 1912, and is reported to be giving satisfactory results. Provision was made so that by a small further expenditure the capacity can be brought up to 100 tons daily.

The company has its own mine inspector whose duty it is to examine the underground workings of the property twice daily and make written reports to the mine office.

Baltic Method of Mining—II

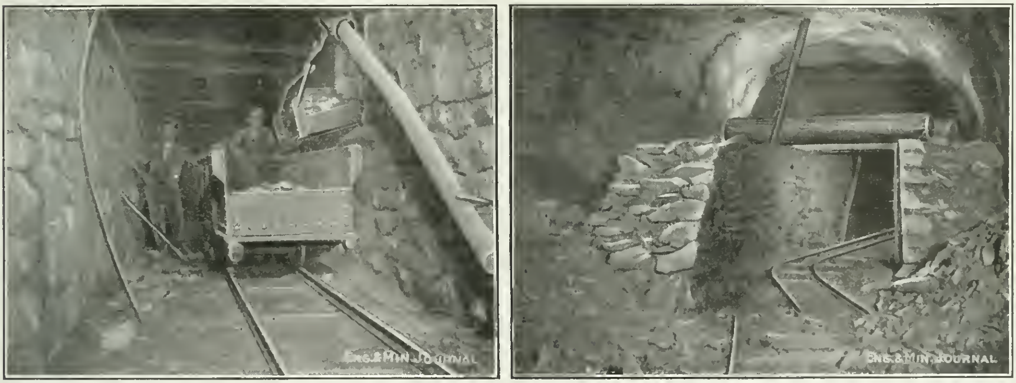
By Claude T. Rice

Before "caving" commences, the whole level is worked out up to within 35 ft. of the level above. Sorting follows the mining closely and any rock showing copper is considered to be ore. The level dry-walls are never less than 3½ ft. thick and are solidly packed.

In the Champion mine a level interval of 125 ft. was used, but this was soon reduced to 100 ft. and that is the level interval now used in the Trimountain and Baltic mines. As rock-lined mill holes are used, there is no real reason why this distance should not be increased to 125 ft., but it is thought that 100 ft. gives plenty of height to the stope. The principal reason for this is, that the ground in the top part of the block becomes heavy because the whole level is worked up to within about 35 ft. of the level above before caving commences.

Mining to Be Done Retreating

In the future it is planned to drift first to the boundary of the ore area or to the midway point between shafts, and then to carry on both stoping and caving retreating. In this way caving will commence earlier in the life of the stoping operations, and in any part of the block the level pillar will have less time to stand after it is undercut, than it does now before it is mined. As a result the ground will be in better condition than at present, and it will be more feasible to use a 125-ft. level interval. When mining is done all retreating, it is not unlikely that either the life of the mill hole or the dip of the load will finally determine the distance between levels, as it is highly desirable to keep these dry wall mills vertical. Under present conditions it is necessary to keep an entire level open for seven or eight years in an outside block served by only one shaft, and for about half that time in a block worked from two shafts. Mills 70 ft. high give little trouble, even when exposed as long as that to the wear and tear of the ore going through them and to the weight upon them. With a shorter length of life, made possible by a retreating method of mining, they should stand well, even when carried to a height of 100 feet.



Car, Chute and Dry Walls, Baltic Copper Mine, Michigan

The timber covering of the dry walls on the level, commences to rot before the walls show signs of failing, and to lengthen the life of this timber the fungus growth is swept off occasionally, and in the shaft the timbers are sprinkled either by hand or by turning water from the foot wall back behind the timbers on the hanging side of the shaft.

The former practice on opening a level was to cut out the lode from wall to wall as the shaft pillar, which is always left at least 50 ft. wide, was passed. Later it was deemed better to drive the drift only 14 to 16 ft. wide, in this way reaching the boundary sooner.

After trying both systems it has been found still better to cut the load out from wall to wall, where of mineable grade, as fast as the level is advanced. There are several reasons for this: First, owing to the poor rock broken down with the ore, the boundaries are not reached before it becomes desirable to put up a cutting-out stope so as to permit the building of dry walls, behind which the poor rock can be placed. If the drift is as wide as the lode, the tracks can be cleared more quickly; again, the wider the workings, the easier it is to follow the irregularities of the hanging wall, which has to be done in opening work or the miners would soon not know whether they were crosscutting or drifting. With a wide working, the holes also break better, and the muck from the last round interferes less with drilling. When poor rock is encountered, the drift stope is drawn to an ordinary 7x7-ft. drift.

In small drifts and crosscuts a corner cut is taken next the hanging wall, this now being preferred by the miners to the cut drawn off the bottom, which was formerly used. In the wide drift the ground is broken with a side cut, and the ore slabbed out from floor to roof. The usual practice is to blast on each shift. A floor of hardwood planks is sometimes laid before the ground is blasted, but generally this is not done.

Shovelers do the Tramming

The shovelers, who do the tramming and are called trammers in the Lake mines, since they tram as well as shovel, get out from 13 to 15 tons per shift, according to the distance that the rock has to be trammed. About 35 ft. of drilling, or five 7-ft. holes per shift is considered good work for a 2-man machine in these drifts, although since the 1-man machines are being tried, many of the large machines are drilling about 40 ft. per shift.

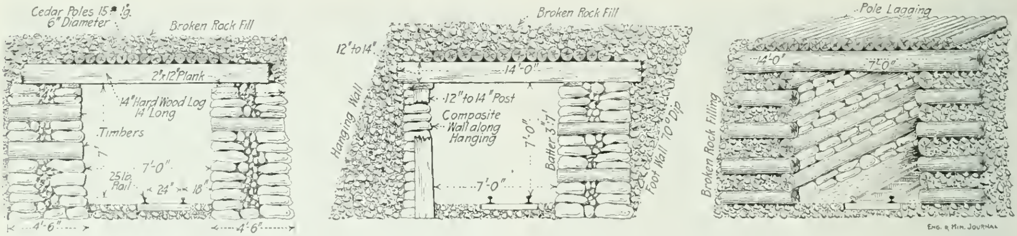
A 9-ft. drill is the longest that is used in these drifts. In the 16x7-ft. drifts formerly driven, an advance of from 55 to 65 ft. per month was made with one 2-man machine drilling on each shift. The cost of breaking the ground in the large drifts varying from 10x7 ft. to 16x7 ft. is as follows: Labor drilling, $4.04 per ft.; explosives, 97c. per ft.; total cost of breaking, $5.01 per foot.

Most of the drilling is now done with 3⅛-in., Rand drills, but for the last two years the company has been experimenting with 1-man machines. Most of this work has been done in drifts, but some of the Leyners have been tried in stopes. Besides the No. 8 water Leyners, 2½-in. Sullivan and 2¾-in. butterfly valve, Ingersoll-Sargeant 1-man drills have also been tried, but the water Leyner is more favorably looked upon. At the Trimountain mine an underground repair shop is maintained, and any repairs, such as can be made at a bench fitted with a vise and ordinary tools, are made without sending the drill to surface. This shop is placed in an old crosscut and the machines are tested on a permanently rigged-up bar before being sent out again; this shop has been a profitable installation.

WAGES

Unlike the practice at most of the copper country mines, the drilling is done on day's pay and not on contract, excepting drifting and shaft sinking. The method of stoping makes it impossible to do drilling on contract unless it is paid for by the foot, and this is not especially desirable in these mines. The men work the usual hours in this district. Miners work five full 9-hr. shifts on night shift and 5½ shifts on day shift, while the shovelers work five full shifts and a 7-hr. shift on Saturday. The number of hours worked in a week is about the same as in a Western mine where 8-hr. shifts are worked every day of the week, with one shift lost every two weeks on change Sunday.

The following wages are paid for underground labor on 9-hr. shifts: Machine men, $2.50; pickers and shovelers, $2.25; dumpers, $2.25; pipe and trackmen, $2.35; timbermen, $2.40; wallers, $2.25. Surface men on 10-hr. shifts receive $1.83. Hoisting engineers on 8-hr. shifts are paid $2.30 per shift, and oilers, who are generally boys, receive about $35 per month. Miners on contract receive on an average from $3 to $3.25 per shift, the shaftmen getting the most. Pit bosses, generally known as shift bosses, receive $3 per day, and under-captains from $3.50 to $4 per day.



DRY-WALL DRIFTS AT BALTIC COPPER MINE, MICHIGAN

TIMBER, EXPLOSIVES AND LIGHTS

The timber used underground is generally maple, with some ash and beech. This timber costs from $1.30 to $1.50 per 14-ft. log between 14 and 18 in. in diameter at the small end; 10-in. flat timber, with not less than an 8-in. face, costs from 10 to 12c. per running ft.; lagging, which is generally split cedar thick enough to be the equivalent of a 4-in. round pole, is 16 ft. long and costs about $12 per cord, 4 ft. high, 8 ft. long and the length of the lagging through.

Thirty per cent. ammonia dynamite is used principally in both development and regular stoping, although a little 40% is sometimes used in development. Lately, 30% Red Cross dynamite, which has a low freezing point, has been used and is well liked; in the future it is planned to use principally Red Cross dynamite, thus doing away with the necessity of thawing, which has been done by the miners in a special thawing box. At present 5X caps are generally used, but 6X caps are being introduced and will be used in the future. The open price for 30% dynamite, in the district, is $10 per 100 lb. Excepting a few of the timbermen, pipemen and bosses, who use acetylene lamps, the men underground use Sunshine grease in lamps, this costing about 1c. per ton of rock. This lighting cost amounts to about as much per ton as the timber used. The mines are well ventilated, and the smoke given off by the grease lamps and the greater consumption of oxygen, compared with candles, is not important. In a few places the men use candles owing to bad ventilation, but as a rule ventilation is good and the men are able to work at full efficiency.

FUEL AND PUMPING

The cost of coal delivered at the mine is about $3.25 per ton, and the cost of power is figured at about $60 per hp. per year. A pressure of 75 lb. per sq.in. is carried on the compressors. Most of the water made by these mines comes in near the surface and is caught on the upper levels, so there is little pumping to be done. Large sumps, locally called forks, are used, and the pumps are run intermittently. The main pumping is done by electric pumps, but both electric and air-driven auxiliaries are used. Four-stage centrifugals and geared plunger pumps are used for the main pumping, but all the later installations are plunger pumps as they are more efficient in these mines. The mine water in the district is peculiarly salty, this quality increasing somewhat with depth.

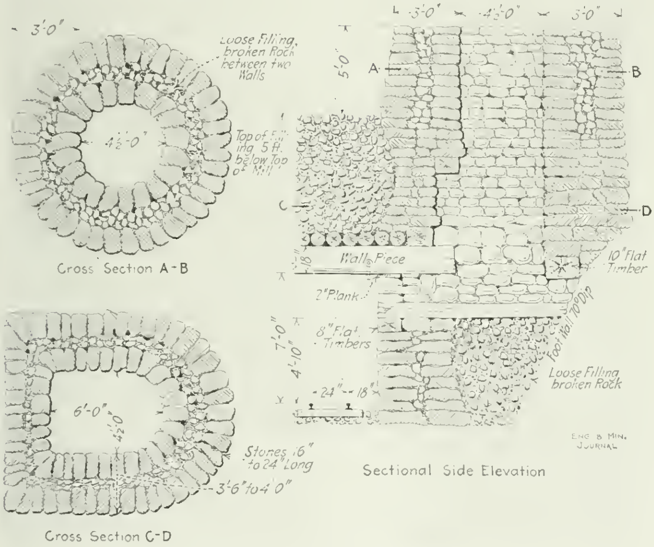
DRY-WALLING ON THE LEVELS

If poor rock is encountered when the drift has been extended some distance from the shaft, it is customary to return to the shaft pillar and to start a cutting-out stope. This stope is carried from 14 to 16 ft. high above the rails, in order that there will be from 5 to 7 ft. of open space above the timbers that are placed as a cover on top of the dry walls. When the ground has been cut out of this height from wall to wall, and the shovelers have worked out the ore for some distance ahead, the building of the dry walls commences. This building is done by crews of two men who use double-hand, trimming hammers to break off irregular corners from the boulders, if necessary to make them fit in the wall. As the shovelers work out the ore from the cutting-out stope, they lay aside the larger pieces of poor rock, so that the wallers can get them easily for use in the outer facing of the dry walls.

These walls, as shown in the illustrations, are built about 4½ ft. wide at the base and about 4 ft. wide at the top. The larger pieces are placed in the face next the drift, and the smaller boulders in the face next the filling. In walls of average thickness the boulders of the two faces frequently lap over each other, thus binding the two facing walls together; when they do not touch each other, the smaller pieces that are placed in between are arranged to tie the inside ends of the boulders together. An accompanying illustration shows this. Pieces of old blocking and broken stulls are occasionally built in to tie the two facing walls together, where, owing to the width of the lode, the walls are carried up wider than the average width given here; the timber pieces, however, are in no way essential to the solidity of the dry walls. The boulders used are generally from 18 to 30 in. long, but many are only 14 in.; consequently in the wider walls a considerable center filling of smaller pieces has to be used. This center filling is built in such a manner as to bind the facing walls to the inside filling, and the solidity of the walls is due largely to this avoidance of open spaces. Care is taken to break joints in the rocks of the two facing walls so that there will be no planes of weakness extending through the walls. Small openings between the boulders are chinked with small pieces of rock.

Height of Walls

These walls are carried 7 ft. high and are built with 7 ft. between them at the bottom, and a batter to the side next the drift of 3 or 4 in. in their height. Because of the double track that is carried for some distance from the shaft, the walls here are 9 ft. apart, but as soon as possible they are drawn to 7 ft. The walls present an admirably smooth face on the drift side and run along in a surprisingly straight course for walls that are built without lines to aid the workmen.



Cross Section A-B

Cross Section C-D

Sectional Side Elevation

Dry-wall Mill Hole at Baltic Copper Mine, Michigan

The men in charge of this work are generally Italians or Austrians who have had some experience in working with stone in the old country; in no sense, however, are they stone masons when they commence to do this work underground, although after a year of such experience they often leave the mine and secure employment as stone masons in other places. Indeed the dry walls underground at the Baltic mine are as excellent a type of such walls as I have ever seen, either in this country or in Mexico. Owing to the tendency of the rock to break into tabular shape, little facing is required to obtain the smooth sides shown in the accompanying illustration, which are typical of the walls. Two men are able to raise up an area of about 30 sq.ft. of wall in a 9-hr. shift. When the poor rock is at some distance from the wall, a low truck is used, and in building the top part the men work from a temporary stage.

Headboard Distributes the Weight

The top of the wall is made as smooth as the sides facing the drift, and a 2x12-in. plank is laid along the top of the inside face, to distribute the weight of the logs used to cover the drift. This prevents the cover pieces from cutting down into the walls as the weight comes on them. While these planks, of course, rot, they last long enough to serve their purpose. It is only in the early life of the walls, when the weight is coming on, that any solicitude is felt for them. It is customary often to put in an occasional plank along the face of the wall with a spreader piece from a similar plank along the other wall to help resistance to any side thrust, while the first few cuts are being taken from the back of the stope. A temporary strut is sometimes placed under the walls to keep them from being broken while the first load of ore is being blasted down on the timber covering of the drift.

The wall pieces, or covering, are hardwood logs, 14 ft. long, although formerly 16-ft. logs were used. They are placed with about an equal hold on each wall, and at about 3½-ft. centers, the latter varying with the size of the logs which are from 14 to 18 in. in diameter. The largest of these are saved and used where a mill hole is to be put up to serve the stope. Over these wall pieces and running lengthwise with the drift, a tight covering of 16-ft., split cedar lagging, or of hard wood poles, is put on, these having a diameter of 4 in. The lagging generally rests on five logs.

Occasional Composite Walls

Where the lode is not wide enough to permit the use of two 4-ft. walls, a wall of usual width is placed along the foot-wall side, as the most weight comes there. In case a wall 3½ ft. wide cannot be placed along the hanging, the covering logs at that side are carried on a series of legs or posts, as a dry wall less than 3½ ft. wide is not strong. A continuous headboard, consisting of 6- or 8-in. flat timbers or a 2-in. plank, is carried along the top of these posts, the wall pieces resting on the headboard but just over the post. The headboard is nailed to the top of the posts to keep the latter from shifting and in this way the former acts as a brace against side swing, as well as a binder to keep the posts from slipping. A narrow wall of poor rock is placed between the posts, and behind that there is thrown as much poor rock as the hanging wall will permit. Such a wall, shown in the illustrations stands well in narrow places, as in the narrow part of the lode the weight of the filling is soon carried principally by the foot-wall side of the drift. A composite wall such as this is being used quite generally at the Trimountain mine, where the stopes are narrower than at the Baltic and at the Champion, and even when there is sometimes sufficient space for a 4-ft. wall; they stand sufficiently well and are somewhat cheaper than the regulation dry wall. In wide parts of the lode a fixed wall is necessary to withstand the side thrusts of the filling, while the first stoping is in progress.

Where sufficient desirable poor rock cannot be easily obtained, the walls are made by building logs into 3-sided pigsties, with pieces of poor rock chinked in between the logs of the outer face to keep them from crushing when the weight comes on them. The inside of this crib is filled with poor rock, which takes the weight, while the outer logs serve principally to hold the filling in place; the short cross logs bind the facing logs to the fillings so that the weight will not push them out. It is merely a matter of cost that determines the type of wall to be used; such a pig-sty, with poor rock chinking stands well until the logs commence to rot, which is not within six or seven years owing to the good ventilation.

Repairing the Walls

These dry walls stand remarkably well, and even after bulging out 6 in. they give no signs of failing; some of the dry walls that were placed in the mine 10 years ago are still standing. In case that any part of a wall does not stand well no trouble is experienced in removing the bad portion and replacing it with new walls, using an occasional piece of timber to tie the inside face to the mass of the wall; the filling becomes so consolidated inside of a year that it will not run readily unless broken into. In this repairing of the walls, the timber of the roof is carried on a false set, placed to catch the unsupported ends.

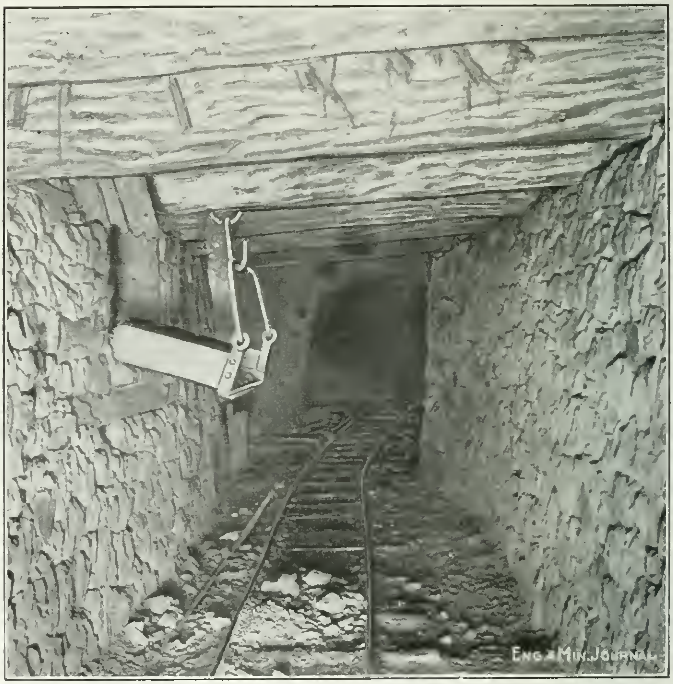
The average cost of these dry walls is about $2.50 per ft. of double wall 4½ ft. wide, not including the covering of wall pieces and poles. With a heaving pole, enough of this covering is hoisted, to cover 50 or 60 ft. of wall, and this is rolled back on top of the planked pieces of the walls, to the proper places. The labor of putting the timber in place is small, as it is straight lifting without cutting or framing. As mentioned before, the mill holes are also dry-walled, and I believe that this is the first time in the United States that dry walling has been used for mill holes; I understand, however, that in German mines, dry-wall mills are not uncommon in places.

Dry Wall Mill Holes

The mill holes, as shown, are carried up with two walls and a center core of loose material. The inner wall is built of the larger pieces of poor rock, as this is the wall that has to withstand the wear and tear of the rock falling down through the mills, and therefore is most apt to be knocked out. Most of the thrust of the filling is taken up by the walls carried up to form the outer ring of the mill. The central filling of loose material gives the walls sufficient width to withstand the shock of blasting when the walls are carried above the mill, and also permits the outer wall to adjust itself to withstand the pressure of the filling, without injuring the inner wall.

The walls all start from a 6- or 8-in. flat timber, for the sides, while the back piece is a 10-in. flat timber, as are also the two brow pieces. The mills are started with a horseshoe shape that extends up about 7 or 8 ft. from the bottom, and at this point the mill is contracted by springing the front wall from another brow piece, so that it has a circular section, about 4½ ft. in diameter, this being large enough to permit the stope cars to be taken up and down.

Rocks about 16 in. long are used in building the inside walls, and normally the latter are about 3 ft. thick. A greater thickness is necessary, however, where the walls have to be carried above the filling. When this is done the bottom of the wall is increased to a thickness of 4 or 4½ ft. and is brought in again to 3 ft. at the top, which extends about 5 ft. above the filling. This enlarging of the top of the mill is shown in the illustrations. In every instance, in order to protect the wood from which the walls are started, the boulders at the bottom are started with an overhang or overlap, on the timbers of about 4 in. The mouth of the mill hole is about 4 ft. 4 in. wide and 3 ft. high from the lip to the brow piece, and the lip piece is an 8-in. flat timber about 8 ft. long, built into the level dry-wall. The apron gate of the chute is fastened to the lip timber with eye-bolts, and a lever consisting of a cedar pole fastened by a clevis to the wall piece next to the mill hole, is used to raise and lower the apron gate. If the mouth of the mill is too wide for the apron gate, the former is contracted by nailing 2-in. planks to the wall pieces and side timbers, thus preventing the fine dirt from running out around the sides.



Dry-walled Level, Champion Copper Mine, Michigan

Interval Between Mill Holes

The distance between mill holes was formerly about 50 ft., but this has been increased until at present it is about 70 ft. for the newer holes. This distance, however, is variable, and depends somewhat on the nature of the ground at the point where the position of the next mill hole would naturally occur. It is difficult to start the back wall of the mill from the foot wall of the lode; it is better also to start from the filling than from a timber piece carried on the side walls. Owing to the manner of mining the level pillar, the first mill is started at the edge of the shaft pillar, and the next one but 25 ft. away, the first mill serving as a manway to get into the stope while the back is being mined. All these mill holes at times serve as manways and to carry air pipes, as well as for ordinary mills to get out the ore. Ladders are carried up through them by springing the upper ladder from the one below it with a pair of S-hooks and overlapping the ladders until three or four 12-ft. ladders have been raised in this manner. It is then customary at the Champion mine to place a sollar at the end of every two ladders, this sollar being carried on temporary sprags in crevices in the walls. These mill holes generally give little trouble during the life of the stope, but occasionally holes are knocked in the inner walls. These are easily repaired, either by patching with timber or with new boulders. If the patch is properly made it will last as well as the original wall.

Three Feet of Mill Built Per Day

In building these mills the wallers work in pairs. The amount that can be put up in a day depends largely on the availability of poor rock and the height of the mill above the filling; the exact amount that a pair of men will build in a shift is difficult to estimate, as no direct account has been kept of this, but it amounts to about 3 ft. of standard mill for a crew of two men. The best and most accurate way of treating the dry-walling cost at these properties is to give the total cost of keeping the mine workings open. These figures for the Baltic mine for the year 1910, when 781,419 tons of ore were sent to the mill, are given below in detail.

COST OF KEEPING BALTIC MINE OPEN IN 1910

	Cents per ton of ore stamped
Labor, timbermen	3.2
Labor, walling	4.97
Labor, spreading filling in stopes	2.3
Total labor	10.47
Material	1.2
Total cost of keeping mine open	11.67

When the mills were first used a piece of sheet iron 4 ft. long and 18 in. wide was used to protect the lip timber from wear at the bottom of the mill; this is still used at the Trimountain, but at the Baltic and Champion it is no longer used and the apron gate is fastened directly to the lip piece with no attempt to protect the timber from wear; in case the holes are cut out by the rock, the gates can be fastened to the side timbers of the mills by straps, the gate and lever being removed from one mill to another when necessary.

Commencement of Stoping

In most cases the space back of the dry walls is filled with poor rock from the cutting-out stope and the drifts, before the walls are covered over; in case there is not sufficient rock to fill in tightly behind both walls, the space behind the wall on the hanging side of the drift is filled, and enough poor rock is usually secured from the lode to fill the space behind the wall on the foot side. This is possible because the cutting-in for each breast in the first slice of the stope is done along the hanging side.

The loading of the timbers of the dry wall with dirt, is done by carrying ahead a flat breast drilled with water holes; this is considered easier on the timbers than would be the case if upper holes were used. This breast is carried about 6 ft. high and rocks from the broken ore, which forms a pile about 9 ft. high on account of the increase in bulk, runs far enough ahead to cover the timbers under the next cut; these cuts are drilled with 8-ft. drills as finishers, and the holes will square only about 6 or 6½ ft. ahead. The holes of the first slice are drilled strong and care is taken not to overload them with explosives.

The ore from the first slice or two taken off a stope, is worked through the lagging into the cars without the use of the mills, because the poor rock is piled along the walls as long as possible. After the timbers are well covered with waste, the mill holes are resorted to for the ore, cars being used between mills. The track for these cars has a gage of 3 ft. 1 in. and is laid with 16-lb. rails. The cars are made with a turntable and are pivoted on the truck, so that they may be used in building out the filling into the stopes, whenever the width of the latter and the shortage of filling make it necessary to cut into the walls. These stope cars hold about a ton and are made with a long, narrow, low body; in order to get these cars through the mill holes, a portable tripod, from which is suspended a pulley, is placed on the top of the mill. The moving of these cars is done by the timbermen, who work generally in gangs of five, and the changing of pipes from one manway to another is done by the pipemen. The miners do only the drilling.

Sorting the Ore

The sorting is done by special men who in time becomes expert in detecting small particles of copper, and the work is so arranged that these pickers have to display no discrimination in regard to what is waste and what is not. It is merely necessary to see copper in the rock, and if this is done, such rock goes into the mill for ore. While it would sometimes seem that some of these pieces might better be left in the stope for filling, it often happens that there is some copper, too small to be seen by the eye, accompanying the other copper, and that the rock will pay for itself even when little copper can be seen. In the case of rock of such size that it has to be shoveled, the bosses tell the pickers whether it shall go into the mill for ore or be used for filling. The decision depends on the general character of the ore in that part of the stope, but the point is that the sorters have this determined for them. The larger boulders are broken with hammers, if they show no copper, and the small pieces are reexamined.

On an average the pickers will put about 13 tons of ore per shift into the mill, but this depends upon the condition of the pile and the proximity of the mill. The character of a pile in regard to the proportion of poor rock and ore, is judged by the trammer boss, or picker boss as he is sometimes called, on his first trip through the mine in the morning. These bosses become expert in judging these piles and when they go through again in the afternoon, they can tell approximately whether the pickers have done a fair shift's work.

Drilling in the Stopes

The miners work ahead on the pile of broken ore and the pickers follow them. Two-man, 3⅛-in., Rand drills are used in all the stopes, excepting a few at the Trimountain, where 1-man, water Leyners are being experimented with. The Leyner drills are doing good work in the stopes and it is probable that they will soon replace the others at the Copper Range mines. A face, 6 to 9 ft. high to the slice is carried and the filling is generally kept within 9 ft. of the back. The breast is usually carried along in a single slice, but occasionally, where the back is high above the filling, a second slice is necessary before the breast can be advanced again. To carry a 9-ft. breast in the Champion mine requires generally two flat, dry holes and three flat, water holes in a row, as a burden of only about 22 in. can be placed on the toe of a hole in the stopes of that mine. The width of the lode determines the number of holes necessary to break across the breast. At the Trimountain mine, where the lode in the stope at present averages about 20 ft. in width, two set-ups and four rows of holes are necessary to break a slice across the lode; in the Baltic and Champion mines it requires three set-ups and six rows of holes to break a breast from 25 to 30 ft. wide.

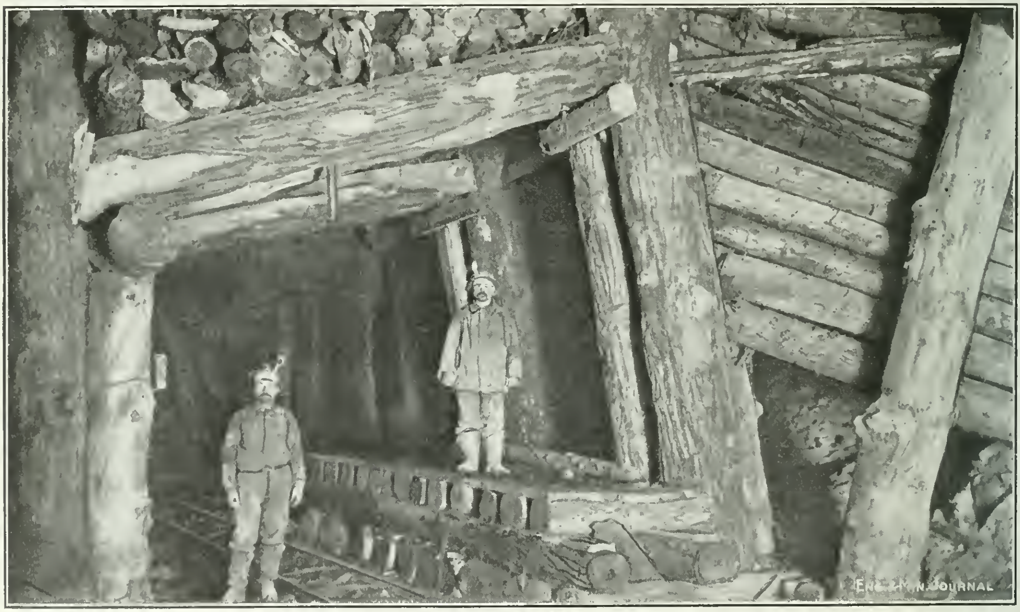
Ground Breaks Easiest in Baltic Mine

With a breast 6 ft. high, such as is commonly carried in the Trimountain mine, two water holes and one flat, dry hole to a row are required; in the Baltic mine, which. in some ways, contains the easiest breaking ground of the three mines, such a row of holes will often bring a breast 8 ft. high. Considering the depth of the breast to be the direction of the depth of the holes and the vertical thickness of the breast to be its height, these holes will break out a breast averaging 6½ or 7 ft. deep. The height of the breast that is taken depends entirely upon the distance that the filling is kept from the roof of the stope; the higher the back from the filling, the thicker must be the slice broken down to secure enough muck to set up on to drill the next face.

Because of this variation in height and also to avoid the carrying about of a quantity of blocking in the stopes, the miners use a post which sets up on a separate jacking block. The miners generally rig up with a 6-ft. post but they are also provided with a 7- and 9-ft. post; 5-, 8-, 10- and even 4-ft. posts are also provided but do not constitute the regular equipment that accompanies a machine. A shift's drilling consists of five or six 7-ft. holes and these are loaded with from five to six sticks of 30% dynamite. The average tonnage broken per machine, including those on development work and filling, is from 750 to 850 tons of stamp rock per month; the amount of filling that comes from the lode and that which must be obtained from the foot wall is known only approximately, but it is probable that for each machine in a stope over 1200 tons of ore and poor rock is broken per month.

Obtaining Filling for Stopes

It is roughly estimated that about half the filling comes from the lode and half from the walls. At the Trimountain mine all the poor rock is obtained from the foot wall, since this is where the copper that has been missed is most likely to be found, and also because more ground can be broken by the holes in the next slice by undercutting the ore along the foot wall. In the Baltic and Champion mines, because of the West lode, the practice is to take a slab off of the foot and if that does not show copper, to crosscut into the hanging and prospect the West lode. If copper is found the pocket is stoped out and the rock for filling is broken from the West lode in the hopes that this work will disclose more copper; the filling is trammed in stope cars and spread out in the main stope. In case that no copper is found, the practice is generally to open a waste stope near the Baltic lode with a foot sloping at about 45°, so that the broken rock will run to the cars itself.



Old Method of Mining with Timbered Levels, Champion Mine

As the slice is advanced, the mill holes are covered over before the ore is blasted down on them. As the pickers work ahead and get the ore off from the top of the next mill, the ladderway and air pipes are gradually carried ahead to a mill near the breast. Where the back stands well, it is carried rather flat, but in bad ground it is broken with a considerable arch. This arched roof is characteristic of the Baltic stopes.

Cutting Down Bad Ground

Owing to the fact that the miners are made to pay especial attention to the back, it is often an hour before they are ready to drill the first hole on a shift. In case barring will not bring down a slab, a gad with a string tied to it is used, so that it will not be lost in the pile of muck that follows. If this, too, fails, a dangerous slab is often shot down with a double-jacked hole. Strong temporary stages for this work are made by burying ladders in the boulders to a depth of 3 ft. and placing planks between ladders, the latter having been placed in the form of a triangle. The machine men in the stope generally devote the Saturday half-shift to cleaning down the back and making things safe for the next week. Rarely is any drilling done in a stope on Saturday. If the miners get well ahead of the pickers, and waste rock is needed in the stope, the miners set to work obtaining filling from the walls until the pickers have caught up again.

Flat Holes Used

In this way the stope is worked up by a series of horizontal cuts taken off the roof by flat holes; these flat holes break more ground than upper holes would, and they also leave the back in a safer condition because the upper holes tend to loosen the back. With machines it is also considered healthier for the men in a stope to drill as many water holes as possible. The breast is carried from the shaft pillar to the end of the stope and is then worked out again, until finally a bar of poor ground is encountered. In case the stope is short of poor rock, filling may be obtained by stoping poor ground in the Baltic lode itself, but a drift is always driven through these bars to test them thoroughly. Such a bar usually ends a stope temporarily but as the stope is carried up, the ore will almost always be found to extend farther and farther over the poor rock until the patch of poor ground drops out and the stope joins again with the one beyond. A smaller number of these bars are left in the Baltic than in the Champion mine, where sometimes, when wide, they give considerable trouble while caving the top part of the stope. The stope is worked up to within about 35 ft. of the level above, and if the latter has been completely worked out in that part of the ground, the so-called "caving" process commences.

(To be concluded.)

The Mining Index

A Classified Bibliography of the Current Literature of Mining and Metallurgy

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print), in the original language, for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COAL AND COKE

18,557 — ALBERTA — Report of the Commission Appointed to Investigate Turtle Mountain, Frank, Alberta, 1911. (Can. Dept. of Mines, Memoir No. 27, 1912; 84 pp., illus.)

18,558 — CALORIMETRIC VALUE of Fuel. John A. Rhodin. (Engineer, Mar. 29, 1912; 1½ pp.) 40c.

18,559—COKE—A Retort Coke Quencher and Loader. A. Goodall. (Coal Age, Mar. 2, 1912; 2 pp., illus.) 20c.

18,560—COKE-OVEN GAS—Extensive Use of Coke-Oven Gas in Combustion Engines. C. A. Tupper. (Coal Age, Apr. 6, 1912; 4 pp., illus.) 20c.

18,561—DUST—Die französischen Versuche mit Kohlenstaub in Liévin. M. Rybak. (Oest. Zeit. f. B. u. H., Feb. 24 and Mar. 2, 1912; 7 pp.) French experiments with coal dust at Liévin, France. 60c.

18,562—ELECTRIC LAMPS—Portable Electric Lamps for Miners. (Coal Age, Apr. 6, 1912; 2 pp., illus.) Describes equipment installed by the Lehigh Coal & Navigation Co. 20c.

18,563—ELECTRIC POWER — Central Station for Colliery Service. E. B. Wagner. (Coal Age, Apr. 6, 1912; 2 pp., illus.) 20c.

18,564—EXPLOSION at Sans Bois Mine No. 2, at Chant, Okla. (Coal Age, Mar. 30, 1912; 1⅝ pp., illus.) 20c.

18,565—EXPLOSION at Welch, West Virginia. H. J. Brook. (Coal Age, Apr. 6, 1912; 2½ pp., illus.) 20c.

18,566—EXPLOSION—The Susie, Wyoming, Explosion. C. S. Beach. (Coal Age, Apr. 20, 1912; 1 p., illus.) 20c.

18,567—GAS—Testing for Fire-Damp and Black-Damp by Means of a Safety Lamp. Henry Briggs. (Trans. Min. Inst. of Scotland, Vol. XXXIV, Part 3. 1912; 15 pp., illus.)

18,568—GAS DETECTION—The Use of Mice and Birds for Detecting Carbon Monoxide after Mine Fires and Explosions. George A. Burrell. (U. S. Bureau of Mines, Tech. Paper 11, 1912; 15 pp.)

18,569—GERMANY—Die Arbeitslöhne, die Kohlenpreise und der Reingewinn der Bergwerke im Oberbergamtsbezirk Dortmund. (Bergbau, Mar. 14, 1912; ¾ p.) Wages, prices of coal and net profit of the coal mines in the Dortmund district. 40c.

18,570—MINE AIR—A New Type of Mine Humidifier. (Coal Age, Mar. 23, 1912; ¾ p.) 20c.

18,571—MOISTURE DETERMINATION —The Determination of Moisture in Coals. E. H. Archibald and J. N. Lawrence. (Journ. Ind. and Eng. Chem., Apr., 1912; 4 pp.) 60c.

18,572—OKLAHOMA—The Dewar, Oklahoma, Coal Field. John A. Garcia. (Coal Age, Apr. 20, 1912; 2 pp., illus.) 20c.

18,573—PEAT—Dr. Wielandt's Machine for the Production of Air-Dried Peat. (Journ. Am. Peat Soc., Jan., 1912; 5 pp., illus.)

18,574—PEAT—The Recent Development of Peat as a Power Factor. T. A. Mighill. (Journ. Am. Peat Soc., Jan., 1912; 6½ pp.)

18,575—PLANT—The Roden Co.'s Plant in Alabama. C. A. Tupper. (Coal Age, Mar. 30, 1912; 3¾ pp., illus.) 20c.

18,576—RESCUE APPARATUS — Versuche mit dem Pneumatogen 1910. Grahn. (Glückauf, Mar. 2, 1912; 5 pp., illus.) Tests with the pneumatogen, pattern of 1910. 40c.

18,577—SAARBRUCKEN—Die Schichtenreihen und Flözgruppen des Saarbrücker Steinkohlengebirges. Recktenwald. (B. u. H. Rundschau, Feb. 20, 1912; 4¼ pp.) Series of strata and groups of coal seams of the Saarbrücken coal field.

18,578—SAFETY LAMPS—Die Sicherheit verschiedener Arten von Sicherheitslampsen. (B. u. H. Rundschau, Mar. 5, 1912; 3¼ pp.) Safety of various kinds of safety lamps. A comparison of the construction of different lamps; fuel, manipulation; lighting contrivances and manner of locking.

18,579—SILESIAN MINING METHODS. (Coal Age, Apr. 6, 1912; 1½ pp., illus.) 20c.

18,580—TENNESSEE—Lignite and Lignitic Clay in West Tennessee. Wilbur A. Nelson. (Resources of Tenn., Apr., 1912; 5 pp., illus.) 20c.

18,581—TIPPLE—Double Tipple for Colonial Coal Co. W. T. Griffith. (Coal Age, Apr. 20, 1912; 2 pp., illus.) 20c.

18,582 — VENTILATION — Coal Mine Ventilating Equipment. W. M. Weigel. (Coal Age, Mar. 23, 1912; 3¼ pp., illus.) 20c.

18,583—WATER PURIFICATION for Collieries. (Coal Age, Mar. 30 and Apr. 20, 1912; 5½ pp., illus.) 20c.

18,584—WYOMING—The Cambria Coal Field in Wyoming. Jesse Simmons. (Coal Age, Mar. 23, 1912; 3 pp., illus.)

18,585—WYOMING-SOUTH DAKOTA—Coal Near the Black Hills, Wyoming-South Dakota. R. W. Stone. (U. S. Geol. Surv., Bull. 499; 73 pp., illus.)

COPPER

18,586—ANALYSIS—The Sources of Error and the Electrolytic Standardization of the Conditions of the Iodide Method of Copper Analysis. Amos W. Peters. (Journ. Am. Chem. Soc., Apr., 1912; 32½ pp.) 60c.

18,587—ARIZONA—Duncan, Ariz., and Surrounding Mining District. C. A. Dinsmore. (Min. and Eng. Wld., Mar. 30, 1912; 1¾ pp.) 20c.

18,588—ASIA—Der Kupferbergbau in Ostasien. A. Fleck. (Bergbau, Feb. 29 and Mar. 7, 1912; 4¼ pp.) Copper mining in Eastern Asia. 40c.

18,589—BRASS—The Influence of Tin and Lead on the Microstructure of Brass. F. Johnson. (Engineering, Mar. 15, 1912; 1¼ pp., illus.) Paper before the Institute of Metals. 40c.

18,590—CAVING SYSTEM at Ohio Copper Mine. C. G. Bamberger. (Eng. and Min. Journ., Apr. 6, 1912; 1¾ pp.) 20c.

18,591—CONSUMPTION—Ratio of Copper to Pig-Iron Consumption. James Douglas. (Eng. and Min. Journ., Apr. 20, 1912; ¾ p.) 20c.

18,592—EQUIPMENT—A Lake Superior Mine Plant. W. J. Perkins. (Mine and Quarry, Mar., 1912; 6 pp., illus.) Surface equipment of the Hancock Consolidated Mining Co. 20c.

18,593—LEACHING Applied to Copper Ore. (XVI). W. L. Austin. (Mines and Methods, Mar., 1912; 3¾ pp.) Treating on the recovery of the silver and gold content of ore. 20c.

18,594—MICHIGAN—The Copper-Mining Industry in Michigan. Reginald E. Hore. (Min. and Eng. Wld., Mar. 30, 1912; 3 pp., illus.) Continuation of article previously indexed. 20c.

18,595—MICHIGAN—The Quincy Mine, Mich., from Stope to Smelter. G. E. Edwards. (Min. and Eng. Wld., Apr. 20, 1912; 3¼ pp., illus.) 20c.

18,596—MILLING the Ore of the Chino Mine. John M. Sully. (Min. and Sci. Press, Mar. 30, 1912; 2½ pp., illus.) 20c.

18,597—MONTANA—Conditions of Mineralization in the Copper Veins at Butte, Montana. Charles T. Kirk. (Econ. Geol., Jan., 1912; 48 pp., illus.) 60c.

18,598—NEW MEXICO—Mining Copper Ore at Chino. James O. Clifford. (Min. and Sci. Press, Mar. 30, 1912; ¾ p., illus.) 20c.

18,599 — PHYSICAL PROPERTIES — Ueber den Einfluss geringer Mengen Phosphor, Mangan und Zinn auf die physikalischen Eigenschaften von Kupfer. Münker. (Metallurgie, Mar. 22, 1912; 13½ pp., illus.) On the influence of minute quantities of phosphorus, manganese and tin on the physical properties of copper. 40c.

18,600—PYRITIC SMELTING—Air in Pyritic Smelting. E. W. Walter. (Eng. and Min. Journ., Apr. 20, 1912; 1¼ pp.) 20c.

18,601 — SAMPLING — Mathematics of Copper Sampling. Edward Keller. (Eng. and Min. Journ., Apr. 6, 1912; 2¼ pp., illus.) 20c.

18,602—SLAG DISPOSAL — The New Granby Slag Disposal Plant. C. M. Avery. (The Labor Saver, Apr., 1912; 2¼ pp., illus.)

18,603 — SMELTERY — The Granby Smeltery. George M. Lee. (Met. and Chem. Eng., Mar., 1912; 5½ pp., illus.) 40c.

18,604—SMELTING—Ueber Schmelzen von Kupferoxydul mit Kieselsäure. C. N. Otin. (Metallurgie, Feb. 8, 1912; 7 pp., illus.) On the smelting of cuprous oxide with silica. 40c.

GOLD DREDGING

18,605—BRAZIL—Gold Dredging in the River Coxipomirim, Mato Grosso, Brazil. L. C. Ferraz. (Min. Journ., Mar. 30, 1912; 1 p.) Abstracted from "Annales da Escola de Minas de Ouro Preto," No. 11, 1909. 40c.

18,606—CALIFORNIA—Innovations in California Dredging Fields in 1911. A. H. Martin. (Min. and Eng. Wld., Feb. 24, 1912; 1 p.) 20c.

18,607 — CALIFORNIA — Present-Day Problems in California Gold Dredging. Charles Janin. (Bull. A. I. M. E., Mar., 1912; 19 pp., illus.) 40c.

18,608—EXAMINATION of Dredging Properties. Francis J. Dennis. (Bull. A. I. M. E., Apr., 1912; 4 pp.) 40c.

18,609—OREGON—Rogue River Gravel Beds. Clement H. Mace. (Min. and Sci. Press, Mar. 23, 1912; 1¼ pp., illus.) 20c.

GOLD AND SILVER—CYANIDATION

18,610—AGITATION—The Parral-Tank System of Slime Agitation. Bernard Macdonald. (Bull. A. I. M. E., Apr., 1912; 20 pp., illus.)

18,611 — COLORADO — Cyaniding the Sulphide Ores of Idaho Springs. Charles J. Downey. (Min. Sci., Mar. 21, 1912.) 20c.

18,612—PRECIPITATE—An Electrical Drier for Zinc Precipitate. Donald F. Irvin. (Min. and Sci. Press, Mar. 16, 1912; 1 p., illus.) 20c.

18,613—RECORDS—Cyanide Mill Metallurgical Records. E. H. Webster. (Eng. and Min. Journ., Apr. 20, 1912; 3½ pp., illus.) 20c.

18,614—ZINC DUST TESTS to Determine Its Suitability for Precipitating Purposes. W. J. Sharwood. (Journ. Chem., Met. and Min. Soc. of South Africa, Feb., 1912; 6⅝ pp., illus.) 60c.

GOLD AND SILVER—GENERAL

18,615—ALASKA AND THE YUKON. Guy A. R. Lewington. (Min. and Sci. Press, Mar. 30, 1912; 1½ pp., illus.) 20c.

18,616—AMALGAMATION — Treating Refractory River Gravels by Amalgamation. C. J. Rollandet. (Min. Sci., Feb. 1, 1912; 2 pp., illus.) Description of patented apparatus designed to overcome the scouring of coarse sands, and befouling of impure mercury and the incrusting of gypsum. 20c

18,617—CALIFORNIA—Mining Operations in Sierra County, Calif. John G. Morse. (Min. Sci., Feb. 1, 1912; 1½ pp., illus.) 20c.

18,618—CALIFORNIA—The High Grade District, California. Algernon Del Mar. (Eng. and Min. Journ., Apr. 20, 1912; ½ p., illus.) 20c.

18,619—CRUSHING—The Slow Speed Chilcan Mill as Applied to Mexican Practice. J. B. Empson. (Informes y Memorias del Instituto Mexicano de Minas y Metalurgia, Vol. II, No. 6, 1911; 15 pp., illus.) 20c.

18,620 — FORMOSA — Gold Mining in Formosa. W. M. Knox. (Min. and Sci. Press, Mar. 23, 1912; 1¼ pp.) 20c.

18,621—HOMESTAKE MINE—Analyses of Some Rocks and Minerals from the Homestake Mine, Lead, S. D. W J. Sharwood. (Econ. Geol., Dec., 1911; 60 pp., illus.) 60c.

18,622—HUNGARY—Die Golderzlagerstätten und das Braunkohlenvorkommen der Rudaer Zwölf-Apostel-Gewerkschaft zu Bradiin Siebenbürgen. Schumacher. (Zeit. f. prakt. Geol., Jan.-Feb., 1912; 85 pp., illus.) The gold ore deposits and the lignite occurrence at Brad, Transylvania. 60c.

18,623—HYDRAULIC MINING—Elevating Ten-Cent Gravel at a Profit in California. C. S. Haley. (Min. and Sci. Press, Apr. 13, 1912; 3 pp., illus.) 20c.

18,624—HYDRAULIC MINING—Flume Construction in Colombia. R. D. O. Johnson. (Eng. and Min. Journ., Mar. 30, 1912; 2⅝ pp., illus.) 20c.

18,625—MILL—Colburn-Ajax Mill, Victor, Colo. S. A. Worcester. (Eng. and Min. Journ., Apr. 13, 1912; 3⅓ pp., illus.) 20c.

18,626—MILL—The "Purisima Grande" Mill in Pachuca. G. Witteveen. (Informes y Memorias del Instituto Mexicano de Minas y Metalurgia, Ano II, No. 6, 1911; 4 pp.)

18,627—NEVADA—Como, Nevada. H. C. Cutler. (Min. and Sci. Press, Apr. 13, 1912; 1¼ pp., illus.) 20c.

18,628—NOVA SCOTIA—The Domes of Nova Scotia. T. A. Rickard. (Bull. I. M. M., No. 90, Mar. 14, 1912; 76 pp., illus.)

18,629—ONTARIO—Gowganda during 1911. G. M. Colvocoresses. (Can. Min. Journ., Apr. 15, 1912; 3½ pp., illus.) 20c.

18,630—ORE HAULING — Preliminary Handling of Ore at El Tigre Mill. J. W. Malcolmson and L. R. Budrow. (Min. and Sci. Press, Mar. 16, 1912; 2 pp., illus.) 20c.

18,631—ORE TREATMENT — Customs Treatment at Kalgoorlie. M. W. von Bernewitz. (Austral. Min. and Eng. Rev., Mar. 5, 1912; 2¾ pp., illus.) Ore treatment at mill of the Associated Northern Blocks mine. 40c.

18,632—PORCUPINE—A Visit to Porcupine. W. R. Ingalls. (Eng. and Min. Journ., Mar. 30, 1912; 2⅝ pp., illus.) 20c.

18,633—PORCUPINE—Diamond Drill Results at Pearl Lake, Porcupine, Ontario. G. W. Thomson. (Can. Min. Journ., Apr. 1, 1912; 3 pp.) 20c.

18,634—PORCUPINE—The Dome Mine, Porcupine. (Eng. and Min. Journ., Apr. 13, 1912; 1¾ pp., illus.) 20c.

18,635 — PORCUPINE — The McIntyre Mine and Mill, Porcupine. S. N. Graham. (Can. Min. Journ., Apr. 1, 1912; 1½ pp., illus.) 20c.

18,636—PRECIPITATE—Cupellation of Gold Precipitate at Bau, Borneo. Cecil J. Brooks. (Min. Mag., Mar., 1912; 3¾ pp., illus.) 60c.

18,637—RAND—Gloomy Outlook on the Rand. (Eng. and Min. Journ., Apr. 20, 1912; 1½ pp., illus.) 20c.

18,638—SHAFTS—Vertical versus Incline Shafts in Precious Metal Mining. John Malcolm Nicol. (Informes y Memorias del Instituto Mexicano de Minas y Metalurgia, Ano II, No. 6, 1911; 9 pp.)

18,639—STAMPS—Heavy Stamps at Nevada Mines. A. H. Martin. (Min. and Eng. Wld., Mar. 30, 1912; 2⅓ pp., illus.) 20c.

IRON ORE DEPOSITS, MINING, ETC.

18,640—ALGERIA—Etude sur les Gisements de Fer de l'Algerie. M. Dussert (Ann des Mines, Vol. I, Part 2, 16 pp.)

18,641—LAKE SUPERIOR—The Effects of a Basic Igneous Intrusion on a Lake Superior Iron-Bearing Formation. Carl Zapffe. (Econ. Geol., Mar., 1912; 34 pp.) 60c.

18,642—MICHIGAN—Iron Ore Reserves of Michigan in 1911. C K Leith. (Advance Chapter from Mineral Resources of the U. S., 1911; 18 pp.)

18,643—NORWAY—Mining and Concentrating the Sydvaranger Iron Ores. D. E. Woodbridge. (Eng. Mag., Apr., 1912; 12½ pp., illus.) 40c.

18,644—ORE CONVEYING—Die Maschinelle Abbauförderung in ihrer Bedeutung für die Eisenindustrie. Gerke. (B. u. H. Rundschau, Jan. 20, 1912; 6 pp.) Removal of ore from working faces by machinery, with special reference to iron industry.

18,645 — ORE HANDLING PLANT — Storage and Ship-Loading Plant, Vivero Iron Ore Co., Spain. C. A. Tupper. (Min. and Eng. Wld., Feb. 24, 1912; 2 pp., illus.) 20c.

18,646—PENNSYLVANIA—A Peculiar Hematite Ore on the Tract of the Durham Mine, Durham, Penn. W. S. Bayley. (Econ. Geol., Mar., 1912; 5¼ pp.) 60c.

18,647—UNITED STATES STEEL CORPORATION in 1911. Abstract of annual report. (Eng. and Min. Journ., Mar. 30, 1912; 2⅓ pp.) 20c.

IRON AND STEEL—METALLURGY

18,648—BLAST FURNACE—Ueber die Berechnung des Zurdireckten Reduktion im Hochofen verbrauchten Kohlenstoffs. F. Wüst. (Stahl u. Eisen, Mar. 7, 1912; 2¼ pp.) On the calculation of the carbon consumed in direct reduction in the blast-furnace. 40c.

18,649—BLAST FURNACE—The Detroit Iron & Steel Co.'s Thin-Lined Stack. (Iron Tr. Rev., Apr. 18, 1912; 2⅔ pp., illus.) How a thick-lined blast furnace was converted into one of the thin-lined spray cooled variety. 20c.

18,650—BLAST-FURNACE—Ueber die direkte und indirekte Reduktion im Eisenhochofen. M. Levin. (Stahl u. Eisen, Feb. 8, 1912; 2 pp.) On the direct and the indirect reduction in the iron blast-furnace. 40c.

18,651—BLAST-FURNACE—Reduktion und Kohlung im Hochofen, im Zusammenhange mit Hochofenstörungen und auf Grund von Schmelzversuchen erläutert. Bernhard Osann. (Stahl u. Eisen, Mar. 21, 1912; 8¾ pp., illus.; to be continued.)

18,652—BRIQUETTING FLUE-DUST—Zur Frage der Brikettierungen des Gichtstaubes. (Stahl u. Eisen, Feb. 15, 1912; 2¾ pp.) Concerning the briquetting of blast-furnace flue dust. 40c.

18,653—CORROSION—A New Method for Testing Paint Films and Preservative Coatings for Iron and Steel. W. C. Slade. (Journ., Ind. and Eng. Chem., Mar., 1912; 9¾ pp., illus.) 60c.

18,654—CORROSION—Ueber den Einfluss von Austrichen auf das Rosten des Eisens. Liebreich and Spitzer. (Zeit f. Electrochem., Feb. 1, 1912; 5 pp., illus.) On the influence of paints on the rusting of iron.

18,655—ELECTRIC FURNACE PRODUCTION of Pig Iron and Pig Steel. Jos. W. Richards. (Proc. Engrs.' Soc. Western Penn., Mar., 1912; 32 pp., illus.) 40c.

18,656 — ELECTRIC SMELTING — Experiments in Electrical Smelting of Iron Ores. S. Rice. (Min. and Eng. Wld., Apr. 13, 1912; 3 pp., illus.)

18,657 — ELECTRIC SMELTING — Essais de Production de la Fonte au Haut Fourneau électrique, a Trollhättan (Suède). (Génie Civil, Mar. 16, 1912; 3¼ pp., illus.) 40c.

18,658 — ELECTRIC SMELTING — La Production de la Fonte au Four électrique. P. Nicou. Compte Rendu des Experiences de Trollhättan. (Rev. univ. des Mines, Feb., 1912; 58 pp.)

18,659—ELECTRIFICATION of a Reversing Mill of the Algoma Steel Co. Bradley T. McCormick. (Proc. A. I. E. E., Apr., 1912; 11 pp., illus.)

18,660 — FERROCHROMIUM — Schnellverfahren zur Kohlenstoffbestimmung in Ferrochrom. F. Gercke and N. Patzukoff. (Stahl u. Eisen, Mar. 14, 1912; 1½ pp., illus.) A quick method for determining carbon in ferrochromium. 40c.

18,661 — FERROMANGANESE — Ueber das Umschmelzen von Ferromangan in elektrischen Ofen. R. Kosten. (Stahl u. Eisen, Mar. 14, 1912; 7 pp.) On the remelting of ferromanganese in the electric furnace. Discussion. 40c.

18,662—FOUNDING—Das Eisengiessereinwesen in den letzten zehn Jahren. (Stahl u. Eisen, Jan. 25, Feb. 29, Mar. 28, 1912; 7 pp., illus.; to be continued.) The iron-foundry industry during the last decade. $1.

18,663—FOUNDRY—Gegenwärtiger Stand des Formmaschinenwesens in Nordamerika. Lohse. (Zeit. d. Ver. D. I., Jan. 20, Feb. 3 and 10, 1912; 15¾ pp., illus.) Present state of molding by machinery in the United States.

18,664 — ITALY — Italiens Eisenindustrie. (Stahl u. Eisen, Feb. 15 and 22, Mar. 14 and 21, 1912; 16¾ pp., illus.) Italy's iron industry. $1.20.

18,665—LOW-CARBON STEEL — Beitrage zur Frage der Seigerungen im Flusseisen. E. Heyn and O. Bauer. (Stahl u. Eisen, Mar. 7, 1912; 1 p., illus.) Contributions to the question of flaws in low-carbon steel. 40c.

18,666—MANAGEMENT—Notes on the Development of Engineering Supervision for Steel-Making Plants. Alex. L. Hoerr. (Proc. Engrs.' Soc., Western Penn., Mar., 1912; 8 pp.) 40c.

18,667—METALLOGRAPHY—Das metallographische Laboratorium im Hüttenbetrieb. Weiller. (Chem. Ztg., Mar. 23 and 26, 1912; 2½ pp.) The metallographic laboratory in operating iron works. 40c.

18,668—ROLLING MILL—Large Rerolling Mill of Unusual Design Operated by Laclede Steel Co. (Iron Tr. Rev., Apr. 4, 1912; 4 pp., illus.) 20c.

18,669—SINTERING and Briquetting of Flue-Dust. Felix Vogel. (Advance proof, A. I. M. E., Feb., 1912; 5 pp.)

18,670—STEEL WORKS—Einige Mitteilungen über Betriebs-Neuanlagen deutscher Hüttenwerke, Schömburg. (B. u. H. Rundschau, Feb. 29, 1912; 1¼ pp.) Some notes on new constructions in German iron and steel works.

18,671 — TESTING MACHINES — Prüfungsmaschine von 3000 t Druckkraft für Eisenkonstruktionsteile. (Stahl u. Eisen, Mar. 7, 1912; 2¾ pp., illus.) Testing machine of 3000-ton compressive strength for structural iron. 40c.

LEAD AND ZINC

18,672—BLAST ROASTING — On the Theory of Blast-Roasting of Galena. C. O. Bannister. (I. M. M. Bull. Nos. 90 and 91, 1912; 24 pp.) Discussion on paper previously indexed.

18,673—BLAST ROASTING—The Important Factors in Blast Roasting. H. B. Pulsifer. (Met. and Chem. Eng., Mar., 1912; 6 pp., illus.) Bibliography is included. 40c.

18,674—CANVAS-TABLE TESTS for Recovering Lead Slime. Evans W. Buskett. (Min. and Eng. Wld., Feb. 24, 1912; 1 p.) 20c.

18,675—ELECTRIC SMELTING—Ueber die Verarbeitung von sulfidischen oder oxydischen Zinkerzen im elektrischen Ofen. W. Borchers. (Metallurgie, Mar. 8, 1912; 1 p.) On the reduction of sulphide and oxidized zinc ores in the electric furnace. 40c.

18,676—LEAD-FURNACE FUME, a Method for the Utilization of. L. S. Hughes. (Journ. Ind. and Eng. Chem., Apr., 1912; 1¾ pp.) 60c.

18,677—ZINC BLENDE—Untersuchungen über den Einfluss von Lösungen von Eisen in Schwefeleisen auf Zinkblende. Eulenstein. (Metallurgie, Mar. 8, 1912; 4 pp., illus.) Investigations on the influence of solutions of iron in iron sulphide on zinc blende. 40c.

OTHER METALS

18,678 — LITHIUM. Its Occurrence, Uses, Determination and Methods of Extraction. Amil A. Anderson. (Pahasapa Quart., Apr., 1912; 5 pp.)

18,679—PLATINUM—The Russian Government Platinum Monopoly. (Min. and Eng. Wld., Apr. 13, 1912; 1 p.) 20c.

18,680—PLATINUM—Ueber Platin. E. Priwoznik. (Oest. Zeit. f. B. u. H., Mar. 16 and 23, 1912; 7 pp.) 60c.

18,681—QUICKSILVER—A New Volumetric Method for the Determination of Mercury. George S. Jamieson. (Am. Journ. of Sci., Apr., 1912; 3 pp.) 40c.

18,682 — TIN — Concentrating Bolivian Tin Ores. (Min. Mag., Mar., 1912; 2 pp., illus.) 40c.

18,683—TIN—Occurrence of Tinstone in the Burnett District, Queensland. L. C. Ball. (Queensland Govt. Min. Journ., Mar. 15, 1912; 4 pp., illus.) 60c.

18,684—TIN—The Sale of Tin Ores. O. J. Steinhart. (Min. Mag., Mar., 1912; 1¼ pp., illus.) 40c.

18,685—TIN MINING in Bolivia. O. Gore Adams. (Aust. Min. Stand., Feb. 15 and 22, 1912; 2 pp., illus.) Continuation of article previously indexed 60c

18,686—TITANIUM: Its Place in Metallurgy and Chemistry. H. M. Henton. (Pahasapa Quart., Jan., 1912; 6 pp.)

18,687 — TUNGSTEN — Rasche und genaue Bestimmung des Wolframs in Ferrowolfram. Fieber. (Chem. Ztg., Mar. 26, 1912.) A quick and accurate determination of tungsten in ferrotungsten. 40c.

18,688—TUNGSTEN—Scheelite Mining in New Zealand. M. Russell. (Queensland Govt. Min. Journ., Mar. 12, 1912; ¾ p.) 60c.

18,689—VANADIUM—A New Method for the Determination of Vanadium. D. J. Demorest . (Journ. Ind. and Eng. Chem., Apr., 1912; 1 p.) 60c.

18,690—VANADIUM—The Reduction of Vanadic Acid in Concentrated Sulphuric Acid Solution by Hydrogen Peroxide and by Persulfates. J. R. Cain and J. C. Hostetter. (Journ. Am. Chem. Soc., Mar., 1912; 2 pp.) 60c.

18,691—VANADIUM ORES and Uses. Thos. F. V. Curran. (Mex. Min. Journ., Apr., 1912; 1 p.) 20c.

NONMETALLIC MINERALS

18,692—ASBESTOS—The Production of Asbestos in 1911. J. S. Diller. (Advance Chapter from Mineral Resources of the United States, 1911; 9 pp.)

18,693—BARYTES — The Barite Deposits near Five Islands, Nova Scotia. C. H. Warren. (Econ. Geol., Dec., 1911; 8½ pp.) 60c.

18,694—DIAMONDS—History of the Diamond Fields of South Africa. C. Roe Gardiner. (Min. and Eng. Wld., 1⅗ pp.) 20c.

18,695—GYPSUM—Some Difficulties in the Analysis of Gypsum. Gordon Surr. (Min. and Eng. Wld., Feb. 24, 1912; ½ p.) 20c.

18,696—GYPSUM—The Occurrence and Origin of Gypsum and Anhydrite at the Ludwig Mine (Copper), Lyon County, Nev. A. F. Rogers. (Econ. Geol., Mar., 1912; 4¾ pp., illus.)

18,697—PHOSPHATE MINING in Relation to the Fertilizer Industry. C. G. Memminger. (Am. Fertilizer, Apr. 6, 1912; 4¼ pp.) 20c.

18,698—PHOSPHATE ROCK—Production of Phosphate Rock in Florida During 1911. E. H. Sellards. (Fourth Annual Report, Florida State Geol. Surv., Mar., 1912; 5 pp.)

18,699—PHOSPHATES—A Report on the Natural Phosphates of Tennessee, Kentucky and Arkansas. William H. Waggaman. (U. S. Dept. of Agriculture, Bureau of Soils, Bull. No. 81, 1912; 40 pp., illus.)

18,700—POTASH Near Ely, Nevada. Arthur R. Schell. (Min. Sci., Apr. 11, 1912; ¾ p.) 20c.

18,701—POTASH—The Business Aspect of the Kelp Proposition. F. P. Dewey. (Journ. Ind. and Eng. Chem., Apr., 1912; ¾ p.) 60c.

18,702—POTASH DEPOSITS in America. Guy Elliott Mitchell. (Cassier's Mag., Apr., 1912; 11 pp., illus.) 40c.

18,703—POTASH SALTS: Summary for 1911. W. C. Phalen. (Advance Chapter from Mineral Resources of the U. S., 1911; 31 pp.)

18,704—SALT—Die Salinen in Galizien und in der Bukowina. F. Piestrak. (Oest. Zeit. f. B. u. H., Feb. 17 and 24, 1912; 9½ pp.) The salt works of Galicia and of the Bukowina. 60c.

18,705—SALT—The Form of Salt Deposits. F. F. Hahn. (Econ. Geol., Mar., 1912; 15 pp., illus.) 60c.

18,706—TALC AND SOAPSTONE Resources of Virginia. T. L. Watson. (Min. and Eng. Wld., Apr. 20. 1912; ¾ p.) From Bull. 6 of the Va. Geol. Survey. 20c.

PETROLEUM AND NATURAL GAS

18,707—AUSTRIA—Einiges über die galizsche Erdölindustrie. Krantz. (B. u. H. Rundschau, Feb. 5, 1912; 8½ pp.) Some points on the Galician petroleum industry.

18,708—CALIFORNIA—Preliminary Report on the Geology and Possible Oil Resources of the South End of the San Joaquin Valley, Calif. Robert Anderson. (U. S. Geol. Survey, Bull. 471-A-5, 1912; 30 pp., illus.)

18,709—CALIFORNIA—Present Conditions in the California Oil Fields. Mark L. Requa. (Bull. A. I. M. E., Apr., 1912; 10 pp.) 40c.

18,710—CHILE—Petroleum Deposits in Chile. C. Zelaya. (Eng. and Min. Journ., Apr. 13, 1912; ½ p.) 20c.

18,711—COLORADO—Oil Signs and Prospects in Colorado and Alberta. Arthur Lakes. (Can. Min. Journ., Apr. 15, 1912; ¾ p.) 20c.

18,712—ROUMANIA—Ueber den geologischen Bau der Region der Schlammvulkane und Oelfelder von Berea und Beciu bei Buzen in Roumänien. Preiswerk. (Zeit. f. prakt. Geol., Jan.-Feb., 1912; 7½ pp., illus.) On the geological formation of the region of the mud volcanoes and oil fields of Berea and Beciu near Buzen, Roumania.

18,713—RUSSIA—The Maikap Oilfield: A Review and a Suggestion. E. H. C. Craig. (Min. Journ., Mar. 30, 1912; 1½ pp.) 40c.

18,714—UTAH—The Green River, Utah, Oil Field. (Salt Lake Min. Rev., Feb. 29, 1912; 3½ pp., illus.) 20c.

ECONOMIC GEOLOGY—GENERAL

18,715—DURANGO—Apuntes Sobre la Distribucion de Minerales en el Estado de Durango. Manuel Rangel. (Bol., Sociedad Geologica Mexicana, T. VII, Part 2, 1911; 19 pp.)

18,716 — GEOLOGIC MAPPING — The Plane Table in Detailed Geologic Mapping. F. L. Ransome. (Econ. Geol., Mar., 1912; 6 pp.) 60c.

18,717 — NORTH DAKOTA — Geologic Atlas of the United States, Bismarck Folio. A. G. Leonard. (U. S. Geol. Surv., 1912; 8 pp.)

18,718—ORE DEPOSITION — Gels in Relation to Ore Deposition. E. Hatschek and A. L. Simon. (I. M. M., Bull. 91, Apr. 11. 1912; 8½ pp.)

18,719—ORE DEPOSITION — Physical Data of Igneous Emanation. Blamey Stevens. (Bull. A. I. M. E., Apr., 1912; 10 pp., illus.) 40c.

18,720—ORE DEPOSITION—The Laws of Igneous Emanation Pressure. Blamey Stevens. (Bull. A. I. M. E., Apr., 1912; 17 pp., illus.) 40c.

18,721 — ORE DEPOSITS — Magmatic Origin of Ore-Forming Solutions. C. F. Tolman. (Min. and Sci. Press, Mar. 16, 1912; 4 pp.) 20c.

18,722—ORE DEPOSITS—The Original Source of Metalliferous Ores. G. W. Miller. (Min. and Eng. Wld., Mar. 2, 1912; 1½ pp.) 20c.

18,723—ORE SHOOTS—Decrease of Values in Ore Shoots with Depth. R. E. Hore. (Can. Min. Journ., Apr. 15, 1912; 3 pp.) 20c.

18,724 — ORTHOCLASE-BEARING VEINS from Rawhide, Nev., and Weehawken, N. J. Austin F. Rogers. (Econ. Geol., Dec., 1911; 9 pp., illus.) 60c.

18,725—ROCK ANALYSES—Conversion of Rock Analyses into Terms of Minerals. A. J. Mead. (Econ. Geol., Mar., 1912; 8 pp., illus.) 60c.

MINING—GENERAL

18,726—ACCIDENTS in Mines Caused by Falls of Ground. George B. Harrison. (Trans. Manchester Geol. and Min. Soc., Vol. XXXII, Part 11, 1911-1912; 14 pp.)

18,727 — ACCIDENTS in Transvaal Mines, with Special Reference to Falls of Ground. James Chilton. (Journ. Chem., Met. and Min. Soc. of South Africa, Feb., 1912; 12½ pp., illus.) Discussion on paper previously indexed. 60c.

18,728 — ACCIDENTS — Prevention of Mine Accidents, with Special Reference to Inspection. Heath Steele. (Mex. Min. Journ., April, 1912; 2¼ pp.) 20c.

18,729—ACCIDENTS—Report of the Mining Accidents in Ontario in 1911. E. T. Corkill. (Ont. Bureau of Mines, Bull. No. 9, 1912; 25 pp.)

18,730—AFRICA—Engineering on the Gold Coast. W. H. Barker. (Cassier's Mag., Mar., 1912; 8 pp., illus.) 40c.

18,731—BELGIAN CONGO—Note sur le Régime Légal des Mines au Congo Belge. Louis Aguillon. (Ann. des Mines, Vol. I, Part 1, 1912; 24 pp.)

18,732—BLASTING—Where Should the Primer Go? F. H. Gunsolus, H. S. Brown and J. T. Fuller. (Eng. and Min. Journ., Mar. 30, Apr. 6 and 13, 1912; 1 p.) Discussion. 20c.

18,733—CAVING SYSTEM at Ohio Copper Mine. C. G. Bamberger. (Eng. and Min. Journ., Apr. 6, 1912; 1¾ pp., illus.) 20c.

18,734—DIAMOND DRILLING—Recent Practice in Diamond Drilling and Bore-hole Surveying. J. I. Hoffman. (I. M. M. Bull. 91, Apr. 11, 1912; 14 pp., illus.)

18,735—DIAMOND DRILLING—Speeds and Costs of Diamond Drilling at Porcupine, Canada. Albert E. Hall. (School of Mines Quart., Apr., 1912; 4 pp.) 60c.

18,736—DRAINAGE—Unwatering Tresavean Mine. C. Brackenbury. (Bull. I. M. M., No. 90, Mar. 14, 1912; 15 pp., illus.) Author's reply to discussion on paper previously indexed.

18,737 — DRILLING — Bohrmaschinelle Bergbaubetriebe. Ludwig Henker. (Oest. Zeit. f. B. u. H., Mar. 9, 16, 23 and 30, 1912; 12 pp., illus.)

18,738 — ENCAVATING EARTH and Rock and Handling the Spoil on the Panama Canal. (Cassier's Mag., Apr., 1912; 18 pp., illus.) 40c.

18,739—FINANCE OF A MINE, The. Morton Webber. R. B. Hoffmann and C. S. Herzig. (Min. Mag., Mar., 1912; 1¼ pp.) Discussion of a series of articles previously indexed. 40c.

18,740—HOISTING ROPES—Ergebnisse der preussischen Statistiken der Schachtförderseile für das Jahr 1910. F. Herbst. (Glückauf, Mar. 2, 9 and 6, 1912; 27 pp., illus.) Results of the Prussian statistics of shaft hoisting ropes for 1910. $1.

18,741 — HONDURAS — Mineral Resources of Honduras, Central America. A. D. Akin. (Min. and Eng. Wld., Apr. 20, 1912; 2 pp.) 20c.

18,742 — HUNGARY — Ungarns Berg- und Hüttenwesen, 1910. (Oest. Zeit. f. B. u. H., Mar. 9, 16 and 23, 1912; 7 pp.) Hungary's mining and metallurgical industry in 1910. $1.

18,743—INDO-CHINA—Nouvelle Réglementation minière de l'Indo-Chine. (L'Echo des Mines, Feb. 15, 1912; 1 p.)

18,744 — LADDERS — Turning Ladder Rungs with Circular Saw. H. V. Wallace. (Min. and Eng. Wld., Apr. 20, 1912; ¾ p., illus.) 20c.

18,745 — LAND SLIDES — Effects of Land Slides in Mining Regions. Arthur Lakes. (Min. Wld., Apr. 20, 1912; 1¾ pp., illus.) 20c.

18,746—MANAGEMENT—Efficiency Engineering Applied to Mining. G. A. Collins. (Min. and Eng. Wld., Apr. 20, 1912; 1⅓ pp.) 20c.

18,747—MEXICAN LAW—Extent of Mining Titles Under the Mexican Law. D. A. Richardson. (Min. and Eng. Wld., Mar. 30, 1912; 2 pp.) 20c.

18,748—MICHIGAN—Appraisal of the Mines of Michigan. J. R. Finlay. (Harvard Eng. Journ., Jan., 1912; 8½ pp.) 40c.

18,749—MINE CAGE—A Light Mine Cage. H. L. Botsford. (Eng. and Min. Journ., Apr. 13, 1912; ¾ p., illus.) 20c.

18,750—MINE CAGE—The Hiawatha Mine Cage. H. L. Botsford. (Eng. and Min. Journ., Apr. 6, 1912; ⅔ p.) 20c.

18,751—MINE INSPECTORS—The Election of Mine Inspectors. J. T. Beard. Coal Age, Apr. 20, 1912; 2½ pp.) 20c.

18,752—MINERS' HOUSES—Housing of Scottish Miners. (Coal Age, Apr. 20, 1912; 1½ pp., illus.) 20c.

18,753—MINING LAW—The Birth of the American Mining Act—I. H. V. MacFarren. (Min. and Sci. Press, Apr. 13, 1912; 3½ pp.) 20c.

18,754—MINING METHODS—Methods Used in Mining Underground Wide Lodes or Masses. J. Bowie Wilson. (Aust. Min. Stand., Feb. 29, Mar. 14 and 21, 1912; 3⅗ pp.) Describes caving, rill, shrinkage and the flat back slice and fill systems. $1.

18,755—PUMPING by Compressed Air. Herbert T. Abrams. (School of Mines Quart., Apr., 1912; 19 pp., illus.) 60c.

18,756—QUEENSLAND—The Queensland Mining Industry in 1911. Report by the Under Secretary for Mines. (Queensland Govt. Min. Journ., Mar. 15, 1912; 17 pp.) 60c.

18,757—REPORTS—Systematizing Annual Reports to Stockholders. Arthur Prill. (Min. and Eng. Wld., Feb. 24, 1912; 2¼ pp., illus.) 20c.

18,758—RUSSIA—Labor Conditions on the Lower Amur. D'Arcy Weatherbee. (Min. Mag., Mar., 1912; 3¼ pp., illus.) 40c.

18,759 — SAXONY — Der Bergwerks- und Hüttenbetrieb im Königreich Sachsen im Jahre 1910. (Oest. Zeit. f. B. u. H., Mar. 2, 1912, 1½ pp.) 40c.

18,760—SHAFT SINKING—Leistungen und Kosten beim Schachtabteufen nach dem Gefrierverfahren. Stegemann.

(Glückauf, Mar. 16, 1912; 6½ pp.) Efficiency and cost of shaft sinking by the freezing method. 40c.

18,761—SIGNAL SYSTEM in Use at the Tonopah Belmont Mine, Tonopah, Nevada. C. H. Fox. (Mex. Min. Journ., April, 1912; 2 pp., illus.) 20c.

18,762—STOPING at the Calamon Mine. E. P. C. Sullivan. (I. M. M. Bull. 91, Apr. 11, 1912; 3 pp.) Author's reply to discussion.

18,763 — SURVEYING — Mine Survey Notes. George W. Riter. (Bull. A. I. M. E., Apr., 1912; 7 pp.) Discussion of paper previously indexed. 40c.

18,764—TIMBERING—The Problem of Mine Timbering. R. B. Woodworth. (Coal Age, Mar. 30, 1912; 3 pp., illus.) Paper before Ky. Min. Inst., Dec. 11, 1911. Discusses the use of steel. 20c.

18,765—TUNNEL—Notes on the Laramie Tunnel, Colo. David W. Brunton. (Bull. A. I. M. E., Apr., 1912; 18 pp.)

18,766—UTAH—Mining on the East Side of Tintic District. Leroy A. Palmer. (Salt Lake Min. Rev., Apr. 15, 1912; 3½ pp., illus.) 20c.

18,767—WIRE ROPES—Discussion of Dugald Baird's Paper on Wire Ropes as Applied to Mining. (Trans. Min. Inst. of Scotland, Feb. 15, 1912; 9 pp., illus.)

ORE DRESSING—GENERAL

18,768—CLASSIFIER—A Critical Discussion of the Principles of the Richards Pulsator Classifier. L. B. Skinner. (Proc. Colo. Sci. Soc., Apr., 1912; 33 pp., illus.)

18,769 — CRUSHING — Largest Single-Unit Crushing Plant in the World at Valhalla, N. Y. Samuel W. Traylor. (Min. and Eng. Wld., Feb. 24, 1912; 4¾ pp., illus.) 20c.

18,770 — FLOTATION PROCESS — Das Schwimmaufbereitungsverfahren der Grube Friedrichssegen nach System Leuschner. Holtmann. (Glückauf, Mar. 9, 1912; 5 pp., illus.) The Leuschner flotation process at the Friedrichssegen mine near Ems. 40c.

18,771—SEPARATION—New Wet Centrifugal Separating-Grading Process. W. J. Gee. (Min. and Eng. Wld., Apr. 20, 1912; 1½ pp., illus.) Abstract from Journ., Royal Society of Arts. 20c.

METALLURGY—GENERAL

18,772 — COBALT-NICKEL SPEISS — Verarbeitung einer gerösteten bleireichen Kobalt-Nickelspeise. Barth. (Metallurgie, Mar. 22, 1912; 18 pp., illus.) Method of working a roasted cobalt-nickel speiss rich in lead. 40c.

18773 — FERROSILICON — Ferrosilizium-Explosionen und ihre vermutlichen Ursachen. A. von Gumberz. (Stahl u. Eisen, Feb. 15, 1912; 3¾ pp.) Ferrosilicon explosions and their probable causes. 40c.

18,774—SLAG DISPOSAL PLANT of the Granby Consolidated Mining, Smelting and Power Co., at Grand Forks. C. M. Avery. (The Labor Saver, Apr., 1912; 1¼ pp., illus.)

18,775 — SMELTER SMOKE — Experiments with the Thiogen Process. Frank L. Wilson. (Min. and Sci. Press, Apr. 6, 1912; 1½ pp., illus.) 20c.

18,776—SMELTER SMOKE—Progress of Smelter Smoke Control in California. A. H. Martin. (Min. Sci., Apr. 4, 1912; 1¾ pp., illus.) Baghouse system of the Mammoth Copper Co.; a cooling pipe arrangement for warm weather; the Reed, Cottrell and Young processes. 20c.

18,777—SOLUTION and Its Importance. Harry C. Jones. (Eng. and Min. Journ., Apr. 6, 1912, 4¼ pp.) 20c.

18,778—SOLUTION—Electrolytic Dissociation and Solvation. Harry C. Jones. (Eng. and Min. Journ., Mar. 30, 1912; 4 pp.) 20c.

18,779—SOLUTION—Further Studies in Solution. Harry C. Jones. (Eng. and Min. Journ., Apr. 20, 1912, 4¾ pp.) 20c.

18,780—VALUATION—Notes on the Valuation of Ores and Minerals and on Metallurgical Calculations. George T. Holloway. (Bull. I. M. M., No. 90, Mar. 14, 1912, 16 pp.)

18,781—WELDING—Acetylene Welding and Welding Schools in Europe. J. M. Morehead. (Eng. News, Apr. 18, 1912; 2 pp., illus.) 20c.

18,782 — WELDING — Das Schweissen mittels Elektrizität und Gassauerstoff. Hempel. (Oest. Zeit. f. B. u. H., Mar. 23, 1912, 1 p.) Welding by means of electric and gaseous oxygen. 40c.

MINING AND METALLURGICAL MACHINERY

18,783 — AERIAL TRAMWAY — Construction of Argentine Tram. C. A. Tupper. (Eng. and Min. Journ., Apr. 6, 1912; 2⅓ pp.) Describes the construction of the aërial tramway operated by the government of Argentina from Chilecito to the Famatina group of mines. 20c.

18,784—AERIAL TRAMWAY—Discussion of J. Balfour Sneddon's Description of the Aerial Ropeway from the Shale Mines to the Oil Works at Oakbank, Mid-Calder. (Trans. Min. Inst. of Scotland, Feb. 15, 1912; 7¼ pp., illus.)

18,785—AERIAL TRAMWAY of the Real del Monte Company, in Pachuca. C. W. Van Law. (Informes y Memorias del Instituto Mexicano de Minas y Metalurgia, Ano II, No. 6, 1911; 9 pp., illus.)

18,786—AERIAL TRAMWAY—Transporte Aero de Gran Capacidad en Bilbao. (Revista Minera, Apr. 1, 1912; 1½ pp.) 40c.

18,787—AIR COMPRESSOR ECONOMY in Driving the Catskill Aqueduct Tunnel, New York City. F. A. Halleck. (Mine and Quarry, Mar., 1912; 14 pp., illus.) 20c.

18,788—AIR COMPRESSORS—Centrifugal Compressors. Louis C. Lowenstein. (Gen. Elec. Rev., Mar. and Apr., 1912; 18 pp., illus.) 60c.

18,789—CONVEYORS—A Study of Mechanical Conveyors—II. Lincoln D. Moss. (School of Mines Quart., April, 1912; 26 pp., illus.) 60c.

18,790—ELECTRIC FURNACES—Elektrischer Widerstandsofen für beliebige Badlängen. F. Thomas. (Metallurgie, Mar. 8, 1912; 2¼ pp., illus.) 40c.

18,791—EXCAVATORS—Moderne Trockenbagger im Dienste der oberschlesischen Montanindustrie. (B. u. H. Rundschau, Jan. 20, 1912; 1 p., illus.)

18,792—GAS PRODUCERS—The Gasification of Fuel. IV, Constructive Suggestions for Future Progress in Producer Design. C. E. Lucke. (Eng. Mag., Apr., 1912; 11 pp., illus.) 40c.

18,793—HAULAGE—A New Type of Gravity Plane. J. J. Smith. (Eng. and Min. Journ., Apr. 13, 1912; 7 pp., illus.) 20c.

18,794—HOISTING—Safety Catch for Cage. H. L. Botsford. (Eng. and Min. Journ., Mar. 30, 1912; 1 p., illus.) 20c.

18,795—HOISTING—The Walker Overwind Prevention Gear. John Paul. (Eng. and Min. Journ., Apr. 13, 1912; ½ p., illus.) 20c.

18,796—HOISTING ENGINE—Versuche an einer elektrisch betriebenen Hauptschachtförderanlage mit Schwungradausgleich. Wille. (Zeit. d. Ver. D. I., Mar. 2, 1912; 11 pp., illus.) Tests on an electrically driven main hoisting engine with equalization of the balance wheel.

18,797—HOISTING ENGINES — Elektrisch betriebene Fördermaschinen. Recktenwald. (B. u. H. Rundschau, Mar. 20, 1912; 2¼ pp.)

18,798—HOISTS—Electrical Mine Hoists and Their Control. C. A. Tupper. (Min. and Eng. Wld., Mar. 30, 1912; 2 pp., illus.) 20c.

18,799—LOCOMOTIVE—The Otto Internal Combustion Locomotive. J. B. Van Brussel. (Eng. and Min. Journ., Mar. 30, 1912; ⅜ p.) 20c.

18,800—LOCOMOTIVES—Vergleichende Untersuchungen an Grubenlokomotiven. Bütow and Dobbelstein. (Glückauf, Mar. 23 and 30, 1912; 17 pp., illus.) Comparative investigations on mine locomotives. To be continued. 60c.

18,801—PUMP—German Development of the Hydraulic Ram. (Journ. Elec., Power and Gas, Apr. 13, 1912; ½ p.) 20c.

18,802—PUMP—The Adaption of the Centrifugal Pump to Chemical Problems. F. G. Wheeler. (Journ. Ind. and Eng. Chem., Apr., 1812; 9 pp., illus.) 60c.

18,803—PUMPS—High-Speed Turbine Pumps. J. W. Rogers. (Cassier's Mag., Apr., 1912; 14 pp., illus.) Continuation of article previously indexed. 40c.

18,804—TURBINE TESTING—Elements of Turbine Testing. Robert Sibley. (Journ. Elec., Power and Gas, Mar. 16, 1912; 2¼ pp., illus.) 20c.

SAMPLING AND ASSAYING

18,805—CYANIDE BULLION—Cadmium and Nickel in Cyanide Bullion. F. P. Dewey. (Eng. and Min. Journ., Apr. 13, 1912; ¾ p.) 20c.

18,806—GAS ANALYSIS APPARATUS, New Forms of. G. A. Burrell. (Journ. Ind. and Eng. Chem., Apr., 1912; 5 pp., illus.) 60c.

18,807—LEAD ARSENATES—A Short Method for the Determination of Soluble Arsenic in Commercial Lead Arsenates. B. E. Curry and T. O. Smith. (Journ. Ind. and Eng. Chem., Mar., 1912; 2 pp.) 60c.

18,808—LEAD, NICKEL AND ZINC—The Estimation of Lead, Nickel and Zinc by Precipitation as Oxalates and Titration with Potassium Permanganate. H. L. Ward. (Am. Journ. of Sci., Apr., 1912; 5 pp.) 40c.

18,809—PLATINUM—The Direct Determination of Small Amounts of Platinum in Ores and Bullion. Frederic P. Dewey. (Bull. A. I. M. E., Apr., 1912; 4 pp.) 40c.

18,810 — POTASSIUM PERMANGANATE SOLUTION—Standardization of Potassium Permanganate Solution by Sodium Oxalate. R. S. McBride. (Journ. Am. Chem. Soc., Apr., 1912; 23 pp.) 60c.

18,811—RAPID METHODS of Technical Analysis. Frank D. Aller. (Colo. School of Mines Mag., Apr., 1912; 1¼ pp.) Continuation of article previously indexed; analysis of copper and lead slags. 40c.

18,812—SAMPLE CRUSHER—A Simple Crusher for Samplers. George J. Bancroft. (Min. Mag., Mar., 1912; 1¼ pp., illus.) 40c.

18,813—UNITED STATES ASSAY OFFICES; Methods of Operation. (Min. and Eng. Wld., Feb. 24, 1912; 2 pp.) 20c.

18,814—VALUATION OF ORE RESERVES—A Graphic Method for Facilitating Valuation of Ore Reserves. James M. Platt. (Informes y Memorias del Instituto Mexicano de Minas y Metalurgia, Ano II, No. 6, 1911; 4 pp., illus.)

18,815—VANADIUM—A Rapid Method for the Determination of Vanadium in Steels, Ores, Etc., Based on Its Quantitative Inclusion by the Phosphomolybdate Precipitate. J. R. Cain and J. C. Hostetter. (Journ. Ind. and Eng. Chem., Apr., 1912; 6 pp., illus.)

INDUSTRIAL CHEMISTRY

18,816 — AMMONIA — Geschäftsbericht der Deutschen Ammoniak-Verkaufvereinigung über das Jahr 1911. (Glückauf, Mar. 23, 1912; 1¼ pp.) Abstract of the annual report of the German ammonia selling union for the year 1911.

18,817 — LITHOPONE — Bemerkungen über die Lithoponefabrikation und ihre mechanische Vervollkommung. Nagel. (Zeit. f. angew. Chemie, Mar. 29, 1912; 3 pp., illus.) Notes on the manufacture of lithopone and its mechanical improvement. 40c.

18,818—SULPHURIC ACID MANUFACTURE in Tennessee. Wilbur A. Nelson. (Min. Sci., Feb. 8, 1912; 2½ pp., illus.) Development of an important byproduct industry as an incident to copper smelting. 20c.

18,819—WATER PURIFICATION and Its Application to Industrial Uses. H. Royal-Dawson (Chem. Trade Journ., Jan. 20, 1912; 2 pp.) 40c.

18,820 — WATER TREATMENT — The "Luminator" Treatment of Water. Henry B. Lake. (Journ. Soc. Chem. Ind., Jan. 31, 1912; 2½ pp.)

18,821—WATER TREATMENT—Ueber die Reinigung und Enthärtung des Wassers durch Permutit. Kolb. (Chem. Ztg., Dec. 16, 21 and 23, 1911; 4½ pp.) On the purification of water by permutite.

18,822—WHITE-LEAD INDUSTRY in the United States, with an Appendix on the Lead-Oxide Industry. Alice Hamilton. (Bull. U. S. Bureau of Labor, July, 1911; 71 pp.)

MATERIALS OF CONSTRUCTION

18,823—CEMENT—Eisenportlandzement im Vergleich zu Portlandzement. H. Passow. (Stahl u. Eisen, Mar. 21, 1912; 3½ pp.) 40c.

18,824—CEMENT—The Effect of High-Pressure Steam on the Crushing Strength of Portland Cement Mortar and Concrete. Rudolph J. Wig. (Tech. Paper No. 5, Bureau of Standards, Washington, D. C.)

18,825—CEMENT PLANT—The New Tidewater Portland Cement Plant at Union Bridge, Maryland. (Eng. Rec., Apr. 13, 1912; 3 pp., illus.) 20c.

18,826—CEMENT PLANT—The Plant of the Crescent Portland Cement Company. W. B. Ruggles. (Cement Age Dec., 1911; 3¼ pp., illus.) 20c.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

W. de L. Benedict has removed his office from 43 Cedar Street to 19 Cedar Street, New York.

C. A. Dawley, consulting engineer, has removed his office to the West Street Building, New York.

L. C. Trent, of the L. C. Trent Engineering Co., of Los Angeles, has been visiting San Francisco.

J. B. Hastings, general manager of the Yellow Jacket Mining Co., near Hailey, Idaho, is in New York.

Col. E. A. Wall, of Salt Lake City, Utah, is in the East, under treatment for an affection of the eyes.

E. M. Rabb, of Denver, Colo., is ill, following an operation for appendicitis on Apr. 23, in St. Luke's Hospital.

C. H. Macnutt, general manager of the Poderosa Mining Co., of Chile, expects to be in London at the end of May.

Frederick G. Clapp, of Pittsburg, has been in Monongalia County, W. Va., making some geological examinations.

A. L. Queneau, of Philadelphia, sailed for Belgium on Apr. 27, where he expects to be during the remainder of this year.

D. L. H. Forbes, Toronto, Ont., has been appointed consulting engineer for the Trethewey Silver-Cobalt Mine, Ltd., at Cobalt.

C. W. Purington has been appointed chief engineer of the Pioneer Co. of Siberia, Ltd., which has its principal office in London.

R. E. Cavnah left Denver, Colo., Mar. 31 to take the position of superintendent of the Eagle Mining Co. at Edwardsburg, Idaho.

Prof. Edwin C. Holden, of the University of Wisconsin, intends to make a professional trip to Montana, Idaho and Utah in June and July.

Hoxie & Goodloe, consulting engineers, announce that their New York office has been removed from 50 Church to 50 East Forty-first Street.

B. C. Moise, recently appointed secretary of the National Tube Co., Pittsburg, has also been appointed a director, succeeding J. D. Culbertson, deceased.

Dr. Richard Borchers, Duisburg-Ruhrort, Germany, is in the United States for the purpose of making a special study of loading and unloading machinery.

E. M. Hamilton has returned to Los Angeles from Taviche, Oaxaca, Mexico, and is now on his way to England, where he expects to remain for three months.

Harold C. E. Spence, of the International Mining Syndicate, Ltd., has returned to Nova Scotia after a year spent in Europe on business, and will go to New Mexico shortly.

Gerald Lovell, general manager for Canada of the Bewick Moreing Co., of London, was recently in the Manitou Lake gold area, examining mining properties for the company.

Henry B. Kaeding is visiting the Panama Canal on a vacation. He will be in New Orleans about May 1 to purchase a new mill for the Siempre Viva Mining Co., of Nicaragua.

Julius A. Lewisohn has been chosen president of the Kerr Lake Mining Co., Cobalt, Ont., in place of Edward Steindler, deceased. William G. Nickerson, of Boston, has been chosen a director.

W. S. Keith returned recently to San Francisco from an examination of the Helester mine, in Placer Co., Calif., and has left for Last Chance, Calif., to resume operations at the Home Ticket drift gravel mine.

L. H. Burnett has been appointed assistant to President A. C. Dinkey of the Carnegie Steel Co., Pittsburg, and in addition to other duties, will have charge of the accident and relief bureaus, succeeding Geo. K. Preston, resigned.

Cecil P. Poole, who has been the junior editor-in-chief of *Power*, for the past seven years, has severed his connection with that paper and will engage May 1 in consulting engineering in Atlanta, Ga., in partnership with Lamar Lyndon, of New York. The firm will operate as the southern branch of Mr. Lyndon's New York office, which will continue as heretofore. The Atlanta office will be conducted by Mr. Poole. For the past 12 years Mr. Poole has made a special study of electrical machine construction and of gas-power engineering. He is widely known as a writer on both subjects and is a member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers.

OBITUARY

Jacob E. Friend, president of the Nordberg Manufacturing Co., Milwaukee, Wis., died Apr. 20 in Italy, while on a trip for his health.

Henry T. Bragdon died at Oakland, Calif., Apr. 21, from a pistol shot inflicted by himself. He was 65 years old, and was born in Lynn, Mass. He went to California 35 years ago and was actively engaged in mining in California and Nevada, and was at one time president of the Goldfield Stock Exchange. He made his home in that town for several years. Two years ago he moved to Oakland. Ill health and a nervous breakdown are attributed as cause for his act.

John Pattinson, a distinguished chemist and inventor of the Pattinson process of desilverizing lead, died at Newcastle, England. Mar. 12, aged 84 years. Notwithstanding his age he was active until a few days before his death. Mr. Pattinson was vice-president of the Chemical Society; an original fellow of the Institute, on whose council he served, and of which he was a censor; vice-president of the Society of Public Analysts; original member of the Iron & Steel Institute. He was one of the founders of the Society of Chemical Industry.

George W. Grayson died at San Francisco, Apr. 20, aged 83 years. He went to California in 1849, returned to his home in Kentucky for a short visit and made a second journey across the plains in 1851. He has been engaged in mining in California, Idaho and Nevada since that time. He was associated with J. B. Haggin in Idaho, and in the bonanza days of the Comstock with E. J. Baldwin, Archie Borland and James R. Keene. Besides his mining investments, Mr. Grayson was one of the prominent cattle men of the West. He established the firm of Grayson, Owen & Co., although he later sold out his interests in that company. He has lived a great part of the time in the last few years on his ranch in Nevada, his business affairs in San Francisco being handled by his son-in-law, W. C. Ralston. Mr. Grayson was one of the members of the original board of trustees of the California State Mining Bureau. He left an estate valued at about $700,000, consisting chiefly of mining stock and real estate in California, Nevada and Washington. He was a member of the Association of California Pioneers.

Societies and Technical Schools

American Society of Mechanical Engineers—The date for the spring meeting has been changed. It will be held May 28-31, at Cleveland, Ohio.

American Electrochemical Society — The recent election of officers resulted as follows: President. W. Lash Miller; vice-presidents, F. A. Lidbury, E. R. Taylor, William Brady; managers, E. F. Roeber, L. E. Saunders and L. Kahlenberg.

American Society of Mechanical Engineers—Honorary membership in the society was conferred on Dr. Rudolph Diesel, Apr. 30, in the auditorium of the Engineering Societies Building, New York. This was followed, under the auspices of the Gas Power Section, by an illustrated address by Dr. Diesel on "The Development of the Diesel Engine."

University of Illinois—Work has been commenced upon the construction of the new Ceramics and Mining Engineering laboratories. These buildings are to form a part of the group of engineering buildings to be located upon ground which has recently been acquired by the University. The contracts for the new Transportation Building and the Locomotive Testing laboratory will soon be let.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Apr. 24—The State Anti-Débris Association recently made a report of investigation of the dredging fields. The investigation was chiefly confined to the Feather River district in Butte County. On Honcut Creek, a tributary to the Feather, the inspection disclosed the flotation pond of Kentucky No. 1 dredge to be well land-locked. The Honcut dredge was found not so safe for the creek although the flotation pond was land-locked. Directions were given to the superintendent to provide further safeguards. The mining camps on Yuba River in the vicinity of Scales, Camptonville and Brandy City were also inspected. Recently the State Conservation Commission sent out an agent to investigate the probability of dredges operating on lands well adapted to agriculture. These investigations have evidently disclosed little disposition for dredge operators to disregard the laws. It has been the plan of most dredging companies to conduct operations in such a manner as to conserve the waters and leave the land in condition to be reclaimed readily for agricultural purposes. The Natomas Consolidated is constructing levees for the protection of the reclaimed dredging lands belonging to the company. The drag-line excavators are being removed to the Sacramento River to begin the construction of a levee from Sacramento to Vernon, 22 miles upstream. The drag-line excavator prepares the way for the suction dredges by throwing up dikes of soil, 100 ft. apart. These suction dredges are being built by the Yuba Construction Co. at Marysville.

The final settlement of the Coleman-Lightner-Utica litigation at Angels Camp in Calaveras County, while regarded as a victory for James V. Coleman, owner of the Angels mine, is none the less a benefit to the entire camp. This litigation has been pending for years and the controversy was expensive and a detriment to the camp. The disputes arose over conflicts between townsite and mining titles, extralateral rights and geological differences. There is a present suit pending between the Kennedy Extension Mining Co. and the Argonaut Gold Mining Co. in Amador County, which is purely a question of apex. The suits to quiet title to the Keystone and Wildman mines in Amador County have engaged the courts for some time and have retarded the reopening of these old mines which in former years were large producers. These properties and the Lincoln were taken over by W. J. McGee, C. R. Downs and others who are in a position to develop them. There is a prospect now that the creditors will be settled with and the cases taken out of the courts, after which development will probably proceed without further interruption. There is a brighter outlook for improvement in both Calaveras and Amador Counties with the end of the litigation in sight.

The taking of evidence in the case of the United States *vs.* the Southern Pacific Co., involving the posession of large tracts of land in the Elk Hills is in progress at Los Angeles before Leo Longley, a special examiner of the Department of Justice. The counsel for the railroad company has not cross-examined the witnesses closely and it is evident that the chief defense in the suits will be that the land was not of mineral character in the strict meaning of the Federal act. It was shown that the oil expert of the Southern Pacific knew and stated that the geological conditions in the Elk Hills indicated the presence of oil, and that development work was ordered in that district. It was shown by one witness that as early as 1874, he had prospected in that district and found indications of oil. This is the first of a series of suits to be brought by the government which will involve several hundred thousand acres of land, lying chiefly in the San Joaquin valley.

Butte

Apr. 25—John D. Ryan, president of the Amalgamated Copper Co., accompanied by a party of Eastern bankers, has been making an inspection of conditions in the West, and particularly in Montana. They spent a day in Great Falls looking over the smeltery and water-power sites, and arrived in Butte, Apr. 25, for an inspection of the mines. While in Great Falls, Mr. Ryan made the announcement that a complete reconstruction of the Boston & Montana smeltery at that place, at a cost of $2,500,000, has been ordered, the work to be commenced with the delivery of the structural steel by the Eastern mills, which will be within three or four months. The plans and specifications have been accepted, and the new plant will be entirely of steel and concrete, situated principally on the present smeltery site and upon considerable additional ground along the river on the east. It is calculated that the new plant will be finished in about a year, and, in the meantime, the old smeltery will be kept running and the output probably increased. Although the present plant is an excellent one, it was constructed 22 years ago, and to keep up with the strides made in the reduction of the costs of smelting, the company has decided that in the long run large savings will be effected by constructing an entirely new plant, modern in every detail. Situated at a point where almost unlimited water power is available, it is probable that the new smeltery will be second to none in the country in economy of results.

The Garnet placer-mining district, in Granite County, is coming to the front as a mining center again, and a number of properties are being developed. Placer gold was discovered there in 1865, and since then it has produced nearly $10,000,000 in gold. In recent years the source of the placer gold has been discovered in a number of fissure veins, and development work on them has shown a number of excellent sulphide deposits containing gold. The district is on Elk Mountain, near the boundary line of Granite and Powell Counties, and includes the mining camps of Garnet, Top O'Deep and Coloma. On the Magone and Anderson group of claims, operated by Col. A. B. Peake, active development work is being done on the 350-ft. level.

Denver

Apr. 25—In addition to the 50,000 tons of steel ordered by the Hill lines, already chronicled in the JOURNAL, the Harriman lines have given an order to the Minnequa plant of the Colorado Fuel & Iron Co., at Pueblo, for 50,000 tons.

Manager M. W. Cooley, of the Uintah Ry., running from Mack, on the Rio Grande Western, to the gilsonite deposits near Dragon, Utah, has announced that he will broad-gage that line, and build a series of tunnels northward from the Book cliffs. The longest of these will be 5000 ft., and it is said that $1,000,000 will be expended on the entire work.

The electric power business of the Cripple Creek district has been consolidated under one head, the H. M. Byllesby Co., of Chicago, having taken over the Consolidated Electric Co., of Cañon City, and the Pueblo Light & Traction Co. This power company will now furnish ample and continuous service in that field and has made full arrangements to do so. There is a double transmission line from Victor to Cañon City, and when the line from Cañon City to a point on the Pueblo-Victor lines is connected, it will mean that three lines of wires will be running into the district from the three power plants, all tied together so that it will be impossible for the district to be deprived of power.

The Portland mill has installed a 300-hp. motor; the Isabella mine has started its electric motors, which have now been leased to Morris Brothers, of Victor, who will treat the tailings from the mill dumps in summer and the mine dump in winter, and the Blue Flag mill, which is being increased in capacity, will install additional motors. Most of the large mines are changing from steam to electricity, the new company agreeing to reduce the cost one-half.

The transaction is now closed by which the old Hill pyritic smeltery, at Ouray, passes to the Brown Mountain Smelting Co., of which A. C. McCall, of Denver, is president, and Col. B. Crawford, manager. J. M. Head, a banker of Jefferson, Iowa, is said to be interested. The company owns the Indiana mine, near Ironton, in the Red Mountain district.

Salt Lake City

Apr. 25—Attention has been called recently to the iron ores of Iron County, Utah, by testimony given before the Senate Committee in investigating the United States Steel Corporation. The estimated amount of 1,000,000,000 tons is far in excess of the tonnage now developed. The report of the U. S. Geological Survey, published in 1908, gives a tonnage of 40,000,000 tons, which is obtained by multiplying the known area by the depth given by drill holes, pits and erosion sections. This is undoubtedly low, for most of the pits are bottomed in ore, and the probability of large deposits extending under the limestone must be considered. Conservative engineers have placed the amount at from 200,000,000 to 300,000,000 tons.

The average composition of the ore is iron, 56%; silica, 7%; phosphorus, 0.20%; lime and magnesia, 4%, with small amounts of copper, sulphur, manganese and titanium, but not in sufficient amounts to be injurious. The ore occurs as a replacement of limestone near its contact with intrusive andesite and also in fissures in the andesite. The deposits are due to contact metamorphism, as are most of the iron ores of western America.

Experiments made some years ago show that coke, sufficiently strong to bear the burden in an 80-ft. furnace, can be made from certain Utah coals by crushing before coking. Limestone of sufficient purity occurs in many parts of the state, notwithstanding the statement made before the Senate Committee to the contrary. High freight and labor rates in connection with a limited demand for the product are important factors to be considered at the present time, but this ore will undoubtedly be utilized in the future.

Negaunee, Mich.

Apr. 27—Iron ore shipments have started from the three Michigan ranges. Pocket and stockpile ore is being forwarded from the mines to Escanaba, on Lake Michigan, the first port to load ore; Marquette and Ashland, on Lake Superior, are also receiving ore, and Lake boats are now passing the Soo canal. A night crew is at work on the Chicago & Northwestern Ry. ore docks, at Escanaba, and the Chicago, Milwaukee & St. Paul R.R. has a good-sized day crew; ore is no longer giving trouble from freezing in the docks. The Menominee Range is the most active in shipping, a number of mines there having started as early as possible, including the old Hemlock mine, of Pickands, Mather & Co., at Amasa, which was the last mine to stop shipping last season. In the Gwinn district of the Marquette Range, the Stegmiller mine, of the Oliver Iron Mining Co., is shipping stockpile ore loaded by steam-shovel, and the Stephenson mine, of the Cleveland-Cliffs Iron Co., is shipping from pockets. In the Cascade district, the Empire mine, of Oglebay, Norton & Co., which has been closed all winter, is preparing to open, and Frank Klinglund, formerly of Iron River, has been transferred to take charge.

Shaft sinking has been commenced at the Lucky Star property, at Negaunee, owned jointly by the Breitung-Kaufman interests and the Cleveland-Cliffs Iron Co., and to be operated by the former, who have a controlling share. The tract of about 50 acres was the subject of litigation between the two organizations, which was settled last winter by a compromise. About 5,000,000 tons of soft ore have been indicated between depths of 900 and 1300 ft., by four diamond-drill holes; the land is in the center of a group of producing mines, including the Negaunee, of the Cleveland-Cliffs Iron Co. on the north, the Queen group, of the Oliver company, on the southeast, and the Breitung-Hematite and Mary Charlotte mines, of the Breitung interests, on the southwest. The shaft, which is near the center of the tract, is 14 ft. 10 in. by 12 ft. 2 in., will be wood lined and will have four compartments. From diamond drilling, which has been carried on at the shaft site, about 85 ft. of overburden is anticipated.

Cobalt

Apr. 25—The arrest of Kalil Farah in connection with the flotation of the Big Pete Canadian mines, has caused discussion throughout the mining districts of northern Ontario. The company owned 25 claims in the Larder Lake section, and in 1908 sold about $400,000 worth of stock in France at from $2 to $2.50 per share. The company was a wildcat flotation, and the prospectus was replete with misleading information. The French shareholders, represented in this country by Count de Forez, a Paris lawyer, charge Farah, the president of the company, with the issuing of the fraudulent prospectus and with wrongfully converting $10,000 of the company's money.

There is a revival of activity in the Elk Lake district, and to a lesser extent in Gowganda, as a result of the commencement of railroad construction. The following mines have plants in operation: Moose Horn, Beacon, Hitchcock, Donaldson, Regal, Cobalt-Frontenac and Bateese. A Montreal syndicate has purchased two claims in Smyth township from Frank Westcott and will develop them. At Gowganda a rich find at the 250-ft. level of the Miller Lake-O'Brien is reported. The Mann has run into rich ore at the 90-ft. level and will soon make another shipment. The Millerett will begin shipping when the roads will permit. The Hudson Bay, at Hanging Stone, is taking out high-grade ore from the 80-ft. level. All indications point to an active season.

Porcupine

Apr. 25—Considerable interest has been aroused over the suspension of the brokerage firm of J. Thomas Reinhardt, largely interested in three Porcupine flotations: Porcupine Central, Porcupine Southern, and Porcupine Northern. Porcupine Central was the first stock on the market, but it did not take well. Due to a considerable short interest the price was advanced to $5.50 per share. Several of the brokers refused to settle, and there were legal proceedings last autumn in Toronto and New York. After the suspension some of the stocks dropped to about 7c. per share. These properties never had anything especially to recommend them and so far nothing except the assessment work has been done. On some of them the overburden is 40 ft. deep so that it is impossible to prospect them by trenching.

The Pearl Lake Mining Co. has made an assignment for its creditors. In a circular mailed to the shareholders, the president states that the company still has 251,000 shares in the treasury, but the state of the market is such that it has been impossible to sell treasury stock to meet current liabilities. He states that he expects soon to be in a position to pay off all claims.

A syndicate headed by D. Lorne McGibbon and H. Holgate, both of Montreal, has arranged to take over the nearly completed power plant at Waiwaitin Falls, on the Mattagami River, for supplying electricity to the Porcupine camp. The Dome interests are understood to be represented in the enterprise. The carrying out of the project will enable the Dome and other companies to dispense with individual power plants except as auxiliaries.

The Mining News

The Current History of Mining

Alaska

Alaska-Treadwell—During March, the mill crushed 64,120 tons of ore, yielding $159,782 gross and net $58,613. Operating expenses were $95,183; construction $5985; yield per ton, $2.51; development 1072 feet.

Alaska-Juneau—The tunnel on the property in Silver Bow Basin is expected to be finished by Mar. 1 1914. The company is erecting wharves and a 150-stamp mill on the water front, two miles below Juneau, and these will be connected with the mines by the 7200 ft. tunnel mentioned above. Electric locomotives will be used in the tunnel.

Porcupine—The management of this gold mine, 38 miles from Haines, states that steady production will be maintained from now on.

Cliff—The March output of this gold mine was worth $36,000.

FAIRBANKS DISTRICT

Daly Bench — Smith Bros., operating this property on Eva Creek, are still in the rich gravel, which they opened recently. One pan from the drift yielded $300 and pans yielding from $50 to $80 are quite common. Delegate Wickersham is one of the owners.

Homestake—The tunnel is now in 590 ft. from the portal. The vein is still quite a distance ahead, although several rich stringers have been cut, which are too narrow to work.

Arizona

GILA COUNTY

Inspiration Consolidated—W. H. Aldridge, who is visiting the mines, states that the two 3-compartment, steel-concrete working shafts will be started soon and that contracts will soon be let for the grading and excavation work for the 7500-ton concentrator and the necessary railroads. Representatives of manufacturers of concentrating machinery are at the mines, including A. R. Wilfley, E. J. O'Connel, of the Deister Concentrator Co., C. I. Glassbrook, of the Mine & Smelter Supply Co., and P. H. Craven, representing the Craven slime machine. Emil Deister, formerly of the Deister Concentrator Co., is conducting tests on his new slime-treating machine at the Miami and Old Dominion concentrators.

Southwestern Miami—Churn-drill hole No. 3 has been discontinued at 780 ft.; the tools were lost in the hole and could not be recovered on account of caving. The hole is reported to have passed through 285 ft. of chalcocite-bearing schist. Holes 4, 5 and 6 are 380,330 and 240 ft. deep respectively and have not yet passed through the Gila conglomerate.

Arizona Commercial—A small force of men is at work repairing the Copper Hill shaft. The work has progressed below the 300-ft. level.

Superior & Boston—Development work continues on the 1200-ft. level with two crosscuts and a drift. Mining has been resumed on a sublevel below the sixth level and the company has commenced shipping ore to the Old Dominion smeltery.

Old Dominion—The third section of the concrete lining of the Kingdon shaft has been completed, making a total distance of 525 ft. from the collar. The fourth section will be started 155 ft. below this point.

Uneeda—C. W. Cross is developing this group of 18 claims in the Pinal Mountains, 4½ miles south of Globe. The shaft is being deepened and is now down 140 feet.

Copper Reef—Men and teams are hauling machinery and supplies from San Carlos to the mine, a distance of 15 miles. The new equipment includes an engine and compressor. These will be erected at the portal of the California tunnel, after which the driving of this tunnel will be continued.

Sho Me—Drifting on the vein on the 90-ft. level continues. The vein carries soft red hematite and some native copper. The footwall schist carries pyrite and chalcopyrite.

Gibson—The mine has shipped another car of chalcopyrite ore to the Old Dominion smeltery. Ore is reported in the face of the drift on the Pasquale vein on the fourth level. Stoping is being done above this level.

Black Warrior—Lessees are shipping three cars per week of copper silicate ore to the El Paso smeltery. The company is doing some repair work on the lower levels. Nine men are employed at present.

SANTA CRUZ COUNTY

Augusta—This mine, owned by Neil McDonald, from which several thousand tons of ore were shipped two years ago, is now being unwatered by A. G. Fraser for purposes of examination.

Little Johnny—This group has been bonded by Thomas Fraser, associated with Bisbee men.

Eureka—Shipments will begin from this mine under bond to B. F. Lindsly, the latter part of this month. Good ore is now being taken out, running high in silver, showing much wire silver.

California

AMADOR COUNTY

Central Eureka—The orebody opened on the 2700-ft. level is believed to be the west vein found in the South Eureka.

Plymouth Consolidated—The unwatering of the Pacific shaft is progressing. The purpose is to sink 500 ft. below the old workings and to prospect the mine at that level and above. This will make a total depth of 1950 feet.

South Amador—The orebody recently opened on the footwall of the 500-ft. level shows a width of 45 ft. at two points tapped by crosscuts. Drifting is in progress. A mill will be installed if the mine continues to show well.

CALAVERAS COUNTY

Lightner—All of the suits resulting from the Coleman-Lightner litigation have been settled and dismissed and the present owner is the Lightner Gold Mining Co.

Big Fraction—A 5-ft. vein of quartz has been disclosed in this mine at Mokelumne Hill. If development warrants, a stamp mill will be installed for treating the low-grade ore.

FRESNO COUNTY

An organization has been effected by the property owners on the west side of the Coalinga district to drill a test well in the paraffin sand first discovered in well No. 80 of the Standard. An assessment of $4 per acre will be paid by the owners of the lands, and if the well proves successful and profitable, the profits are to be distributed *pro rata*. This is a close corporation. Twenty acres of land have been donated to the company by A. P. May. It is believed that oil-bearing sand will be found below the brown shale. The average depth of the territory is 2000 ft. The purpose is to drill this well 3800 ft. if necessary.

INYO COUNTY

Four Metals Co.—A plan has been evolved for the settlement of the debts of this company which will insure the creditors about 90c. on the dollar. This will enable the leasers of the mine to continue operation but it is reported that the stockholders will lose their investment.

Kern County

American Oilfields Co.—A 55,000-bbl. steel tank was struck by lightning on Apr. 9. The oil caught fire, but was extinguished with a loss of only part of the contents. The fire was overcome by blankets soaked in water and placed around the edge of the roof of the buildings covering the tanks. Steam was then forced into the tanks smothering the flames.

Modoc County

Dispatches from the High Grade camp state that snow is still present in large amounts. The North Star, Sunset, Old Glory, Lucky Boy and Discovery properties are reported as having veins that show gold in panning.

San Bernardino County

California Trona—This company is doing development work on the Searles Lake properties. The wells are being sunk 75 to 100 ft. deep in developing the saline deposits. The trona deposit is also being developed. The chief value of the Searles Lake property is its deposits of trona and other forms of carbonate of soda. The potash will be treated as a byproduct. S. W. Austin was recently appointed receiver of the company.

Sierra County

Fruitvale—A quartz mill is to be installed at this mine, near Alleghany, this season. A. Fitzgerald has charge of the property.

Tightner—A shoot of ore, 100 ft. long and from 30 to 40 ft. wide, with a raise of over 100 ft., all in good milling ore, has recently been developed at this mine. About 6 ft. of this ore, along the footwall, is rich, as is usually the case along the serpentine contact in this county.

Telegraph—Additional men have been put to work on power drills at this mine, to drive the cutoff tunnel, being run to shorten the distance into the pay gravel. J. W. Finney is superintendent.

Siskiyou County

Siskiyou River Bend Mining Co.—This company, operating on Klamath River, near Walker, has purchased nearly 60,000 ft. of yellow pine, at $2 per thousand, from the Government Forest Service, to be used in the completion of the flume.

Michigan Salmon Co.—A hydraulic elevator has been installed on Know-Nothing Creek. There is plenty of water to operate the giants during the greater part of the season.

Bennett Mining Co.—This company is operating the Crapo placers with three giants. The company has leased the Nigger Hill hydraulic property to Gorham McNeil.

Colorado

Boulder County

It is stated that tungsten ore and concentrates worth $50,000 have been shipped this month by the Primos and Wolf Tongue companies. The Primos company will sink the Conger shaft to 1000 ft., and is overhauling its mill. The Wolf Tongue mill is running steadily.

Clear Creek County

Bellevue-Hudson—It is reported that a streak of high-grade gold-silver ore 8 to 12 in. wide, has been found by August Swanson & Co., leasers.

Cripple Creek District

Moose — This property, with Peter Busch as manager, has three sets of leasers at work and is producing from eight to 10 cars per month.

Montrose—Young & Herron, leasers, have opened a new orebody.

El Paso—A report is current that J. Darnell, lessee, has made a strike of rich sylvanite ore, but the company refuses to give particulars.

Elkton—On No. 1 level of the Walter vein a strike of high-grade sylvanite and free-gold ore has been made.

Lake County—Leadville

The properties being worked in the upper down-town district are the Chip, Hope, Ypsilanti, Luzerne, Jolly, Buckeye Bell and Elk.

Winthrop Gold Mining Co.—In Big and Little English Gulches, 1000 acres have been secured under bond and lease by this company; J. M. Moore, of Leadville, is president, and Harry Robinson, Denver, secretary. The ground will be worked from the Crescent tunnel which will be driven 2000 ft. John Murray is superintendent.

Hayden—Shipments of carbonate of zinc ore are again going out regularly.

Big Four—This mine has two shafts working, and lessees are shipping good ore from both.

Jolly—A 3-ft. vein of zinc ore has been opened in this mine at the head of East Fifth Street. Shipments are also going out from a body of iron ore, which was found in prospecting for the zinc ore.

Lillian—J. C. Hersey and associates are shipping fair gold ore from the lease on the north side of the Lillian in Iowa Gulch, and Murcrary has a car of gold ore ready for shipment from his lease on the same mine, in addition to the regular output of zinc ore.

Castle View—This mine is said to have enough ore opened to continue hoisting 45 tons per day for many months. The Yankee Doodle work is being done through the Castle View shaft.

Fairplay—Manager Corey expects soon to double the shipments from this mine in Adelaide Park.

Ouray County

Camp Bird—It is estimated that the company made a net profit of £36,874 during March.

Saguache County

Rawley Mining Co.—The large tunnel, which is to be 6000 ft. long, is now in 4000 ft., and is said to have cut three veins of ore. A 16-mile narrow-gage branch from Villa Grove, on the Rio Grande R.R., is said to be projected by that line. W. C. Russell is manager of the Rawley company.

Idaho

Couer d'Alene District

Bunker Hill & Sullivan—The company's new concentrator, costing $375,000, was placed in commission recently. It has a capacity of 35,000 tons per month, and is operated electrically.

Idaho County

McRae-Goldman—Good ore has been found in this mine and the owners, the American Development Co., 42 Broadway, New York, are preparing to erect a 20-stamp mill this summer to be in operation by Oct. 15, this year.

Michigan

Copper

Hancock—No. 2 vertical shaft continues sinking below 3500 ft., and is nearing the point where the Pewabic lode should be cut; when this is accomplished, lateral development will be carried on. A crosscut is being extended to open the formation cut by the shaft at the 34th level.

La Salle—It is rumored that the Tecumseh mine is to be reopened soon. Underground conditions were satisfactory when operations were suspended. With the advance in the price of copper, the property can probably be worked advantageously.

Indiana—The shaft is sinking below 775 ft. At the 65-ft. level, the crosscut has opened a formation about 30 ft. wide, carrying copper in encouraging quantities. This formation is being developed.

Osceola Consolidated—The hearing in the Turner injunction case was held before Judge Weist, at Lansing, on Apr. 22. In the examination of W. J. Uren, the latter acknowledged that he was in error in his charges against the management of the company, and also that his calculations on the operation of the North Kearsarge branch of the company were based on mistaken assumptions.

Iron

Mary Charlotte—This mine, at Negaunee, has changed from the three 8-hr. shift system to two 8-hr. shifts. About 100 of the 150 men who worked on the third shift have been discharged and the remaining 50 put on the other two shifts. The two shifts will now work from 7:30 a.m. to 4 p.m., and from 7:30 p.m. to 4 a.m., with a half-hour off for lunch in each case.

Iron County Steel Co.—A contract has been let by this Iron River company to Andrew Peterson, for exploratory work on the Jesse Armitage 40-acre tract; a test pit has been sunk to bedrock.

Oliver Iron Mining Co.—The diamond drill on Lake Michigamme, in Brown's Bay, has been taken off. The Cole & McDonald Exploration Co. has moved the drill to the shore near-by, where a deep hole is being drilled. This is on the strip of iron formation extending west from the old Michigamme mine, along the north shore of Lake Michigamme. Drilling by the Oliver company and the Jones & Laughlin company still continues in the Republic district.

Marquette County Gas & Electric Co.—This company, which operates the street railway between Ishpeming and Negaunee, and which has been taken over by the L. E. Myers Co., of Chicago, has proposed to furnish electric power to mines in the vicinity for pumping, hoisting and air compressing. A representative from the Chicago office has been figuring with several of the smaller mine operators. The power is generated by steam.

American—This mine of M. A. Hanna & Co., 10 miles west of Ishpeming, has let a contract for the erection of a concentrating mill to treat 40% iron ore of which the property contains a large amount. The mill will have one unit of a capacity of 500 tons per day and will be so constructed that more units can be added if desirable; electricity will be the power.

Missouri

Central States—This mine at Duenweg recently made a turn-in of 456,000 lb. of calamine.

Meese—This company, operating on the Snapp land at Thoms Station, has made a strike of rich ore in a drill hole, the cuttings assaying 27 per cent.

Montana

BUTTE DISTRICT

Butte-Alex Scott—On the 1700-ft. level, the drift has been driven 235 ft. on an orebody 30 ft. wide and this ore is being shipped. When the West Colusa shaft is 2000 ft. deep a raise will be driven to connect with the Alex Scott shaft. C. J. Stone is superintendent.

DEER LODGE COUNTY

Hidden Lake—A vein 8 ft. wide has been intersected in a tunnel on this group of mines, in the Georgetown mining district. The vein is 2500 ft. west of the Gold Bug vein, which is the largest in the group. A winze is being sunk on the Gold Bug vein, and is 85 ft. below the tunnel level, in ore all the way. The condition of the roads makes it impossible to ship ore at present, but there are several stockpiles, which will be shipped as soon as the roads are passable.

GARNET COUNTY

Nelson—A force of 10 men is working on the 100-ft. level of this mine at Summit, and regular shipments of ore are being made to the Shafter mill, a mile from the property. The ore is being taken from a 3-ft. vein of first-class milling ore, and work will soon be started in a tunnel which will intersect the vein at an estimated depth of 500 ft. Upon the completion of this, the company intends to build a mill of its own at the mouth of the tunnel.

JEFFERSON COUNTY

Boston & Corbin—Plans have been practically completed for the erection of a 200-ton concentrator on the property, at a cost of between $85,000 and $100,000. The tests on the ore have indicated that the company, with its own plant, can produce copper at about 5c. per lb., after crediting the silver and gold in the ore to operating costs. Although the company has sufficient capital in the treasury at present to erect the mill, it has been decided to issue 10,000 shares of treasury stock in order to have working capital when production begins, which will probably be next October. A meeting of stockholders will be held May 6, to authorize this issue by the directors.

Comet—Denver men, who believed that the vein in the bottom of this old mine, near Wickes, assayed 20% zinc, recently pumped the water from the property and found that the average of the assays from the samples taken was only about 4% zinc; the mine was again closed down after about a week taken for the inspection. The property was mined for gold and silver over 30 years ago.

Nevada

CHURCHILL COUNTY

Nevada-Hills—The mill, which has been closed since about Jan. 1, due to freezing of the company's water supply for power purposes, resumed operation Apr. 15. It is reported to be working satisfactorily at full capacity.

CLARK COUNTY

Yellow Pine—The new concentrating plant has been operated successfully during the last three months and now makes a monthly production of 1200 tons of zinc concentrate and 250 tons of lead concentrate. Oil-burners have been installed and the plant is lighted throughout by electricity. At the mine, development is progressing steadily and a large body of lead-zinc carbonate ore was recently discovered on the 200-ft. level, north of the shaft. This orebody has been followed 60 ft. on its dip, and a drift has been started to intersect it on the 300-ft. level. Bodies of high-grade zinc carbonate ore have been opened on the 500-ft. level and shipments will begin soon. The new Shay engine, recently purchased to operate on the company's narrow-gage railroad from the mine to Jean, is doing satisfactory work. Charles K. Barnes, of Los Angeles, is general manager of the company.

Prairie Flower—This property, adjoining the Yellow Pine on the north, is under lease to George Meacham, J. A. Fredrickson and M. G. Wadey. Considerable development has been done and shipments of zinc carbonate ore will be resumed soon.

COMSTOCK LODE

Ophir—Work has been resumed in the southwest drift on the 2500-ft. level, in a strong vein. The header is about 100 ft. north of a point under the first oreshoot cut on the 2400-ft. level, where a stope was carried up 48 ft. in second-class ore.

Mexican—Second-class ore is being stoped from the 2300- and 2400-ft. levels, and work has started in the west fork of the vein on the 2500-ft. level. The mill is running on ore from the surface reserve dumps, and last week treated 402 tons, averaging $24.28 per ton.

Andes—Work has been resumed in the west drift from the 350 station of the shaft. This drift was extended to the diorite wall, but on breaking through, fractures were found on the other side containing copper carbonate and oxide. Occasional high assays in gold have been found, and the drift will be extended further west.

Segregated Belcher—A raise has been started on the 1100-ft. level, near the west stope, and 12 in. of ore in the top have given assays of $50. The raise will be continued up along the course of the ore streak.

ESMERALDA COUNTY

Goldfield Merger—The 7x18-ft. shaft is 900 ft. deep and sinking about 140 ft. per month. Above the 600-ft. level, the shaft passed through two bodies of quartz. No lateral work will be done until considerable more depth has been attained.

Atlanta—The meeting to elect new officers and directors has been postponed until May 8. The first work is expected to consist in driving from the deepest level of the 1300-ft. Grizzly Bear shaft of the Consolidated into Atlanta ground, and after this to raise to the present Atlanta shafts, which are about 600 ft. deep.

Goldfield Midway—The controlling interest has passed to Philadelphia men. The officers are Peter B. Reed, president; George W. Eaton, vice-president. Arrangements are underway to sink the main shaft to 500 ft., at which point it is intended to crosscut.

HUMBOLDT COUNTY

Mines Development Co.—This company is reported to be doing some development work in the Juniper Mountain district, about 25 miles west of Lovelock. The ore is said to contain gold, silver and copper.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended Apr. 18, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,200	52,519
Tonopah-Belmont	1,850	34,276
Montana-Tonopah	1,047	16,024
Tonopah Extension	980	15,002
West End	790	11,139
Midway	......	180
MacNamara	440	4,937
North Star	......	40
Totals	8,307	134,117
Estimated value	$207,675	....

Tonopah Mining—The company's March statement shows that 14,706 tons of ore were milled of an average grade of $19.15 per ton, with total returns of $206,650 and 100 tons of concentrates, worth $44,700; the net profits for the month amounted to $150,940.

Tonopah-Midway—The extension of the vein of high-grade ore opened recently in the 565-ft. level of the Montana-Tonopah has been found at corresponding depth in this mine.

WHITE PINE COUNTY

Argus-Monitor—This mine at Taylor was examined and sampled recently by engineers, supposedly for the Tonopah Mining Company.

Nevada Consolidated—During the first quarter of 1912, net profits were 1,233,767, and production amounted to 17,578,450 lb. of copper.

New Mexico

GRANT COUNTY

Oro Grande—It is reported that these claims, sometimes known as the Apache Box, have been sold by W. N. Small and John Kniffin to Smith Brothers, of Boston and Springfield, Mass., for a large amount. It is further reported that the intention is to erect soon a 200-ton cyanide mill.

Chemung—It is rumored that Phelps, Dodge & Co., have relinquished their option on this property, that the Chemung company plans to consolidate with an adjoining property, and that active mining operations will be resumed.

SANTA FÉ COUNTY

Santa Fé—H. F. Wierum, consulting engineer, is at the property, arranging for the resumption of work at the mine and smeltery. Operations are expected to start about June 15. Additional machinery has been contracted for. Sufficient ore is said to be opened to supply the smeltery for several years.

SOCORRO COUNTY

Deadwood—The mine has been unwatered below the 300-ft. level and within 10 days the lower workings will probably be drained. A new orebody has been opened on the 200-ft. level.

Socorro—The 700-ft. level is the best yet opened in the mine and the shaft development indicates even better ore on the 800 level.

Ernestine—The second cleanup for April is being smelted. Mine developments continue in satisfactory ore.

Oaks—The Pacific tunnel has passed through the oxidized zone into sulphide ores.

Treasure—A large tonnage of reserve ore is accumulating. Two hundred tons per day are being broken, of which 70 tons are being drawn and transported to the mill.

Oregon

BAKER COUNTY

Bonanza—At this mine a drift is being driven to connect a portion of the workings with a shaft, but no ore is being produced at present.

Ibex—It is reported that this property, which was closed down during the winter, will resume about June 1, and that a mill will be installed during the summer.

Cougar—The property has recently been taken over by Spokane men, and active operations will probably be resumed.

Mammoth—A second-hand stamp mill, purchased from the Golden Chariot company, is being erected at this property.

Dixie Meadows—This property, controlled by a New York syndicate, headed by L. Vogelstein & Co., and closed down since Jan. 1, is still idle, and it is not reported when operations will be resumed.

Highland—A 50-ton mill has been completed, and hereafter the product, which has been shipped direct to smelteries, will be milled.

Tennessee

Tennessee Copper—Present production amounts to about 1,250,000 lb. of copper per month and 600 tons of sulphuric acid per day.

Southern Calcium Phosphate Co.—This company, organized at Chattanooga, and capitalized at $2,500,000 will erect plants at Atlanta, Hillsdale and Macon, Ga., so it is reported, and also at Montgomery, Birmingham, Selma and Mobile, Ala. The plan is to manufacture fertilizer without sulphuric acid, using a process invented by George Fishburne, president of the company.

Texas

Holloway—Another gas well has been brought in on this tract near Petrolia, and is reported to be running more than 25,000,000 ft. per day.

Utah

BEAVER COUNTY

Indian Queen—This property is being worked under lease, with intermittent shipments. The work will probably be taken over by the company, at the expiration of the lease in June.

JUAB COUNTY

Chief Consolidated—Work is being done in ore at the south end of the 1400-ft. level; also out into the Townsite territory on the same level.

Gold Chain—Ore is being mined from the 300-, 400- and 700-ft. levels, and drifting for this ore will be started on the 1000-ft. level.

Victoria—Ore is being followed on the 1200, the deepest level. A statement to stockholders is being prepared and will be issued soon.

Beck Tunnel—The indebtedness is being reduced monthly. A drift has been driven from the Humbug stope 150 ft., showing some ore all the way. The most important work at present is being done on the 175-ft. level, where drifting is being done on the vein opened in the tunnel level farther north.

Black Jack—Work through the Star shaft continues, and a cave has been opened on the 300-ft. level. Some fair shipping ore left in the old stopes on the 100 is being broken down for shipment.

SALT LAKE COUNTY

Ohio Copper—During the first week of April, the amount of ore handled by the mill was lowered to 1500 tons per day, on account of mechanical difficulties. The average for the following eight days was 1960 tons. The ore treated recently has carried a high excess of iron, reducing both the ratio of concentration and the usual amount of copper.

Columbus Consolidated—A car of ore netting $55 per ton has been marketed, and two more of a similar grade are expected soon.

Utah Copper—During the year ended Dec. 31, 1911, reserves were increased about 50%, totaling 301,500,000 tons on Jan. 1, 1912. The estimated copper content decreased from 1.67% to 1.532%. The average content of the ore treated in 1911 was 1.51%, and 93,514,419 lb. of copper were produced at a cost of 7.86c. per pound.

SUMMIT COUNTY

Park City shipments for the week ended Apr. 19 totaled 4,511,380 pounds.

Thompson-Quincy—The limestone-quartzite contact has been cut in the raise, being driven from the 1600-ft. level. The ground is heavy and an incline will probably be driven to reach the contact at another point.

Silver King Coalition—Forces have been increased to 400 men, and the output for the week ended Apr. 19 was 1079 tons. This tonnage is larger than formerly.

New York Bonanza—A strike is reported between the 200- and 300-ft. levels, about 150 ft. from the shaft. During March 94 tons of ore were shipped.

UTAH COUNTY

Eva—Shipments have been resumed and six cars are reported ready for the market.

Canada

ONTARIO

St. Anthony—Gold production is being well maintained at this Sturgeon Lake mine. A gold brick containing 200 oz. was shipped recently, being the sixth sent out since operations were resumed. A new compressor and three boilers of 100 hp. each, have been installed and 10 machine drills are at work underground.

Hughes—The main shaft is 100 feet deep and a crosscut will be run from this point to intercept the vein. At the 50-ft. level there were 11 ft. of quartz with only a 4-in. pay streak.

ONTARIO-COBALT

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Apr. 26, and for the year to date, are:

	Week	Year
La Rose	76 42	1074 70
Coniagas		546 35
O'Brien	.	199.78
Right of Way		110.30
Chambers-Ferland		129.60
McKinley-Darragh	78 07	920 72
Nipissing	79 88	553 00
Hudson Bay		249 88
Buffalo	28.35	350 73
Crown Reserve	21.37	170 48
Cobalt Townsite	56.17	376 48
City of Cobalt	....	145.84
Trethewey	..	147 06
Colonial	...	20.00
Kerr Lake		231 48
Cobalt Lake	..	136 01
Drummond		300 32
Temiskaming		260 37
Beaver		101 99
Wettlaufer	.	111.21
Provincial	.	22.22
Casey Cobalt	..	24.50
Totals	340 26	6,182.78

BULLION SHIPMENTS IN OUNCES

Mine	Week	Year to Date
Nipissing	65,818 00	1,190,348 52

Arrangements have been made whereby the low-grade ore from the Kerr Lake and the Crown Reserve mines, formerly sent to the Nova Scotia mill, will be treated by the Northern Customs concentrator, which has increased its capacity.

Wettlaufer-Lorrain—During the quarter ended Mar. 31, 106 tons of ore were mined, yielding 264,683 oz. of silver. Total costs were 19.289c. per oz. and profit 38.61c. per oz. Development work amounted to 456.5 ft., but disclosed no new orebodies, although it opened milling ore. Drifting was done on the Keeley property but results were discouraging and the option was given up. Other properties were investigated but with negative results.

Nipissing—The following financial statement as of Apr. 1 has been issued: Cash in bank, $1,091,826; ore in transit and at smelteries, $254,936; ore sacked for shipment, $203,650 and $1,550,412 total.

La Rose—The financial statement as of Apr. 1 shows: Cash in bank, ore in transit and at smelteries, $1,619,476; ore sacked ready for shipment $89,841 and $1,709,318 total.

Donaldson—A plant is being installed as rapidly as possible at this Elk Lake mine, and is expected to be ready for operation in a few days.

Regal—This property, which immediately adjoins the Donaldson at Elk Lake, will be developed under the supervision of N. R. Morrison. The plant of the Big Six has been purchased.

ONTARIO-PORCUPINE

Three Nations—A narrow vein of rich ore has been found in the drift on the 100-ft. level.

Keora—Work has ceased on this property for the present. Negotiations for its purchase are under way.

Crown Chartered—Recent development is giving satisfactory results, good ore having been encountered in the deepest workings.

La Palme—Negotiations are under way for the purchase of this property by Montreal men.

Porcupine Lake—The vein under the lake has been cut by the diamond drill at a depth of about 400 feet.

Dome—This company has made its first shipment of bullion amounting to 1600 oz. worth $25,000. Owing to slight trouble with the Pachuca tanks the full complement of stamps is not yet running. This defect will be remedied soon, when the 40 stamps will be put in operation.

McIntyre—This company has shipped over $11,000 worth of bullion from the 10-stamp mill.

Timmins Syndicate—Contracts have been let to George Harris for sinking two shafts on the Miller-Middleton properties, west of the Hollinger, and one shaft on the Dixon south of the McIntyre.

Miller-Porcupine—At a meeting to be held May 4, the shareholders will authorize the directors to negotiate a sale of all or part of the company's property.

Jowsey—This property, comprising 260 acres on which six veins have been uncovered, has been purchased by the Gold Peak Mining Company.

North Dome—At the 50-ft. level a lens of quartz showing visible gold has been found in a crosscut 34 ft. from B shaft. The drift from the main shaft is also in ore.

Scottish-Ontario—This mine has been unwatered and the property made ready for inspection by a representative of the English syndicate that has a controlling interest in it. The examination is expected to determine whether further development will be undertaken.

Mulholland—The main shaft is down 160 ft. Drifting on the 100-ft. level shows the vein about 8 ft. in width, carrying good ore. A second level will be run at 200 ft. Electrical machinery will be installed. W. S. Edwards, of the Dome, is president of the company.

Hollinger—This winze below the 200-ft. level is down 21 ft. Since the publication of the annual report the following work has been accomplished: On the 100-ft. level, 423 ft. of drifting on the No. 2 vein, 288 ft. on the No. 4 vein, 69 ft. on the No. 8 vein and 26 ft. of sinking on the No. 1 vein; on the 200-ft. level, 137 ft. of drifting on No. 1 vein, 85 ft. on the No. 2 vein and 134 ft. of crosscutting to reach No. 4 vein. Mr. Robbins states that the results of this work bear out the conclusions given in his report.

Mexico

Dispatches state that the U. S. Army transport "Buford" left San Francisco on Apr. 28, for points on the west coast of Mexico, to take off refugees.

Mines Company of America—During the year ended Dec. 31, 1911, the company paid dividends of $798,917. Total receipts were $702,808; expenditures, $17,472; net profit, $685,336 equal to 8.29% on the outstanding capital stock.

CHIHUAHUA

La Republica—During the quarter ended Mar. 31, 2683 tons of ore were milled, worth 173,774 pesos; operating charges were 129,560 pesos; construction and equipment, 21,690 pesos. Gordon Hardy, consulting engineer, states that operations are greatly hampered and restricted by insufficient labor and other handicaps due to revolutionary troubles.

NUEVO LEON

Soledad—A 4-ft. vein of good gold and silver ore is reported to have been opened on the north side of the dike that cuts the Mololoa vein.

SONORA

Calumet & Sonora—No actual mining work is being done at present but the mill is treating accumulated ore. It is expected that the mill will close soon. It is rumored that negotiations are pending for the sale of the property.

South America

PERU

The discovery of emeralds is reported from the Department of Cuzco. The property is 12 km. from Chuquicahuana, in the Cerro Takee-Ccacca, 13,500 ft. above sea level and is reached by a good road. Mr. Colmenares, of Lima, has denounced the property.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, May 1—The coal trade in the West is gradually settling down, as the district scales are adjusted on the new basis. Trade is rather quiet, as many large consumers are well stocked.

The anthracite sub-committee has agreed upon a compromise plan, which is to be submitted to the general committee for approval. Briefly this plan provides for an increase of 10 per cent. in wages; the abolition of the present sliding scale; a new arrangement of local committees for the adjustment of minor differences which may arise from time to time, and a partial recognition of the union. It is believed that this compromise will be approved and that work may be resumed before the end of May—by May 15, probably.

Coal and coke carried on all lines of the Pennsylvania R.R. east of Pittsburg and Erie three months ended Mar. 31, short tons:

	1911	1912	Changes
Anthracite........	2,988,025	3.288,737	I. 300,710
Bituminous	10,162,175	12,169,935	I. 2,007,760
Coke............ ...	2,740,636	3,111,786	I. 371,152
Total............	15,890,736	18,570,458	I. 2,679,622

The total increase was 16.9% this year.

Imports of coal into Spain two months ended Feb. 29 were 397,489 metric tons, an increase of 90,333 over 1911. Imports of coke were 78,193 tons, an increase of 29,506 tons.

United States Foreign Trade—Imports of coal and coke in the United States three months ended Mar. 31, long tons:

	1911	1912	Changes
Anthracite....	. ...	25	I. 25
Bituminous	426,259	364,064	D. 62,195
Coke	37,791	21,521	D. 16,270
Total......	464,050	385,610	D. 78,440

Canada furnished this year 316,759 tons of coal and nearly all the coke; Australia 40,483 tons of coal.

Exports of coal and coke from the United States, with coal furnished to steamships in foreign trade, three months ended Mar. 31, long tons:

	1911	1912	Changes
Anthracite .	608,291	730,811	I. 122,520
Bituminous. .	2,174,121	2,336,014	I. 161,893
Coke	257,893	183,043	D. 74,850
Bunker coal.......	1,552,885	1,751,919	I. 199,034
Total....... ...	4,593,190	5 001,787	I. 1,408,597

The bunker or steamship coal is practically all bituminous. Canada took this year 2,020,969 tons of coal; Cuba and the West Indies, 452,151; Mexico, 81,614; Panama, 80,160 tons.

IRON TRADE REVIEW

New York, May 1—The iron and steel markets continue strong, and indications are favorable for some time to come.

In finished material, mills are generally working well up toward capacity, in almost all lines. Prices continue to firm up and in all advances are the rule. Structural material seems to lag behind as far as prices are concerned, and orders are still taken at pretty low figures. The railroads are doing more in ordering cars and bridge work, while good rail orders are gradually coming in.

In pig iron basic has been especially active and some good tonnages have been placed. Foundry iron has also sold well, and there are reports that some bessemer pig will be taken from merchant furnaces. Prices are firmer and sellers are holding to advances, especially in seaboard territory.

Export trade is active. The coal strike in England sent some European orders here, owing to the stoppage of English works. Our mills have some bids in on a large quantity of rails for Canada.

United States Steel Corporation—The statement for the quarter ended Mar. 31 is as follows:

Net earnings	1911	1912
January	$5,869,416	$5,243,406
February	7,180,928	5,427,320
March .	10,468,859	7,156,247
Total	$23,519,203	$17,826,973
Depreciation, etc		$4,148,444
Internal and sinking funds		7,311,963
Total charges		$11,460,407
Surplus for the quarter		$6,366,566
Dividend, 1¾% on preferred		$6,304,919
Dividend, 1¼% on common		6,353,781
Total dividends.		$12,658,700
Deficit		$6,292,134

The surplus for the quarter compares with $12,689,855 for the corresponding quarter last year. The usual dividends on both preferred and common stock were declared for the quarter, although the common dividend was not earned.

The earnings reported by the Steel Corporation for the first quarter were smaller than generally assumed in the trade. In some quarters the suggestion is made that as trade prospects have greatly improved, the allowances were on a liberal scale, resulting in low earnings, as a basis for the better showing which is expected for the second quarter. We estimate the Corporation's shipments in the quarter to about 2,600,000 tons, which would mean earnings of about $6.75 per ton. This compares with $11.01 in 1911 and $16.59 in 1902, which year showed the maximum earnings per ton. Shipments during the current quarter should reach or exceed 3,000,000 tons, and while the current shipments are chiefly on old contracts, the average realized price should be somewhat higher than in the first quarter. An average increase of $1.25 per ton would make $8 per ton profits in this quarter, so that earnings would run about $25,000,000. According to last year's showing the Corporation requires precisely $100,000,000 to meet all charges, including the regular dividends.

Birmingham

Apr. 29— There has been a steady selling of pig iron by Southern makers and general reports are most encouraging. Inquiry elicits the information that practically every manufacturer of iron in this section of the country has sold during the present month considerably more iron than was produced. It is now estimated that by June 1 there will be bare storage yards noted. It is announced that during the coming month two blast furnaces will resume operation in order that all demands can be met promptly. The quotations for iron are firm at $11 per ton, No. 2 foundry. Sales are not mentioned any more at $10.50 and $10.75, but all talk is to the effect that $11 is the price. There is no probability of higher quotations being realized in the near future. The report of another sale of 20,000 tons is heard, making something like 110,000 tons of pig iron sold to cast-iron pipe interests in the last 30 days. The pipe makers have orders in hand and others in sight that promise to keep the plants going for many months yet.

Steel conditions, in fabricated steel, rails and steel-wire goods, are taking on a little strength in the South. Charcoal iron is a little firmer, too, with the prices still $22@22.50 per ton. The make is not very large and will not be at any time this year, but two or three small furnaces are prepared to produce charcoal iron. Scrap iron is demanding a little more attention.

Chicago

Apr. 30— There has been a large sale of pig iron in the last week, and the outlook, from the seller's point of view, is decidedly better. Lots of 1000 to 5000 tons have been disposed of in the last fortnight, and the tendency is toward increasing confidence in the future and larger sales among all the melters. In consequence, prices are firm.

No. 2 Northern iron now brings $14.50@15, at the furnace, and No. 2 Southern $10.50@11, Birmingham, which is equivalent to $14.85@15.35, Chicago. At these prices, most of the business for the third quarter and last half is being done, though in some cases slightly higher prices are asked for last-half delivery. Lake Superior charcoal is firm at $16@17 per ton.

The demand for iron and steel products has not been materially checked by advances in prices applying nominally for the last 10 days of the month, but practically spreading out to become effective in May. On structural material there is firmness generally and a slowly increasing demand for bridge and building work, which, with the adjustment of labor troubles, seems bound to go rapidly forward. Railroad purchases in this respect continue good, with 1.43c. generally asked, for Chicago delivery. Railroad supplies sell well, with a number of orders for standard rails pending and track fastenings in very good demand. Bars are active, with the probability of a slackening of business on May 1; soft-steel bars bring 1.33@1.38c., and iron bars 1.15@1.20c., with the lower prices predominating. Plates are actively in demand, at 1.43c. for ¼-in. tank plates. The demand for sheets and wire goods is reported very good, with country trade especially active. General business conditions are encouraging for heavier business in the future.

Cleveland

April 29—The Lake begins to look like an early opening, and a pretty good lot of ore is expected in May.

Pig Iron—Activity continues. The recent sales have been largely of basic and malleable iron. Basic is firmer and $13, furnace, is asked on recent sales. Other quotations, Cleveland delivery, are $15.15 for bessemer, $13.25@13.50 for No. 2 foundry and $15.50@16 for Lake Superior charcoal.

Finished Material—The buying of bars has subsided for the present. Many contracts were placed before the advance in prices took effect. Structural steel has been active, and has been the prominent feature this week.

Philadelphia

May 1—A few eastern Pennsylvania furnaces, having secured considerable business, have put prices at a point which is checking the placing of additional orders at the present time. Less business has been transacted during the past week. A number of inquiries are pending from New England, New York and New Jersey which total a large amount, but there appears to be no immediate probability of much of this business being closed right away. The most active iron on the list at present is low-grade foundry for summer delivery, but business of this sort is not encouraged by the stronger quotations. The strength of No. 3 foundry seems to be assured by the low condition of stocks and the oversold condition of several Southern furnaces which have been taking the lead in securing business for pipe. Quotations for No. 2 X foundry have been permanently advanced, while gray forge and basic are available at any desired delivery at figures heretofore prevailing. The tone of the entire market has been strengthened by two facts, namely, the depletion of stocks and the volume of inquiries which have actually been made, is likely soon to appear. Quotations are $15@15.50 for No. 2 X, with Southern 25c. or 50c. below, and gray forge and basic at $14.50 per ton.

Steel Billets—Latest quotations for billets show an advance of $1 on open-hearth, without an urgent demand. Consumers are pretty well supplied for the present, but the feeling prevails that billets are likely to go on the war path.

Bars—Bars have advanced enough to stimulate halting demand. The refined is feeling the influence of the strong undertone and jobbers are quite active in replenishing depleted stocks.

Sheets—Sheets have been quiet for the week. The mills are well supplied with business.

Pipes and Tubes—Cast pipe is strong and some recent contracts have been closed on more favorable terms. Tubes are strong with only a moderate few orders.

Plates—Only small orders have been placed for plates, but the large volume of business in sight for car work, ship work and general construction is imparting a tone to the market which makes recent maximum quotations really minimum quotations for summer delivery.

Structural Material—Practically the same condition prevails, but owing to the sold-up condition of car works, immediate orders are hardly probable, while for ship work more encouraging indications are apparent.

Scrap—The cleaning up of desirable scrap continues and quotations were advanced late last week, though the negotiations in hand at previous quotations if closed—as they probably will be—will make a scarcity in the more desirable grades.

Pittsburg

Apr. 30—The iron and steel market has reached an uneventful stage in its development. The price advances are practically over for the time being, and buying by jobbers and ordinary manufacturing consumers is on a light scale, while their specifications on old contracts are good, but by no means phenomenal. There is no quarter from which an added stimulus can come except from the railroads, and it is still confidently expected that they will become heavy buyers within the next 30 to 60 days. This would readily save the situation from the lethargy into which it is likely otherwise to drop when present low-priced contracts are worked out with jobbing and manufacturing consumers. It can hardly be expected that these will quickly take hold at the advanced prices of today as soon as their low-priced contracts run out.

The strongest lines in the market are bars, plates and shapes, which are firmly established on the basis of 1.20c. for bars and 1.25c. for plates and shapes. The line which has experienced the least improvement is wire products. The spring business has proved quite disappointing and the mills are still making deliveries on $1.50 and $1.55 contracts, probably in about equal proportions, and selling very little on the present basis of $1.60. It is not improbable that some $1.50 contracts have been extended when they were really worked out. Mills in the Pittsburg district are operating substantially at full capacity, and have turned out as large tonnages as in March, when many mills made new tonnage records for a month.

Pig Iron—The local pig-iron market has been very quiet. There have been rumors of large inquiries, but little buying seems to result, and the only interesting expectation is that the Steel Corporation will buy a block of bessemer iron, perhaps 20,000 or 25,000 tons. This was under consideration a week ago, but nothing definite has been developed. We continue to quote: Bessemer, $14.15@14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; forge, $12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The English makers have made another advance in ferromanganese, dating from Apr. 29, of $2.50, putting the price to $46, Baltimore, freight to Pittsburg being $1.95. The previous advance was $2.50, Apr. 15. Small lots for spot shipment have been bringing $46 up to $50, Baltimore.

Steel—The steel mills are practically out of the market for any early delivery of billets or sheet bars, and there are only occasional offerings by brokers, so that the market is largely nominal. We quote billets at $20.50, and small billets and sheet bars at $21, f.o.b. maker's mill, Pittsburg or Youngstown. Wire rods are $25, Pittsburg. There is very little fresh demand for any of these products, consumers being well covered, but specifications on contracts are very heavy.

Sheets—The market does not seem to firm up any further, despite the fact that the leading interest withdrew to the extent of quoting a minimum of 1.95c. on black and 3.00c. on galvanized. While 1.90c. on black and 2.90c. on galvanized can be quoted as the market, instances are frequently coming out of these prices being shaded $1 a ton. We quote painted corrugated at $1.35 per square and galvanized at $2.55 per square, these prices being sometimes shaded. The American Sheet & Tin Plate Co.'s extras are 5c. per 100 lb. for corrugating, and 15c. extra for painting gages 25 to 28, inclusive.

St. Louis

Apr. 29—The demand for pig iron continues quite brisk. A number of inquiries have been coming in for delivery during the third and fourth quarters. The demand for finished products remains fairly good. The steel foundries and railway-supply companies all seem to have a good volume of business.

No. 2 foundry is bringing from $10.50 for immediate shipment to $11 for third-quarter shipment, f.o.b. Birmingham, or $14.25@14.75, f.o.b. St. Louis. Northern iron is being quoted around $14.50 per ton. The demand for Northern iron is light.

Connellsville foundry coke is bringing $5@5.15 per ton, St. Louis.

Iron Ore Trade

Nearly all the large buyers of Lake ore seem to be supplied, and buying is slow. The ice on the Lakes is going off rapidly and the first shipments of ore down are expected this week, having already left Duluth.

The first cargo of ore from Wabana, Newfoundland, is expected at Philadelphia this week. It is understood that contracts already made for this ore cover between 150,000 and 175,000 tons.

METAL MARKETS

New York, May 1—The metal markets show comparatively little change. The principal incident has been a sharp advance in tin.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Mar. 1912..	$ 7,453,589	$ 4,335,67	Exp. $3,117,911
" 1911..	505,615	4,119,063	Imp. 3,613,448
Year 1912..	19,958,088	12,414,195	Exp. 7,543,893
" 1911..	1,854,014	19,465,737	Imp. 17,611,723
Silver			
Mar. 1912..	5,806,307	3,711,734	Exp. 2,094,573
" 1911..	5,896,795	3,197,409	Exp. 2,699,386
Year 1912..	16,955,988	11,850,220	Exp. 5,105,768
" 1911..	16,001,842	10,646,781	Exp. 5,355,061

Exports from the port of New York, week ended Apr. 27: Gold, $564,733, chiefly to Argentina; silver, $872,939, principally to London. Imports: Gold, $216,266; silver, $149,534, from Central and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Most of the supplies arriving went to the Bank of England.

Iridium—Prices are unchanged at $64 per oz. for pure metal, New York.

Platinum—Business is quiet and prices are unchanged. Dealers ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

The Consolidated Goldfields of South Africa have purchased La Lozana and some adjoining platinum properties near Buena Ventura, Colombia. This probably means that those properties will be systematically worked.

Silver—The market advanced this week to 28$\frac{3}{16}$d. in London, the highest point touched on the recent rise. The strength of the market is due to good buying for the Indian Bazaars and to Continental purchasers; and while there may be some reaction, the undertone continues strong.

SILVER AND STERLING EXCHANGE

Apr.-May	25	26	27	29	30	1
New York....	60¾	60¾	60⅞	60⅝	61¼	61¼
London .	27$\frac{13}{16}$	28	27$\frac{13}{16}$	27$\frac{15}{16}$	28$\frac{3}{16}$	28$\frac{3}{16}$
Sterling Ex..	4.8705	4.8705	4.8700	4.8690	4.8675	4.8670

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Apr. 18, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India....	£3,023,500	£2,213,300	D. £810,200
China	752,800	520,000	D. 232,800
Total	£3,776,300	£2,733,300	D. £1,043,000

India Council bills in London averaged 16.4d. per rupee for the week.

Copper, Tin, Lead and Zinc

LONDON

Apr.-May	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
25	70¾	71⅛	75¼	203½	199¾	16⅝	25¾
26	70$\frac{5}{16}$	71$\frac{3}{16}$	75¼	206	202½	16½	25¾
27	......	......	......	......	......	.....	....
29	70$\frac{11}{16}$	71$\frac{9}{16}$	75½	212	209	16⅝	25¾
30	70⅜	71$\frac{3}{16}$	75¼	210½	208	16½	25¾
1	70$\frac{3}{16}$	71	75¼	210¾	208¾	16½	25¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The business during the week of Apr. 25-May 1 was very light, transactions having amounted to but a few millions of pounds. These were chiefly for domestic account, there having been no demand from Europe. The speculative offerings to which we referred last week seem to have been cleaned up, and the recent business has been done by first hands, several of the agencies having made sales at 15.80@15.87½c., delivered, usual terms. But little business in Lake copper has been reported to us, and the quotations for that kind are largely nominal. The relative stagnation of the market this week and the slightly lower prices accepted are not considered in the trade to be indicative of any impending change in the situation. Manufacturers, both in this country and in Europe, are very busy, but being well supplied with copper and having bought considerable ahead, are at the moment not buying. Producers, on the other hand, are in a very comfortable position, and generally are holding firm for their prices. At the close, Lake copper is quoted at 15⅞@16c., and electrolytic copper in cakes, wirebars and ingots at 15.65@15.75c., while casting is quoted nominally at 15¼@15⅝c. as the average for the week.

The standard market in London has been dull and has fluctuated within narrow limits. On Monday, spot sold at £70 13s. 9d. and three months at £71 11s. 3d., and on Wednesday it closed at £70 3s. 9d. for spot and £71 for three months.

The additions to the Baltimore copper refinery have now been completed and put into use. The present capacity of this refinery is about 24,000,000 lb. per month. At the Raritan refinery the old tank house is being rebuilt along the lines of the new one.

NEW YORK

Apr.-May	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
25	15⅞ @16	15.70 @15.80	44½	4.20	4.07½ @4.10	6.65 @6.80	6.50 @6.65
26	15⅞ @16	15.65 @15.75	45	4.20	4.05 @4.07½	6.65 @6.80	6.50 @6.65
27	15⅞ @16	15.65 @15.75	45¼	4.20	4.05 @4.07½	6.65 @6.80	6.50 @6.65
29	15⅞ @16	15.65 @15.75	46½	4.20	4.05 @4.07½	6.65 @6.75	6.50 @6.60
30	15⅞ @16	15.65 @15.75	46¼	4.20	4.05 @4.07½	6.65 @6.75	6.50 @6.60
1	15⅞ @16	15.65 @15.75	46¾	4.20	4.05 @4.07½	6.65 @6.75	6.50 @6.60

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 17@17⅛c. base, carload lots at mill.

Copper exports from New York for the week were 5215 long tons. Our special correspondent gives the exports from Baltimore at 1430 tons.

Tin—While during last week the metal evinced stubborn strength and advanced in an orderly fashion, the market became very much excited the beginning of this week. Quotations were advanced by leaps and bounds, buying became general, and transactions increased to large proportions. At one time during the excitement three months' tin touched £215. This movement is due to the excellent statistical position of the metal and its continually increasing consumption, especially in this country. Conditions have become quieter at this writing, and the market closes steady at £210 15s. for spot and £208 15s. for three months, and at 46⅜c. here for May tin.

Tin output of Federated Malay States in 1911: Perak, 437,339; Selangor, 231,175; N. Sembilan, 29,230; Pahang, 43,954; total, 741,698 pikuls, or 44,149 long tons. This is an increase of 286 tons over the previous year.

Arrivals of Bolivian tin in England in March, as reproted by H. A. Watson & Co., included 2247 tons concentrates and 8 tons bars; equivalent to 1356 tons fine tin.

Lead—The market is quiet and transactions have taken place in Western lead at slightly lower figures. At the close, St. Louis is quoted at 4.05@4.07½c. and New York at 4.20 cents.

The London market is somewhat easier, Spanish lead being quoted at £16 10s., and English 2s. 6d. higher.

Spelter—The demand for this metal has been light and offerings to large buyers have been met by bids that have not been entertained. The quantity of metal available for early delivery has increased materially and this has brought the market into more normal condition. During this change there has naturally been some irregularity in transactions according to the extent of shopping. During the early part of the week spelter for May delivery realized 6.65c., St. Louis, but during the latter part was available at 6.60c., while June-July was offered at 6.50c.

The London market for spelter is quiet, good ordinaries being quoted at £25 15s., and specials at £26 per ton.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7½c. per lb., New York.

Other Metals

Aluminum—Business has been more active, and there have been a number of sales. Prices are firmer and we quote 20½@22c. per lb. for No. 1 ingots, New York.

The foreign market has had a good advance on the statement that the old aluminum syndicate will be renewed. Ingots cannot be bought for less than 15c. This has caused the advance here.

Antimony—Business remains quiet and prices are unchanged. Cookson's is 8@8¼c. per lb.; Hallett's and U. S. are 7¾; while 6⅞@7c. is quoted for Hungarian, Chinese and other outside brands.

Quicksilver—Business is good again, but prices here are unchanged. New York quotations are $41.50@42 per flask of 75 lb., while 60@62c. per lb. is charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. The London price was dropped from £8 12s. 6d. to £8 early in the week, but today is raised again to £8 5s. per flask; while £8 is asked by second hands.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 50@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Imports and Exports of Metals

Exports and imports of metals in the United States, three months ended Mar. 31, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess	
Copper, long tons	96,342	47,906	Exp.	48,436
Copper, 1911..	75,583	37,591	Exp.	38,992
Tin, long tons..	149	12,793	Imp.	12,644
Tin, 1911........	101	13,972	Imp.	13,871
Lead, short tons	17,768	25,801	Imp.	8,033
Lead, 1911.....	18,211	21,343	Imp.	3,132
Zinc, short tons..	2,985	2,209	Exp.	776
Zinc, 1911 ..	1,079	579	Exp.	500
Nickel, lb........	6,265,120	8,441,230	Imp.	2,176,110
Nickel, 1911...	6,121,318	7,195,391	Imp.	1,074,073
Antimony, lb...	40,320	3,274,270	Imp.	3,233,950
Antimony, 1911.	150,704	1,641,670	Imp.	1,491,966
Platinum, oz	....	21,205	Imp.	21,205
Platinum, 1911.	47	27,579	Imp.	27,532
Aluminum, lb..	9,656	6,233,754	Imp.	6,224,098
Aluminum, 1911	....	....	....	
Ores, etc.				
Zinc in ore, lb .	9,174,701	7,201,306	Exp.	1,973,395
In ore 1911..	4,874,020	10,853,519	Imp.	5,979,499
Zinc oxide, lb. .	7,870,415	....	Exp.	7,870,415
Zinc oxide, '11..	6,177,577	....	Exp.	6,177,577
Zinc dross, lb....	352,650	....	Exp.	352,650
Zinc dross, '11..	1,187,482	....	Exp.	1,187,482
Chrome ore, l.t..	....	16,851	Imp.	16,851
Chrome ore, '11	....	11,479	Imp.	11,479

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 11,824 tons; exported, 7660. Imports of aluminum were not reported previous to July 1, 1911. The metal exports given above include re-exports of foreign materials.

Zinc and Lead Ore Markets

Platteville, Wis., Apr. 27—The highest price paid this week for zinc ore was $53.50 the base price, 60% zinc, was $52. The base price paid for 80% lead ore was $53@54 per ton.

SHIPMENTS, WEEK ENDED APR. 27

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point........	983,300	..	....
Galena...	777,600	65,400	.. ....
Benton...............	560,000	....	522,100
Platteville	408,500	....	.... ..
Cuba City...........	319,500	166,860	80,000
Hazel Green.........	300,000	120,000	....
Shullsburg......	281,500	....	....
Rewey.................	82,000	....	....
Harker..	64,000	....	....
Linden	....	....	60,000
Total....	3,776,400	352,260	662,100
Year to date.......	64,295,440	2,121,790	7,541,750

Shipped during week to separating plants, 1,544,110 lb. zinc ore.

Joplin, Mo., Apr. 27—The high price of zinc sulphide ore is $56, the base price, per ton of 60% zinc, $50@54. Zinc silicate base $25@28 per ton of 40% zinc. Average price, all grades of zinc, $51.08. Lead ore sold from $52 to $55, at an average of $53.80 per ton.

Realizing that increasing shipments of Western zinc ore are moving toward the smelters, sellers become more willing to accept current offerings, and buying was easier on practically the same offerings as last week.

SHIPMENTS, WEEK ENDED APR. 27

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,825,700	......	879,190	$149,106
Joplin	1,997,730	......	153,240	57,075
Miami	698,950	......	555,430	30,345
Galena.	853,220	......	......	22,180
Alba-Neck ...	558,860	......	24,090	15,726
Duenweg....	486,650	......	61,230	14,304
Cave Springs.	360,260	......	......	9,725
Oronogo......	251,620	......	......	9,206
Spurgeon ..	62 690	191,450	178,710	9,195
Carl Junction	205,000	......	......	5,740
Granby	88,410	115,030	12,920	3,605
Carthage	125,300	......	......	3,140
Jackson......	56,320	......	16,230	1,840
Wentworth...	61,220	......	.....	1,530
Quapaw......	51,870	. ....	......	1,190
Totals ...	10,783,800	306,480	1,881,040	$333,907
4 mos.......	169,815,440	10,019,260	28,461,820	$4,984,288

Blende val. the week, $278,755; 4 mos., $4,057,108
Calamine, the week, 4,553; 4 mos., 143,568
Lead value, the week, 50,601; 4 mos., 783,614

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January....	$41 85	$44.90	$40 55	$43.54	$55 68	$58.92
February....	40 21	45 75	39 16	43 31	54 46	52 39
March.......	39 85	51.56	38.45	49.25	54.57	54.64
April.........	38 88	52.00	37 47	50.36	56 37	54 18
May....	38 25	.....	36 79	. ....	55 21	. . ..
June	40 50	......	38 18	.....	56 49	......
July....	40 75	......	38 36	......	58 81	......
August	42 50	......	41 28	.....	60 74	......
September .	42 63	......	41 29	.....	59 33	......
October	42 38	......	40 89	.....	54 72	......
November.	45 10	.... ..	43 25	..	57 19	....
December	44 13	.....	40.76	. . ..	62 03	......
Year.	$41.45	......	$39.90	.....	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, May 1—Business continues unchanged and the markets generally are in good condition.

Copper Sulphate—Business is good. Quotations are $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Demand continues good and supplies are still scarce. For white arsenic $3.75@4 is quoted for spot, with $3.50@3.75 per 100 lb. for futures.

Nitrate of Soda—The market is steady and quotations are unchanged at 2.40c. per lb. for spot, and 2.40c. for future positions up to Aug. 1; while 2.35c. is asked for deliveries later than that date.

CURRENT WHOLESALE PRICES

Ammonium sulphate	cwt.	3 40
Arsenic, white	lb.	0 03¾@0.04
Barytes, ground	sh. ton	12 50@14 00
" floated	sh. ton	16 00@17 00
Calcium acetate, gray	cwt.	2 25@2 30
carbide, ton lots f.o.b. Niagara Falls	sh. ton	70 00
Carbons, good drill quality,	carat	75 00@85 00
Cement, Port., Am. 400-lb.	bbl.	1 33
Chrome brick, f.o.b., Pittsburg	M.	175 00
ore, 50%, ex-ship, N. Y.,	lg ton	14 00@16 00
Copperas, bulk	cwt.	0 55
bbl	cwt.	0 60@0 85
Copper sulphate	cwt.	5 25@5 50
Fluorspar, lump, f.o.b. Pittsburg,	ton	8 00@9 00
Magnesite, crude, 95%	lg. ton	7 50@8 50
calcined, powdered		26 00@35 00
brick, dom. f.o.b. Pittsburg....	M.	160@180
Paints, litharge, Am. powd.	lb.	0 05½@0 06
red lead, American	lb.	0 06¼@0 07
white lead, Am., dry	lb.	0 05¼@0 05¾
zinc white, Am., dry	lb.	0 05¼@0 06¼
Phosphates, acid:		
*Fla., hard rock 77%		5 75@6 25
land pebble 68%		3 70@3 80
†Tenn., 78@80%		5 00@5 50
75%		4.75@5 00
68@72%		4 25@4.50
‡So. Car. land rock 60%		3 50@3 75
Potassium cyanide, 98@99%	lb.	0 19
Pyrite:		
Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit		0 12@0.12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines....		0 11½@0 12
Imported, non-arsenical, furnace size, ex-ship, per unit		0 13½
Imported, arsenical, furnace size, ex-ship, per unit		0.12¾@0 13
Imported, fines, arsenical, ex-ship		0 11@0 12
Imported, fines non-arsenical, ex-ship, per unit		0 12½

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

Sodium cyanide, 120 to 130% KCN (per 100%)	lb.	0 18
nitrate 95% spot...	cwt	2.40
95% future	cwt.	2.35
Sulphur, Louisiana prime, N. Y.,	lg. ton	22 00@22 50
roll	cwt.	1 85@2 15
flour	cwt.	2 00@2 10
flowers, sublimed	cwt.	2 20@2 60
pow. com., bags	cwt.	1 50
Sicilian, crude brimstone	lg. ton	22 50
Zinc chloride, granular	lb.	0 01¼@0 01½

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.

Petroleum

Petroleum production in California in March was 7,289,498 bbl.; shipments, 6,551,765 bbl. There were 53 new wells completed in March.

Exports of mineral oils from the United States in March were 122,254,481 gal. For the three months ended Mar. 31 the exports were 378,797,345 gal. in 1911, and 353,663,751 gal. in 1912; a decrease of 25,133,594 gal., or 6.6%, this year.

MINING STOCKS

New York, May 1—On Apr. 25, the Exchange was active but inclined to be irregular, with advances in a few special stocks. On the Curb there were many dealings in the copper stocks generally at small advances. Cobalt shares were uncertain, while there was a fair demand for other mining stocks.

Apr. 26, the Curb was active and sales of mining stocks were large, the coppers leading; but Cobalts and Nevada gold shares also sold well. Prices were irregular, showing both gains and losses of fractions. The Exchange was also active in a few specialties, but rather quiet for the rest of the list.

Apr. 27 again showed a rather irregular market. Amalgamated Copper remained strong. The Curb was also inclined to be variable, on a fair amount of business. Coppers generally held their own, but other mining stocks were off a little.

Apr. 29, the Exchange was active, but mainly on a few special lines. Amalgamated Copper touched a high at 85, and Steel common was firm. On the Curb a fair business was done in copper stocks, but other mining stocks were rather heavy.

Apr. 30 the Exchange was halting and stationary. Steel common, however, advanced, making a high price at 72¼. The Curb was rather hesitating and mining stocks were variable and uncertain. May 1 the Exchange and Curb were both rather reactionary, but with only slight changes in prices. The Steel Corporation's March statement had litte effect on the stock.

Boston, Apr. 30—Outside of a few specialties the copper-share market has toned down somewhat, but not at all to the detriment of optimistic sentiment. The feature of the market was the $11 rise in the price of St. Mary's Mineral Land shares to a high of $67. From this, however, a reaction of $3.25 followed. A big block of the stock was recently taken over privately at around $60, and this proved an incentive for quite an active speculation in the stock. Different valuations of the company have been given, varying all the way from the present market price up to $200 per share.

Results of diamond-drill operations have again brought Indiana to the fore and caused a $2.50 advance to $23. Old Colony made a new high record at $13, a rise of 1.87½. Little of interest is heard from either this or the Mayflower

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Feb.	March	Jan.
Alaska shipments.	2,662,243	4,987,916	....
Anaconda..........	27,450,000	25,900,000	....
Arizona, Ltd..	3,020,000	3,150 000	....
Copper Queen......	6,046,860	7,197,121	....
Calumet & Ariz....	4,452,004	4,652,000	....
Detroit...	2,068,370	2,246,238	....
East Butte....	1,440,000	....	....
Mammoth........	1,722,954	1,939,310	....
Mason Valley......	1,100,000	....	....
Nevada Con.	4,888,790	6,380,000	..
Old Dominion .	2,039,000	....	..
Ray..............	2,140,000	....	...
Shannon	1,300,000	1,388,000	....
South Utah...	283,838	299,000	......
United Verde*	2,250,000	....	...
Utah Copper Co .	8,612,739	8,160,000	.
Lake Superior*....	19,100,000	19,750,000	.....
Non-rep. mines*	8,000,000	8,400,000	.....
Total production.	98,476,798	....	......
Imports, bars, etc.	18,976,513	23,519,215	......
Total blister....	117,453,311	....	.....
Imp. in ore & matte	10,432,438	8,736,874	.....
Total...	127,885,749	....	...
Miami..............	2,475,996	2,755,000	......
Brit. Col. Cos.:			
British Col. Copper	860,003	....	....
Granby	1,773,496	1,882,073	....
Mexican Cos.:			
Boleo..............	2,204,720	2,424,800	....
Cananea	2,948,000	2,834,000	....
Moctezuma	2,687,712	2,446,731	....
Other Foreign:			
Cape Cop., S. Africa	786,440	725,760	...
Kyshtim, Russia...	1,055,000	....	...
Spassky, Russia..	649,600	....	...
Famatina, Argen..	....	....	...
Tilt Cove, Newf'd..	109,059	104,992	.
Exports from:			
Chile..............	6,720,000	3,584,000	....
Australia	7,164,000	8,064,000	.....
Arrivals in Europe†	10,868,680	12,559,680	....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
IV, 1911........	118,085,223	52,407,650	62,129,599
V.	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII........	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI........	111,876,601	68,039,776	67,049,279
XII........	122,896,697	65,988,474	79,238,716
Year, 1911.	1,431,938,338	709,611,605	754,902,233
I, 1912........	119,337,753	62,343,901	80,167,904
II.	116,035,809	56,228,368	63,148,096
III........	125,694,601	67,487,466	58,779,566
IV........	....	....	....

VISIBLE STOCKS

	United States	Europe	Total
V, 1911........	165,555,908	212,284,800	377,840,708
VI........	165,995,932	202,540,800	368,536,732
VII........	157,434,164	195,932,800	353,366,964
VIII........	137,738,858	191,891,840	329,630,698
IX........	133,441,501	191,228,800	324,670,301
X........	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912........	89 454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III........	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757
V........	....	....	....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month property. Activity is mainly in the Lake Superior issues, although Nevada Consolidated rose almost $2 today to $21.87½.

Trading on the Curb has slackened somewhat, although a firm tone is maintained. First National is one of the most active stocks.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1.00
Belcher, Nev	Apr. 8	Apr. 30	0.10
Black Jack, Utah	Feb. 6	....	0.01
Bullion, Nev	Apr. 30	May 20	0.05
Caledonia, Nev	May 21	June 11	0.10
Cedar-Talisman, Utah	Apr. 20	....	0.005
Con. Imperial, Nev	Apr. 30	May 23	0.01
Con. Virginia, Nev	Apr. 24	May 15	0.20
Ely Con., Nev	....	....	0.05
Exchequer, Nev	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0.05
Hancock, Mich	Mar. 28	....	1.00
Houghton Copper, Mich	May 17	....	1.00
Julia, Nev	May 15	June 5	0.05
Kentuck, Nev	Feb. 29	Mar. 19	0.05
Lehi Tintic, Utah	Feb. 29	....	0.01½
Lower Mammoth, Utah	Mar. 15	....	0.01
Michigan Cop. & Gold, Utah	May 15	May 30	0.002½
New York Bonanza, Utah	May 8	....	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	....	1.005
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1	....	0.10
Southwestern Miami, Ariz	Jan. 15	....	1.00
Union Con., Nev	May 9	May 31	0.15
Utah Antimony, Utah	June 1	....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	......	24.797	24.583	......
June	53.462	53.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24.428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53.486	53.304	......	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.081	12.611	14.329	54.971	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.031	70.294
May	11.989	......	12.214		54.313	......
June	12.385	......	12.611		56.365	......
July	12.163	......	12.720	......	56.673	......
August	12.405	......	12.634		56.266	......
September	12.201	......	12.508		55.253	......
October	12.189	......	12.370		55.170	......
November	12.616		12.769		57.253	......
December	13.552		13.768	......	62.068	......
Year	12.376	......	12.634	......	55.973	......

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	......
February	41.614	42.962	August	43.319	......
March	40.157	42.577	September	39.755	......
April	42.185	43.923	October	41.185	......
May	43.115	......	November	43.125	......
June	44.606		December	44.655	......
			Av. Year	42.281	......

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.158	12.889	16.331
May	4.373	......	4.223	......	12.984	......
June	4.435	......	4.292	......	13.260	......
July	4.499	......	4.397	......	13.530	......
August	4.500	......	4.406	......	14.260	......
September	4.485	......	4.356	......	14.744	......
October	4.265	......	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	15.648	......
Year	4.420	......	4.286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.643
May	5.348	......	5.198	......	24.375	......
June	5.520	......	5.370	......	24.612	......
July	5.695	......	5.545	......	25.006	......
August	5.953	......	5.803	......	26.801	......
September	5.869	......	5.719	......	27.750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.796	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	16.00	14.15
May	15.90	......	14.30	......	14.72	......
June	15.90	......	14.06	......	14.56	......
July	15.90	......	14.03	......	14.53	......
August	15.90	......	14.00	......	14.47	......
September	15.90	......	13.57	......	14.40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14.25	......
December	15.15	......	13.10	......	13.90	......
Year	$15.72	......	$13.94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS Apr. 30

Name of Comp.	Bid.
Acacia	‡.05½
Cripple Cr'k Con.	‡.01½
C. K. & N	‡.18
Doctor Jack Pot	.06¼
Elkton Con	.66⅞
El Paso	.78⅜
Findlay	.04
Gold Dollar	.15¾
Gold Sovereign	‡.02
Isabella	.11¾
Jack Pot	.06
Jennie Sample	.06
Lexington	‡.01
Moon Anchor	‡.01
Old Gold	.03⅞
Mary McKinney	.67
Pharmacist	.02
Portland	.90
Vindicator	.70½
Work	‡.01

SALT LAKE Apr. 30

Name of Comp.	Bid.
Beck Tunnel	.14
Black Jack	.20
Cedar Talisman	.02
Colorado Mining	.19¼
Columbus Con.	.18¾
Crown Point	.03¾
Daly-Judge	‡6.00
Grand Central	.68
Iron Blossom	1.20
Little Bell	.40
Lower Mammoth	.02½
Mason Valley	11.50
May Day	.10
Nevada Hills	2.31
New York	‡.06
Prince Con	1.42½
Silver King Coal'n	2.00
Sioux Con.	.03⅞
Uncle Sam	.20
Yankee	‡.10

TORONTO Apr. 30

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.80	Hollinger	12.00
Hudson Bay	‡70.00	Imperial	.04
Temiskaming	.39	Pearl Lake	.15
Wettlaufer-Lor	.61	Porcu. Gold	.35
Apex	.01	Porcu. Tisdale	.04
Central	‡5.56	Preston E. D.	.05
Crown Chartered	.26	Rea	.50
Dobie	.45	Standard	.03
Dome Exten	.52	Swastika	.20
Foley O'Brien	.21	West Dome	.15

SAN FRANCISCO Apr. 30

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.20	Belmont	10.40
Belcher	.62	Jim Butler	.68
Best & Belcher	.16	MacNamara	.25
Caledonia	1.25	Midway	.73
Challenge Con	.18	Mont.-Tonopah	3.42½
Chollar	.08	North Star	.25
Confidence	.73	West End Con	2.20
Con. Virginia	.81	Atlanta	.26
Crown Point	.70	Booth	.11
Gould & Curry	.07	C.O.D. Con	.11
Hale & Norcross	.23	Comb. Frac	.16
Mexican	3.42½	Jumbo Extension	.46
Occidental	.60	Pitts.-Silver Peak	1.40
Ophir	1.42½	Silver Pick	.14
Overman	1.15	St. Ives	.30
Potosi	.07	Tramp Con.	‡.01
Savage	.14	Argonaut	2.25
Sierra Nevada	.34	Bunker Hill	5.00
Union Con	1.05	Cent. Eureka	.80
Yellow Jacket	.88	So. Eureka	‡5.00

N. Y. EXCH. Apr. 30

Name of Comp.	Clg.
Amalgamated	83¼
Am. Agri. Chem	60¾
Am.Sm.&Ref.,com	85¾
Am. Sm. & Ref., pf.	107½
Am. Sm. Sec., pf. B	87½
Anaconda	42⅝
Batopilas Min	2¼
BethlehemSteelpf	72
Chino	29½
Federal M. & S., pf.	43
Goldfield Con	4¼
GreatNor.,ore.,ctf.	40½
Homestake	93
Miami Copper	25½
Nat'nalLead,com	57¾
National Lead, pf	107
Nev. Consol	21⅝
Pittsburg Coal, pf.	88
Ray Con	19⅝
RepublicI&S,com.	24¼
Republic I & S. pf.	81
SlossSheffi'd,com.	49
Sloss Sheffield, pf.	‡100
Tennessee Copper	44½
Utah Copper	63⅛
U. S. Steel, com	72⅛
U. S. Steel, pf.	113⅛
Va. Car. Chem	61¾

N. Y. CURB Apr. 30

Name of Comp.	Clg.
Barnes King	¼
Beaver Con	.46
Braden Copper	6¼
B. C. Copper	5½
Buffalo Mines	‡1¼
Butte & Vipond	‡.53
Caledonia	¾
Con. Ariz. Sm	⅝
Davis-Daly	1⅝
Diam'field-Daisy	10
Ely Con	5/16
Florence	.78
Giroux	5⅞
Gold Hill Con	‡¼
Greene Cananea	9
Greenwater	08
Guggen. Exp	230
Inspiration Con	19⅝
Internat. S. & R.	‡126
LaGrange Placer	‡2⅞
Kerr Lake	2⅞
La Rose	3⅝
McKinley-Dar-Sa.	1 11/16
Min. Co. of A. new	3
Nev. Utah M. & S.	1/16
Nipissing Mines	7⅞
Ohio Copper	1 9/16
Pacific Sm. & M	¼
Precious Metals	‡1⅜
Ray Central	2⅜
Red Warrior	‡1⅛
South Utah M. & S.	1
Standard Oil (Old)	880
Stand'd Oil of N.J.	386
Stand'd Oil Subs.	490
Stewart	1⅛
Tonopah	7⅛
Tonopah Ex	1 5/16
Tri-Bullion	[illegible]
Tularosa	[illegible]
United Cop., pfd.	15
Yukon Gold	3⅛

LONDON May 1

Name of Com.	Clg.
Camp Bird	£1 9s 9d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 13 9
Mexico Mines	6 16 3
Oroville	0 4 3
Stratton'sInd.	0 3 1½
Tomboy	1 3 0

BOSTON EXCH. Apr. 30

Name of Comp.	Clg.
Adventure	8¾
Ahmeek	300
Algomah	7¼
Allouez	46
Am. Zinc	30⅜
Ariz. Com., ctfs.	5 11/16
Bonanza	½
Boston & Corbin	7½
Butte & Balak	4½
Calumet & Ariz	73½
Calumet & Hecla	491
Centennial	25⅛
Con. Mercur	‡.05
Copper Range	53⅝
Daly West	5½
East Butte	13⅝
Franklin	13½
Graaby	57¼
Hancock	32½
Hedley Gold	‡17
Helvetia	1½
Indiana	20⅞
Island Cr'k, com.	45
Island Cr'k, pfd.	88
Isle Royale	27
Keweenaw	2
Lake	44⅛
La Salle	7¼
Mass	7½
Michigan	3½
Mohawk	63½
New Arcadian	5
New Idria Quick.	‡6⅞
North Butte	30¼
North Lake	7⅝
Ojibway	4⅞
Old Dominion	54
Osceola	118
Quincy	90¾
Shannon	14
Shattuck-Ariz.	‡21
Superior	37
Superior & Bost.	2⅞
Tamarack	44
Trinity	7⅝
Tuolumne	3½
Union Mines	‡3⅜
U. S. Smelting	37
U. S. Smelt'g, pf.	49
Utah Apex	‡2¾
Utah Con	14
Victoria	4¾
Winona	6
Wolverine	111
Wyandot	2¾

BOSTON CURB Apr. 30

Name of Comp.	Last
Bingham Mines	2½
Boston Ely	3/16
Boswyocolo	.08½
Butte Central	8
Cactus	.12
Calaveras	2¼
Chief Cons	1¼
Corbin	2⅜
Cortez	1
Crown Reserve	3
First Nat. Cop.	3 3/16
Majestic	.77
Mazatan	‡.60
Moneta Porc.	.15
Nevada-Douglas	3 7/16
New Baltic	3
Oneco	3
Raven Copper	.37
Rhode IslandCoal	20
San Antonio	‡3
S. W. Miami	8⅜
South Lake	7½
Trethewey	.60
United Verde Ext.	.45
Vulture	‡5.00

‡Last quotation.

The Engineering and Mining Journal

Vol. 93. MAY 11, 1912. No. 19

Issued Weekly by the
Hill Publishing Company
John A. Hill, Pres Rob't McKean, Treas.
505 Pearl St., New York.

Monadnock Bldg., Chicago
6 Bouverie Street, London, E. C
Unter den Linden 71—Berlin N. W. 7.

Walter Renton Ingalls, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Enginmjour, N. Y.

CIRCULATION STATEMENT

Of this issue 10,000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE
Editorials:
 The Utah Copper Co. 921
 Mining or Buying Ore 922
 The Iron and Steel Division of the American Institute 922
 Proposed Arizona Legislation 922
The Highgrade Boom 923
A New California Gusher 923
Transvaal Mining Notes 924
The Leuschner Flotation Process 924
Southern States Phosphate Deposits 924
Correspondence and Discussion:
 Utah Copper Cost in "Lake Superior Figures"....Safety Appliances in Inclines....As to Prospecting 925
*Notes on the Design of Drill Bits. Ward Blackburn 927
*Process for Separating Blende and Barite .... F. C. Bryant 929
Proposed Mining Legislation 930
Details of Practical Mining:
 *Triangular Timbering in Tonopah-Belmont Mine....Bending Sand-Filled Pipe....Tempering Drill Steel—I....*Air Driven Side Dump Car....*Gravity Plane with Auxiliary Hoist....*Table for Cutting Fuse....Tramway Tower in Path of Snowslide....Blasting in the Laramie Tunnel....Soapy Water for Compressor Lubrication....Electric Mine Pumps in California....*Pumping Diagrams 931
Details of Metallurgical Practice:
 *Slag Disposal at Granby Smeltery....Winch Head for Lifting Mill Machinery....*A Handy Riveting Dolly....Increase of Available Cyanide after Alum Clarification....*Bin for Concentrate....Sleeves for Worn Elevator Pulley Shafts 935
The Cost of Doing Things:
 Tonopah-Belmont Mining Costs....Unit Production at Tennessee Copper Co....Electric Power Costs....Balaklala Smelting Operations....Unit Costs in a Small Cyanide Mill....Shaft Sinking Costs in Wisconsin....Supplies for Locomotives....Openpit Mining of Mesabi Iron Ore....Development Work at Alaska-Treadwell Mines 937
How the Metals Are Sold—Copper—II .... W. R. Ingalls 939
*Storage Battery Locomotive in Tunnels 942
*Tests of Zinc Dust for Cyaniding. W. J. Sharwood 943
*Baltic Method of Mining—III. Claude T. Rice 947
*Breaking of the Gold Cliff Hoist Cable .... Lewis H Eddy 952
Personal, Obituary and Societies 954
Editorial Correspondence 955
Mining News 957
Markets 963

*Illustrated.

The Utah Copper Co.

The communication from Mr. Steele, that is published elsewhere in this issue, is a temperate criticism of the position of the Utah Copper Co. As we have remarked in previous articles, the doubt respecting this company pertains chiefly to the matters of the deferred charges and to amortization of plant. The deficiency upon the latter score is, we think, beyond dispute. The mills of the company have now been in operation for nearly five years. During this period, the outlays upon them have been carried to capital account, which has consequently been steadily increased. There has been, of course, the insidious explanation that capacity has been increased, and to a certain extent there is truth in that, but every mining company finds it necessary to put money into its plant and most companies charge this to operation, where it belongs, because the money thus expended is not an addition to capital, but is a replacement of things that have been worn out. Besides this there ought to be accumulated a fund to provide for total replacement sooner or later. Besides the mere keeping of things in repair and in running order, the time comes when the whole plant must be discarded and a new one substituted. Thus, at the present time, the United Verde company is building a new smelting works, and the Anaconda company is about to replace its Great Falls works. There is no reason to believe that the Utah Copper Co. is going to be more fortunate in this respect than other companies have been, and in disregarding this principle it underrates its cost of production by a considerable amount.

The matter of the deferred charges on account of stripping is more complicated. In principle the management of the company is, in the main, correct. If we could imagine the Calumet & Hecla opening its entire conglomerate lode so that the whole would be ready for mining, even though extraction would not be completed for 20 years yet, it would be manifestly erroneous to charge the entire cost of development to the concurrent mining. In a vein or lode mine that would not be done, but in the case of a deposit like that of the Utah Copper Co., and with a method of mining as adopted by it, an analogous procedure must necessarily be followed. We think that the officers of the Utah Copper Co. fail to make things quite clear to their stockholders, because of their presentation of too many confusing details, and a general overstatement of their case. A more concise report would really be better.

As we understand the situation, the company had a total of about 40,000,000 cu.yd. of overburden to remove from about 200,000,000 tons of ore, this estimate of overburden allowing for what we may call the dead slopes. If we assume one cubic yard of overburden to be two tons, the ratio of overburden to ore is as 2:5. If the cost of shoveling both ore and overburden were 25c. per ton, and if the removal of each were being done proportionately, there would be for every five tons of ore two tons of overburden, costing 50c., or 10c. per ton of ore obtained. The company began by allowing 5c. for this, but later raised the allowance to 7¼c. In fact, however, overburden has been removed at a greater rate than ore. Up to the end of 1911, a little more than 12,600,000 cu.yd. of overburden had been removed, and only about 16,000,000 tons of ore. There has consequently been an enormous anticipation of operating expense. Assuming this to have been financed by a special fund, rather than by a special bookkeeping account, the expense charged off annually to operation ought to be subject to interest on the total sum advanced for this special fund. Nothing of this kind seems to have been allowed, nor does there seem to have been any allowance for the increasing cost of removing overburden, as it must be carried further and further away from the mine, not for any unforeseen adverse contingencies. We understand Mr. Steele's criticism to have reference to such points as these, rather than to any fundamental fallacy in the method of bookkeeping adopted by the Utah Copper Co.

The figuring that we have done in the foregoing paragraph is intended to be more by the way of illustration than to arrive at any hard-and-fast deductions. We think that if the Utah Copper Co., in its next report, should discuss the matter in somewhat the same way, its stockholders should be satisfied. At the end of 1910, the company estimated that it had developed 203,500,000 tons of ore. At the end of 1911, during which year 4,680,000 tons of ore were extracted, it was estimated that there remained 301,500,000 tons of fully developed and partially developed ore. We are quite ignorant as to how this additional development of ore affects the ratio of overburden to ore.

In drawing attention to these points, we have no idea of disparaging the wonderful property of the Utah Copper Co., or the remarkable achievements of Mr. Jackling and his associates in developing it. Scarcely more than 10 years ago this orebody was disregarded. It is now recognized as one of the largest known deposits of copper ore, and the company owning it has become the second largest producer of copper in North America. Ten years ago but few persons would admit that ore yielding but 20 lb. of copper per ton could be worked under the conditions of Utah. In making this a commercial ore, new methods of mining and milling have been developed by bold imagination, and have been carried out upon a colossal scale to a successful outcome. In this, Mr. Jackling has been a leader, and the credit that is due to him ought in no wise to be minimized. But while recognizing the magnitude of this mine and the enterprise and ability of its management, we still suffer from uncertainty as to what its real earning power is likely to be.

Mining or Buying Ore?

The reduction in prices of Lake Superior ore sold on the open market this season has led to reports that some of the companies which operate their own mines will buy ore instead of mining it to cover at least part of their requirements for the season. A Mesabi bessemer ore brings this season $3.50 and a nonbessemer $2.85 f.o.b. Lake Erie port. The fixed deductions from this are 60c. for freight to the Lake Superior port; 50c. for Lake vessel freight; 10c. for unloading charges; a total of $1.20, leaving $2.30 and $1.65, respectively, to pay for mining and loading and for royalty or value of the ore in the ground. This, of course, assumes that the ore is up to the base standard of 55% iron for bessemer and 51.5% for nonbessemer ores. These seem low allowances, but we have no doubt that the actual cost to most of the companies mining their own ores will not exceed the figures given, unless the mining is done under excessive royalties.

The Iron and Steel Division of the American Institute

In the establishment of an iron and steel division under the charge of a special committee, the Council of the American Institute of Mining Engineers has taken a step, the necessity of which has been apparent for a long time. The work of the Institute and its members has come in recent years to cover such a variety of subjects and such a wide scope that no one man or set of men could be expected to cover it all, or even to be interested in all its branches. Of course, there is a certain relation among them all, but the mining and handling of iron ores and the metallurgy of iron and steel are quite sufficient to absorb the study and energy of an engineer; and they differ at so many points from the treatment of the other metals that one cannot well be deeply interested in both.

It is not impossible that this action may have averted the formation of a separate society by the iron and steel men, who now have no special technical representative outside of the Institute. The American Iron & Steel Association is entirely a statistical society, and the new Iron & Steel Institute is rather a trade association—with some sociological work brought in incidentally—than a technical society. The establishment of the Iron & Steel Division as a working unit will permit a concentration of interest which ought to be of great advantage to those interested; and which should, at the same time, hold them in allegiance to the Institute as a whole.

Without knowing what, if any further action the Council may have in mind, a still further differentiation of the work would seem to be both possible and probable. The formation of a coal-mining section or division would be a natural sequence to the present action.

The formation of the new section is, we believe, a necessary and judicious measure. We have every reason to hope and believe that, under the charge of the capable committee selected, its results will fully justify the action of the Council.

Proposed Arizona Legislation

A bill regulating metalliferous mining and providing for mine inspection, now pending in the legislature of Arizona, follows, in the main, the general draft for such legislation recommended by the committee originally appointed by the American Mining Congress and now serving in the U. S. Bureau of Mines. The proposed legislation has therefore had the benefit of careful preliminary consideration. The modifications that have been made in the Arizona bill are partly good and partly bad, but, on the whole, the proposed legislation is commendable and is a distinct improvement upon similar legislation that has previously been enacted in the other mining states. This bill has been introduced by Mr. Hall.

We are unable to give the same approval to the Kinney bill, which prohibits the employment of non-English-speaking workmen in the mines. Such a prohibition was carefully considered by the engineering committee to which we have referred, and was condemned by it, on the ground that it would impose a serious hardship upon the mine operators and upon men, would be difficult to carry out, and is unnecessary, anyway.

We regret that it became necessary to interrupt the series of articles by Prof. H. C. Jones, the publication of which in the JOURNAL has attracted general and appreciative attention. The next of these articles will appear in the issue of May 18, and the following articles in the issues of May 25, June 1 and June 8.

The copper report showing an increase of only 2,698,472 lb. in April is chiefly noteworthy for the continued small production. The mystery of what has become of the new copper promises to rival that of the blowing up of the "Maine."

The Highgrade Boom

San Francisco Correspondence

In the San Francisco *Chronicle,* of Apr. 5, a note from the State Mining Bureau was published, calling attention to the extravagant statements made by promoters concerning the certain fortunes to be made by investment in mining companies at Highgrade, Modoc County, Calif. The *News,* of Carson City, Nev., has taken issue with the state mineralogist of California as to his attitude on Highgrade and suggests that his scalp be taken and that he be torn limb from limb, as according to the *News* this is about what would have happened to him had he been in southern Nevada at the time of the Goldfield boom and had he taken a similar position against fakers there. Mr. Storms has issued the following open letter addressed to the editor of the Carson City *News*:

> Sir: Your editorial remarks on the position I have taken regarding the "boosting" of Highgrade camp and stocks of mining corporations claiming to own properties there, has come to my attention, and I think it proper to place myself on record through the medium of your columns as to the attitude I shall take in all such cases. It is the purpose of the California State Mining Bureau and the duty of the state mineralogist, to foster and promote the legitimate mineral industry of California in every possible way. I also consider it my duty to protect those who may be induced to buy stocks in mining companies of doubtful repute, and this I propose to do even though I "lose my scalp and be torn limb from limb," as so cheerfully suggested in your editorial of Apr. 11.
>
> I find certain mining publications advertising Highgrade as a camp where success is certain. I do not blame the publishers of these papers for accepting this "business" as that is what the papers are printed for, to make money for their owners; but I do blame irresponsible promoters for the untruthful statements made by them and warn all intending investors to investigate carefully first. There is no doubt that there is gold at Highgrade, the principal property there at present being that of the Fort Bidwell Consolidated Mining Co., which has a 10-stamp mill. The camp will probably develop other good mines, I hope it will; but I repeat what I have already said, that the present knowledge of the camp does not justify the strenuous attempts being made to create a stampede to that district where the snow is still deep, for if a rush does occur it is bound to result in great hardship to many, besides the loss of money, which most of those joining in the rush can ill afford. They who profit by the stampede are the promoters, the transportation companies and the saloon men; that others will, is doubtful. I have been in many mining camps and an experience of many years in this sort of thing makes it unnecessary for me to visit it to know and say that every foot of ground that shows a sign of mineral, and much that does not, has long since been located on general principles.
>
> I note you conclude your editorial by advising me to remain in California, as "knockers" are not wanted in Nevada. I will respectfully call your attention to the fact that Highgrade camp is in California and is within the jurisdiction of my official inquiry. I wish Highgrade well, but I also wish the investors well, and it is my intention to protect them in this, as well as in every other attempt of irresponsible boosters, to sell stock in companies organized not to mine, but to exploit the public.
>
> W. H. STORMS,
> State Mineralogist.

A more recent development in the situation is the publication of a second letter by Mr. Storms, addressed to N. E. Guyot, a Denver assayer connected with Highgrade. From Mr. Storms' answer it is not difficult to infer in general the contents of Mr. Guyot's initial letter to him. This letter of Mr. Storms covers much the same ground as the one reproduced above, but some of the closing sentences are particularly interesting. He says:

> I have before me several copies of the Denver "Mining Record," in which appears a number of advertisements of stockbrokers and others. I say without hesitation that up to this time development at Highgrade does not justify the promises made in these advertisements. . . .

American Institute of Mining Engineers

The Council of the American Institute of Mining Engineers, at its meeting on Apr. 26, established an Iron and Steel Division to represent the interests of the Institute in the mining and metallurgy of iron and steel; its business to be in charge of the following committee, upon which shall rest the responsibility of securing papers and discussions on iron and steel for the meetings of the Institute: Charles Kirchhoff, chairman; Charles F. Rand, vice-chairman; Bradley Stoughton, secretary, 165 Broadway, New York; John Birkinbine, James Gayley, Henry D. Hibbard, Henry M. Howe, Robert W. Hunt, Julian Kennedy, Charles K. Leith, Richard Moldenke, Joseph W. Richards, F. W. C. Schniewind, Leonard Waldo, William R. Webster and Felix A. Vogel.

The committee has met and formulated plans for carrying out its intention of securing papers and discussions dealing with all phases of the mining and metallurgy of the ferrous metals, to such an extent as will make the American Institute of Mining Engineers the foremost iron and steel association in America, useful alike to the theoretical as well as the practical iron and steel man. The following subjects have been suggested: Geology; mining and preparation of ores; concentration; nodulizing, sintering and briquetting; manufacture of coke and other fuels; refractory materials; blast furnace; bessemer, openhearth and electric furnace practice; the duplex process; treatment, physics and chemistry of iron and steel, including metallography. A campaign has already been started to secure papers and discussions on: Alloy steels; heat treatment of steel; the duplex process; the thin-lined blast furnace; fuel gas for openhearth furnace; ore concentration; manufacture of pig iron; mechanical charging of blast furnaces; gas producers; charcoal iron; electric furnaces; recent improvements in openhearth furnaces and practice. The committee will use its utmost endeavors to bring the papers presented on iron and steel to the attention of all members qualified to discuss them, and to stimulate a continuance of the discussion until all available data and information of interest have been secured for the *Transactions* of the Institute.

Cleveland-Cliffs Iron Co. School

Negaunee Correspondence

The Cleveland-Cliffs Iron Co. has announced that James W. Swent, of Oakland, Calif., a graduate of the Michigan College of Mines, will have charge of its new school for miners, of which the Journal has made editorial mention. The plan is to train the company's employees so that shift bosses and foremen can be picked from them.

Classes will be held in the evening, one section at Ishpeming on the Marquette range and one section at Gwinn on the Swanzy range. A large number of employees has already enrolled in the school and more have signified their intention of doing so; all employees who can speak English are eligible; the expenses of the school will be borne by the company. It will probably be June 1, before regular classes will be held.

A New California Gusher

San Francisco Correspondence

The McKee No. 4 well, owned by the Standard in the Midway field, California, came in as a gusher on April 25. The oil ran the full capacity of the 10-in. pipe and the estimated rate of flow was 30,000 bbl. per day. Sumps and reservoirs were immediately constructed to take care of the excess oil over a normal production. The sand was entered at 2406 ft. and the well began gushing 10 to 15 ft. deeper. The well is situated about a mile north of the Standard main pumping station in the narrow valley between the two ranges of Buena Vista hills.

The *Ebano News*, a little journal published by employees of the Huasteca Petroleum Co., of Mexico, claims that the Casiano well No. 7 is the greatest well in the world. For the last 17 months it has produced 11,000,000 bbl. under steadily increasing pressure, and now its average daily output is 25,000 barrels.

Transvaal Mining Notes

JOHANNESBURG CORRESPONDENCE

The Brakpan mines continue to give good returns and to show low working costs. About 42,000 tons per month are milled, the grade being 28s. 9d., and working costs 17s. 9d. per ton.

In a recent letter I mentioned the West Rand Consolidated as having so far proved a disappointing proposition. There are 2000 claims covering 2½ miles along the reef and the milling plant consists of 100 stamps and four tube mills. Shortage of native labor has been a drawback, there being a shortage of 1000 natives and 75% of the reef mined is broken from narrow and broken stopes by machines. About 4000 ft. of development work is accomplished per month at a cost of 2s. per ton developed. At the end of last year the ore developed was 1,124,631 tons valued at 5.54 dwt. over 40 inches.

Recent returns from 28,000 tons per month crushed show a grade of 23s. with working costs 19s. 3d. As there are over 2,000,000 shares, prospects of dividends on the present scale of working and present costs are remote. Last year working profit totaled £50,000 and capital expenditure £96,700.

The historical Ferreira mine is to be absorbed by the Ferreira Deep. In this way another funeral is avoided, a deathbed marriage being arranged instead. The ore reserves in the Crown mines total 10,124,172 tons, averaging 7.25 dwt. per ton. On capital account £500,000 was expended last year and 71,023 ft. of development was accomplished. The cost per ton at the Main Reef West mine was 22s. 1.7d., while last quarter's development of 2058 ft. averaged only 5.9 dwt. over 48 in. There are 671,000 tons developed.

The latest developments in the 18th and 19th levels of the Globe & Phoenix mine, in Rhodesia, continue to be disappointing and though the consulting engineers furnish favorable reports rumor is persistent that the oreshoots are shortening in the 8th level of the mine.

TIN AND DIAMOND MINING

Tin mining is dull, but the Zaaiplaats mine continues to give good returns. Last month 2679 tons were mined and concentrated at a cost of £2900 for a yield of 138 long tons of tin ore assaying 68% tin. The Rooiberg mine treated 1573 tons for 61 tons of concentrates assaying 68% tin for £3015 profit.

The rich Roberts Victor diamond mine, which at one time was the richest in South Africa, is practically finished as the small pipes contracted in depth and became unprofitable. Several thousand people are still winning about £30,000 worth of diamonds per month from the surface wash covering the farms in the neighborhood of the Vaal River, near Bloemhoff, on the line between Kimberley and Johannesburg. An output of 850,000 karats is expected this year from the German Southwest Africa fields against 900,000 karats for 1911. These fields show signs of exhaustion.

The Leuschner Flotation Process

The Leuschner flotation process, a combination of the oil- and acid-flotation processes, has been in successful operation at the Friedrichssegen and Ludwigseck mines, in Germany, for some time, according to *Glückauf,* Mar. 9, 1912. It is claimed that both oil and acid consumption are reduced, and the necessity for vacuum is done away with. Gas for flotation is generated from carbonates. If these do not exist in sufficient amount in the ore, finely divided carbonates are mixed with it. Oil is added in the usual manner.

The disadvantage of the process is that it is not applicable to mixed sulphides, except, we understand, as a means of getting rid of the gangue, and other methods must be adopted for final separation. Thus, on a Thuringian hornblende, carrying 0.8% Pb and 2.9% Zn, the concentrates carried 8.4% Pb and 24.7 of Zn; the tails traces of lead, 0.8% zinc.

At Friederichssegen, the process has superseded Wetherill magnetic concentration on a blende mixed with spathic iron ore, the gangue being quartz and graywacke. The heads are a mixture of sand and slime up to 1 mm. diam., and a zinc content of 10 to 15%. The concentrate carried from 47 to 50% of Zn, and only 0.3% remains in the tailings, giving an extraction of 90 to 97%. The acid used is 60° Glover acid, and the bath has a specific gravity of 1 to 2° Bé, at a temperature of 60 to 80° C. From 40 to 60 kg. of acid are used per ton of ore. The concentration of the bath depends on the solubility of the carbonates. The oils used are the cheapest grades obtainable, and as the consumption is proportional to the metal contents of the ore, the expense for oil is low with poor ores. On the 10 to 15% Friedrichssegen ore the oil consumption is four to six kilograms per ton of ore. The oil is not recovered after use.

At the Ludwigseck mine, a mixture of galena and blende mixed with spathic iron ore and a quartz and graywacke gangue is jigged, giving a galena concentrate, blende middlings and a worthless tailing. The blende is then concentrated by the Leuschner process.

At Friedrichssegen, the total working costs, including transportation of ore from shaft to works, but exclusive of amortization and interest charges, is $0.96 to $1.42 per ton of ore. Steam costs $0.07 to $0.17. The cost of a plant, designed for 10 to 15 tons per 10-hour shift, is $1250 to $1500, and two to three horsepower is sufficient for running the plant.

An experimental laboratory has been established at Friedrichssegen, where various copper, lead and zinc sulphides have been experimented upon with success. One example has been given. Others were: A copper pyrite, carrying 5.1% Cu, gave a concentrate 24.9% Cu, with 97.60% recovery; and a boulangerite, carrying 9.8% Pb and 3.8% Sb, gave a concentrate. carrying 27.4% Pb and 9.3% Sb, with a joint recovery of 98.4 per cent.

Southern States Phosphate Deposits

A recent report of the Bureau of Soils is devoted to the phosphates of Tennessee, Kentucky and Arkansas. Due to large-scale working with modern machinery and mining methods, the Tennessee brown-rock deposits which several years ago were given a life of only six or seven years, promise to yield as much rock as has already been extracted. The average price of 72% brown-rock phosphate, f.o.b. mines, is about $3.75 per ton.

Actual mining operations in Kentucky will probably begin in 1912. The development of the Kentucky field has been hindered by the exorbitant demands of the holders of the phosphate properties, which were the outcome of large sums paid for options in the vicinity of Midway, several years ago.

Only one company has mined much Arkansas phosphate. This was done about 12 miles northwest of Batesville, where numerous tunnels have been run into a hill on a creek bank. From the deposit thus opened, about 50,000 tons have been taken out. The deposit of high-grade rock is 3½ to 4 ft. thick. In Arkansas mining, the phosphate stratum underlying the main bed is either left untouched, or taken out and discarded. There is no local market for ground rock at present, to make the low-grade material profitable. Mining operations in Arkansas should increase, as a fertilizer factory in Little Rock is preparing to increase an already large plant.

Colorado Gold Production

The gold production of Colorado for the year ended Dec. 31, 1911, is given as 921,274 oz. by the Colorado Bureau of Mines. The production by counties was as follows: Teller, 511,607 oz.; San Miguel, 118,760; Ouray, 93,603; Lake, 56,150; Gilpin, 38,107; Clear Creek, 26,933; San Juan, 15,634; La Plata, 13,897; Summit, 13,556; Mineral, 8706; Boulder, 7888; Gunnison, 6650; Chaffee, 3186; Park, 2844; Eagle, 2001; Costilla, 1082; Dolores, 362; all others, 309 ounces.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Utah Copper Costs in "Lake Superior Figures"

The Utah Copper Co. in its annual report states that it produced copper for 8.07c. per lb. in 1910 and 7.87c. in 1911. In summing up the copper situation in his report to the state of Michigan in 1911, J. R. Finlay, in reference to the porphyry copper mines said: "So far as costs are concerned, the porphyry mines are in essentially the same situation as other mines. Some can produce copper cheaply and others cannot. It is highly doubtful if their average cost will even be as low as in the Lake Superior district." The average cost of production in the Lake district during the five-year period 1906-1910 was 10.1c. per lb. for all the profitable mines. The Utah Copper Co. claims that the cost figures reported cover costs of every kind and description, but before it is fair to compare any two cost records it is only fair to see if the figures given for each represent the same costs. It is the custom in the Lake Superior district to charge every expenditure to operations. Their reports are by far the most satisfactory statements issued by any of the American mining companies; the total receipts and expenditures are itemized so that one can see at a glance the profit or loss for the year. No attempt is made to defer charges. Let us take two of the mines in this district as examples, the Calumet & Hecla, a mature property; and the Ahmeek, a new one.

During the five years mentioned it cost the Calumet & Hecla 8.95c. per lb. to produce 410,614,189 lb. of copper from 13,185,376 tons of rock averaging 31.2 net lb. of copper per ton. The total cost was $36,662,696, made up as follows: Mining, transportation and milling, $26,850,772, $2.04 per ton or 6.54c. per lb. of copper; construction, $2,889,570, or 0.74c. per lb.; smelting, refining and commissions, $4,684,975, or 1.14c. per lb.; and general expenses, $2,237,379, or 0.53c. per lb. of copper. It must be borne in mind that these figures represent every expenditure during this period, so that the total cost as given, subtracted from the gross receipts, $61,313,175, leaves the actual net profits, $24,650,479; therefore there is no disputing the reported cost of production, 8.95c. per pound.

The Ahmeek Mining Co. produced 35,911,797 lb. of copper, during the same period, from 1,722,281 tons of rock, having a net yield of 20.9 lb. per ton at an average cost of 13.3c. per lb. of copper. But like the Calumet & Hecla figures, this cost includes all expenditures, which were partly absorbed in equipping the property, as will be noticed by the construction item in the costs herewith: Mining, transportation and milling, $3,002,075, or $1.74 per ton of rock, or 8.36c. per lb. of copper; smelting, refining and commissions, $411,804, or 1.15c. per lb.; construction, $1,226,945, or 3.42c. per lb.; and general expenses, $145,192, or 0.40c. per lb. of copper The total expenditures were $4,786,018, which, subtracted from the gross receipts, $5,134,777, gives the actual profit, $348,758 for the five years. In the case of the Ahmeek the cost will be lower in the future owing to a reduction in construction at the property; in fact, the cost reported for 1911 was 7.17c. per lb. but the amount spent during the year for construction was much below the average required for the Lake Superior mines. 0.8c. per lb. of copper. It seems safe to say in regard to the future costs, that if the yield is maintained at the present amount and construction figured at the average cost, Ahmeek will produce copper at a cost of 7.5 to 8c. per lb. with a certainty of an increase if the yield falls below the present amount.

The Utah Copper reports are elaborate and give many figures, but it cannot he said that they are plain to the average layman who tries to figure out the net results. It is a large property and owing to various investments and holdings the accounts are necessarily numerous; however, let us see what its costs would be in the plain language of the Lake Superior copper-mine reports.

For 1910 the report gives the operating expenses as $7,819,477, for a production of 84,502,475 lb. of copper from 4,340,245 tons of ore yielding 19.5 lb net of copper per ton. This indicates a cost of 9.25c. from which 1.18c. per lb. is deducted for gold and silver, making 8.07c. per lb. as reported. But if this figure is to be compared with the Lake Superior costs let us look further into the figures reported. We find that the operating expenses as reported include $272,675 for "prepaid expense-ore stripping" but in addition to this item as charged to operation, there has been a further expenditure of $1,022,967.34 for stripping and an additional sum for improvements and equipment charged to property account of $822,170.58. Add these two amounts to the total operating expense as reported and we have a total of $9,664,614.82, which makes the total cost of copper 11.49c. per lb., and deducting 1.18c. for gold and silver leaves an actual cost of 10.31c. per lb. instead of 8.07c. as reported.

The 1911 annual report, just published, states that 93,514,419 lb. of copper were returned by the smelters from 4,680,801 tons of ore yielding about 20 lb. net per ton at a cost of $8,324,053 or 7.87c. per lb. after deducting 1.07c. for gold and silver credits. The operating cost reported includes $351,060 for stripping ore, but like 1910 there was an additional amount spent, $1,628,766, for the same item, but charged to deferred account. If we add this amount and $1,215,121, which was spent for improvements and equipment as charged to capital account, as well as $30,966 for interest paid but deducted from miscellaneous earnings, we have a total expenditure of $11,198,905.75 for the year. We then have a cost of 11.94c. per lb. and after deducting gold and silver credits, 10.87c. per lb. instead of 7.87c. as reported. It will be noticed in this report that $2,500,000 of the stripping expense which in the past had been charged to deferred accounts, was charged to profit and loss account this year. In this way this sum will never appear in the report as an operating cost where it belongs. It is plain to see that the claims of 8c. costs have not been actually realized at the Utah Copper and are nothing more than estimates of hopes for the future, and are obtained at present only by deferring to some future date charges that may or may not be charged off at present in the correct proportion to the tons of ore produced. The fact that such a sum has to be charged off through profit and loss certainly leads to the inference that it has been found necessary to allow more than has been charged through the operating cost statements.

In regard to construction and equipment expenses, it must be remembered that these charges are inevitable and will continue to be a large item as long at the property operates. For example, the Calumet & Hecla figures given above, show that it has cost this mine 0.74c. per lb. of copper or 7.86% of the total expenditures during the five-year period. In the case of the Utah Copper the amount charged to capital accounts for construction and equipment in 1910 was 8.5% of the total expenditures or 0.97c. per lb. of copper; and in 1911, 10.8% of the total or 1.29c. per lb. of copper. The Calumet & Hecla current-construction expense represents about the average of what it has cost all the Lake Superior mines for the same expense.

If we reconstruct the figures of the Utah Copper Co.'s report in this way the operating profits are materially different from those reported in the 1910 and 1911 annuals; $5,401,775 and $6,237,928 respectively. In 1910 the operating revenue was $11,710,389; deducting the total expenditures for mining, milling, transportation, construction, improvements and stripping as stated, $9,664,615, the net operating profits will be only $2,045,774. The revenue from investments, etc., amounted to $1,510,863, making a total net revenue of $3,556,637, out of which was paid a dividend of $4,648,676, a deficit of $1,092,038 for the year.

In 1911 the operating revenue was $12,825,953, from which deduct $11,198,906 for expenditures and the operating profit is $1,627,047. The income from investments, etc., amounted to $1,766,995, making a total net revenue of $3,394,042, out of which a dividend of $4,703,022 was paid, leaving a deficit of $1,308,980 for the year. This makes a total of $9,451,698 paid in dividends in the last two years out of a total net revenue of $6,950,679, or an excess of $2,501,018 over revenue. During 1911 the current assets were reduced $2,030,753. The figures stated do not include any investments made by the company in various enterprises. It should be perfectly plain to any one that these figures must be reconstructed in this way if they are to be compared with the copper mines of Lake Superior carrying no deferred charges. The stripping that has already been done will surely yield more ore than has been taken from the pits but it is a question whether the operation of the mine can be continued from year to year with a less amount of stripping. An important fact in connection with this question is, that to increase the tonnage production 7.84% in 1911 over 1910 it was necessary to increase the underground proportion 8%—from 18 to 26% of the total tonnage. If this means that any further increase in output will have to come largely from the underground workings it certainly does not argue that the cost of mining and stripping will be lowered.

HEATH STEELE.

New York, May 3, 1912.

Safety Appliances in Inclines

Referring to the closing paragraph of Claude T. Rice's letter, published in the JOURNAL of Apr. 27, 1912, I wish to state that the main shaft of the Burra Burra mine, of the Tennessee Copper Co., in the old village of Ducktown, Tenn., is a three-compartment shaft, sunk at an angle of 80 from the horizontal. In the hoisting compartments there are operated two 5-ton skips by means of a Nordberg first-motion, double-cone drum hoist. Between each skip and the hoisting rope there is interposed a Humble disengaging hook, in which, when overwinding occurs, a copper pin is sheared, the skip hangs up and the end of the rope with its corresponding connection is let free.

In the 10 years this hoist has been in operation, one overwinding has, to my knowledge, taken place, in which the device worked perfectly, and in an hour the skip was again in commission.

J. PARKE CHANNING.

Miami, Ariz., May 1, 1912.

As to Prospecting

In the JOURNAL of Apr. 6, 1912, there was an editorial with the above title, on which I wish to make a few remarks. There are few prospectors in the field now, not one where 10 to 20 years ago there were hundreds. It is an impossibility for a prospector to get a grubstake these days. Even if he finds something worthy of development, he cannot interest a mining man with capital, to assist him. The main reason appears to be the arbitrary action of the Government, and of some petty officers, in the rulings which drive the prospector off the forest reserves. The great majority of the mining men, now, will not even look at any thing that is not patented and developed, because they cannot get titles any more.

Judging from this district alone, there must be thousands of claims upon which receivers' receipt has been issued, and patent denied because of insufficient mineral showing on the surface. Here, in many cases it means a shaft 800 to 1200 ft. deep. The land itself is not worth 10c. per acre, growing a few scrub juniper and cedar trees and brush, a steer would starve on 100 acres.

If attempted today, the land office would refuse to patent the Nevada Consolidated Copper Co.'s properties, which are paying dividends on ore of less than 2% copper. It recently threw out a large gold ledge in California, averaging $4 to $5 on the surface, claiming it was not a commercial proposition. This is certainly not the intent of the mineral laws as construed up to recent years, and the worst is, there is no appeal from these unjust rulings of the Land Office. Canada, Mexico and South America all have better mining laws than the United States. It looks as though our Government was determined on driving us from home. No doubt there are many small areas in out-of-the-way places, that have not yet been thoroughly prospected; but it is problematic, whether there will ever be discovered other Leadvilles or Cripple Creeks, in the United States (not including Alaska).

The best chances for other good mines are in present known veins, that may prove profitable at depth with development. There are many dividend mines today that never paid until 150 to 300 ft. deep; the United Verde is an example of the latter. There are few cases similar to Butte, where more recent cross veins of silver proved up the deeper copper deposits.

As to Professor Newsom's remarks before the Metallurgical and Mining Society regarding Chilean nitrates, one must consider the climatic conditions there: An elevation of 3000 to 5000 ft., an absolutely barren waste, not a thing growing, no rainfall whatever, except once in 25 to 30 years, and the deposit covered 12 to 20 ft. deep with wash, clay and sand cemented together, impervious to water. Death Valley offers the nearest similar conditions, in our country.

The "Mineral Industry" and the State Engineer of California have both reported immense deposits of commercial nitrates there, but it is a mistake, as far as I know. There are nitrates there, yes; a deposit of an average thickness of 1 ft. or less, with an average content of 3½% nitrate of soda, distributed over a rough, broken, sandy country, miles in extent, eroded away in many places, in others covered deep, that will not pay even transportation to a central plant. The same can be said of the deposits on the Colorado River and also in Arizona. I have seen a deposit in Mexico, covered with eruptive rock, making it perfectly dry and preserving it. The Mexicans have extracted the nitrate and left a cave approximately 200 ft. deep, 100 ft. wide and 20 ft. high, the walls and floor of which are all of the same deposit; they made powder out of it. It shows from 3 to 14% of nitrate of soda.

As to finding potash at Searles Lake, San Bernardino County, Calif., while no doubt the Geological Survey's activity attracted their attention to it, the discovery was made by the owners, who had worked it years for its borax and soda values. At 600 ft. depth they encountered the potash. It is estimated that there are 15,000,000 tons, and that it can be put on the market at a good profit for 60% of the price of the German product.

For years their property has been on the market at a price of $250,000; recently they refused $5,000,000. Here at Railroad Valley, potash was known to exist 30 years ago. Salt was made here for the chloridizing of ores at Tybo, 45 miles distant, but it contained so much potash that it interfered with its use. The enterprise of a Tonopah company, which, after having its engineers examine many favorable localities, settled upon Railroad Valley as the best, looks as though it would be rewarded. The drill hole is now over 400 ft. deep, and the managers are well pleased with the results so far.

G. L. SHELDON.

Ely, Nev., Apr. 20, 1912.

Notes on the Design of Drill Bits

By Ward Blackburn*

> **Improved drill chucks permit changing bits so quickly that cutting rather than staying qualities are desired, except when transportation from shop to face is expensive. Machine sharpeners effect economy, even at small mines, because the accuracy of gage permits more efficient and rapid drilling.**

The efficiency of a rock-drilling plant is determined by the amount of power delivered to the bit and converted into cutting power. No matter how efficient the compressing plant and the rock drills, or how careful the drill operator, if the bit is dull or of incorrect shape, the rock is not cut, good energy is wasted, and money and time are lost in reaming the bore hole or in pulverizing the rock, and the real object of the work is defeated.

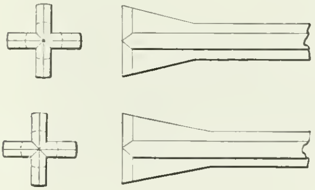
At most mines little attention is paid to the drill bits by anyone except the blacksmith. The drill runner is satisfied if the bits run out a change and hold gage well for the next bit to follow. The fewer changes, the better he likes it. The same is true of the blacksmith The longer a bit is in service the less frequently must it be sharpened. The bit is designed for use as long as possible without resharpening and the cutting properties take second place.

Cutting More Important Than Staying Qualities

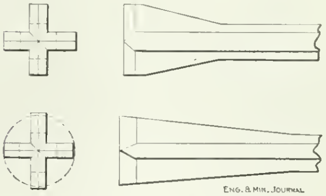
In designing a good bit both cutting and staying properties should be considered, but the day of hand-sharpening and of chuck bolts is rapidly passing, and now the efficiency sacrificed to staying properties is determined largely by the cost of transportation and handling of bits and permissible loss of gage. It is not influenced to the same extent as formerly by the labor of sharpening or trouble of changing bits. The cost of transportation and handling of bits amounts to a considerable item which increases as the lasting qualities of the bit are replaced by cutting qualities, so that it often governs the extent to which the design may be changed.

Light, compact mechanical sharpeners can now be obtained at a reasonable price, and as these machines reduce the cost of sharpening to a low figure and enable the blacksmith to make several hundred bits per day, shop considerations offer no serious reason for retaining merely staying qualities in the design of the bit. Nearly all rock drills can be provided with a wedge chuck, or some means of holding the bit behind chuck keys so that bits can be changed in a fraction of a minute. This largely overcomes the objection to short bits. In several mines the cost of transportation and handling of bits is greatly reduced by installing the power sharpener with oil or coke furnaces underground.

Allowable loss of gage is an important factor, for the greater the loss the larger must be the diameter of the shorter bits to insure a certain diameter of hole at a fixed depth. This larger diameter means a loss of power, so this point can never be lost sight of in determining the bit to be used. Operators who believe the gage should be retained irrespective of the amount of power used run the edges of the wings of the bit back about one inch in a line parallel to the axis, making the bit a reaming tool. If this is done, as soon as the cutting edges wear a little the shoulders begin to bind and stick against the sides of the hole, and it must be reamed out to a size which will allow the bit to move forward. When such a bit is removed from the hole it will show greater wear on the edges of the wings than on the cutting edges. As the bit is apparently as hard ½ in. back, as on the cutting edge it is reasonable to suppose that there has been as much work done in wearing the steel of the wings as in wearing an equal amount at the cutting edge, that is if the reaming edges show more wear than the cutting edges, it is to be supposed that they have done at least as much work as the latter. In other words, as much if not more power has been expended in reaming the hole as in cutting it; half the power has been used in cutting an area of say seven sq.in., that of a 3-in. circle, and half the power has been used in reaming an area of a little more than ½ sq.in., the area of the 1/16-in. rings reamed out. Furthermore, the rock drill is designed to cut rock by means of a blow. It is not a reaming machine, and as soon as a bit is cutting or reaming the side of the hole it is retarding the action of the drill. This strains the rotation and has a tendency to twist and break the bit. Power expended in reaming is power lost. From this it is apparent that because of the rapid loss of power and the wear and tear on the rock drill, little of the efficiency of the bit should be sacrificed to the reaming qualities.



Correctly Made Bits



Incorrectly Made Bits

It is sometimes claimed that unless the bit has reaming edges, the hole will become rifled. This was true to some extent when the bits were forged by hand, but it was due to the difficulty of getting each corner or wing equidistant from the center of the bit. With most power sharpeners this difficulty is removed, and with the correctly formed bits there is little trouble from rifling.

What Constitutes a Good Bit

While it is true that one bit cannot be selected as a standard for any and all classes of rock, still the power-sharpener manufacturers, especially those who have gone into the study of drill bits, are gradually working towards a few standard types. The consensus of opinion is that under average conditions a good bit for power-drilling work should embody the following points:

(1) It must take full advantage of the chipping and fracturing of the rock. In a bore hole there is a certain depth to which rock will fracture when struck by a sharp tool. If the tool is driven deeper than this it will not fracture the rock, it will crush it. If the cutting edge of the bit is blunt it will not get full advantage of the fracture, and considerable of the force will be expended in crushing or pulverizing. The bit acts as a wedge.

(2) The wings of the bits should be as thin as is consistent with standing-up quality to allow for the ejection of the cuttings. If the wings are left heavy there is little space for the escape of cuttings and consequently they are held in front of the bit and continually churned and ground, the bit does not easily reach solid rock and the blow loses a large proportion of its cutting power before it reaches the rock.

(3) The bit must be perfectly free in the hole at all times; because of the

---

*Mining engineer, care of Ingersoll-Rand Co., 11 Broadway, New York.

tendency of the rock to fracture, the drill hole will be a trifle larger than the cutting edge. If the bit is so designed that the cutting edge is its greatest diameter and will practically remain so until dull it will always remain free in the hole.

(4) The bit must allow equal wear on all corners. If the bit is not symmetrical, that is if the ends of all the cutting edges are not the same distance from the center of the bit, the longest end will cut a groove in the side of the bore hole and a rifled hole will result. Furthermore, the wear is unequal and the extra strains in the steel often break it. The rotation of the drill is impeded and the parts subjected to excessive wear.

(5) The bit must be dressed in a manner consistent with the treatment of good steel. It must not be overheated, or worked while too hot. Light rapid blows should be used in forging. The bit must be tempered properly. The proper temper should be determined by experiment and rigidly adhered to. The bit should be allowed to cool thoroughly after forging and should then be reheated for tempering. It should never be sharpened and tempered on the same heat.

Bits Should Fracture the Rock

In Fig. 1, are shown bits designed to fill these requirements. An angle of about 90° for the cutting edge is generally accepted as the correct angle. If the angle is greater the bit has a tendency to crush rather than fracture the rock, and as a rule the bit cuts slowly. An angle less than 90° gives a bit which will cut fast, but it has a tendency to break off and wear rapidly. There is also a tendency for it to enter the rock, especially soft rock, past the point of fracture and expend energy in crushing or wedging out the rock. The "mudding" powers are greatly diminished. The thickness of the wings may range from ¾ in. on a large steel to ⅜ in. or even less on a stoper and hammer-drill bit. The wing must not be so thin that it breaks off, still, the less stock necessary the better the clearance for the cuttings.

The third point is probably the hardest to comply with. When the bits shown in Fig. 1 are first placed in the hole the cutting edge is the largest diameter, and as it may be safely assumed that the rock will fracture 1/16 in. beyond the bit, the latter must be free in the hole. The wings of the bit taper in the ratio of one to four, or one to five, and as the cutting edge wears a shoulder or reaming edge forms on the wing. When it wears between 1/16 and ⅛ in. from each wing a shoulder ¼ to ⅝ in. forms and there is a point between these where the cutting edge is fracturing the rock in the side of the hole to a diameter equal to the diameter of the bit through the shoulders. In other words, the shoulders of the bit are just touching the sides of the hole. If the bits run past this point, the cutting edge will not cut the hole to a diameter large enough to admit the bit and the shoulders immediately become reaming surfaces.

The taper of 1:4 or 1:5 is determined upon a medium. If less taper is used, say 1:7, the shoulders become more prominent and the cutting edge has less allowable wearing surface before the bit binds in the hole causing the shoulders to become reaming surfaces. If the wings have a greater taper, say 1:2, the wear is excessive, and the loss of gage prohibitive. The sharp taper leaves the ends of the cutting edge in a weakened condition and they easily break and chip off.

Machine Sharpeners Make Uniform Bits

The necessity for having the drill bit concentric is obvious. In hand sharpening and even with some power sharpeners it is not uncommon to find one of the ends of the cutting edges protruding 1/32 to 1/16 in. beyond the others. Some sharpener manufacturers have effectively overcome this difficulty by entirely inclosing the bit under a heavy pressure while it is being forged. When this is done there can be no question as to the corners falling within a circle.

The tempering and manner of heating and treating the bit is generally left to the discretion of the blacksmith. This is a mistake as a little attention and study given the subject by the manager or superintendent will often result in marked improvements. Many kinds of steel now on the market, and the scientific methods of treatment are entirely new to the average smith.

A word should be said about mechanical sharpeners. These machines have been greatly improved in the last few years, and now extremely light, simple designs of remarkably high capacity and efficiency are within the reach of all. The bits dressed in the sharpener are always perfect in form and gage and everything considered, will give from 25 to 50% greater efficiency than if sharpened by hand. In addition to the increased speed of drilling there is a noticeable saving in the wear and breakage of machine parts and the bit itself lasts longer and wears much better.

When installing a power sharpener one should not lose sight of its main advantage, increasing the efficiency of the drill bit. It should be installed with the idea that because of the marked reduction in the cost and time of sharpening one can afford to furnish the drill with better steel more often. It is impossible to make a hard and fast rule as to when a power machine should be installed, but it is certain that a sharpener will effect a material reduction in cost per steel dressed, lessen the machine repair parts required, save steel and steel breakage, and greatly increase the drilling speed of machines.

Great Falls Power Company

A recent report of John D. Ryan, president of the Great Falls Power Co., contains the following information concerning this company's affairs. The property of the company includes practically all of the land, all water rights and all available power sites on both sides of the Missouri River, extending from a point just below the city of Great Falls, Mont., for about 8 miles down the river. Within this distance the river makes a drop of over 400 ft. with a water flow of sufficient volume for the development of 76,000 continuous electrical horsepower at the lowest stage of the water, and without any benefit from storage reservoirs already in service. It is stated that with the amount of storage obtainable, at least 130,000 continuous horsepower can be developed.

At Rainbow Falls, the company completed in 1910 a modern hydro-electric plant, having a total capacity of 21,000 kw., in generators, and 36,000 horsepower in water wheels. The natural fall of the river here is about 80 ft., and the available head is increased to 105 ft. by a rock-filled crib dam 29 ft. high, and 1146 ft. long. The water is carried by steel pipes to a balancing reservoir above the power house. The power developed at this station is carried over two separate three-phase transmission lines to Butte, a distance of 135 miles and on a single three-phase line to Anaconda, 25 miles beyond, as well as to the smeltery and lighting plants at Great Falls. The company also owns a dam and power house at Black Eagle Falls, two miles above the Rainbow Falls development, having an available head of about 45 ft. where about 10,000 hp. is developed. All of this power is sold to consumers in the vicinity of the falls.

Referring to the issue of $5,000,000 bonds, dated May 1, 1911, Mr. Ryan says that this issue constitutes the only bonded debt of the company, and is secured by an absolute first mortgage on property valued at over $9,000,000. The sinking fund of 1% per annum on all bonds authenticated is estimated to be sufficient to retire nearly one-half of the issue before maturity. Earnings for 1911 were over 2½ times full annual interest charges on outstanding bonds. It is estimated that earnings for 1912 will be over three times the interest. The stability of earnings is assured by long-term contracts at profitable rates. The operating expenses are stated to be less than 20% of gross earnings. Additional bonds can be issued only under carefully guarded restrictions.

The Rio Tinto Company

At the recent annual meeting in London Chairman C. W. Fielding made the following statements which supplement the annual report: "Mining operations in Spain have been carried on as usual, and in the opencasts very good work has been done during the past year. The preparation for the mining of mineral in future years is being arranged for in proper sequence. You will no doubt remember, from what I have said on previous occasions, that we have to take a very long view in connection with such operations. Engineering programs for the different lodes are laid out for years to come, so that work may be done most economically over a period of years, and not in regard to the exigencies of any one year irrespective of the total economy of the whole operation. In the larger opencasts we have, this year for instance, to remove more than the due proportion of overburden actually required in connection with the year's operations, in order to make a considerable economy in the cost of getting out the mineral from the mass as a whole during subsequent years. . . The program that may ultimately be decided upon for this operation will in all probability introduce electric traction into one or more of our underground departments at a lower level than now worked by adits. It is not expected that any very heavy expenditure will be required, or that new capital will have to be raised for this purpose.

"I have nothing new to report to you this year in connection with methods of extracting copper from our ores, although gradual improvements are being developed in all the departments in which these operations are carried out, and further alterations and economies are being worked out experimentally on a commercial scale, with a view to still further cheapening the cost of the copper produced in Spain.

"I am glad to be able to give you a cheerful forecast as to the future of the sulphuric acid industry. As you know, we are deriving a large portion of our profits from the sale of pyrites and washed ores, which are used all over the world for the manufacture of acids. The demand for these is ever growing and during the last year our deliveries have again considerably increased. For consumption in the current year, we have already sold as much as we delivered in 1911. Of course, we make our sales with the proviso that deliveries need not be made if we are prevented from making them by causes beyond our control. The coal strike may have a bad effect upon our shipments because steamers are unable to get coal for their own propulsion, and consequently we cannot get as many boats to carry ore as we require. For our own consumption of coal, however, at the mines, we are fairly well situated, having accumulated before the strike broke out a stock that would last us for nearly three months."

Ray Consolidated Copper Co.

The report of the Ray Consolidated Copper Co., operating at Ray, Pinal County, and Hayden, Gila County, Ariz., for the 18 months ended Dec. 31, 1911, shows that the first section of the mill was put in operation about the middle of March, but that it was not run continuously until after Apr. 1. Another section was started in April, and three more sections have since been completed, although it has never been necessary to operate over four sections at a time, for the tonnage available. The total ore treated was 681,519 tons of an average grade of 1.83%, giving 15,721,520 lb. of copper, or an average extraction of 63.1%. However, during the last quarter of the year the extraction was 66.27%, and in February, 1912, the extraction was 70.32% on a 1.68% Cu ore. Costs were 10¾c. per lb. of copper, but these were about 1½c. higher than they should have been, because of the necessity of shipping concentrates to El Paso, instead of to the plant at Hayden. The concentrates carried 22.4% of copper.

Ore reserves are calculated at 64,700,000 tons of fully developed ore carrying 2.16% copper, and 12,600,000 tons of partially developed 2.23% ore. Fully developed ore is that marked out by drill holes in 200-ft. squares. Altogether 353 drill holes, aggregating 147,449 ft., have marked out ore on 183.4 acres. Commercial ore was cut by 277 holes. The average thickness of the overburden is 225 ft., and of the ore 101 feet.

Underground development on Jan. 1, 1912, amounted to 158,898 ft., or a little over 30 miles. Underground work, which is to be done by the shrinkage-stope system, is stated to have checked drill assays satisfactorily.

The mill is designed in eight sections of a nominal capacity of 1000 tons per day each, though actually higher.

Process for Separating Blende and Barite

By F. C. Bryant*

During the last 20 years or more, a constant effort has been made by the mine owners and operators of central Missouri to separate the blende ores from the associated barite, which invariably occurs throughout the central zinc belt. These ores are found in at least 10 of the counties in Missouri. When a successful means of separation shall have become generally known, this section of the state should produce a large amount of zinc.

It is the purpose of this article to describe a device in use at the Tahoma mine, in Benton County, which has given entire satisfaction, at this mine, but which strangely enough utterly failed at the Black Jack mine, in Cole County. The device has been tried out on ores from 20 different mines, and has been successful in all cases except at the Black Jack. There is something in the barite at the Black Jack that makes it impervious to the heat, or I should say, the barite contains some element that makes it proof against heat. At the Tahoma, the usual method of concentration with Cooley jigs is employed. The milling capacity is 400 tons per day. The concentrates are partially dried and then fed by gravity into the separator.

Tahoma Mill, Benton County, Missouri, Using Bryant Process for Separating Zinc and Barite

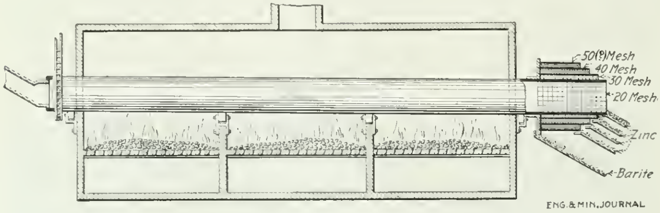
The separator is a device consisting of a tube 12 ft. long by 8 in. in diameter, set into a brick furnace, built for burning oil. The tube inclines slightly toward the discharge end. The tube is equipped with a loose ring hopper on the feed end, and with a series of screens, arranged concentrically, the coarser one on the inside. The first screen is of 20 mesh, the next one is 30 mesh and the outside 40 mesh. In some cases a finer screen may be used. At Tahoma, little of the zinc will break to pass through a 40-mesh screen; all the barite will readily pass the 40-mesh screen, in fact 90% of it will pass through a 200-mesh screen, as it comes from the tube. The accompanying engraving shows one of the first designs.

---

*General manager, Black Jack Mining Co., Bass, Mo.

The later furnaces differ in that they are provided with oil burners; are fired at the lower or discharge end and have a target at about the center of the furnace and the stack at the feed end.

The concentrates, after being partially dried, are dumped into a hopper, from which they slide into the tube, the latter being run at 25 r.p.m. The concentrates gradually work down through the tube, and owing to the revolving motion they are carried up on the side and thoroughly exposed to the red-hot surface of the tube. The barite begins to explode or pop like popcorn the instant it comes in contact with the hot surface. This action also hastens the motion of the ore in the tube. As the decrepitated barite and blende come from the tube, they go on to the screens. The oversize from the 20- and 30-mesh screens goes into the bin; the oversize from the third screen is a middling product and is returned to the head end. The latter has an impure barite in it that usually goes down on the second run.



Bryant Apparatus for Separating Zinc and Barite

As stated above, 90% of the barite will pass a 200-mesh screen as it comes from the tube, and but 10% of the blende will pass a 40-mesh screen. What blende does pass with the barite through the 40-mesh screen is put into what is called a "plow arrastre." This is a concrete vat 10 ft. in diameter, having 8-in. walls provided with a frame into which are fitted 10-in. sections of 200-mesh screens. The arms of this arrastre have plows in place of weights, and are run at 25 r.p.m. During the operation, a stream of clean water is kept running into the arrastre until all the barite is washed out through the screen. The zinc is then drawn off and another charge put in. The barite cleaned in this manner is worth $5 per ton in St. Louis. This is sufficient to pay the cost of all the treatment. This is an inexpensive method, and has the advantage of making a byproduct of the barite, while other systems allow it to go to waste. The apparatus has been patented (U. S. pat. No. 631,951, F. C. Bryant).

Peruvian Mineral Production

By Eduardo Higginson*

The accompanying figures for the mineral production of Peru are furnished by the director of the Institute of Mining Engineers, of Peru, at Lima, and are arranged in order of descending values of the 1910 productions.

PERUVIAN MINERAL PRODUCTION, 1909-1910

Substance	1909	1910
Copper, metric tons....	20,068	27,375
Silver, fine, kg.	207,656	252,565
Crude petroleum, net tons	188,128	167,712
Vanadium ore, tons....	1,749	3,130
Salt, tons	22,715	17,594
Coal, tons	321,502	307,320
Gold, kg.	554	708
Kerosene, tons	3,843	3,979
Boxax, tons	2,715	2,351
Bismuth, refined, kg...	30,300	24,136
Lead ore, tons.........	2,093	1,866
Tungsten ore, tons....	.....	12
Antimony, fine, tons....	20.1	48.7
Mercury, kg.	350	350

Utah Copper Co.

The report of the Utah Copper Co. for the first quarter of 1912 shows production of copper in concentrates as follows: January, 8,156,612 lb.; February, 8,612,739; March, 8,160,199; total 24,929,550 lb. Ore milled was 1,365,910 tons carrying 1.435% copper. The seventh remodeled section of the Arthur plant was placed in operation about the middle of January; the eighth, the last of February; and the ninth early in April. Total profits for the quarter are given as $1,797,652; dividends paid, $1,181,288; there was an addition of $616,364 to surplus.

Norway Mining in 1909

The statistics of Norwegian mineral production for 1909 have recently been issued. The principal items are as follows:

Pyrites, 282,606 metric tons, 1867 laborers employed, value, $1,637,480; copper ore, 42,612 tons, 2243 laborers, $450,240; silver ore, 2729 tons, 1566 laborers, $150,080; feldspar, 36,439 tons, $127,568; iron ore, 40,389 tons, $79,260; nickel ore, 5770 tons; apatite, 1364 tons; zinc and lead ore, 983; arsenical pyrites, 160; molybdenite, 30 metric tons.

Fine copper produced amounted to 1594.48 metric tons; fine silver to 7780 kg., and nickel to 110 metric tons.

Proposed Mining Legislation

Washington Correspondence

The House of Representatives, on May 1, passed a bill to modify certain mining laws of Alaska, the salient sections of which are as follows:

No association placer-mining claim shall hereafter be located in Alaska in excess of 40 acres, and on every placer-mining claim hereafter located in Alaska, and until a patent has been issued therefor, not less than $100 worth of labor shall be performed or improvements made during each year, including the year of location, for every 20 acres or excess fraction thereof.

No person shall hereafter locate any placer-mining claim in Alaska as attorney for another unless duly authorized by a power of attorney in writing, duly acknowledged and recorded in any recorder's office in the judicial division where the location is made. Any person so authorized may locate placer-mining claims for not more than two individuals or one association under such power of attorney, but no such agent shall be permitted to locate more than two such claims for any one principal or association during any calendar month.

No person shall hereafter locate, or cause to be located, for himself more than two placer-mining claims in any calendar month: Provided, that one or both of such locations may be included in an association claim.

Changes in Mint Law

In reporting the new Legislative, Executive and Judicial Appropriation bill, the House Appropriations Committee has taken important action affecting mints and assay offices by including the following provision:

All laws or parts of laws authorizing the establishment of coinage mints at San Francisco, Calif.; New Orleans, La., and Carson, Nev.; and assay offices at Boise, Idaho; Charlotte, N. C.; Deadwood, S. D.; Helena, Mont.; Seattle, Wash., and Salt Lake, Utah, are repealed, to take effect July 1, 1912; but nothing herein shall be construed as abolishing or prohibiting the maintenance of an assay office at San Francisco.

The position of coiner, which has heretofore existed in each of the coinage mints, and the position of melter and refiner, which has heretofore existed in each of the coinage mints and in the United States assay office at New York, are hereby abolished, to take effect on July 1, 1912, and after that date the duties and responsibilities heretofore imposed by law on the officers holding said positions in each of said mints and the assay office shall devolve upon the superintendents of said institutions; and all assistants and employees of the mint and assay offices of the United States shall, from and after July 1, 1912, be appointed by the Secretary of the Treasury.

Turkish Mineral Production

The Turkish statistics for their year 1324, covering the period from Mar. 14, 1908, to Mar. 13, 1909, has just been issued. These show: Bituminous coal, 675,757 metric tons; lignite, 26,965; pyrites, 78,641; chrome ore, 11,547; manganese ore, 7578; iron ore, 8697 tons.

---

*Peruvian Consul General, New York.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Triangular Timbering in Tonopah-Belmont Mine

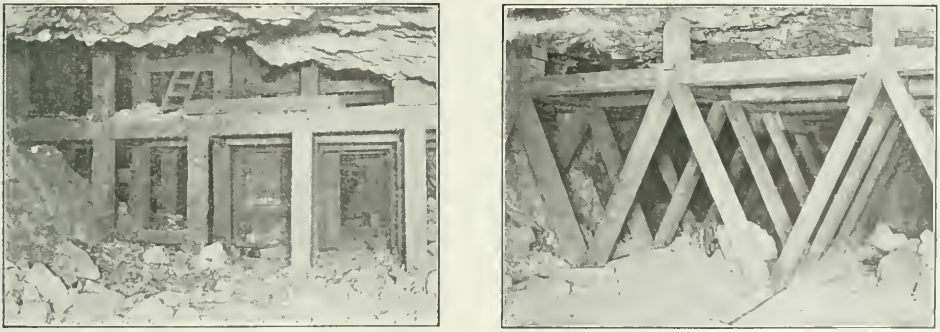
The Belmont vein which is being mined by the Tonopah-Belmont Development Co., at Tonopah, Nev., dips steeply and would seem to afford opportunity for using one of the methods of stoping without timbers; in fact, a modification of the shrinkage system has been considered for use in certain parts of the mine. However, because of the scaling of the hanging wall and because horses of rock exist in the vein it has been impracticable to use this cheaper system of mining.

The first stopes opened in the vein were from 10 to 16 ft. wide and stull timbering was used, but the weight of the hanging wall was so great that serious difficulties were experienced in holding the stopes open until they could be filled with waste. It was therefore necessary to resort to the use of the square sets shown in the accompanying illustration. As the exploitation of the wider stopes, which range from 15 to 45 ft. wide, proceeded it was found that even the heavy square sets were insufficient and that only prompt filling of the timbered stopes would hold them open.

In an attempt to reduce timbering costs the system of triangular sets was adopted, probably for the first time in an American mine. These sets, as shown in the accompanying illustration, consist of the usual caps and girts of the square-set system, but insteao of posts inclined braces are used so that in effect the completed structure becomes a series of adjacent isosceles triangles. This system was described at length by A. J. Moore in the JOURNAL of Sept. 16, 1911. It is claimed that the triangular sets by virtue of the inclined posts offer more resistance to deformation than the square sets.

It is stated that at the Belmont mine the triangular sets require 10% less timber than square sets, but the greatest economy from their use is expected to be derived from the increase in strength which, it is hoped, will overcome to some degree the necessity of immediately filling the timbered stopes with waste. The waste filling has, with square sets, become expensive at times as the quantity of waste available has often been inadequate and had to be procured by driving raises or crosscuts in the walls.

The framing of the great quantity of timber used is economically done by a timber-framing machine and by saws especially arranged for the work.



SQUARE AND TRIANGULAR SETS IN TONOPAH-BELMONT STOPES

Bending Sand-Filled Pipe

The loss of pressure in steam, air, and water lines caused by using sharp bends or elbows is now receiving more attention than formerly. It is the uptodate practice to use as few elbows as possible and to use instead bends of as large radius as is economical, even for small pipes.

It takes time and patience to bend the larger sizes of pipe, and usually a better bend is obtained by using many short heats. It is not easy to obtain smooth bends, especially with small pipes. There is a tendency to hasten the work with the result that the pipe is flattened on the inside of the bend. This flattening can be avoided by ramming the pipe full of dry sand or flue dust before heating and bending. Dry sand should be used; otherwise the pipe may burst from the pressure of the steam derived from the moist sand when the pipe is placed in the forge.

Tempering Drill Steel—I

BY CLARENCE C. SEMPLE

The aim of the drill maker is to produce a tough bit the edge of which, while not hard enough to be cracked, will hold its gage and shape until the hole has been drilled to a depth approximately equal to the length of feed of the machine. It is not always possible to produce such a bit for drilling very hard rock, and, in such cases, the drill sharpener is called upon to use his best judgment in the compromise between hardness and toughness. The cutting edge of the bit is the only part that must be hard and the degree of this hardness and thickness of the hardened layer are within the control of the smith. Too thick a layer of hardened steel would result in cracking of the edge while in use.

The operation of giving the bit the requisite hardness is known as tempering. It is the final heat treatment that the bit undergoes before it is ready for use, and this operation consists in making the entire end of the bit as hard as possible, then softening it the desired amount.

Steel may be hardened by sudden cooling after heating it above its critical temperature, a temperature which is different for steels of different composition; for ordinary tool and drill steel bright-red heat. Steel heated to or above its critical temperature is not magnetic and this fact may be used as a method of determining the critical heat; the hot end of a bar will not affect the compass needle if the temperature is at or above the critical temperature. Certain molecular changes take place at the critical temperature, the nature of which it is not necessary to discuss in this article. Heating the steel to even a few degrees below the critical temperature will not produce the change, neither will heating the steel much beyond a few degrees above the critical temperature have any effect upon the hardness. Too high a heat will only tend to produce coarse-grained steel—not a desirable quality.

The degree of hardness depends upon the rate or speed of cooling the steel after it has been heated above its critical temperature. If the steel is cooled slowly, taking several days, it will be as soft as it is possible to make it. On the other hand if the steel be quenched suddenly from its critical temperature by plunging into cold and good conductors of heat, such as ice water, ice cold brine, sulphuric acid or cold mercury, it will have the greatest possible hardness. In hardening steel the plunging should be done on an ascending, not on a descending heat. That is, with a steel the critical temperature of which is 1465° F., the plunging should be done as the temperature rises say from 1470° to 1475°; it should not be heated say to 1500° or more, then be removed from the forge and held until the temperature drops to 1470° before plunging.

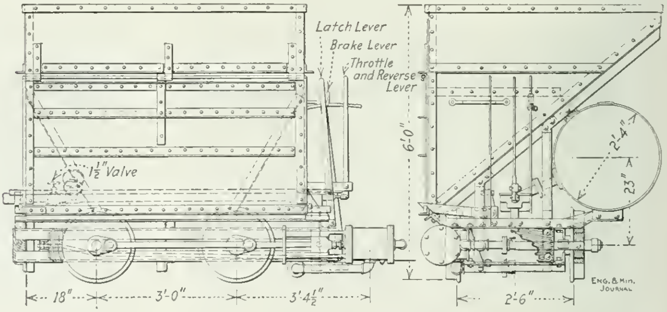
If steel, so hardened by quenching, be placed in a liquid of low boiling point for several days it will be slightly softened; by using liquids of higher boiling temperatures a greater degree of softening of the hardened steel will ensue. The degree of softening is also a function of the time of immersion, for a piece of hardened steel left in a liquid of low boiling point for a sufficient length of time can be softened to the same degree as if it had been placed for a shorter time in a liquid of higher boiling point. The steel must not, however, be heated above its critical temperature. It makes no difference in the hardness whether the steel is quenched suddenly or allowed to cool slowly when taken from the hot softening solution, but slow cooling may impart greater toughness.

The operation of softening after hardening is called tempering and restores some of the toughness to the steel and reduces its degree of hardness. Drill bits could be tempered by standing in a hot liquid after the hardening operation. A liquid, such as hot oil that boils at 500° F. or a molten alloy of two parts lead and one part tin, which melts at 440° F., and which should be maintained at a temperature of 460° to 500°, could be selected, which would sufficiently temper the bits without reducing the hardness to too great a degree, but such tempering takes place from the outside inward so that by such treatment the hardened external layer might be softened to a greater degree and more quickly than the interior. This is just the opposite of what is required in a drill bit. Tempering by heating in liquids is rarely used in preparing bits for drilling in rock.

Air Driven Side Dump Car

By S. A. Worcester*

The car illustrated in the accompanying drawing was designed by me for use at a mine in which electricity cannot be conveniently used for this work, but air at 100 lb. pressure is available in the mine. The car has to make a maximum trip of 300 ft. loaded and return empty. A 28x72-in. air receiver is mounted on the car frame and is automatically recharged after each trip while at the loading station. A brass male coupling on the car which is connected to the receiver, enters a corresponding female stationary coupling as the car strikes the bumper at the loading station. When the couplings are brought together the stems of two check valves encounter each other and both are opened, thus admitting air from the stationary air line to which the female coupling is attached, to the receiver on the car. When the car starts away, separating the couplings, the pressure instantly closes the check valves, thus preventing any loss of air.



Side-dump Car Driven by Air Engines

The engines are of simple construction and are made so that as few adjustments as possible are necessary, for they are used by unskilled operators. The construction of the car is inexpensive, the number of parts being few and the same pattern being used for both engines with but few and slight changes. The engines are reversed and controlled by a single throttle and reversing slide-valve in front of the operator and exactly similar to the slide-valves of the engines. Moving the lever controlling this valve in either direction starts the car in the corresponding direction and placing it vertically shuts off air from the engine.

The axle bearings and rod bushings are made of cast iron and are of the simplest construction. The crossheads are made of cast iron turned to fit the guides, and are equipped with straight pins. The cylinders are cast in one piece with the valve chests and front heads. The pistons are riveted to the piston rods which are screwed into the crossheads. Plain snap rings are used for piston packing. The eccentrics are cast on the drive wheels and eccentric straps and rods are forged in one piece and valve stems are made without any adjustment for length, so that when set they cannot be moved out of adjustment by unskilled operators. The brake has ample leverage and few parts. It is equipped with a pawl or latch which is used for holding the car in place against the pressure at the air coupling, which is sufficient to push the empty car away if the brake is not set. The car door latches are lifted by the lever at the left of the operator and all three operating levers are nearly vertical and close together, making a convenient and safe arrangement. The speed of this car, unlike that of most electric-motor cars, is almost unlimited, the 7x7-in. cylinders giving ample power. The air consumption is small.

At the Butte plant of the Anaconda Copper Co., four hoists are being operated by the compressed-air system and six more are being erected. These last are designed for hoisting a balanced load of six tons or an unbalanced load of 17 tons from an ultimate depth of 3500 ft. Twelve additional hoists are being built, each of which is designed to hoist a balanced load of two tons or an unbalanced load of 8½ tons from an ultimate depth of 3500 feet.

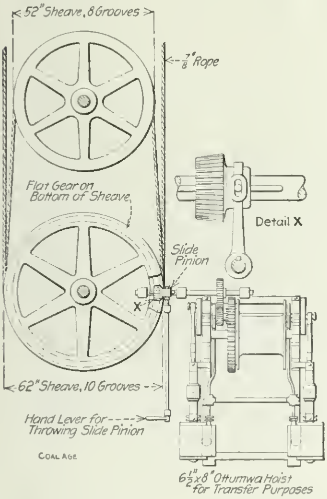
---

*Mechanical engineer, Victor, Colo.

Gravity Plane with Auxiliary Hoist

A number of mines in the Roslyn district in the state of Washington are situated in the hills at some height above the tipples and railroad tracks states Joseph Daniels in *Coal Age*. The coal is usually sent down to the tipples by an engine, or gravity plane. At the No. 2 mine of the Roslyn Fuel Co. the gravity plane is 3400 ft. long, with an average grade of 14½%, and crosses three ravines on timber trestles. From the mouth of the mine tunnel, the plane has three rails to the midway point. The pass-by here is 120 ft. long and below this point a single track runs to the tipple. The track gage is 30 inches.

Cars are handled in trips of 10. The weight of an empty car is 825 to 850 lb.; the weight of the average loaded car is 2400 lb.; the size of the rope is ⅞ in.; and the time required to hoist or lower a trip is 2½ min. A set of gravity-plane sheaves is used to lower the cars to the tipple, but the usual arrangement has been modified, as shown in the accompanying illustration. A gear wheel is fastened to the under side of the larger sheave. This gear meshes with a small pinion, mounted on a shaft, which is driven from the main gear of the hoisting engine, as shown in the sketch. The small beveled pinion is thrown in or out of mesh by being moved back and forth along the shaft, under the control of a hand lever, situated conveniently near the throttle and operating levers of the hoisting engine. This latter is a small second-motion, friction-clutch, single-drum engine, used for transfer purposes at the mouth of the tunnel.


52" Sheave, 8 Grooves
⅞" Rope
Flat Gear on Bottom of Sheave
Detail X
Slide Pinion
X
62" Sheave, 10 Grooves
Hand Lever for Throwing Slide Pinion
COAL AGE
6½"x8" Ottumwa Hoist for Transfer Purposes

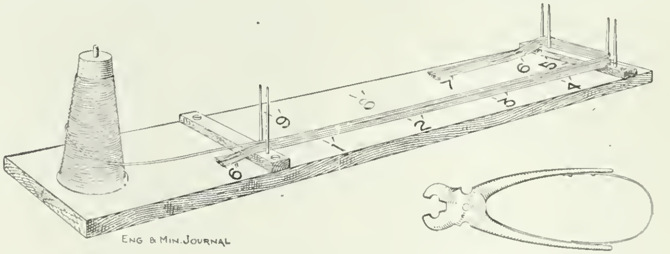
GRAVITY SHEAVE AND HOIST

The purpose of this arrangement is to enable the sheave to be driven when occasion demands; that is, if, for any reason, it is necessary to hoist the empty cars from the tipple to the tunnel mouth and there are no loaded cars available for sending down, the engine is started up and by throwing the pinion in mesh with the large gear, the sheave of the gravity arrangement is made to act as a drum for hoisting purposes. The device is also useful in case of breakdowns and derailments at any point along the road, when it may be used for putting the cars on the track, hoisting ditched cars out of the ravine and in many like contingencies.

Table for Cutting Fuse

The accompanying drawing shows the design of a table for conveniently cutting fuse. It is used at the Blackberry and Montana mines, near Joplin, Mo. The coil of fuse is carried on a conical spindle at the end of the table, and from this spindle the fuse is unwound as it is measured. The fuse is held between a series of two 60-d. nails driven into two cleats of 1x2-in. wood that are screwed to the table. The cutting is done six inches ahead of the first pair of nails, so that there are no long, loose ends in the way. On the table are marks which are used in measuring the several lengths of fuse usually required.

In cutting the fuse, the loose end from the coil is run through the first pair of nails, taken around the turning nails, passed through the last pair of nails that hold the loose end when the fuse is being cut, and the end is pulled along to the mark indicating the length desired. Then with the fuse cutters the fuse is cut off at the other end, and another piece of fuse measured until all the fuses have been cut, the different pieces being left securely held between the nails until the miner is ready to cap them. To aid in the cutting, the fuse cutters, which are ordinary crimpers, are made with a spring riveted to one of the handles, so as to keep the jaws apart. This increases the speed of cutting the fuse somewhat, and makes the use of the crimpers more convenient.



FUSE TABLE AND CAP CRIMPER USED IN JOPLIN DISTRICT

Tramway Tower in Path of Snowslide

By Warren C. Prosser*

The aërial tramway of the Sunnyside mines in San Juan County, Colorado, passes along a steep hill slope which can hardly be avoided, and each year the tower that must be situated here, is carried away by a snowslide. It is known as the Johnson tower and is built on a foundation of heavy cribbing securely anchored to bed rock.

Above the base of the foundation a tunnel has been driven into a cliff for a distance of 50 ft. and in it a complete tower, knocked down, is stored at all times. When the Johnson tower is carried away by the snowslide that occurs but once each year, the reserve tower is taken from the tunnel and erected at the site of the one carried away. Another reserve tower is then ordered to replace the one taken from the tunnel. It takes but a few hours to erect the reserve tower on the old foundation.

Blasting in the Laramie Tunnel

In driving the Laramie tunnel in Colorado the average depth of hole was 17½ ft.; a stick of 60% powder was placed in the bottom of the hole; then the primer, on top of which five sticks of powder were used except in the case of cut holes, each of which were loaded with three or four extra sticks. The three lifters were loaded to the collars in order that the broken ground should be thrown as far as possible from the face.

Soapy Water for Compressor Lubrication

Soapy water for compressor lubrication continues to be advocated by J. Broad Roberts (*Journ.* So. Af. Inst. Engr., Jan., 1912) as a means of keeping mine air pure. Contamination with decomposition and volatilization products of lubricating oil is thus avoided.

---

*Mining engineer, Silverton, Colo.

Electric Mine Pumps in California

By L. H. Eddy

A new Deane of Holyoke 5x12-in. horizontal, double-acting, triplex, electrically driven pump was recently put in operation on the 2000-ft. level of the South Eureka mine in Amador County, California.

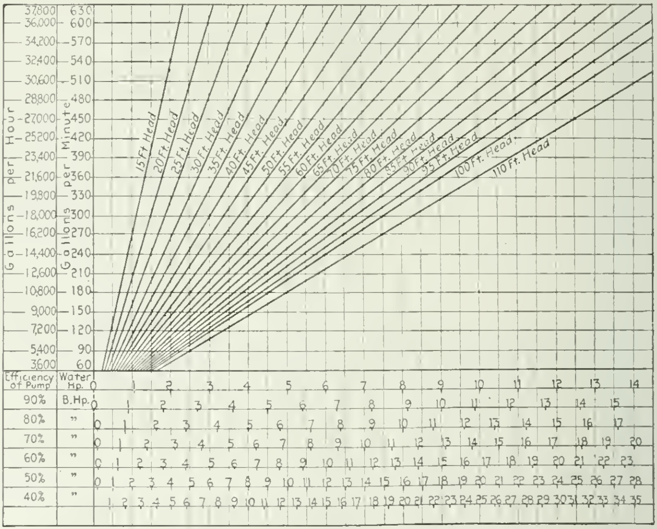
This pump is driven by a 150-hp. Westinghouse, 3-phase, 440-volt, induction motor. It has a capacity of 225 gal. per min., pumping the water to the surface or against a working pressure of 850 lb. per sq.in. As an auxiliary, a Dow 4x16-in. horizontal, double-acting, triplex, electrically-driven pump is installed on this level. This pump is driven by a 150-hp., Westinghouse motor and has a capacity of 200 gal. per min. against 850 lb. pressure. Only one pump is operated at a time, the other being always in readiness in case of breakage; the motors run at the same speed and are interchangeable, thus giving almost unfailing pumping facilities.

The pumps are installed in a room or station 25x50x12 ft., excavated in solid rock. There is also a Deane of Holyoke pump on the 2730-ft. level which pumps the water to the larger pumps on the 2000-ft. level. This is a 5x8-in. vertical single-acting triplex pump with a capacity of 90 gal. per min. against a pressure of 325 lb. per sq.in. This pump is chain-driven by a 30-hp., Westinghouse, 3-phase, 440-volt, induction motor. The electric current for these pump motors is carried down from the surface through a 300,000-circ. mils, lead-covered, steel-armored, 3-conductor cable at 440 volts.

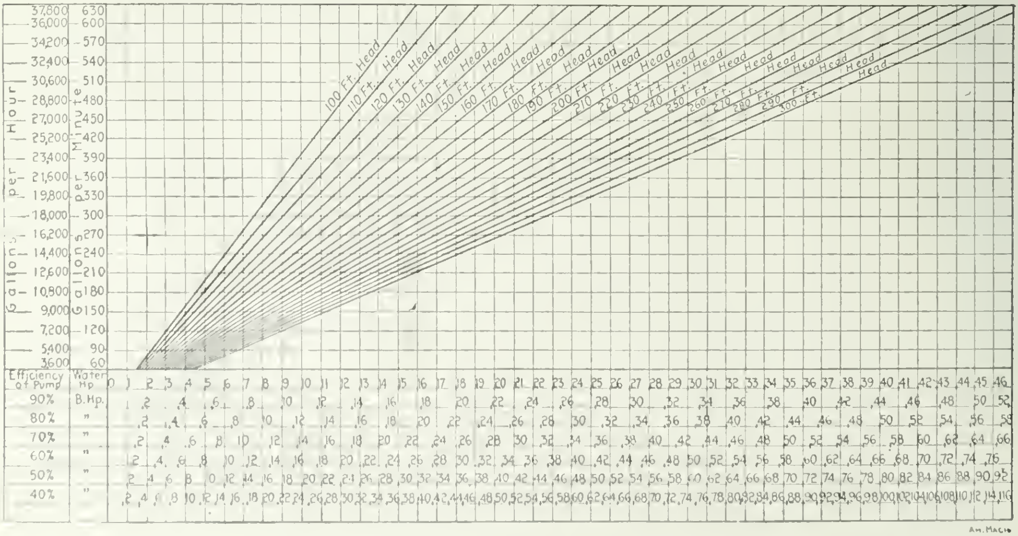
Pumping Diagrams

The power required to pump a given quantity of water to a given height, when the efficiency of the pump is known, or how much water can be raised to a given height by the power available can be determined from the accompanying diagrams which were prepared by W. E. Wort for the *American Machinist*. These diagrams give the brake horsepower number of U. S. gallons per minute and per hour, the pump efficiencies, and various heads in feet from 15 to 300 feet.

For example, if it be required to pump 350 gal. per min. against a total head of 85 ft. and the efficiency of the pump is 60%, the brake horsepower is found by following the 350-gal. horizontal line to its intersection with the 85-ft. head diagonal, then following down the vertical line to its intersection with the 60% efficiency horizontal line at the lower part of the table. It will be seen that 15 b.-hp. is the power required for the duty specified.



Pumping Diagram, 15- to 110-ft. Head (U. S. Gallons)



Pumping Diagram, 100- to 300-ft. Head (U. S. Gallons)

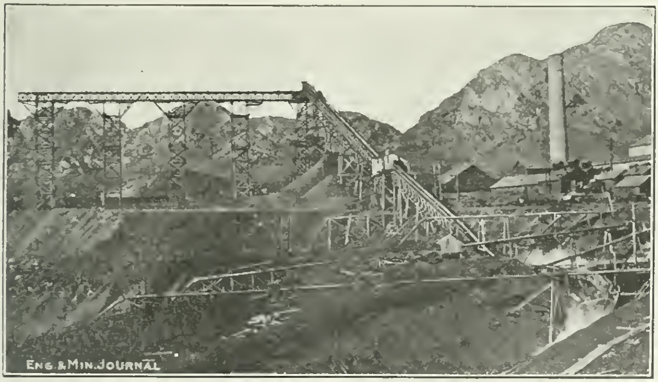
Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Slag Disposal at Granby Smeltery*

By Colby M. Avery†

At the smeltery of the Granby Consolidated, Mining, Smelting & Power Co., at Grand Forks, B. C., all slag until recently was disposed of by being transported in 6-ton slag pots drawn by dinky engines to a slag dump. This method of slag disposal had to be abandoned because all the available space for a dump had been taken up, and it was no longer possible to dispose of the slag in a molten condition because the highest level accessible to the cars had been reached. It was therefore decided to granulate the slag, elevate it after having been dewatered, and build up the granulated material on the old dump.



Conveyors for Granulated Slag at Granby Smeltery

The slag is granulated by being discharged into a stream of water by which it is carried in a flume to a four-compartment bin where the slag is allowed to settle and the water is drained off. From suitably arranged gates the material in the various compartments is drawn out upon a 24-in. belt conveyor which is supported by the trestle shown at the right in the accompanying halftone, and which leads up the incline to the horizontal conveyor operating on the high trestle shown in the center. This trestle is supported on the original slag dump and is 120 ft. above it. An automatic tripper on this conveyor distributes the slag over the ground below on each side. The pile will be allowed to rise 120 ft. or to the level of the distributing conveyor. When it has reached this level the buried truss will be abandoned and the conveyor framework will be moved sideways on skids to the edge of the pile From this position the tripper will distribute the slag until the pile has again reached the limiting height. The conveyor will then be moved sideways a second time and the pile will be advanced this way until the entire area is covered to the depth of 120 ft. The moving of this long conveyor will be effected by long skids and jackscrews fitted with levers and ratchets set at frequent intervals.

The great height to which the slag has to be piled and the vast storage capacity that has to be provided called for conveyors of considerable length and of interesting design. The total length of the incline or No. 1 conveyor necessary to reach the elevation of 120 ft. is 645 ft. In order to reduce the strain on the belt this conveyor was made in two sections of about 324 ft. each with one section delivering upon the other midway up the incline.

Under the present conditions No. 1 conveyor discharges directly to No. 3 conveyor, the horizontal conveyor on the elevated structure. When the pile reaches this conveyor, however, and it will be necessary to move it sideways, No. 2 conveyor will be used. This conveyor telescopes beneath No. 1 conveyor and allows for lateral motion of No. 3. conveyor. As No. 3 is moved out, No. 2 will be moved up and outward so that when No. 3 has been moved to its final position, No. 2 conveyor will be horizontal, delivering from No. 1 to No. 3. The length of No. 2 conveyor is 500 ft. and of No. 3, 600 ft., which will be the limiting dimensions of the top of the pile when completed.

The supporting framework of No. 3 conveyor is connected rigidly to that of the tail end of No. 2 conveyor, and in this connecting framework is supported the motor which drives the two conveyors and the chute which delivers from No. 2 to No. 3 conveyor. All conveyors in this system are driven from electric motors through geared drives; 24-in. special belts are used, equipped at the delivery ends with automatic brushes. This method of disposing of waste slag is said to be no more expensive than was the former method of dumping the molten slag from slag pots.

---

*Excerpt from the Labor Saver.

†Manager, mines and smelter department, Stephens-Adamson Manufacturing Co., Aurora, Ill.

Winch Head for Lifting Mill Machinery

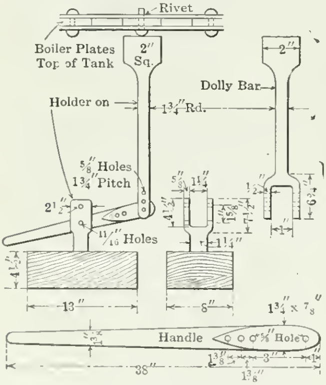
A convenient device for raising heavy objects in mills to a greater height than can be attained by chain blocks is a two-piece winch head. The two pieces are symmetrical and are of the same shape as would be obtained by splitting the familiar winch head usually found on most derrick hoisting engines througn the long axis of the bore, except that at the ends of the castings there are flanges or lugs bored with holes to take the bolts that hold the two pieces together.

To use the winch head the two parts are disconnected; then each half is placed on opposite sides of line shaft in the mill; the four bolts are placed in the holes in the lugs and the nuts are tightened, bringing the two parts close together and making in effect an ordinary winch head on the mill shaft. The object of making the winch head in two pieces is, of course, to permit using it on any part of the shaft. The hub part of the casting projects beyond the ends of the winch barrel and in these hubs holes are tapped and threaded for setscrews which are used to hold the winch head securely on the shaft. A pulley is then hung in the mill rafters above the place to which the object is to be raised. A rope is threaded through the pulley and one end is attached to the object to be elevated; the other end is then pulled taut and four or five turns are taken around the winch head. The engine is then started and the mill shaft turned slowly, and as the object is raised the operator pulls in the rope paid off from the winch head.

The idea of a split winch head was originated by J. A. Rogers, of Joplin, Mo. The device is used in the mills of that district especially for raising elevator belts over the top pulley, which elevators are 60 ft. high in some mills. Of course, this work can only be done when the mill is not in operation. The objection to the device is that it necessitates turning all the shafts and pulleys that are driven from the main shaft. The winch head should be placed on the shaft close to a bearing if a heavy object is to be lifted, otherwise there would be danger of bending the shaft.

A Handy Riveting Dolly

With the increased use of steel tanks and flues around the larger metallurgical works, riveting jobs have multiplied proportionately. The accompanying illustration from *Shop Notes Quarterly* shows the construction of a useful riveting device. This dolly can be used where a great many rivets have to be held overhead and close to the sides where it is hard to hold a dolly bar. By placing the rivet and then applying the dolly-bar end and holding down on the lever, the rivet may be upset without any strain on the man inside.



DETAILS OF A RIVETING DOLLY

This appliance can be operated by a rivet boy where it would call for a man by the usual dolly-bar method.

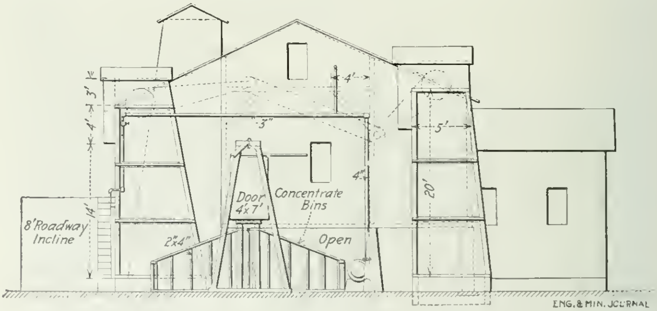
Increase of Available Cyanide After Alum Clarification

In the JOURNAL of Apr. 13, 1912, Chester Steinem described some experiments in clarifying cyanide solutions by the use of aluminum alum, carried on at Mogollon, N. M. In a recent letter, he writes that H. W. Miller tested several samples of solutions, the results showing an increase of 9 to 12% of available cyanide after the treatment with alum.

Bin for Concentrate

All mills in the Joplin district are built on flat sites and with the floors from 7 to 10 ft. above the ground. Instead of elevating into bins it has been found cheaper to shovel the concentrates from the boxes into a side-dumping car, which is run out on a trestle and dumped into bins with open ends. These bins are stalls rather than bins. Leaving the end wall out is typical, for it makes the shoveling of the concentrates into the wagons easier. If there were an outer wall, it would be necessary, when loading the concentrates, for the shoveler to work from the top of the pile down until the floor was reached.

In some mills the table concentrates are kept separate from the jig concentrates; in others the different table products are mixed with the different jig products. The practice depends upon whether the smelter usually buying the ore penalizes for fineness, and also whether the sludge concentrates are of such a nature as to be penalized. Generally there are three or four stalls or compartments on each side of the middle dividing wall, and each side is a duplicate of the other. The tracks for the car are carried on bents independent of the ore bin. All supplies are taken into the mill over this trestle. Consequently, it is surmounted at the end by a frame, from which a chain block can be swung to aid in lifting the heavier supplies, such as roll shells, out of the wagons.



TYPICAL JOPLIN MILL, SHOWING POSITION OF CONCENTRATE BINS

The accompanying drawing shows a custom mill; there are many of these in the Joplin district. Generally the price for treating ore in a custom mill is $1 per ton for hauling and milling. Of course, the wagon haul must be short. When the wagon haul would compel a much higher charge for treatment, hand jigging would probably be cheaper, provided that the ore is at all adapted to hand jigging, as a favorable ore can be hand jigged for about 75c. per ton. The general type of custom mill is shown, in which the ore is hauled up on a platform in wagons, dumped and then shoveled into the crusher. It is owing to this fact that the mill is built only 6 ft. above the ground.

Sleeves for Worn Elevator Pulley Shafts

As illustrated in the sketches accompanying the article "Take Up Device for Elevator Belts," p. 787, JOURNAL of Apr. 20, 1912, the shaft of the lower pulley of the bucket elevators used for raising wet material in the mills at Joplin, Mo., is carried in recesses in the end of two pieces of timber that slide within guides. As this shaft is often submerged in the wet pulp in the boot of the elevator, and as no protection from grit entering the recesses in the end of the timbers is provided, the ends of the shaft become grooved and corrugated.

To permit further use of a corrugated shaft, J. A. Rogers, a Joplin manufacturer of mining machinery, has placed cast-iron trunnion sleeves on the local market; they are not patented. The sleeve is a simple hollow cylinder 6¾ in. long and 4½ in. in diameter, through which is a bore 2$\frac{15}{16}$ in. in diameter. A flange, 10 in. in diameter and ¾ in. thick is cast, integral with the cylinder, and 2 in. from one end, so that the part of the cylinder projecting beyond the flange on one side is 2 in. long and on the other side 4 in. Two holes are tapped in the shorter projection for ¾-in. setscrews. The external surface of the longer projection and the face of the flange on the side of that projection are machine finished.

One of these sleeves is slipped over each end of a corrugated shaft, the longer projection toward the end, which brings the shorter projection over a part of the shaft that has not been abraded, thus affording a firm bearing for the setscrews, by tightening which the sleeve is firmly held to the shaft. The longer projection goes into the recesses in the timbers and thus, for all practical purposes, a shaft as good as new is obtained. The flange acts as a set collar, or guide, and also tends to keep grit from entering the recess.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Tonopah-Belmont Mining Costs

According to the report of the Tonopah-Belmont Development Co. for the year ended Feb. 29, 1912, the total ore and waste mined was 188,988 wet tons. Of this 152,599 tons was crude ore from which 33,624 tons of waste was sorted and 115,563 tons of dry sorted ore was produced.

The costs per dry, sorted ton were: For development, miners, 47.4c.; muckers and trammers, 22.2c.; timbermen and helpers 8.4c., a total expense for direct development of 78c. per ton. The stoping costs were: Miners, 44.5c.; shovelers, 33.9c.; trammers, 19.2c.; timbermen and helpers, 97.8c.; filling, 4.2c.; piston-drill repairs and maintenance, 5c.; stoping-drill repairs and maintenance, 2.9c.; steel and sharpening, 7.1c.; explosives, 28.6c.; hoisting to surface, 30.9c.; auxiliary hoisting, 9.4c.; ore sorting and loading, 27.3c.; sampling and assaying, 4.7c.; surveying, 5.6c.; superintendent and shift bosses, 13.7c.; mine office, 12.9c.; surface and plant, 16.2c.; lighting, 4.6c.; heating, 4.1c.; drayage, 6.1c.; maintenance and repairs to buildings, 2.5c.; maintenance and repairs to machines and machine tools, 2.3c.; maintenance and repairs to pipe lines and tanks, 1.6c.; maintenance and repairs of railroad spurs, 0.8c.; maintenance and repairs to pole lines, 0.2c.; pumping, 6.2c.; ventilation, 1.7c.; or a total direct cost for mining, including development, of $4.72 per ton.

The total indirect cost, including administration, taxes and insurance, legal and traveling expense, bullion tax, depreciation and rescue, was 71.9c., which made the total direct and indirect costs of mining $5.439 per ton of dry, sorted ore produced.

Unit Production at Tennessee Copper Co.

A six-year record at the Tennessee Copper Co., shows that 882 tons per year are mined for each man employed at the mines.

The material treated in the smeltery and converting operations was 687,412 tons during 1910, made up as follows: Company's sulphide ore, 61.8%; custom ore, 4.6; converter slag, 1.3; blast-furnace slag, 3.9; sintered flue dust, 1.3; quartz flux, 8.6; limestone flux, 3.9; first matte, 14.6; total, 100%. One ton of coke was used for every 15 tons of material treated. One man was employed in the smelting department for every 1735 tons of material handled annually, including coke.

Sixty-three men were employed in the railroad department, handling 919,188 tons of material. This is equal to one man for every 15,000 tons handled annually.

Electric Power Costs

Some interesting figures on the cost of steam-power generation are given by the Pacific Gas & Electric Co. (*Electrical World*, Apr. 13, 1912). This corporation generates about 86,000,000 kilowatt-hours per annum, or a load of about 9700 kilowatts.

P. G. & E. CO. POWER COSTS, 1911

	Cents per kilowatt-hour	
Generation:		
Labor	0.225	
Materials	0.731	
Repairs	0.104	
		1.060
Distribution:		
Labor	0.216	
Materials	0.098	
Repairs	0.191	
		0.505
Administration:		
Labor	0.271	
Materials	0.082	
Legal expenses	0.021	
Fire insurance	0.005	
Bad debts	0.026	
Advertising	0.008	
Damages to persons	0.005	
Rents	0.005	
Taxes	0.153	
		0.576
Interest on floating debt		0.006
Depreciation		0.789
Total		2.936

Balaklala Smelting Operations

The record of smeltery operations at the Balaklala Consolidated Copper Co., Coram, Shasta County, Calif., as shown by the annual reports, gives the ratio of ores smelted as one ton of silicious ore to 14.1 tons of sulphide ore. The total burden to blast furnaces was composed of 77.6% sulphide ores; 5.6% silicious ores; 4.15% matte; 2.75% slag; and 9.9% limerock. The percentage of ore treated by blast furnace was 99.38%, 0.62% of silicious ores being used as converter lining.

Coke consumed equaled one ton for every 17.1 tons handled, or one ton for every 14.9 tons of copper-bearing material treated. The percentage of coke to total burden was 5.90%, and of coke to sulphides, 7.58 per cent.

Flue dust produced equaled one ton for every 49 tons of copper-bearing material treated, or 56 tons of burden. Of the total metal contents of the material treated, the flue dust contained; 1.49 of the gold; 1.21% of the silver; and 2.24% of the copper, or approximately 2.12% of the total value in dollars.

The average furnace burden per day was 453 tons, and of sulphides 352 tons. Two 52x240-in. water-jacketed blast furnaces were operated during the time this record was made. Later reports show ratio of tons smelted as follows; sulphide ores, 70.6%; silicious ores, 11.3%; flue dust, 2.6%; and limestone, 17.2 per cent. The cost of smelting was about $3 per ton treated.

Unit Costs in a Small Cyanide Mill

In a 20-stamp mill, crushing an average of 80 tons per day of oxidized ore (quartz), containing 1.93 oz. of gold per ton, 42.46% of the gold was recovered by amalgamation; 21.97% by concentration, and 29.57% by cyanide, of which 14.06% was by leaching and 15.51% by slime agitation. The unit cost of chemicals was as follows:

Cyanide: The average consumption per ton of ore milled was 2.241 pounds.

Lead Acetate: About 0.419 lb. were used per ton of ore milled.

Lime: Consumption was at the rate of 7.73 lb. per ton of ore.

Zinc Shavings: Precipitation by zinc boxes consumed 0.978 lb. of zinc shavings per ton of ore milled, or 5.751 lb. of zinc per pound of dry refined precipitates produced, and 1.69 lb. per ounce of gold recovered by cyanide. Wet, refined precipitate (vacuum dried) averaged 1.16 lb. per ton of ore milled, and after fire drying, 0.165 lb. per ton of ore, or 0.286 lb. per oz. of gold recovered by cyanide.

Quicksilver—The loss per ton of ore milled was 0.411 oz. A portion of this, however, was lodged in launders and other places where it could be eventually recovered by a thorough cleanup.

Tube Milling: The tube mills received a feed, 55.31% of which was above 40 mesh and 32.55% below 40 and above 60 mesh; 42% of the discharge was about 80 mesh, and 58% fine slimes, of which 57.31% was below 200 mesh. The consumption of pebbles, as shown by one year's record, averaged 1.5281 lb. per ton of ore milled. The tube-mill discharge contained 49% water, while the overflow (slimes) from the classifiers handling the discharge was 80.55% water. Two trunnion-type mills were used: One 4x16 ft., and the other 4x12 ft. They were set parallel and connected to one motor by belt drive. Running at 30 r.p.m., it required 38.6 hp. for the two mills running together, while with the 12-ft. mill running alone it required 22.6 horsepower.

Shaft Sinking Costs in Wisconsin

By W. F. Boericke*

The following figures on the cost of sinking a small shaft in the Wisconsin zinc fields are in no way remarkable, but may be useful to engineers who are working under somewhat similar conditions. The shaft in question was to serve as a means of ventilation and as an escapeway for the men, and speed in sinking was deemed more important than great economy. The time was most unfavorable for outside work, the work being done in the dead of winter, at a temperature most of the time much below zero.

The shaft was made 5x7 ft. in the clear, and, except for a little top cribbing, was untimbered. It was sunk through the Galena limestone for nearly the full distance—81 ft., at which point connection was made with a raise from below. This Galena limestone, the principal rock formation of the Wisconsin zinc field, is a coarse, crystalline dolomite of great strength and firmness, and stands especially well, hence, except where a shaft is to be equipped with a cage or skip, timbering costs are almost negligible. The rock is not particularly hard for drilling, and breaks well, but the holes have a tendency to pack and do not clean well; hence drilling speed is not great.

COST OF SINKING 81 FT. IN GALENA LIMESTONE

	Total	Cost per Foot
Total labor	$553.00	$6.827
Powder, 638 lb.....	70.18	0.865
Power, 81 shifts at 45c.	36.45	0.450
Total	$659.63	$8.142

Total time to sink 81 ft., 45 days of 81 shifts.
Progress per shift, 1 ft.

The shaft was sunk on a crevice and drillhole, the former running diagonally across the shaft. By pointing the holes so as to break to the crevice, better progress was made than was otherwise possible. No more water was encountered than was needed for drilling. Two shifts of three men each were employed. Wages in shaft work were $2.50 and $2.25 per shift of eight hours. The drill used was the regular first-size post Wonder, using a 3½-ft. steel. About one-third of the time was used in drilling, and the balance in cleaning out and hoisting, which was done with a hand windlass. Six to eight holes would be drilled before shooting; about 14 holes made a round. All shooting was done by electricity. About four sticks of 40% dynamite were used to the hole. The steel used was the customary eight-point bit used with Wonder machine.

In calculating the costs, powder is taken at 11c. per lb., and power assumed to amount to 15 kilowatt-hours per shift, and to cost 3c. per kilowatt-hour. Nothing was allowed for superintendence or repairs, nor for a proportion of blacksmith or enginemen's wages. These would not add materially to the cost, however.

---

*Mining engineer, Mineral Point, Wis.

Supplies for Locomotives

The consumption of fuel for locomotives varies greatly with circumstances, such as grades, curvature, number of cars in train, skill of engineer and fireman, etc. A record covering eight years' operations of one of the Eastern railroads shows that the consumption of coal has averaged about 182 lb. per mile, and ranged from 152 lb. to 219 lb. for freight service. In the passenger service the consumption averaged 106 lb. per mile and ranged from 98 to 116 lb. The consumption of coal for locomotives switching averaged approximately 80 lb. per mile and ranged from 64 to 105 lb.

The consumption of cylinder oil was approximately one quart for every 123 miles and varied from 99 to 147 miles per quart consumed. Approximately one quart of lubricating oil was used for every 43 miles covered by the locomotive and ranged from 38 to 48 miles per quart. Waste consumption averages 1.86 lb. per 100 miles traveled and varies slightly. Only once during the period did it average 2 lb. per 100 miles.

Openpit Mining of Mesabi Iron Ore

The report of the Minnesota Tax Commission in 1910, giving a description of the mining methods on the Mesabi iron range states that one steam-shovel crew can load up to 8000 tons of ore per 10 hr. with 4000 to 5000 tons as an average day's work. The ore is generally carried in steel cars from the pits, these cars have a nominal capacity of 50 tons each but their actual capacity is about 46 tons each.

The Mesabi ore is soft and lies near the surface in an almost horizontal plane, with a covering of 20 ft. or more of glacial drift. The orebodies vary in size, their length may be a mile or more, though this is unusual, the maximum width is approximately one-half mile, and their thickness varies from 50 to 300 feet.

The openpit system is used in nearly every case where the overburden is not too heavy. It is claimed that more material has been moved by the steam shovel on the Mesabi than the total excavation required for the Panama canal. A shovel crew consists of an engineer, crane man, and four pit men to prepare the road bed and lay track upon which the shovel stands. A spotter is employed to keep the stripping train moving as the cars are filled. A standard steam shovel weighs 90 tons and lifts from four to five tons at a time from the bank and dumps its load into the cars. The weight of the ore varies from 13 cu.ft. for 62% on to 17 cu.ft. for 49% iron ore. Including the cost of necessary stripping it is estimated that the average cost of mining the Mesabi ore by steam shovel is about 70c. per ton.

Development Work at Alaska-Treadwell Mines

Figures compiled from the annual reports, 1906 to 1910 inclusive, of the Alaska United Gold Mining Co., Douglas, Alaska, show that at the end of 1905 the total ore reserve on the 700-ft. claim was 156,236 tons, including all ore broken in stopes. At the end of 1910 the reserve had been increased to 865,223 tons, making a gain of 708,987 tons during the period. The total tons milled amounted to 1,141,670; adding this to the increase shown for the ore reserve gives a total of 1,850,657 tons of ore produced and developed on the 700-ft. claim. During the same period, 16,687 ft. of development was performed; this indicates an average of about 111 tons of ore per foot of development. On the Ready Bullion claim, located on the same vein, the reserve amounted to 1,754,350 tons at the end of 1910; this is a gain of 845,415 tons since 1905. During the same period 1,141,670 tons were milled, and 16,308 ft. of development performed, indicating an average of 121 tons of ore for every foot of development.

The annual reports of the Alaska-Treadwell show that at the end of 1906 the ore reserve was estimated at 5,049,792 tons, and at the end of 1911, 6,637,370 tons, an increase of 1,587,578 tons during the five years. The ore sent to the mill amounted to 3,728,988 tons, and 50,860 ft. of development work was performed; this gave about 105 tons of ore per foot of development.

At the Alaska-Mexican Gold Mining Co. 22,693 ft. of development was performed during 1906-1910 inclusive, according to the annual reports. At the end of 1905 the total ore reserve was estimated at 841,876 tons and for 1910, 1,093,029 tons, a gain of 251,153 tons for the five years. During the same period 1,010,737 tons were milled, based upon the total tons milled and the gain in the ore reserve, 55.6 tons of ore were secured per foot of development. The total average for the three companies is approximately 98 tons of ore per foot of development work.

How the Metals Are Sold—Copper—II

By W. R. Ingalls

An account of the customs and practices obtaining in the marketing of an important metal and the conditions that determine them.

For the most part, Lake copper is sold directly by producer to manufacturer; however, some of it is distributed through the selling agencies and some through metal brokers. The several sellers of Lake copper do not adopt the same plan in making their quotations. Some sell on the basis of New York, net cash, adding or deducting difference in freight between shipping point and New York. Thus, in selling copper for delivery at Buffalo, some producers name tneir New York price and deduct the difference in freight between Michigan-New York and Michigan-Buffalo. Other producers sell at a price including delivery to the manufacturer's yard, allowing 30 days' time for payment, or not, as the case may be. Some producers selling to brokers allow them a commission of 0.5% and in selling directly to manufacturers give them (the manufacturers) the same allowance, which of course is simply a trimming from the nominal price. When the bill is discounted for cash the total discount comes to 1%. This allowance is not made by all of the Lake producers.

The agencies which sell the bulk of electrolytic copper differ slightly in their methods, but in the main they are obliged to accomodate themselves to each other in order to remain competitive. The transactions in electrolytic copper come under three heads, as follows: (*A*) Sales to manufacturers situated in the West. (*B*) Sales to manufacturers situated in eastern districts. (*C*) Sales for export.

Western Sales

The manufacturers situated in the West are, as a rule, supplied by the western refiners, who have a double advantage, saving a part of the freight to the Atlantic Coast and obtaining a higher price for their product, eastern refiners being obliged to pay freight backward in order to compete. The western refiners in selling at interior points, are, however, limited by the competition of Lake copper. This will be made clear by the following example:

Assuming the price for electrolytic copper to be 12½c., net cash, New York, and the price of Lake copper to be 12¾c., same basis, if a western refiner sells at 12½c., Chicago, he saves about ⅛c. freight from Chicago to New York. In order to realize the equivalent of 12½c., cash, New York, the eastern refiners would have to quote 12.70c. at Chicago. The Lake producers can afford to sell at 12⅝c., Chicago, netting the equivalent of 12.75c., New York. Consequently, in times when there is a fair market for copper, the price in Chicago is likely to be just enough lower than the price for Lake copper to induce the buyer to take electrolytic instead of Lake and still sufficiently high to make it more profitable to the western electrolytic refiner to sell there than in New York. The result of this condition is that in ordinary times the eastern refiner does not compete in the western market. If business, however, is slack and it is difficult to sell copper, the eastern product will be offered competitively in the West, because then it is chiefly a question of finding a market and the equalization of freight becomes a secondary consideration.

Deliveries to Eastern Points

Similarly copper may be delivered to some interior points more advantageously from Baltimore than from Perth Amboy. These conditions produce complications in the competitive selling of copper at points west of the Atlantic Coast and in connection with the prevailing custom of the trade affect materially the price quoted for any particular point and the amount that the seller will net. The producer of Lake copper often finds himself embarrassed by widely different freight rates, the rate from Michigan to Connecticut by rail being about 34c. and by water and rail only about 18c. This materially influences his attitude toward the market at the opening and closing of navigation and gives play to the operations of shrewd outside speculators at about those times.

In selling upon the basis of price delivered to domestic manufacturers, with time allowance, or discount for cash, the freight that is paid by the sellers differs naturally according to the respective situation of the refinery and the manufacturers' works. Thus, while the refiners at Perth Amboy have merely to pay a switching charge for delivery of copper to a Perth Amboy wire mill, a refinery situated on Long Island has to pay a lighterage charge or a freight charge. The freight from the principal refineries around New York to the principal mills varies from a switching charge of 1c. per 100 lb. to a rate of 18c. per 100 lb. It has become the custom among the principal selling agencies to quote a uniform rate, disregarding differences in freight, the idea being to treat all consumers alike and the assumption being that in the long run the freight will equalize itself. A very large part of the shipment of copper goes to the Naugatuck valley in Connecticut, the freight rate to there being about 10c. per 100 lb., which expense is generally assumed to be about the average. This rate, however, applies to only part of the shipments, a large part of the Western copper going through on milling in transit rates, which reduce the cost of delivery from New York to 4½@7½c. per lb. The producers who sell copper to domestic manufacturers in the East, are consequently subject to freight charges of from 4½ to 12½c. per 100 lb., or even a little more to some out-of-the-way places.

The terms, cash 30 days after arrival, are generally reckoned as corresponding to an average interest loss of 45 days, which amounts to a little more than 10¼c. when figured on a price of 14c. per lb. and at 6 per cent. interest. Several of the large agencies sell at the flat discount of 0.5% for cash upon delivery, which is 7c. per 100 lb. when the price of copper is 14c. The net cash equivalent, New York, of a sale "delivered, 30 days," is consequently from 12½ to 20c. per 100 lb. less than the commonly quoted price. What the producer realizes comes back, of course, to the basis of New York, cash. The variation in terms is frequently a method of shading prices without jolting the nominal position of the market.

Sales to Europe

Sales to Europe are made by the several agencies through their European connections or agents. None of the American agencies or producers sells directly its copper to European manufacturers. A custom similar to that in the domestic trade exists with respect to quoting a uniform price for delivery at various ports regardless of difference in freight. In times when business is brisk an exception is likely to be made in quoting for delivery to the so-called "outports," to which the freight rate is materially higher than to Liverpool, London, Rotterdam and Hamburg. However, in times of keen competition some of the sellers prefer to waive the differential for the so-called "outports" rather than to reduce their price.

The average freight rate to regular ports in Europe is about 11c. per 100 lb.[1]; the insurance amounts to about 1.3c., interest and banking expense 3c., and brokerage (at 0.25%) 3c., making the total of charges about 18.3.[2] The terms of payment for European sales vary; common conditions are three days' sight draft, or sight draft on consumers, or cash on arrival of steamer. In either case the seller suffers a certain loss of interest or a loss in the rate of exchange. Some sellers extend credits to European buyers and in consideration thereof sometimes receive higher prices, the credits ranging from two weeks to three months. It is a common custom when making sales to Europe on credit to sell the risk to a bank at an expense of ¼ to ½%. The average cost to the seller of delivering copper to regular ports in Europe is about 17½c. on the average, some figuring it a little higher (20c.), some a little lower (15c.)

---

[1] This refers, of course, to what may be considered normal conditions. Lately there has been a sharp rise in ocean freights, which has affected copper shipments as well as other commodities. Thus, the rate on copper from New York to Liverpool has gone from 7s. 6d. to 15s. (from 8.1 to 16.2c. per 100 lb.); the rate from New York to Hamburg has gone from 10c. to 16c. per 100 lb.; and the rates to other ports about the same way.

With respect to what is actually netted by the seller it appears, therefore, that there is no material difference between the selling for delivery in America and in Europe upon the usual terms in each case, i.e., when ocean freights are normal.

Casting Copper

The market for casting copper is relatively narrow and erratic. In the market for this sort the smelters of scrap and junk figure prominently, their product being casting copper and trade customs are not so firmly established as they are in the market for other kinds of copper. This is to say, casting copper may be sold in almost any way that occurs to the imagination and may be agreed upon by the parties concerned. It is sold upon the basis of cash, New York, and upon the basis of delivery, with or without time allowance. Time allowance may run to considerably more than the 30 days commonly allowed on electrolytic bills. The credit of buyers and sellers is also a more important consideration in this market than in the others.

In general casting copper is worth from 12½ to 20 points less than electrolytic, but the ordinary disparity may not always appear in the records of actual transactions. Electrolytic copper is quoted upon the basis of a wholesale market in the broadest sense, while the business in casting copper is always relatively of a more or less retail character. Thus it may actually happen that transactions in casting copper may be made at a higher price than for electrolytic, which, of course, is in no way a true index of actual market conditions, but merely the difference between a retail and a wholesale market.

Neither casting copper nor cathode copper is a reliable basis for commercial calculations, except in so far as concerns transactions in those particular forms, which in fact are of minor importance. Lake copper is a more valuable index inasmuch as its sales represent upward of 200,000,000 lb. per annum, and the record of Lake prices is important because it goes back to the early years of copper production, while the record of electrolytic is still comparatively brief. The real index of the copper market is the price for electrolytic copper and that ought always to be the basis, both casting and cathode copper being subject to erratic and non-indicative variations.

Contracts

The expression of "the spot price for copper" is sometimes used, but it is substantially meaningless. There is no stock of copper in warehouse at New York that is capable of delivery on demand. There may be such a stock at the refineries, but even when the refiners have an ample supply of refined copper on hand, about 10 days after receipt of order is usually expected as an allowance of time in which to conform to specifications as to shape of bars, etc. Such a filling of an order would be called "prompt delivery." The bulk of the copper is not sold in that way but rather is sold on contracts for forward delivery. Few manufacturers conduct their business upon the basis of hand-to-mouth buying, although they may approach that condition in periods of great plethora of supply, such as existed in 1910 and 1911. A manufacturer receives orders for wire, brass and other goods to be delivered at a subsequent date or during a period beginning with some date. Knowing pretty nearly what his requirement for copper is going to be, he places contracts with the agencies for delivery on their part at corresponding periods. The agencies are generally desirous of providing for the disposal of their product as far ahead as possible, but neither buyer nor seller is commonly disposed to take chances on the market for more than two or three months ahead. This practice of contracting explains the alternating periods of dullness and activity in the copper market. Having during January, let us say, arranged for their February and March copper, buyers may keep out of the market for a month or more before opening negotiations for their April requirements, especially if recession in the market is anticipated. On the other hand, if an advance is expected, they are likely to keep right on in their buying, keeping steadily booked up for two or three months ahead. Some manufacturers contract for their supplies upon the quotational basis, ordering their requirements from day to day, or from week to week, as wanted, and settling upon the basis of the monthly average. The manufacturers who do this escape the risk of speculative pinches (losing also, of course, the chances of speculative profit) but in the long run undoubtedly come out as well as the manufacturers who rely wholly upon their trading ability.

European manufacturers as a rule are compelled to cover their wants further ahead than the American because by far the larger portion of their supply must be brought over sea. A manufacturer who needs a certain shape of wire bars at his mill in Germany in March, for example, will have to buy it ordinarily in January for February shipment from the United States. The London standard market creates a complication for the selling agencies and no matter whether they like it or not, they have to graduate their quotations for forward delivery somewhat according to the premium that may be being paid for standard for forward delivery. If they should not do that their copper would ultimately find a market in London anyhow.

The custom of contracting for future requirements that prevails in the industry not infrequently leads to irregular conditions. Thus in periods of extraordinary demand, as in 1906, when stocks on hand had been substantially exhausted and refiners had become substantially sold out for one or two months ahead, a belated manufacturer requiring immediate delivery may be obliged to offer such a premium as will induce some holder to resell or to uncover some reserve supply. On the other hand, in periods when the condition of the market is the opposite a producer needing immediate cash may be unable to sell in such a way as to produce it except at a sacrifice, but may be able to sell for forward delivery and instead of waiting for his money may discount his contract. Transactions of either kind are small in relation to the great volume of business.

Speculation

Speculation in the copper business in this country is severely discouraged, for the simple reason that the producers and agencies are primarily concerned with the merchandising of copper. They cannot regulate the European market in this way and are obliged to meet conditions over there as they find them, but in this country they can and do refuse to sell to any but manufacturing interests. The refusal does not necessarily take the form of an absolute declination, but may be conveyed by the quotation of a prohibitive price. All of the agencies do not, however, consistently follow this policy. Some of them at certain times have distinctly encouraged speculative participation even on the part of persons who are no more concerned in the copper industry than they are in cotton or coffee, undertaking to carry copper on margin in the refinery yards. The seller may later on be plagued by the competition of copper in his own yard. This kind of speculative business is by no means general.

---

[2] The bank commission (1.5c.) may be saved by drawing directly on customers, but such drafts are frequently subject to foreign stamp taxes, and moreover a draft on a commercial or industrial concern cannot be sold so well as a draft on a bank, wherefore the net result is likely to be about the same as if the drafts be sent to a bank for collection, with a commission to the bank, which is the practice of some of the selling agencies. The interest (1.5c.) is always a disputed item in these calculations. Some of the agencies figure it some do not. Some concerns reckon the brokerage at upward of 0.25%, there being few, if any, of the sellers who are not subject to higher charges than that nominal rate. Some figure 5c. per 100 lb. with copper at about 11c. These points explain the differences of opinion respecting the charges upon European shipments that exist among the selling agencies.

It is possible, of course, for speculation to be carried on in other ways, either regularly or only occasionally. Thus the representative of an European buyer who has purchased for export may turn around and resell in this country. Similarly a manufacturer who has contracted for copper not yet shipped from the refinery may offer it for sale on his own account.

In spite of the discouragement of speculators pure and simple and also of brokers, a few manage to do business under handicaps. Some of the Lake producers do not hesitate to sell to brokers and at certain times it is fancied that electrolytic copper may be put in their hands by some of the great agencies, which, while ostensibly out of the market, asking a price that they are unable to get, are not averse to cutting prices vicariously.

A consideration of all of the conditions that have been discussed in the foregoing sections of this article will explain why business in copper on the metal exchange of New York practically disappeared and why it has been impossible to revive it. The producers and agencies, now few in number, are able to merchandise their copper without the intermediary assistance of brokers and middlemen. The customs that have developed in the trade, moreover, do not conform to the customs of trading on an exchange. The American market of copper is in the offices of the agencies and not "on 'change." The few transactions that take place on the latter are insignificant and command no general attention.

Market Information

The question may be asked, how do dealers in an unorganized market, a market in which there is no public exchange, truly speaking, obtain the information that is necessary for the conduct of sharp competition. In fact this is done in the same way as in the market for pig iron and many other substances. In this present era of the telephone, physical meeting between buyers and sellers is unnecessary. Inquiries are made and transactions involving large sums of money are consummated over the telephone.

The agencies manage to keep well posted through their elaborate organizations and continual intercourse with buyers. Offerings in Europe are promptly cabled back to New York. Domestic buyers generally do some "shopping," and frequently communicate information about what is offered to them. The would-be seller whose offer is rejected knows of course that his price has been cut by some one else. The invitation to manufactures to make bids throws light upon the situation in a dull market. These and similarly ordinary exchanges of bids and offers exhibit the nervous system of the copper market. Of course the London market is always a factor.

It happens occasionally in certain periods of excitement that an agency may buy copper at a certain price and immediately resell it at difference of 10 points, or vice-versa, just as on the stock exchange transactions sometimes occur contemporaneously in the same crowd at a material difference in price. However, such inequalities are soon smoothed out as conditions become calmer.

Absolute Price

There is no way of determining the absolute price for copper from day to day or even from year to year, as must be evident from a consideration of the market conditions that have been outlined and discussed in this article. By "absolute price" I mean the average that might hypothetically be obtained by dividing the proceeds of all of the copper sold by the number of pounds sold. An approximation is all that can be expected.

In the record of the JOURNAL the daily quotation is essentially quantitative. i.e., it is aimed to represent the bulk of the transactions, basis New York, cash. The small lots occasionally sold at premiums figure almost disappearingly small when averaged in the great volume of transactions. The monthly and annual averages are simple arithmetical means.

Many of the producers state in their official reports the amount actually received for their output; their averages are of course quantitative individually. It is impossible to arrive at a general quantitative average because many producers fail to report their figures and also because those that do report employ different methods of bookkeeping. Some report the net receipts on the basis of New York, but many state the gross receipts upon delivery and debit freight and other charges in another account. The matter of interest is generally disregarded.

In any given year there is a moderately wide difference among the averages reported by individual companies. This is explainable partly by the variation in methods of accounting referred to in the previous paragraph, and partly by differences in selling. All producers are no more likely to realize the same price for their copper than are all farmers for their wheat; some sell more judiciously and alertly than others. Some may sell but sparingly on a declining market and find themselves ultimately compelled to dispose of large blocks at the lowest price, while others may be successful in the policy of reserve in the opposite way.

Two Distinct Selling Policies

There have been during recent years two distinct policies in selling on the part of agencies. Some have distinctly conformed to the system of reserved selling above indicated, remaining to a large extent out of the market for long periods, unable to realize the price asked by them. Other agencies have followed the policy of selling all the time, taking the price that could best be obtained. In periods of dull and declining markets this policy of constantly pressing sales has been quite irritating to other agencies desirous of starving manufacturers into paying their price asked. The copper market has, however, been always an open one, save for the brief attempts of the Secretan Syndicate and Amalgamated Copper Co. to corner it (both of which were colossal failures) and has historically obeyed the law of supply and demand. Some of the agencies take in immense quantities of crude copper under contract and they are naturally bound ordinarily to sell it more or less in the ratio of its acquisition. On the other hand the producer who is selling through an agency on commission may be more disposed to carry his output awaiting a favorable time for its sale.

While the different policies in the market may lead to materially different averages in any single year, it seems from such evidence as is available that in the long run there is no great difference in the results. This refers to the comparative experience of individual companies. Considering the results of all companies year by year a summary of the figures of those reporting publicly affords a fair approximation to a true quantitative average. A study of these figures indicates that the producers generally fall a little short of attaining the quotational average. A consideration of the psychology of buying and selling affords an explanation of this. In a declining market, frequently started by large selling by one or two concerns more farseeing than the others, the time is soon reached when buyers themselves become frightened and but little of the commodity can be marketed until speculators become interested in taking over large quantities at or near the bottom, which usually marks the turn of the tide. Upon an upward movement sales usually become smaller as the culminating point is approached. Thus in 1907 the quantity of copper sold at 25c. and upward was relatively small. The decline started with some heavy selling, but upon the long descent business was comparatively light and did not become large until 12c. and under was reached. The quantitative average in that year was extraordinarily lower than the quotational.

Sheet and Wire

The manufacturers of wirebars, sheet, brass, etc., purchase wirebars, cakes and ingots. The consumers obtain their copper upon the basis of those manufactures, the prices of which do not fluctuate in so mobile a manner as does that of the raw material. During the last four years, the average difference between wirebars and wire was 1.7c. per lb.; between cakes and sheets 5⅞c. per lb. The price for wire was quoted by a pooling agreement until about the beginning of 1911. Upon the disruption of the pool the wire business became strenuously competitive and prices were cut in some cases to the manufacturing margin, which is commonly reckoned at about 1c. per lb. In general the official price for wire has corresponded with the market price for wirebars, i.e. over long periods, although at many times it has been out of tune, the fluctuations in the price for the metal not always having been quickly reflected. This has given some large users of wire an opportunity to play both markets, buying either wire or wirebars to be drawn on total according to variations from the normal difference.

Government Investigation of Health of Miners

Washington Correspondence

An arrangement has been made with the Public Health and Marine Hospital Service by which one or more surgeons connected with that service will carry on jointly for that service and for the Bureau of Mines investigations looking to the improvement of mine conditions. It is important that this work be extended more rapidly, since tuberculosis and hookworm are known to be prevalent among miners in certain districts; the large and continuous influx of foreigners to the mining regions will probably bring to an increasing extent hookworm and other diseases that abound in parts of Europe.

The investigations aim to determine, among other things, the most effective sanitary precautions to be observed in and about mines and the relative healthfulness of occupations pertaining to mining and metallurgical industries.

German Steel and Iron in 1911

The production of steel in Germany in 1911, as compared with 1910, shows a considerable gain, the figures for the two years being as follows, in metric tons:

	1910		1911	
	Tons	Per Cent.	Tons	Per Cent.
Acid converter....	171,108	1.3	187,359	1.3
Acid openhearth..	140,189	1.0	281,877	1.9
Acid castings.....	111,959	0.8	102,018	0.7
Total acid.......	423,256	3.1	571,254	3.9
Basic converter...	8,030,571	58.6	8,640,164	57.5
Basic openhearth.	4,973,569	36.3	5,501,147	36.6
Basic castings....	151,852	1.1	167,354	1.1
Total basic......	13,155,992	96.0	14,308,665	95.2
Crucible..........	83,202	0.6	78,760	0.4
Electric..........	36,188	0.3	60,654	0.5
Total...........	13,698,638	100.0	15,019,333	100.0

The total increase in 1911 was 1,320,695 tons, or 9.6%. The gain in both basic converter and basic openhearth steel was large. In acid openhearth steel there was a large proportional gain, though the total quantity was small. The converter holds its superiority over the openhearth furnace, as it has in Germany for a long time. In giving the quantity of direct castings, no statement of the process used is given, but it is understood that the greater part was made in the openhearth furnace. A noteworthy feature was the large comparative increase in steel made in the electric furnace. Probably this is one cause of the decrease in crucible steel, which is the only form showing a loss in 1911, except acid castings.

Iron Consumption

Consumption of pig iron in Germany is estimated as below, imports and exports of steel and other finished products being reduced to approximate terms of pig iron:

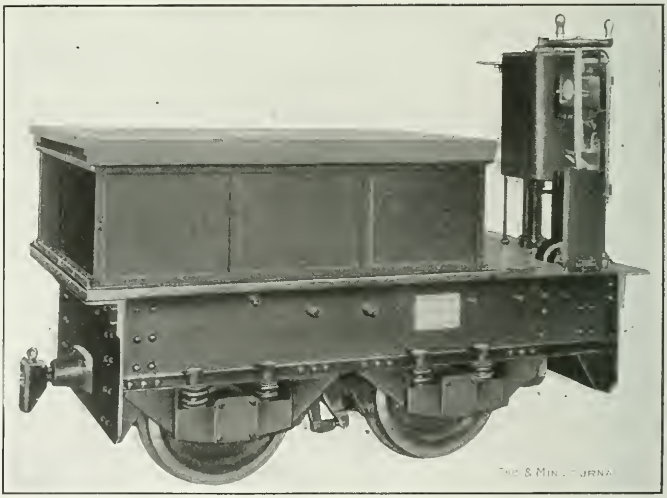
	1910	1911	Changes
Production of pig...	14,793,325	15,652,004	I. 858,679
Imports of pig....	383,535	412,501	I. 28,966
Imports in steel, etc.	376,200	434,672	I. 58,472
Total..............	15,553,060	16,499,177	I. 946,117
Exports of pig......	934,061	1,003,607	I. 69,546
Exports in steel, etc.	5,825,850	6,508,440	I. 682,600
Total exports......	6,759,901	7,512,047	I. 752,146
Consumption.....	8,793,159	8,987,130	I. 193,971

Production of pig iron in 1911 is estimated at 237.43 kg.; consumption at 136.87 kg. per head of population.

Storage Battery Locomotive in Tunnels

The storage-battery electric locomotive of the type shown in the accompanying illustration, is built for hauling loads for short distances at low speed, in places where the trolley system is not feasible.

Six of these locomotives, manufactured by the General Electric Co., are in operation in one section of the New York Aqueduct, now being constructed for conveying the Catskill water supply into the city. Each locomotive has a maximum load haul of half a mile per trip.



General Electric Storage-battery Locomotive

These locomotives have the following specifications: Diameter of wheels, 22 in.; wheel base, 36 in.; length over all, 7 ft. 10 in.; height over batteries, 4 ft.; total weight, 7500 lb. The batteries are 44-cell, 21-plate type, and have 45-amp., 6-hour discharge capacity. The cells are grouped in four or more trays and are mounted in a sheet-iron frame with wooden base and cover, on top the locomotive frame. The automobile type of motor is used, for which high efficiency, large overload capacity and practically sparkless commutation are claimed. The motor is compactly designed and is said to be dust and moisture proof.

Tests of Zinc Dust for Cyaniding

By W. J. Sharwood

Chemical and mechanical methods for examining zinc dust are given, together with results obtained and conclusions reached from the examination of different samples. The efficiency of zinc dust in cyaniding depends largely on its extreme fineness, so at least 95% should pass 200 mesh. Exposure to moist air causes rapid oxidation and consequent loss in efficiency.

Note—An article entitled "Zinc Dust Tests," published in Journ. Chem., Met. and Min. Soc. of South Africa, February, 1912.

The increasing interest among members of this society in zinc dust as a precipitant has suggested the publication of details of a few tests which have proved of some use in examining and comparing samples of it. Unfortunately no very definite criteria have as yet been established for valuing zinc dust for precipitating purposes, but the following will serve to give some idea as to the availability of a sample for the cyanide plant.

Specifications for Zinc Dust

It should be dry and fine; nearly all, say 95%, should pass a sieve of 200 meshes to the linear inch (aperture 0.003) while very little, say not over 1 or 2%, should remain on 100 mesn (0.006 in.), and practically none on 50 or 60 mesh. It should not show any signs of caking, or contain lumps which do not break up at once when shaken on a sieve. Generally speaking, an ash-gray color is a more favorable indication than a decidedly blue or whitish cast; but color cannot be taken as a positive criterion. The presence of a little lead, say 2 or 3%, is an advantage.

Laboratory tests made with pure zinc, and with equal weights of alloys containing up to 5% lead, in the same state of fine division (filings between 0.006 and 0.003 in.), have invariably shown more rapid and more nearly complete precipitation of gold and of silver in the case of the lead alloys, although the weight of actual zinc present was less. The presence of a little zinc oxide is apparently without detrimental effect, except as diminishing the percentage of active metal. Attempts to remove the oxide by solvents inevitably lead to the dissolving of more or less metallic zinc, and possibly to the destruction of the finest particles. No injurious effect has been traced to the small amount of cadmium usually present, and other impurities are generally negligible in amount. A number of samples which have proved satisfactory in actual use have shown from 85% to over 95% metallic zinc (i.e., zinc in the metallic state), most of them over 90 per cent.

Various published analyses have shown metallic zinc ranging from less than 30% up to 92%; zinc oxide from traces to over 50%; and cadmium from traces up to 1.3% in Belgian, and 1 to 2.5% in Silesian samples. A number of analyses from various sources are to be found in Schnabel's "Metallurgy" under Zinc, Ingalls' "Metallurgy of Zinc and Cadmium," and in "Mineral Industry," Vol. II, p. 258. Some of these show carbon up to 3 or 4%, and silica or insoluble up to 9 or 10%, but in general very little of either will be found, and only traces of iron or arsenic. A few of these analyses are summarized in the accompanying table, together with partial determinations of some samples used in gold precipitation.

Various authorities state the specific gravity of zinc as from 6.85 to 7.21, of zinc oxide from 5.6 to 5.78, and zinc carbonate 4.3 to 4.5. Samples of zinc dust have shown results from 6.28 to about 7.0, while the material itself weighs from about 2 to 2.5 grams per c.c., or about 120 to 155 lb. per cu.ft., depending largely upon the extent to which it has been shaken down. No connection has been proved between the apparent density and the quality, but at least one "heavy" sample was found to give unsatisfactory precipitation.

TYPICAL ANALYSES OF ZINC DUST

	Metallic Zinc	Zinc Oxide	Lead	Iron, Cadmium, Carbon, and Insoluble
(1) Belgian...	91 5	little	0 5	...
(2) Belgian...	88 74	6 60	2 5	2 1
(3) Belgian...	79 16	11 26	1 9	7 2
(4) Average (Belgian)...	84 5	9 3	1 6	4 0
(5) Silesian...	84 5	4 9	4.3	6 2
(6) Silesian...	88 5	7 4	2 0	
(7) Silesian..		88 2	4 0	3.0(SO_3 4 1)
(8) American..	29 6	57 5	trace	(Insol. 9.6)
(9) American, good quality	96 0			..
(10) European, imported into U. S., good quality....	90 9	4 0	2 7	....
(11) European, similar, fair quality....	85 0		2 0	.
(12) European, similar, fair quality... .	91 6	3 7	0 2	(Iron 0 3)
(13) Used at Deloro, Canada		3 to 5	1.74	....

Note—Nos. 1-4 by Firket, 5 to 7 by Steger, 1-7 quoted by Ingalls; 7 and 8 from Schnabel, intermediate products in smelting; 10, analysis supplied by importers, quality excellent; 13, Harland, Journ. Soc. Chem. Ind., 1897, p. 968; 9, 11, 12 original; Nos. 9 to 13 used in cyanide precipitation at various plants.

The following serves to illustrate the desirability of avoiding contact with moisture or moist air in the transportation and storage of this material. On a carload of imported zinc dust used some years ago in Montana, the railroad charges were found to be based on a considerably greater weight than was indicated by the weights of the several casks invoiced as originally shipped from Europe. The total weight found by the daily use of the material bore out the railroad figures, and confirmed the suspicion that the discrepancy was due to oxidation from contact with moist air. This was further proved by analyses for oxide and metallic zinc, a sample taken near the staves of one cask showing about 10% more oxide than another from the middle of the mass. In another case, where bad precipitation was noted, the material from the bottom of one barrel was lumpy and yielded 39% zinc oxide, while a sample from near the top of the next barrel opened contained 13.5 per cent.

Estimation of Lead in Zinc Dust

Weigh 10 grams into a large beaker (400 to 600 c.c.), moisten with water; then add 200 c.c. water and stir well; then 10 c.c.[1] strong sulphuric acid, stir well and cover. Stand beaker on a hot plate and warm to 60 or 70° C.; if action is very slow at the start, add a single drop of very dilute platinic chloride solution; stir at intervals. After action becomes slow add 10 c.c. more acid and continue warming until nearly all the zinc has dissolved. Decant the solution upon a filter, wash the residue in beaker two or three times with water, passing washings over the filter[2]. Rinse residue back from filter into beaker.

Dissolve residue with a little nitric acid[3], transfer to a casserole and rinse beaker into casserole. Add 5 or 6 c.c. strong sulphuric acid and evaporate to dense fumes. Cool, dilute with water, stir well, cool thoroughly, filter, wash well with water containing 5% sulphuric acid[2]. Dissolve the lead sulphate in hot ammonium-acetate solution, and wash filter thoroughly with the same solution. Dilute this solution with hot water (about 80° C.) and titrate the lead with standard ammonium molybdate, using 1% tannin or ferrocyanide solution as outside indicator.

The molybdate is standardized on pure lead foil, treated in the same way as the lead residue from the zinc dust. If the ferrocyanide titration is substituted for the molybdate method, the same standard solution will serve for both lead and zinc.

---

[1] The use of 25 c.c. of strong hydrochloric acid, in place of 10 c.c. sulphuric acid, gives equally satisfactory results.

[2] The two filtrates from the lead and lead sulphate contain the iron, cadmium and zinc; they may be mixed, made up to a definite volume, and these metals determined in suitable aliquot portions.

[3] If any considerable residue (silica, carbon, etc.) remains at this stage after treatment with nitric acid, it may be filtered off, washed thoroughly and determined. If in this case a white residue remains after washing it should be treated with hot ammonium acetate solution, and this should be added to the acetate solution obtained later.

Estimation of Zinc Oxide

An approximate method, based on the solubility of zinc oxide in ammonium chloride and ammonia, is given herewith. The solution required consists of: 250 c.c. water; 70 grams ammonium chloride, and 150 c.c. strong ammonia water (sp.gr. 0.90). Weigh out 1 gram of the zinc dust, put into a stout test tube holding 35 to 50 c.c. Use a disk of soft-rubber packing 1/16 in. thick as a cover for the tube, or use thumb as cover while shaking. Add 25 c.c. of the prepared solution, cover tube and shake well for exactly five minutes. Agitation must be violent enough to insure all lumps being broken up. Throw mixture promptly on a 9- or 11-cm. filter, rinse tube and wash filter with hot water, receiving in a 200- or 250-c.c. beaker. Dilute filtrate with hot water to about 100 c.c. Add a drop of phenolphthalein indicator, then HCl till about neutral, then 5 c.c. strong hydrochloric acid. Heat to 80° C. and titrate with standard ferrocyanide, using uranium acetate or nitrate as indicator. Zinc found in solution × 1.245 = zinc oxide in 1 gram.

This method is rapid and gives fairly approximate results, which are closely comparable if constant conditions are maintained in all tests. The results are slightly high, for the reason that metallic zinc is itself slightly soluble in the solvent employed, but there is no known solvent for the oxide which will not also attack the metal. Tests with freshly prepared zinc filings, passed through a 200-mesh sieve, show that the error from this source is negligible if only five minutes' contact is allowed with the above solution. Carbonate of zinc dissolves in the same way as the oxide.

Dissolve 1 gram of dust in dilute hydrochloric acid, heating moderately. Make up to 200 or 250 c.c. in an accurate flask, remove 50 c.c. with an accurate pipette. Add 5 c.c. strong hydrochloric acid, and about 2 grams ammonium chloride, dilute to about 200 c.c. with hot water, heat to 80° C. and titrate with ferrocyanide. The ferrocyanide solution is standardized on pure metallic zinc, dissolved in hydrochloric acid and treated as above.

Determination of Metallic Zinc in Zinc Dust

Many methods have been worked out, most of which are not altogether satisfactory. Those which depend on measuring the volume of hydrogen evolved by the action of acid are hampered by the slow rate at which zinc dust dissolves in dilute acid, and by the readiness with which hydrogen diffuses through rubber tubing and leaky connections. A number of the methods proposed are given in Sutton's Volumetric Analysis. (10th ed., p. 382-383.)

I. Very good results are obtained by determining (1) total zinc, and (2) zinc in the form of oxide, by the methods above given. The difference is assumed to be metallic zinc. This has the advantage of requiring only one standard solution, potassium ferrocyanide, for both titrations.

II. Reduction of chromic acid, by subjecting the zinc dust to the action of potassium bichromate acidified with sulphuric acid. The bichromate should be present in considerable excess of the calculated amount necessary for the zinc used. The residual chromic acid is determined by titrating an amount equal to that originally taken, and the solution after the zinc has acted, or aliquot parts of each, either:

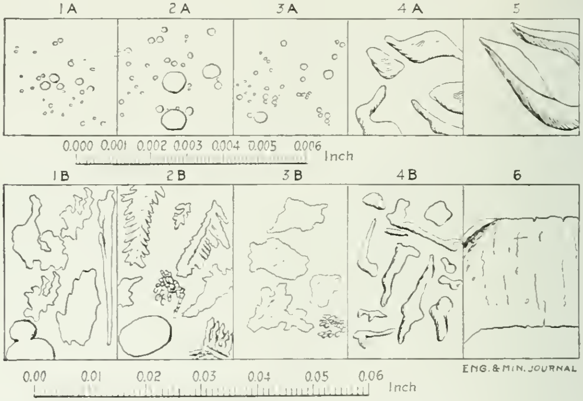
(1) by means of KI, titrating the liberated iodine with thiosulphate (Sutton, p. 383), or

(2) by means of a standardized solution of ferrous sulphate.

(3) by adding an excess of a standardized solution of ferrous sulphate and completing titration with standard bichromate.

III. Reduction of ferric chloride or sulphate and titration of the ferrous salt obtained by standard permanganate or bichromate. Sutton (p. 383) recommends using 0.5 gram zinc dust with 7 grams of ferric sulphate and titrating one-fifth of the solution with permanganate. Presumably 14 or 15 grams of ferric alum would answer equally well.

IV. The reduction by the zinc dust of a solution of iodine in potassium iodide has given fair results, but it is only safe to use rather small quantities, say 0.1 or 0.2 gram, titrating the residual iodine with thiosulphate.


1A
2A
3A
4A
5
0.000 0.001 0.002 0.003 0.004 0.005 0.006 Inch
1B
2B
3B
4B
6
0.00 0.01 0.02 0.03 0.04 0.05 0.06 Inch
ENG.&MIN.JOURNAL

ZINC DUST AND SHAVINGS UNDER THE MICROSCOPE

(1), (2), (3) Zinc dust. (4) Granular zinc. (5) Zinc filings. (6) Zinc shaving.

The following are results obtained with a sample of zinc dust: Method I. Total zinc, 91.6%; zinc as oxide (and carbonate), 12.9%; metallic zinc by difference, 78.7%. Method II. Metallic zinc by reduction of bichromate (3), 79.6%. Method III. Metallic zinc by reduction of ferric alum, 77.1%.

Whatever reduction method is employed for direct determination of the metal, the metallic zinc can be calculated thus: 1 c.c. $N/10$ standard solution = 0.00327 gram zinc.

Determination of Precipitating Efficiency

A solution of potassum silver cyanide is prepared by dissolving 10 grams silver cyanide (AgCN) and 5 grams of "99%" potassium cyanide in a little water and diluting up to 1000 c.c. It is then adjusted by addition of a little more KCN or AgCN until the solution indicates from 0.12% to 0.15% free KCN by titration with standard silver nitrate. The titration is best made by using a 10-cc. or 20-cc. sample, adding 1 cc. of 2% potassium iodide, and a slight excess of ammonia, the end-point is then sharper. Or 15 grams of pure crystallized $KAg(CN)_2$ may be dissolved in a liter of water and 1.5 grams KCN added.

Weigh out 0.5 gram zinc dust into a 300-c.c. beaker. Add a few cubic centimeters of water and stir until zinc is well mixed, then pour in 250 c.c. of the prepared solution, stirring vigorously. See that all lumps are broken up, and continue stirring for fully five minutes. Stir occasionally (at least every 10 minutes) until the end of two hours from the addition of the solution. Then filter upon an 11-cm. filter, wash precipitate thoroughly, sprinkle with test lead, wrap it carefully in the paper, place in a scorifier with about 20 grams test lead, burn paper cautiously in muffle, scorify five minutes, cupel at low temperature and weigh silver. Milligrams silver obtained from 0.5 gram zinc × 0.0606 = percentage precipitating efficiency.

By taking 0.303 gram zinc dust instead of 0.5, each milligram of silver is equivalent to 0.1% efficiency. Instead of cupelling, the silver may be dissolved in dilute nitric acid and titrated with standard thiocyanate with ferric indicator, using the whole or one-half of the solution for titration. Each c.c. of $N/10$ KCNS used for 0.5 gram × 0.654 = percentage efficiency.

This test was devised by A. J. Clark, in 1904, with the idea of utilizing a reaction similar, and taking place under similar conditions, to those actually prevailing in the every-day use of the zinc dust in the cyanide plant. While the results obtained by this method are not entirely satisfactory, they have afforded, during seven years' experience, a better indication of the results to be expected in practical work on the large scale, than those obtained by any other system of examination so far tried. Satisfactory samples of dust usually show efficiencies between 40 and 60%, and sometimes as low as 35%, 100% being the standard calculated for the complete replacement of pure zinc by silver. A better method, one which completely eliminates the personal factor in manipulation, is desirable, but a simple determination of the metallic zinc is not sufficient; the test must automatically take into account the physical condition as well. Attempts to carry out the test in a mechanical shaker, and determining the silver left in solution after filtering after a special time of contact, have always given much lower results than are obtained as above.

Mechanical Tests of Zinc Dust

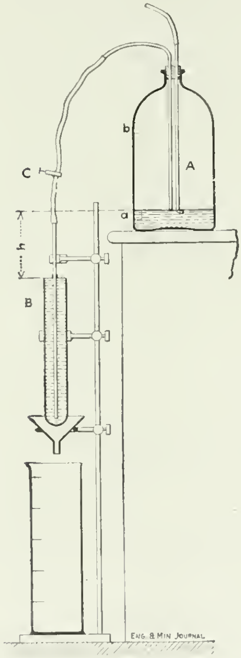
In sizing tests, with sieves of 100 and 200 meshes to the linear inch, using a sample of 20 to 50 grams, good samples of zinc dust usually show at least 95 and often 98 or more per cent. passing the 200 mesh, and not more than 1% remaining on the 100 mesh. This sizing is irrespective of caked lumps, which should never be found in freshly opened barrels.

The elutriation test is based on the separation of the finest particles by a rising stream of water in a vertical tube, the velocity being about 1 cm. per second. It promises to throw some light on the fineness of division of the portion passing 200 mesh, which, as above indicated, ought to include nearly all the material.

Apparatus for Elutriation Test

A convenient arrangement is that shown in the accompanying illustration. A 2500-c.c. acid bottle *A* is fitted with a 2-hole rubber cork, with a Mariotte tube reaching nearly to the bottom and turned at a right angle at the lower end, and a siphon outlet tube reaching to about the same level, thus giving a constant-level water supply. A mark is placed at *a*, the level to which the siphon empties the bottle, and another at *b*, to indicate the surface when 2000 c.c. additional water have been put in. The working cylinder *B* may be a tall 250-c.c. measuring-glass, but it is better to use a large tube with rounded end, say 1.25 in. diameter by 12 or 15 in. long, with a ¼-in. glass tube placed centrally in it and connected with the siphon by a rubber tube with a spring clip *c*, both being fastened to a stand by clamps. A large graduated cylinder and funnel are placed below.

The net area of the cross-section of the working cylinder is best obtained by sticking two labels or making two marks on it 20 cm. apart, then filling with water to the lower mark and measuring the number of cubic centimeters required to fill it to the upper, the central tube being clamped in place. Then the area of cross-section (= volume in c.c. ÷ height in cm.) is obtained once for all.



Apparatus for Elutriation Test of Zinc Dust

To adjust the velocity fill the bottle to the upper mark, fill working cylinder, open spring clip and take time with a stop watch while 1000 c.c. flow out.

$$\frac{1000 \text{ c.c.}}{\text{Area} \times \text{No. sec.}} = \text{velocity in cm. per. sec.}$$

By raising or lowering the working cylinder, the velocity can be adjusted, the effective head *h* being the vertical distance of the top of the cylinder below the level of the Mariotte-tube inlet, the velocity varying approximately as the square root of *h*. The clip on the siphon should be removed or kept wide open during the test, and care should be taken that the rubber connections are not sharply bent or allowed to obstruct the flow. When the point is found at which an upward velocity of exactly 1 cm. is obtained, or some point sufficiently near, it is well to mark the position of the cylinder and clamp or measure the height *h*, so that this position can be reproduced, all the other adjustments remaining the same.

Method for Making Test

Put 20 grams of zinc dust in the cylinder, moisten with a little water, then add 50 or 100 c.c. and stir until all air bubbles are removed, then fill cylinder with water. A wire stirrer is used, reaching to the bottom. The bottle being filled to *b*, open clip and start the flow. Use the stop-watch as a check on the velocity, timing the first 1000 c.c. The wire stirrer must be used at first to prevent packing; most of the fine passes off with 500 to 1000 c.c. of water, but it is best to let 2 liters flow through. Then allow the remaining material to settle a few seconds. rinse into an evaporating dish or casserole, decant off water, wash twice with a little alcohol, dry and weigh the residue. This may be tested with 100- and 200-mesh sieves, if not sifted before making the test, and further examined with the microscope.

By commencing the test with a velocity of say 0.8 cm. per second, and repeating with the same material at 1 and 1.2 cm., several distinct fractions may be obtained from the material passing 200 mesh. The comparatively coarse particles are of several kinds: (1) Impurities, usually chips or sand. (2) Round particles of zinc, or aggregate made up of round particles, looking like grape shot. (3) Feathery or fernlike aggregates of minute crystals of zinc, often forming thin platy masses.

A separation of the coarse particles can, of course, be more simply made by repeatedly stirring with water in a beaker and decanting, but it is impossible to obtain comparable results unless a constant upward velocity is maintained in some such way as indicated.

Zinc Dust Microscopically Examined

The accompanying figures illustrate some of the variations shown in the appearance of certain samples of zinc dust when examined under the microscope. The following is a description of the samples examined: (1) Imported (German) zinc dust, satisfactory, precipitation good. (2) Imported (German) zinc dust, unsatisfactory, precipitation not good. (3) Domestic (U. S.) zinc dust, satisfactory, precipitation good. (4) Granular zinc. (5) Zinc filings, passed 200 mesh. (6)

Zinc shaving, extra fine, about $^1/_{50}$ in. wide.

The figures in the upper row, highly magnified, show the appearance of the medium portion of the "through 200" fractions of three such samples, the very finest part (under $\frac{1}{20,000}$ in.) having been removed by elutriation. As may be seen, these are almost perfect sphericles, and under the highest powers appear to have clean smooth surfaces, and to consist of nearly pure metal. The coarser particles, over 0.003 in. remaining on a 200-mesh sieve, are shown below, and vary greatly in appearance. In several of the more satisfactory samples, illustrated by Nos. 1 and 3, many of these larger particles have a rough, coke-like surface, but some generally exhibit branching crystalline, fern-like aggregates, and other aggregates resembling miniature bunches of grapes. It is possibly only a coincidence that the unsatisfactory sample (No. 2) had an unusually large proportion of the fern-like forms, and also showed more relatively large sphericles in the "through 200" portion. The extreme minuteness of the fine is shown by comparison with the equally magnified filing (No. 5) which had passed a 200-mesh sieve, and the granulated zinc, also passing 200 mesh (4A), the method of preparation of which is not known, but which had a very low precipitating efficiency.

SURFACE EXPOSED BY ZINC DUST

As the efficiency of this precipitate is mainly due to its fine division or extended surface, some calculations of the latter may be of interest. To calculate the surface exposed by zinc dust, we may make use of the fact that the total surface exposed by one ton (2000 lb.) of any material in uniform grains, either cubes or spheres, is $\frac{2.304}{gd}$ sq.ft., g being the specific gravity of the material and d being either the edge of the cube or the diameter of the sphere, expressed in inches. Hence, the density of zinc being very nearly 7, assuming it to be in the form of spheres of a uniform diameter of d inch, we have: Square feet surface exposed by 1 lb. $= \frac{0.165}{d}$

Thus the portion which will *just* pass a 200-mesh (d = 0.003 in.) sieve will expose only 55 sq.ft. per lb., while the material averaging only 0.0001 in. in diameter, which constitutes a considerable proportion of the whole, as may be seen by a microscopic examination of the finer portion, exposes 1650 sq.ft. per lb. It is interesting to compare this with zinc shavings. If we assume this material to consist of a continuous rectangular strip, of width a and thickness b, we have:

Area exposed by 1 lb. zinc shavings = $0.055\left(\frac{1}{a}+\frac{1}{b}\right)$ sq.ft. If, instead of being rectangular, the cross-section of the shaving is a parallelogram of angle A, the above expression must be multiplied by cosec A; in this case the thickness b is measured at right angles to the width a.

For instance, with shavings $\frac{1}{32}$ in. wide, and of various thicknesses, the surface exposed would be:

Thickness...	$\frac{1}{800}$	$\frac{1}{1000}$	$\frac{1}{1500}$ in.
Sq.ft. per pound...	45.8	56.8	84.3

The number of particles (spheres) of zinc dust in a pound, assuming the specific gravity as 7, is $\frac{7.544}{d^3}$. Hence, if the diameter is 0.001 in., 1 lb. will contain 7544 million particles, while at an average diameter of 0.0005 in., there will be eight times as many. This enables us to get some idea as to the intimate nature of the mixture obtained if an "emulsion" of zinc dust is prepared by distributing it with absolute uniformity through the solution to be precipitated. Suppose $^1/_5$ lb. of zinc dust is used per fluid ton (55,296 cu.in.) of solution, or 1 in 10,000 parts by weight, the diameter of the particles being taken as 0.001 in. From the above figures it appears that each cubic inch will contain about 27,300 particles, if uniformly distributed, whence the average distance between the particles will be approximately $^1/_{30}$ in. If the particles are half this diameter and equally distributed, there will be eight times as many to the cubic inch, and half the distance apart.

All samples shown in the upper row are highly magnified (see scale); those marked A are carried off by a stream of water rising 1 cm. per sec., but the finest dust has been removed. Those marked B remain on a 200-mesh sieve, and are less magnified.

MURRAY'S RESULTS DISCUSSED

The foregoing notes were just ready for mailing, when I read a communication[4] from M. Thornton Murray, on the same subject. The sample of zinc dust examined by him appears to have been somewhat coarser than the average, as it is usual to find in the material of less than 0.003 in. diameter a good deal of dust not over 0.0001 in. diameter, and some considerably finer, so that I should be disposed to consider 0.0005 in. more nearly an average for this fraction.

Mr. Murray's assumed gravity (6.92) would give $\frac{0.1665}{d}$ instead of $\frac{0.165}{d}$, which I have assumed for the square feet per pound, or approximately 1% more surface than my formula would indicate. Thus, instead of 144.8 sq.ft. per lb., as calculated by him for a mean diameter of 0.00115 in., my formula gives 143.5 sq.ft. Actually I have found a range from 6.82 to 7 in the specific gravity of samples of zinc dust tested.

Mr. Murray has, however, seemingly obtained his "mean diameter" by multiplying the assumed diameter of each of his fractions by its percentage weight, and dividing the sum of these products by 100, which is not mathematically correct, for the reason that there are far more particles in 1% of the finer grades than in 1% of the coarse[5], if we consider a given weight of the total material. This makes his calculated mean diameter somewhat too high, and the resulting surface correspondingly too low. This may be seen by computing the surface for each fraction separately, as shown in the accompanying table, from Mr. Murray's data for percentages and diameters of the various fractions, the finest fraction alone giving a larger surface than he has computed for the whole.

SURFACE EXPOSED CALCULATED FROM MURRAY'S DATA

Fraction between	Mean Diameter of Fraction (d Inch)	Sq.Ft. for 1 Lb. of Fraction $0.165 \div d$	Per Cent. of Fraction	Sq.Ft. for 1 Lb. of Total Zinc	Sq.Ft. for 0.90 Lb. Metallic Zinc
0.0197 & 0.0100	0.149	11.07	0.16	0.018	0.0162
0.0100 & 0.0060	0.008	20 63	2 42	0 05	0.045
0.0060 & 0.0030	0.0045	36 67	2 88	0.106	0.0954
0.0030 & 0 0	0.00085	194.1	95.54	183.50	165.15
Total	0.0009*	183.67	100.00	183.674	165.3

*Approximate true mean diameter calculated back from total surface by formula ($0.165 \div d =$ sq.ft per lb.).

If the average diameter of the particles in the finest fraction be assumed at 0.0005 in. instead of 0.00085, the surface becomes approximately 330 sq.ft. for each pound of that grade, or 312 sq.ft. for a pound of the total dust, or about 288 sq.ft. of zinc, reckoning 90% of metallic zinc, the surfaces exposed by the coarser fractions being negligible in comparison. As others have pointed out in a previous discussion in fine grinding[6], the results of the calculation depend almost entirely upon the average diameter assumed for the material passing the finest sieve used, which we have no means of precisely determining.

---

[4] Journ. Chem. Met. and Min. Soc. of South Africa, October, 1911.

[5] This is obvious from a consideration of an extreme case. Suppose a mixture of equal weights of bullets of two sizes, half the weight being balls of 1 in. diameter, and half of 0.10 in. The mean diameter is not 0.55 in., since for every 1-in. ball there are 1000 balls of a diameter of 0.10 in.

[6] Journ. Chem., Met. and Min. Soc. of South Africa, Vol. VII. pp. 120, 207, 265, 289.

Baltic Method of Mining—III

By Claude T. Rice

In addition to being comparatively safe the method of caving the floor pillars yields remarkably cheap ore. Exploration is done cheaply. A disadvantage in the method is the tendency to maintain stopes that in reality are unprofitable. Much dead work is necessary. Tonnage per man is watched closely.

The most distinctive feature of the Baltic system is the method of mining the level pillar with a systematic recovery of the ore. A back of ore 60 ft. high is sometimes caved, but it is not good practice to cave a pillar this high, as the back is likely to become bad before the miners can take the top round off the next slice. The fact that the walls along these caves are not prospected, is no great disadvantage because this has been done on the level above and also in the stope at the bottom of the pillar block.

Method Safe and Cheap

The great advantage of the system is, that practically all the ore in the pillar block is obtained safely and cheaply, the ore from the cave being some of the cheapest procured in the mine. Sometimes a back of ore only 20 ft. deep is caved, but that is not good practice either, as it is too thin a block and too little advantage is taken of the cheap filling feature of the caving. Practice has shown that in this ground the most efficient caving height is that which will permit five or six rounds to be taken off before reaching the brow to be blasted with uppers. This makes the bar to be drawn, about 35 ft. thick, as the holes are drilled as half uppers, about 7 ft. deep in most of this pillar mining, or caving. Caving is done retreating from the boundary, or from the middle of a block between two shafts. Sometimes a small stope is carried up with its back at an angle of about 40°, approximating the slope of the caved filling, to come later. Such a stope may be carried up to within about 15 ft. of the level and then a raise put through to the level above; if the stope is short of filling, a raise may be put up from the top of the main stope without any upward slicing, for then filling can be dumped in from above, having been obtained by breaking into the gob on that level or else from some of the development workings. In any case, great care is taken not to damage the walls when breaking through. A feeling hole is first put up, and the place where that hole breaks through is noted. By placing the other holes with reference to that one, the raise is drilled so as to break through in the center between the walls.

Before blasting, the wall pieces on the level above are braced in order to take as much of the weight of the filling from the walls as possible, so that the whole level will not come down into the stope below, in case the walls are injured by the blasting. Spreaders and planks are also used to brace these walls, for it is highly desirable to keep them in perfect condition, until caving really commences. When the raise has broken through either the rilling off of a stope with the back having an angle of about 40° begins from the bottom of the raise, or, if the raise has broken through from the top of the stope, waste is dumped in to enable the miners to get up to the roof to drill the back, it being understood, of course, that the ore has all been sorted out and only poor rock left in the stope. After this is done, the stope is ready for caving.

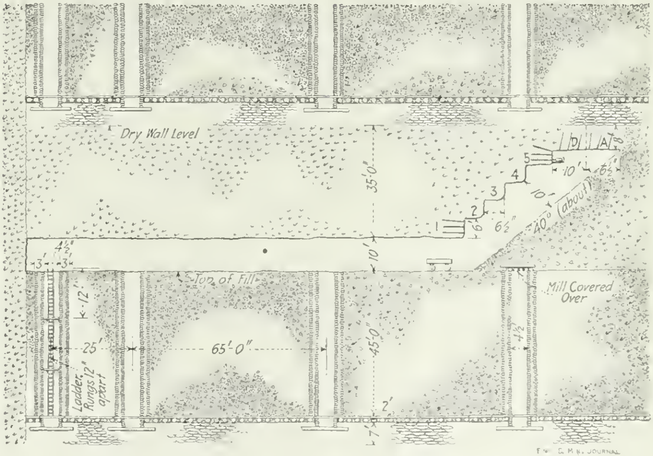


Fig. 1. Caving with Flat Holes, Baltic Method

Drilling in the "Cave"

There are two ways of doing the caving. The older one is still used at the Trimountain and is shown in Fig. 1. In this method, the ore is broken down by flat water and dry holes, just as in the regular stoping, except that the roof is carried up in a series of stepped breasts. In the newer and safer method, the roof is drilled with uppers as shown in Fig. 2. Where the lode is narrow and the back is not broken much, the method of carrying the stope up in a series of flat breasts with flat holes, is better, as the holes break a larger tonnage and less carrying around of the machine is necessary. A difficulty with this method, is that in bad ground the machines must be set up under an old back. If this back is broken much, considerable barring down will be necessary, and the jar of the machine is likely to bring down bad ground.

Where upper holes are used in this work, the machine is always set under a fresh back of ground that has not had time to become bad. The barring down of bad ground, necessary in this method, is no greater than in ordinary stoping operations. Where uppers are used only two breasts really have to be trimmed, the back under the last round blasted, under which the machine is set up; and the back ahead, under the round that is to be drilled. These two places must be trimmed up carefully. In the other methods with the flat-hole pillar stope, the machine is set up ahead of the breast that is being drilled, and four breasts must be trimmed carefully before drilling commences: The back over the last round blasted, the back under the one being drilled, the back of the bench under which the machine is being set up and the back of the bench above.

More Tonnage with Flat Holes

This may seem to be an unimportant matter, but it is really the thing that decides which of the two systems of drilling the cave shall be used. To sum up, the main reason that the benching system with its flat holes is used is, that more tonnage can be broken in this ground with flat holes than with the same footage distributed in half uppers. The question then arises: Will the time taken in barring down the back, be sufficient for the drilling of enough uppers to give the tonnage that could be secured by flat holes in the same stope? Strange to say, it is safer to use upper holes.

Upper holes shake up a back more than flat holes do, because the breaking of the ground at the bottom of the upper holes causes more of a kick on the ore left on the back. It is not the kick of the hole that makes the ground bad in these caves so much as it is the time that the undercut back is left hanging, for upon that depends the extent to which the old slips and cracks that are formed in the level pillars will open up. It is this that really causes the dangerous ground in the pillar stopes.

The fact is important, that only about half as much back has to be trimmed each time in a cave worked with uppers as in one where flat holes are used; this is important in regard to the thickness of the level pillar that can be mined as well as because of the safety attending the use of upper holes. The sooner the machines get to drilling, the sooner is the slice carried up to the top of the pillar stope and a new slice begun. The time that it takes to work one of these slices determines the thickness of the level pillar that can be caved. As this is cheap ore it is highly important to increase its thickness to a maximum. In bad ground, drilling with uppers allows this to be done. It is the time that it takes to work a slice up to the pillar stope, which determines what the mine captains call the "handiness" of the cave.

IMPORTANT FEATURES OF PILLAR MINING

The essence of the pillar mining is to carry the pillar stopes up at an angle approximating that assumed by the filling when it runs down into the stope, and to leave an overhanging brow at the top of the pillar stope, to hold back the filling, permitting it to run down just near enough to the roof to permit the miners to set up and bar down the inclined back of ore easily. After the miners, with the machine set on top of the ore, have worked up another slice of the stope to add new width to the brow under the level above, and after the ore has been worked down from the pile of filling, enough of the brow is blasted to permit the filling to run down, in this way enabling the men to get near enough to the back to take another slice.

As soon as the raise has broken through, waste is run in so that the miners can get within set-up distance of the back and the stope at the bottom of the raise is worked up until it has assumed a slope of about 45°. Several slices are then worked off the sloping face, and waste is dumped in from above as fast as the ore is taken from the stope below. The cuts are carried up until an overhanging brow about 18 ft. long and 8 ft. thick has been formed under the level. The stope is then ready to be caved. This is generally done by drilling the brow from above. From 20 to 30 holes are drilled, so as to blast out all of the brow except about 8 ft. next to the face of the stope. This permits the filling from the level above to run down into the stope below and to fill it up to within about 6 or 7 ft. vertically of the roof.

FILLING IS HELD BACK

Owing to the overhanging brow the filling cannot run down far enough to fill in next to the roof completely. As was mentioned before, the length of the brow at the top is regulated so that it holds the filling back just far enough away from the roof to permit the men to set up their machines. This is one of the features of the pillar mining. At the Baltic mine it is customary to blast out the wall pieces of the dry walls, so as to be sure that the filling will come down in good shape and not be hung up. At the Champion and the Trimountain, this is done only when starting the cave. Owing to the shock of so many holes going at one time, and the fact that the holes are drilled so as to break the roof from under the walls and make a wide hole, no trouble is experienced in making the walls fall in; strangely enough, however, there is no collapsing of the dry walls farther back, as they are generally found standing in good condition within 4 or 5 ft. from the brow of the cave.

At the Trimountain mine, I believe all the drilling for bringing on the cave is done from the stope below, but in both the Baltic and the Champion mines the procedure is as I have outlined. After caving has once started, the back part of the overhanging brow that is left to protect the stope from a deluge of filling, is always drilled before the front part is blasted; it would be unsafe to set up and drill the front of the brow after it has been standing for a long time, drilled and exposed to the hammer of the filling, as it runs down into the stope below.

MIXING OF THE ORE WITH THE FILLING

The theory is that the ore from this brow comes down ahead of the filling, in fact that it is pushed down ahead of it. I have not been in a stope just after the back has been blasted and the filling permitted to run, but I estimate that probably not over half of this ore in the blasted brow is recovered. Before the brow is blasted, all the ore has been cleaned from the top of the pile of filling in the stope, the pickers and the miners working the ore that is lying on the pile near the top, down to the bottom where it is thrown directly into the mill or loaded into a car and run to the mills when the latter are too far away. Most of the ore, however, runs to the bottom of the pile as it is worked away from the latter, for the filling on which the ore falls is just at the angle of repose.

The large pieces of the filling run down first and in case the small material does not come down of its own accord, the miners and pickers work it down so as to decrease the amount of ore that is lost through mixture with the waste, but there is almost always plenty of small dirt at the top of the pile. It is easy to tell the fresh ore from the filling, owing to the partial decomposition of the latter, and it is probable that little ore is lost through mixture with the filling either in the main stopes or during caving. In the main stopes care is taken to get a good covering of fine material on the top of the filling before the ore is blasted down, for this carpeting of the pile with fine material makes the shoveling of the ore easier. There is, of course, some loss of the finest of the ore, but as some of the top layer of filling is always scooped up with the ore, this cannot amount to much, especially as the ore does not break fine.

Before commencing to drill in the cave, the miners try to block back the filling with pole lagging dug from the latter so that the filling will not run down on them. The pieces that are about to roll down of their own accord are then forced down by the miners. It is sometimes possible to climb through one of these caves, but commonly the cave blocks itself tightly, although there is enough open space in the pile to admit a fairly strong draft of air through the cave.

WORKING CAVE STOPE WITH FLAT HOLES

In Fig. 1 there is shown the method of carrying up the back when flat holes are used. The best practise is to use five of these breasts, and each of them is about 6 ft. high and 6½ ft. deep. The sketch represents conditions in the stope just before the brow is blasted. The brow, as will be seen, is composed of two parts. Part *A* is the portion left standing ready drilled from the last brow, while *D* is the portion that has just been drilled and is to be left standing to hold back the filling while the next slice is worked off the roof. It will also be noted that breast 5 stands drilled. This is drilled at the same time that *D* is, and the machines, posts, drills, etc., are left piled on drills that are sticking out of the holes of this breast. When the filling rushes into the stope it cannot reach brow *D* and the machine men can pull down their machines with which to drill at the bottom of the level block, as soon as they have worked down the loose boulders on the waste pile, and blasted round 1 that has been left standing there.

Round 1 is left standing because the fill does not always run well and if it does not it is difficult to set up under 1. By leaving round 1 standing, the miners are always able to get a good start on slicing the back, for when 1 is blasted there is enough ore to set up on, to reach the breast. A new round 1 is then drilled and left standing, and finally the real working up of the roof to the brow, begins again with a round left standing always at *A*, 5 and 1 in the best practice.

It will also be noticed that in Fig. 1 the level is shown well along toward the end of caving operations, as the shaft pillar is only back about 125 ft. from the pillar stope. The reason can now be seen for putting up the first two mills so close together. In caving there must always be both a manway and an ore mill, or two mill holes, open. The caving is continued until the pile reaches the mill next to the manway mill, the first one out from the shaft pillar. After a little horizontal slicing, the rest of the level pillar is left as a projection shooting out from the shaft pillar, possibly later to be obtained when that pillar is also robbed. Whenever the pile of filling is near the mill hole, the latter is covered over before the mill is run, for it is often possible to work back to the mill again by throwing some of the filling to one side.

WORKING CAVE STOPES WITH UPPERS

Fig. 2 shows the method of working the cave stope with half uppers. These holes are drilled 6½ to 7 ft. deep, and about parallel with the top of the pile of filling. About three holes are drilled to a row, and a block of ground about 6 ft. high and 8 ft. long, in the direction of the strike of the orebody, is broken. As shown in Fig. 2 the machine is set up on top of the pile of ore that has been blasted down by the last cut, rather than upon the filling. In Fig. 2, the machine men are drilling the top slice under the brow, it having taken them four such slices to reach that height. A round is left drilled at the bottom, but this is not so common a practice in the stopes drilled with uppers as it is in those drilled with flat holes, because the filling is always near the roof of the stopes in the caves drilled with upper holes. The brow, of course, is always left drilled as is the practice in the other systems. The other details of the work are quite similar to those in the other method of carrying up the cave stopes and do not require comment.

It would seem as though these cave stopes would be good places to use air-hammer stope drills, and a few are being tried. Their use saves much carrying around and the back can be drilled more easily, especially when it is broken up by slips; it is possible to set up the stoper drills any place and to drill away from under dangerous ground. In short, the air-hammer stoper drill is more mobile than a machine set up on a bar, as the set-up can be changed as desired and it is unnecessary to choose a set-up designed to last a day. Mobility is an important thing in drilling these caves.

WORKING CAVE STOPES UNDER PILLARS

It will be seen, of course, that an essential in this so called caving, is the pile of filling to set up on. In case there is a pillar of poor ground along the level above, little trouble is experienced, provided the poor ground is not long. At the Trimountain and the Champion mines, however, where the patches of poor ground are generally longer than at the Baltic, considerable trouble has been experienced in working cave stopes under them. In such a case it is cheaper in the long run to stope up through the pillar and to tap the filling in the stope above the pillar. This is done by continuing past the level with a small inclined stope, until the drill hole that is carried ahead in the breast, as a precaution, goes into the filling. This inclined stope is then enlarged until the blasting of the back will make a hole large enough to permit the filling to run down through it freely. The floor of this stope, of course, is carried up sufficiently steep so that the broken rock will run by itself.

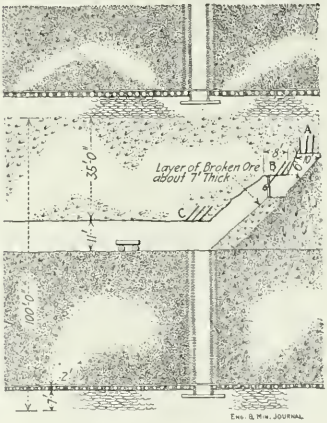


FIG. 2. CAVING WITH UPPER HOLES, BALTIC METHOD

It may be necessary, temporarily, to carry the roof of the cave stope clear up to the top of the poor patch of ground, leaving a brow to hold back the filling, as in robbing the level pillar. Once the connection has been made, so as to get enough filling down to fill the stope, mining can generally progress with the top of the stope at the level, as before the poor pillar was encountered. The length of the poor patch, as well as the amount of poor rock from the level pillar itself, determines this.

Both in the caves and the regular stoping, the ore breaks large and many boulders have to be broken up to get them into the mills. This is sometimes done by pasters, but generally the boulder is blockholed instead of being bulldozed, as most of the machine men can double-jack a hole into a boulder in a short time. Formerly small air-hammer pluggers were used for drilling the boulders. In this event, however, a quantity of boulders would be blasted at once and it was not always possible to determine whether or not the holes had exploded. If there was a missed hole, this was attributed, after a short hunt for it, to two holes having gone at the same time. In time, however, it was discovered that more dynamite was being found in the rockhouse than before. Therefore, owing to the fact that it is necessary to drill the blockholes only 2 or 3 in. deep, to break up an ordinary boulder, there was little, if any saving in having a special man go through the stopes, drilling these pop-holes with a plugging drill, and the practice was discontinued.

KEEPING UPPER STOPES FILLED

Owing to the continual pulling of the filling from the stopes above, to fill the top part of the stopes below, it is necessary, in order to prevent the caving of the surface, to dump in poor rock to take the place of the filling. However, it is considered that after a depth of 1000 or 1200 ft. vertically, has been reached, it will no longer be necessary to fill the upper stopes in this manner. After that the poor rock will be dumped underground only as the most convenient way to get rid of it. At present, however, this filling is supplied by dumping into the mines, the poor rock that is coming from the development work on the lower levels. At the Champion this is hoisted to surface and is there loaded into a car, after being dumped over the grizzley to screen out the fine material for road purposes, the oversize being run back into the mines. At the Trimountain mine this poor-rock dump is on the first level, while at No. 4 Baltic the stopes from surface down to the ninth level have been filled with poor rock dumped from surface; also from the ninth level to the 13th the stopes have been nearly filled by tramming the poor rock from the bin on the ninth level, into which the poor rock is dumped from the skips.

In order to permit this tramming of the poor rock out along the level, the stopes of the level below cannot be caved. Instead, that block of ground is sliced up close to the level and only enough of the back is left to secure the level above.

This floor pillar, however, is left only on a level where the lode is comparatively poor. Several raises are cut up through this level pillar, and as fast as the filling is drawn down more fill is dumped in. Owing to the dip of the lode it is generally feasible to work the filling down in this way for about five levels. Consequently, the poor-rock dump at that shaft is to be changed from the ninth to the 14th level.

This underground dumping of the skip is accomplished by raising the back wheels and dumping the load that way instead of cutting the rails and letting the front wheels of the skip drop away as is done in most of the skip dumps. The dump used at the Copper Range mines was devised locally and called the Angove dump after J. W. Angove, the master carpenter, who invented it.

ADVANTAGES AND DISADVANTAGES OF THE METHOD

In this method like any other where the back is not supported, the ore must be strong and not inclined to scale off badly, thus making it dangerous and requiring much barring down to make it safe for the pickers to work under. The pickers, of course, could be kept nearer the miners if desired, and the filling carried along contemporaneously with the mining, in parts where the poor rock from the lode is insufficient to fill the stope. This would remove, to a large extent, the trouble from the slabbing of the roof, but the ore must stand well. The walls can be weak for they are exposed only over short stretches. To use the dry walls the rock must break into long, flat boulders. A class of labor that is cheap and patient is also essential in this work. The rock should be fissile, so that it can be trimmed up to fit fairly tight in its place. The rock must not be much altered or it will crack in time, partly because of the weight on it and partly because of decomposition.

The method of mining the level pillar is adapted to the mining of any such pillars where the ground will stand in open stopes. The finer the filling that comes down from above and the more difference that there is in color as compared to the ore, the less will be the ore lost through admixture in the working of the pillar. The Baltic method possesses all the advantages that attend mining with a filling. The highest possible extraction is obtained by the method, and therefore the maximum production possible from a given area of ground, especially where irregular fingers break off into the walls, as at the Baltic. Any ground nearby, that is of mineable grade, can be worked cheaply, as the mining of the main lode has not broken up the ground in its vicinity. The walls can be explored cheaply, as the filling can be utilized in the stopes, and the necessity of getting filling encourages a thorough prospecting of the walls, a thing that often is much neglected in American mining. As stated before, enough copper is obtained by the exploration of the walls in this mine, in the opinion of those who know the mine best, to pay for the cost of the filling of the stopes.

DAMAGE BY CRUSHING IS AVOIDED

Because of the filling of the stopes, damage to the mine through crushing is avoided, and it is impossible for the cracking and caving of the walls and adjacent country to be serious. This is an important feature when working the mines at great depth and where the condition of the walls in the upper workings is important in keeping the shaft open. Within limits, there is a control over the grade of the ore that is sent out from the stope. This fact made the Baltic mine one of the lowest-cost mines, per pound of copper produced, of any in the United States, while it had been able only with difficulty to keep its head above water, when the method in which practically all the ore broken had to be sent to surface, was used. This underground sorting means success or failure at many mines.

DETAILED UNDERGROUND COSTS
BALTIC MINE FOR 1910

Tons of rock hoisted	823,352
Tons of rock stamped	781,419
Total shaft sinking	780.5 ft.
Total drifting	11,218 ft.
Total crosscutting	465 ft.
Percentage of waste hoisted to surface	5.09
	Costs per ton stamped
Underground superintendence	$0.015
Underground labor:	
Drillers	0.353
Trammers	0.194
Pickers	0.154
Fillers, all time on filling	0.023
Wallers	0.049
All other underground labor	0.051
Underground supplies:	
Explosives	0.077
Sunshine, carbide and candles	0.010
Timber	0.012
All other supplies	0.036
Compressors and drills	0.055
Hoisting expense	0.060
Rock house	0.047
General expense	0.043
Engineering and assaying	0.003
Office	0.020
Surface labor	0.010
Total cost of mining, per ton	$1.212

The method of contemporaneous filling of the stope permits the sorting to be done at a minimum expense, and at the face, where the ore is fresh and the minerals keep their characteristic lustre, untarnished by exposure to the air. The disadvantage of the method is the difficulty of having the work done properly. The underground sorting requires constant watching and the back must be watched carefully to make the men keep it safe for the pickers when they follow along later. Bossing costs are, therefore, likely to be higher than in other systems, because it is necessary to watch the way the men do the work, rather than the quantity of work that they do. This has its advantages, however, in that the close watching necessary makes the work of the men more efficient. There is the drive of the work behind the men that there is not in ore-filled stoping methods. The pickers must fill the cars or it shows, and the miners must break the ground so that the pickers can have the dirt. The amount of work done shows quickly for each set of men.

MUCH DEAD WORK NECESSARY

A large amount of dead work is necessary so that the underground costs are always high, regardless of whether the fill comes from the lode, is sent down from surface, or is broken from the walls in prospecting, as is the case at the Baltic. Tonnage figures and costs are always against the mine using such a method, except in regard to cost of finished products, and that fact sometimes influences the choice of method. One of the greatest faults is the fact that it is easy to continue to work a stope after it really is failing to carry itself. Poor rock can be disposed of easily, the fall in tonnage figures is not especially noticeable, owing to the large amount of dead work that is done all the time, and unconsciously the tendency is to work for too long a time, ground that is below the border line of profit. In other words, there is a great temptation to prospect by stoping. Moreover, as it is so easy to dispose of the poor rock, since filling must be obtained for the stope, there is also a temptation to sort too clean.

While I have stated that it is difficult to make the men keep the workings safe, the method itself is intrinsically one of the safest. The important thing consists in making the bosses see, that when an accident occurs it is their fault, until they can show that they were not negligent in their inspection of the workings. In this method it is up to the boss as soon as there is an accident and the Copper Range mines are worked on this principle. That is one reason that there are so few accidents in the stopes and, in fact, throughout the whole mine.

COST AND TONNAGE STATEMENTS

The following figures showing costs and tonnages have been compiled from the last three reports of the Copper Range companies for the Baltic and Champion mines. These properties are all on the same lode, and the extreme stopes in the extreme mines are not four miles apart; the mines are operated under the same management and even have the same general underground superintendent. The mining method is the same in all the three mines and the occurrence in a general way is similar except as to grade.

The conditions at the Baltic mine are more normal in regard to the method, than at either the Champion, where the method has not been in use quite so long, or at the Trimountain, where a large amount of development has been necessary in the search for ore. I will give only detailed tonnage statements and detailed underground costs for the Baltic. These are higher than in the past, but are about what they will probably average at present, when all the work is properly proportioned. The company reports give only the general underground costs, but they are enough to show how these costs vary in mines even nearby and working under quite similar conditions.

AVERAGE COSTS AT COPPER RANGE MINES, 1908-09-10

	Costs per ton of rock stamped		
	Baltic	Trimountain	Champion
Rock hoisted, tons, total for three years	2,485,066	1,144,183	2,446,521
Rock stamped, tons, total for three years	2,359,796	975,636	2,280,662
Percentage waste	5.04	14.7	6.78
Shaft sinking, ft.	2,392.5	2,866	2,587
Drifting, ft.	31,320	24,167	35,306
Crosscutting, ft.	1,841	2,116	1,934
MINING COSTS			
Superintendence and labor	$0.815	$1.014	$0.915
Rockhouse expense	0.057	0.074	0.057
Hoisting expense	0.063	0.136	0.054
Power drills and compressors	0.055	0.096	0.074
Powder and supplies	0.154	0.202	0.176
SURFACE EXPENSES			
Superintendence and labor	0.029	0.067	0.028
Supplies	0.017	0.020	0.012
Insurance	0.006	0.014	0.008
Purchasing department	0.003	0.005	0.004
Legal and general expenses	0.002	0.003	0.003
Teaming	....		0.003
Electric lights and telephones			0.001
Library maintenance			0.002
Transportation, rock to mill	0.142	0.113	0.138
Stamp-mill expense	0.187	0.202	0.194
Cost, exclusive of smelting and taxes	$1.510	$1.946	$1.669
Smelting, freight, marketing (variation entirely due to copper content of ore)	0.214	0.194	0.230
Total cost per ton, exclusive of taxes	$1.724	$2.140	$1.899

At the Baltic mine the tonnage of stamp rock obtained per man underground was 2.8 tons per shift during 1910. In that year there was obtained per man at surface and underground at the mine 2.48 tons per shift and in 1909 the figure was 2.62 tons. In 1910 there was sent to the mill 2.26 tons per man employed at the mine and the mill while in 1909 the corresponding figure was 2.39 tons. During 1910, 5.09% of poor rock was hoisted to surface, and in 1909 this figure was 4.34 per cent.

TONNAGE PER MAN WATCHED CLOSELY

The tonnage obtained per man in the cave stopes is about 10.5 tons in the Baltic, 9.75 at the Champion and 6.75 at the Trimountain under present conditions. When the tonnage gets down to five tons per man working in the cave, the cave is watched carefully as it is about at the border line between profit and loss. These tonnage statements and the tonnage per man employed are the two statements that the management watches the closest in the operation of the mine, as the number of men at surface is practically constant and there is no necessity for keeping a separate statement of the tonnage per man underground. Any variation in the tonnage for them shows immediately in the other statement and investigation begins.

Taking the average of the underground labor costs for three years at the Baltic and adding, from the surface costs statement, the cost of surface labor and of supplies, and assuming that the cost of purchasing the mine supplies about balances the mill's proportion of the cost of the accounting for the property, all of which I have included in the mine costs, I find that the total mining cost was $1.19 per ton while the cost for underground labor and superintendence was 81½c. per ton, or 68½% of the total mining cost, being somewhat higher in proportion than in other mining methods because of underground sorting and the fact that by dry-walling the levels, the cost of supplies is decreased at the expense of labor cost. Only in 1908 was a separate construction account kept. It amounted to $99,035 for the three properties. The cost for the three mines, therefore, gives the total cost of producing the copper except that I have not included taxes.

In conclusion, I wish to acknowledge the kindness of F. W. Denton, general manager; W. H. Schacht, assistant manager; John Jolly, underground superintendent for the Copper Range Consolidated, as well as the captains of the different properties, for the information so kindly given during the preparation of these articles.

Queensland 1911 Mineral Production

The advance sheets of the report on the mineral production of Queensland (*Queensland Government Min. Journ.*, Mar. 15, 1912) for 1911, show the following figures: Gold, 386,164 oz., £1,640,323; silver, 549,015 oz., £56,305; copper, 20,383 long tons, £1,151,351; coal, 891,568 tons, £323,998; tin concentrate, 3091 tons, £307,847; wolfram ore, 539 tons, £54,163; limestone, 114,675 tons, £27,887; gems, £27,393; lead, 1771 tons, £23,460; molybdenite, 99½ tons, £13,278; bismuth and wolfram ore, 129 tons, £11,564; iron flux, 20,639 tons, £11,157; miscellaneous items, £12,337; a total of £3,661,063. This is a decrease of £49,159 from the previous year. The gold production decreased £234,627, but other metals and minerals showed slight increases.

Standard Consolidated Mining Co.

The operations of the Standard Consolidated Mining Co. at Bodie, Calif., as shown by the official report for the year ended Jan. 31, 1912, were carried on under adverse conditions. The development work of 6254 ft. was done at the relatively high cost of $4.28 per foot and the amount of ore disclosed was comparatively small. The ore obtained by development was 1486 wet tons and by stoping 7980 tons, giving a total mined of 9466 wet tons or 8798 dry tons, which was insufficient to keep the mill operating at full capacity and resulted in higher costs.

The average grade of this ore was $14.74, of which 45.8% was recovered by amalgamation in the mill. In the slimes plant, the tailings from the stamp mill together with 15,917 tons from the pond, making a total of 24,715 tons averaging $5.73 per ton, were cyanided, the indicated extraction being 86.8% and the actual recovery 128.6%. The total indicated extraction was 90.7%, while the actual extraction was 117.1%. Superintendent Buchanan thinks that this discrepancy between indicated and actual recovery may be due to the presence of amalgam in the old tailings, as the bottoms of several of the ponds were worked out during the year. Due to the small tonnage available from the mine and the difficulty of handling the old tailings, which are practically all clay, and filter slowly, the total tonnage was much less than last year and the cost per ton higher.

The total cost of all operations is given as $17.107 per ton, divided as follows: Mine: General, $3.614; development, $2.827; stoping, $4.362; distribution accounts, $0.978; total, $11.781 per ton. Mill: Labor, 89.6c.; supplies, 33c.; bullion (express and treatment), 6.9c.; distribution accounts, 58.3c.; total, $1.878. Slimes plant: Labor, 93.6c.; supplies, 91.6c.; bullion, 7.8c.; distribution accounts, 46.5c.; total, $2.395. Administration, $1.053. The following additional data concerning supplies consumed in the slimes plant are given: Cyanide, 1.1 lb.; lime, 16.6 lb.; lead acetate, 0.1 lb.; zinc, 0.7 lb.; pebbles, 0.9 lb. per ton of ore.

South Australian 1910 Mineral Production

The mineral production of South Australia for 1910 is officially reported as follows: Copper, 5102 long tons; gold, 6603 oz.; salt, 54,000 tons; iron ore, 46,200 tons. The copper production is valued at £306,120, the other three together at £76,945, while the remaining mineral production is valued at £32,777, of which gypsum, £9000, and bluestone, £5980, are by far the largest items.

Breaking of the Gold Cliff Hoist Cable

By Lewis H. Eddy

The breaking of the winze hoist cable and the dropping of a loaded skip to the bottom of the 900-ft. winze in the Gold Cliff mine, in Calaveras County, Calif., about the middle of February, attracted little attention, owing to the absence of injury to any of the workmen, and to the slight damage to the underground equipment. The Gold Cliff is one of the Utica Mining Co. mines, at Angels Camp. It is situated about half a mile southwest from the Utica and Stickels mines, which are owned and operated by this company within the town of Angels. It is entirely separate and without underground connection with the other workings.

A Utica Mining Co. Mine

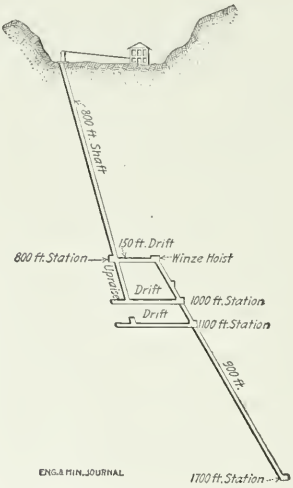
Economically, it is a part of the Utica system and is operated under the direction of the same superintendent, F. J. Martin. The mechanical operation is controlled from the same source. The 60-stamp mill, which crushes the ores from the Stickels and the Cross shaft of the Utica, and the 40-stamp mill, which crushes the ore from the Gold Cliff, receive electric power from the same station, as do the hoists; the compressors are under one roof; the plants are situated at Angels. The operation of each mine is separately controlled; an accident in one cannot affect another.

The trend of the Gold Cliff veins is about northeast; the dip varies from 28° to 60°. The mine is developed by inclined shaft and winze, drifts, crosscuts and raises. The shaft is 800 ft. inclined depth from the collar to the first station; thence a drift is run 150 ft., from which point the winze starts; the winze is about 900 ft. deep from the mouth to the lowest station. At 200 ft. below the mouth of the winze, a station is cut and a drift run toward the shaft; this drift is connected to the shaft by a raise. Another station is cut at 300 ft. below the mouth of the winze, and a drift run toward the shaft; a raise has been started to connect this drift with the first raise. Other drifts from the winze will be run and all will be connected by raises; thus deepening the shaft by raise connections until it reaches the lowest level of the winze.

The ore is mined in the drifts, crosscuts and raises and the bottom of the winze. There are five stations: One shaft station for loading, at the 800-ft. level; one hoist station at the mouth of the winze on the 800-ft. level; two intermediate stations at the 1000- and 1100-ft. levels (in the winze), and one at the 1700-ft. level, the bottom station in the winze. There are two electric hoists: One at the surface, which raises the ore from the 800-ft. level; one at the mouth of the winze, which raises the ore from the lower winze levels. The ore is trammed from the unloading station at the mouth of the winze to the loading station at the shaft. When the shaft is deepened by connecting raises until it reaches the lowest level of the winze, the ore will all be raised to the surface through the shaft by one hoist.

Hoist Cable in Winze Broke

The accident in February resulted in damaging the timbers in the 1100- and 1700-ft. stations. The men in the drifts climbed ladders to the 800-ft. level, and were then lifted in the usual way in skips through the shaft to the surface. The cable parted at a point nearly 300 ft. from the reel, the loaded skip striking the 1100-ft. station, and then going direct to the bottom of the winze. The cable had been in use about six months. It was a 7/8-in. cable, the same size and make as used in all the Utica workings, and by the records of the life of other cables should have been good for two years' wear. The skips in the Gold Cliff carry one ton; in the other Utica workings the skips are 1½-ton capacity.



Gold Cliff Mine, Angels Camp, Calif.

Examination of the broken parts of the cable disclosed some of the center strands corroded and so brittle as to be easily broken with the fingers. Other parts of the cable were cut in the examination and were found to be sound. Black crude oil was used for "doping" or coating this cable, and is the same coating that was and is used on all the cables in the Utica mines, and the same as is used in general practice in this part of the state. The cost of a new cable was the only significant item of expense resulting from the accident. The repair of the damaged stations caused only a short delay and the cost was nominal.

Nevada Consolidated

The report of the Nevada Consolidated Copper Co. for the quarter ended Mar. 31, 1912, shows production as follows: January, 6,309,228 lb.; February, 4,888,790; March, 6,380,432; total, 17,578,450 lb. The low production in February was due to the extremely dry season. Additional settling reservoirs have now been built, so that the concentrator water can be used again when necessary.

Ore milled amounted to 728,592 tons, averaging 1.85% copper, of which 76,547 tons were mined by underground methods from the Veteran mine. After paying the regular quarterly dividend, and charging off depreciation on the Steptoe plant, and ore extinguishment, the balance to undivided profits for the quarter was $212,479.

A contract has been drawn by which one section, or one-eighth of the Steptoe concentrator, will be used hereafter for ore from the Giroux Consolidated Mines Co. The remaining seven sections should be ample for the Nevada Consolidated output. This contract runs for five years, but can be cancelled at any time on one year's notice.

Tennessee Copper Co.

The operations of the Tennessee Copper Co., at Copperhill, Tenn., for 1911, showed a total profit of $407,049. This was not as satisfactory as had been hoped for, and was due to the low price of copper prevailing during the year, and to a fire in the acid plant in June, which damaged the flue connecting the smeltery and the acid plant, and the tops of the Glover towers. This necessitated a complete cessation of operations for over a month, and seriously impaired the efficiency for over two months.

Screens have been installed to get rid of excessively fine material in the blast furnaces. This was necessitated by the enlarged acid-plant capacity, which required that the gas from all the furnaces should be available for acid making. This screening and the bedding plant have permitted cutting off about 20% of carbonaceous fuel, giving more SO_2 in the flue gases, while the acid plant itself has been efficient beyond the early estimates, so that production now is at the rate of about 200,000 tons per year. The fines themselves, with the flue dust, and some custom ore, are treated in a Dwight-Lloyd sintering plant.

Total copper production was 13,808,940 lb. from 436,285 tons of Tennessee company's ore, or 31.6 lb. copper per ton of ore, and 3,832,972 lb. of copper from 34,768 tons of custom ore, or 110.2 lb. copper per ton of ore. Total costs at Copperhill were $0.09599 per lb. of copper, or $3.03772 per ton of Tennessee ore. This is distributed as follows: Mine development, $0.15600; mining, $1.06599; railway, $0.08338; general expense, $0.12455; smelting, $1.38326; converting, $0.22454. Freight, commission, etc., bring these figures to $3.4428 per ton of ore, and 10.88c. per lb. of copper.

Mine development amounted to 3896 ft. of openings, and 1992 ft. of drilling. Ore production was 444,625 tons. Mining has been changed from underhand to back stoping.

Proposed Tariff Legislation

Washington Correspondence

Senator A. B. Cummins of Iowa has offered in the Senate a new bill amending the metal schedule. This bill, presented on April 29, has been examined by experts in the employ of the Democrats of the Senate and is approved by them. The plan as now framed is to start a debate on steel and other metals at once, carry it along until concluded and then insist upon a vote on the Democratic steel bill. This will be defeated. Then reconsideration will be moved and the new Cummins measure will be substituted for the Democratic bill and passed, if enough insurgent Republican votes can be secured, as it now seems probable they can. In that event the Cummins bill will meet the House Democratic metal bill in conference and whatever may be determined upon will be between the two measures. Then presumably this compromise will be passed through both Houses and sent to the President. The Cummins bill contains among others the following provisions:

(1) Iron ore, including manganiferous iron ore and the residuum from burnt pyrites, shall be admitted free of duty.

(2) In this act a ton shall be held to mean 2000 lb. except with respect to pig iron, spiegeleisen and ferromanganese, and as to them 2240 lb. shall be considered as a ton.

(3) Iron in pigs, iron kentledge, spiegeleisen and ferromanganese $1 per ton; cast and wrought, scrap iron and scrap steel, fit only for remanufacture by melting, 50c. per ton.

[Steel ingots and other more advanced forms are to enter under duties ranging from $1.60 to $5 per ton.]

(43) Lead-bearing ore of all kinds, 1.5c. per lb. on the lead contained therein; Provided, that on all importations of lead-bearing ore the duty shall be estimated at the port of entry and a bond given in double the amount of such estimated duties for the transportation of the ores by common carriers bonded for the transportation of appraised or unappraised merchandise to properly equipped sampling and smelting establishments whether designated as bonded warehouses or otherwise. On the arrival of the ores at such establishments they shall be sampled according to commercial methods under the supervision of Government officers, who shall be stationed at such establishments, and who shall submit the samples thus obtained to a Government assayer, designated by the Secretary of the Treasury, who shall make a proper assay of the sample and report the result to the proper customs officers, and the import entries shall be liquidated thereon, except in case of ores that shall be removed to a bonded warehouse to be refined for exportation as provided by law. And the Secretary of the Treasury is authorized to make all necessary regulations to enforce the provisions of this paragraph.

(44) Lead dross, lead bullion, or base bullion, lead in pigs, and bars, lead in any form not specially provided for herein, old refuse lead run into blocks and bars, and old scrap lead fit only to be remanufactured, all the foregoing 1.875c. per lb.; lead in sheets, pipe, shot, glaziers lead and lead wire, 2.125c. per pound.

(45) Zinc-bearing ore of all kinds, including calamine containing less than 10% zinc, shall be admitted free of duty; containing 10% or more of zinc and less than 20%, 0.25c. per pound on the zinc contained therein; containing 20% or more of zinc and less than 25%, 0.5c. per pound on the zinc contained therein; containing 25% of zinc or more, 1c. per pound on the zinc contained therein; Provided, that on all importations of zinc-bearing ores the procedure shall be the same as with lead ores.

(46) Zinc in blocks or pigs, and zinc dust, 1.25c. per lb.; in sheets, 1.5c. per lb.; in sheets coated or plated with nickel or other metal, or solutions, 1.625c. per lb.; old and worn-out zinc, fit only to be remanufactured, 0.875c. per pound.

(47) Aluminum, aluminum scrap, and alloys of any kind in which aluminum is the component material of chief value, in crude form, 6c. per lb.; in plates, sheets, bars and rods, 9c. per lb; barium, calcium, magnesium, sodium and potassium, and alloys of which said metals are the component material of chief value, 2c. per lb., and 20% *ad valorem*.

(48) Antimony as regulus or metal 1c. per pound.

(49) Chrome or chromium metal, ferrochrome or ferrochromium, ferromolybdenum, ferrophosphorous, ferrotitanium, ferrotungsten, ferrovanadium, molybdenum, titanium, tantalum, tungsten, or wolfram metal, and ferrosilicon, 15% *ad valorem*.

(50) Nickel, nickel oxide, alloy of any kind in which nickel is the component material of chief value, in pigs, ingots, bars, rods, or plates, 4c. per lb.; sheets or strips, 25% *ad valorem*.

(51) Copper, in rolled plates and various manufactured forms, 1 to 1.5c. per pound.

(52) Antimony ore, stibnite and matte containing antimony but not containing more than 10% of lead, 0.75c. per lb. on the antimony contents therein contained; the procedure as to assay, etc., to be substantially the same as with lead. Antimony oxide to pay 1.25c. per lb. and 20% *ad valorem*.

(53) Metallic mineral substances in a crude state, but not including ores herein specifically described or producing metals upon which a duty is herein laid, and metals unwrought whether capable of being wrought or not and not otherwise provided for herein, 15% *ad valorem*.

(54) Monazite sand and thorite 3c. per lb.; thorium oxide of and salts of. gas mantles treated with chemicals or metallic oxides, and gas mantle scraps consisting in chief value of metallic oxides, 30% *ad valorem*.

Mortality of Tropical Natives in Rand Mines

Johannesburg Correspondence

In a recent debate in Parliament, the minister of native labor made some startling statements regarding the importation of natives from tropical regions in South Africa for work on the Rand. He stated that there were 25,000 such natives at work, and that the mortality was such that for years a situation had existed which could only have existed because of a cynical disregard of human life and of ordinary humanity.

A year ago the mortality on one mine was 391 per 1000 per annum and many mines showed a mortality of over 100. Since then, owing to warnings from the government, an improvement has taken place, the average rate now being 70 per 1000 against an average of 22 per 1000 for all natives employed. Several groups, however, still show far too high a mortality, up to 269 per 1000, and the government has warned the Chamber of Mines that tropical natives must not be supplied to mines showing a bad record or the whole importation scheme will be stopped.

The mortality among the natives from British Nyassaland Protectorate is still so high (279 per 1000) that these natives will no longer be allowed to be imported. Pneumonia is the main cause of the high death rate and the Chamber of Mines recently brought out Sir Almroth Wright, one of the authorities on inoculation, to ascertain if it is not possible to establish some scheme of inoculation against this disease.

Puzzolan cement, as now understood, is the product resulting from mixing and grinding together in definite proportions, slaked lime and granulated blast-furnace slag or natural puzzolanic matter, such as puzzolan, santorin earth, or trass obtained from volcanic tufa.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Fred Hellmann has gone to California from the Joplin district.

Kirby Thomas has returned to New York from Joplin, Mo., and the Arkansas zinc field.

E. Z. Burns, of Simonds & Burns, New York, has left for Colorado and Nevada on professional business.

Hamilton & Hansell announce that from May 1, their offices are in the Hudson Terminal Building, 50 Church St., New York.

Capt. Joseph Hodgson, of Ishpeming, Mich., has been appointed superintendent of the Copper Queen mine, at Bisbee, Arizona.

F. F. Sharpless, who has been in Missouri on professional business, returned to New York this week and then proceeded to the Pacific Coast.

Ernest H. York has been appointed manager of the Hughes Property, at Porcupine, Ont. He was formerly with the Calcite Lake mine, at Gowganda.

Grenville Chapman, recently of El Paso, Tex., has removed to Miami, Okla., where he will have charge of one of the Chapman & Lennon zinc properties.

Henry P. Brown is the master appointed by the United States Circuit Court to take testimony in the suit against the United States Steel Corporation.

John D. Ryan and the party which accompanied him, have returned to New York from their trip to the West, which included Michigan, Montana and Arizona.

Charles Botsford, recently in Mexico, is now at Houghton, Mich., for the General Development Co., making a geological map of the Naumkeag copper property.

Edmund Putnam, formerly operating at Parral, Chihuahua, Mexico, is at Boston. He will return to El Paso, Tex., and make headquarters there until the Mexican situation changes.

William Crosley, for some years in Mexico as field engineer for some English interests, is now in London, and will leave there for the Gold Coast, West Africa. He expects to return to Mexico about the end of the year.

Henry Leighton, instructor in mining geology at the School of Mines, University of Pittsburg, has been promoted to be assistant professor of economic geology, and will have charge of the departments of economic geology and of ceramics.

S. H. Hamilton has terminated his engagement with the Manatawny Bessemer Ore Co., and is no longer in charge of its prospects, in Berks County, Penn. He is now at Ringwood Manor, N. J., and is engaged in making magnetometric surveys to delineate lenses of magnetite in the Archean rocks of the Highlands of New Jersey.

Charles E. Knox, president and general manager of the Montana-Tonopah Mining Co., accompanied by Edgar Collins, who recently arrived from South Africa, has gone to Pearce, Ariz. Mr. Collins, who for a number of years has been connected with the company, will assume charge of the Commonwealth mine at Pierce, which was recently purchased by the Montana-Tonopah.

John Jermain Porter has resigned from the University of Cincinnati, and after June 1 will devote his entire time to consulting practice as metallurgical engineer. Mr. Porter will make his headquarters at Staunton, Va., and will give especial attention to improving the operating efficiency of blast furnace, foundry, coking and other processes. In this work he will be associated with Charles Catlett, consulting economic engineer, of Staunton, whose strong connections with the Southern iron industry are well known.

OBITUARY

Donald M. Scott died at Laurium, Mich., Apr. 29, aged 50 years. He was born in England and educated as a civil engineer. He went to the Michigan copper country 15 years ago, and had been employed at several mines, besides acting as village engineer at Red Jacket and Laurium.

John Wesley Pullman died at his home at Wyncote, May 5, aged 73 years. He was born in New York, being a grandson of Peter Cooper, and graduated from the College of the City of New York. He was connected with the Cooper Union industrial school for several years and afterward with Cooper, Hewitt & Co. in the iron business. Later he established an iron-ore business in Philadelphia, which he conducted for many years.

Societies and Technical Schools

New York Academy of Sciences—At the regular meeting of the Section of Geology and Mineralogy, on May 6, Alfred H. Brooks, of the U. S. Geological Survey, delivered a lecture on the "Geology and Mineral Resources of Alaska;" illustrated with lantern slides, maps and charts.

University of Illinois—The senior and junior students in the Department of Mining Engineering have recently visited the Illinois Steel Co.'s plant, at Joliet, the mines, zinc works and cement plants in the La Salle district of Illinois, and a number of manufacturing plants in Chicago, where mining machinery is made; also the accounting offices of a number of the larger mining companies, having headquarters in Chicago.

American Institute of Metals—The name of the American Brass Founders' Association, by an overwhelming vote of its membership, has been changed to the American Institute of Metals. In addition, a change in the by-laws has been made which provides that the institute shall meet in convention each year at the time and place selected by the executive committee, instead of the time and place chosen for the annual convention of the American Foundrymen's Association. The Institute will hold its annual meeting in Buffalo during the week of Sept. 23, next.

University of Missouri—Owing to the continued demand for mining students, mine managers and superintendents, graduates and undergraduates of engineering schools, and science teachers, the School of Mines and Metallurgy announces a six-weeks' summer school, beginning June 3, 1912. All of the courses will be given in the laboratories at Rolla. The following courses will be given during the 1912 summer session: Fire Assaying; Qualitative Chemical Analysis; Quantitative Chemical Analysis; Slag Analysis; Mining; Metallurgy Laboratory; Cyaniding; Cyaniding Laboratory.

International Association for Testing Materials—The Organizing Committee announces that the sixth congress will be held at the Engineering Societies Building, New York, Sept. 2-7. After the opening general meeting, the members will be divided into sections, which will hold their annual meetings separately.

The technical proceedings of the congress will be unusually valuable. The list of papers announced is unprecedentedly large and excellent; over 150 reports and papers are in hand or promised. Nearly one-half of them have been already received and are being printed, and the others are to follow shortly. About 35 American papers are included in the list. It is desired that the discussion of the papers and reports may be full and thorough, within the necessarily limited time of the sessions. With this in view, it is urged that discussion be prepared in advance of the congress, when references, figures and similar material are available for citation. Discussion prepared in advance and submitted in writing will have precedence over impromptu discussion. The advance distribution of the printed papers will give opportunity for preparing discussion. For earlier information, however, short abstracts of the foreign papers are being obtained as far as possible, for publication. The secretary of the committee is H. F. J. Porter, whose office is at No. 1 Madison Square, New York.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

May 1—The farmers of Shasta County are still disinclined to allow the Balaklala smelting operations to be resumed, and are disposed to demand further accounting from the Mammoth smeltery. The recent offer of the Balaklala to pay such damages as might be awarded by a commission to be appointed, one member of the U. S. Circuit Court, one by the farmers and one by the Balaklala, was rejected by a meeting of the farmers, on Apr. 27. The rejection was not positive. The farmers are watching the progress of thiogen tests. A majority of the members of the farmers association were in favor of instituting legal proceedings against the Mammoth, but the president of the association reminded the members that it will cost money to carry on a legal fight, and that the association is still in debt to the attorney who represented the farmers in their fight with the Balaklala. The meeting concluded without decision as to paying out more money.

Rain and snow have been general recently throughout the northern and some of the Mother Lode counties. The outlook for water for mining purposes is encouraging, though there is still some fear expressed that there will be a shortage before the season is ended.

Reports from New Pine Creek state that a number of mining men have arrived there from California, Nevada, Utah and Colorado, with the purpose of investigating the Highgrade camp. The men interested in prospects in Highgrade are principally Colorado men. Some interests have been purchased by Los Angeles and Salt Lake mining men. The new properties have not attracted a great deal of attention in San Francisco. Should the camp be a large prospective producer, capital will be obtained easily in San Francisco, but there is an impression obtaining that a good deal of the talk about the Highgrade district, and a portion of the rush, has been the result of the extension of the Nevada-California-Oregon R.R. from Alturas by way of Davis Creek and across the Oregon line to the town of New Pine Creek. So far as geological indications go, the gold-bearing rocks are more generally sought in the vicinity of Fort Bidwell. That district is about 20 miles southeast of New Pine Creek, and on the California side of the line. The new Highgrade district extends from a point between Mount Bidwell and Goose Lake northerly across the line, and to the neighborhood of New Pine Creek. The larger portion of the town and also of the mining district is on the California side of the line. The railroad connections by way of Reno being the most direct route, the district is more likely to receive its greatest attention from Denver and Salt Lake than from San Francisco.

Butte

May 1—Plans are being perfected for developing water power at Thompson Falls, on the Clark's Fork of the Columbia River, in Sanders County. A large dam will be constructed, and power and electric light furnished to the entire county, and to the Cœur d'Alene mines. Work will be started soon on the erection of an auxiliary power plant on Prospect Creek, near-by, to furnish power to drive the machinery used in building the dam. The temporary plant has been designed to furnish about 1000 hp. and the equipment for its construction is now on the road from the East. The work is under the supervision of Engineer George H. Potter, and he will have men employed in building the auxiliary power house and flume within a week. The enterprise is being promoted by Senator Donlan and it is estimated that over $2,000,000 will be expended on the work in the next two years.

The electrification of the Butte, Anaconda & Pacific R.R. between Butte and Anaconda has been commenced, and within a year, passenger and ore trains will be hauled with electric power. The electric motors to be used will be of the same type as those in use at the terminals of the New York Central Lines in New York. Work on the extension of the road from Anaconda to Georgetown is well under way with 300 men engaged in grading, and the new wagon road at Silver Lake is nearing completion. It has been reported unofficially that plans are under consideration for the further extension of the road from Georgetown to Phillipsburg.

The Magone and Anderson group of claims in the Garnet placer district consists of four claims, the Magone and Anderson, Lide, Nancy Hanks and Adlia, partially developed by three tunnels, two of which are being used. About 400 ft. of drifting have been done from the upper tunnel, and a body of ore opened for 300 ft. The upper and lower tunnels have been connected by a raise on the vein, showing ore for 220 ft. Since taking over the property Colonel Peake has installed electric drills. The Mitchell and Mussigbrod group of claims, down the gulch from the Peake property, consists of 30 claims, on a number of which development work has been done, and ore worth nearly $800,000 mined in the last 12 years. The ore is treated in a 10-stamp mill on the property. Above the Peake property is the Ritchey group of 10 lode and several placer claims. The property has been developed by tunneling and considerable ore mined. A tunnel is now being driven to tap the vein at 200 ft., and it is planned to use this as the tramway for the ore to the millsite, 2000 ft. distant.

Denver

May 2—Owners, leasers and miners in the Cripple Creek district have all been making more money during the last three months, and in April, 2000 tons more were produced than in March, the total output for last month being 77,281 tons with a total value of $1,216,693, against $1,140,900 in March. It is said that many of the large companies are leasing their best orebodies at high royalties, as they have found their profits are greater by this method than if worked on company account. Of course, the leaser works more economically and is more careful of the ore than the day's-pay miner, and moreover pays no salaries or office rent. In addition to this, the companies are leasing all the ground they cannot operate profitably on company account.

Better prices for tungsten ore are now coming, as the Primos company announces in its new schedule, with rates as follows: $3.50 per unit for 10%, $4.40 for 20% and $4.90 for 40% ore. This company will start its Lakewood mill soon. The Colorado Tungsten Co. will start its new concentrating plant in about a month, and the Boulder Tungsten Production Co., with J. C. Clark at the head, is planning extensive development in the district.

In the Silverton district, work has been resumed in the Copper Bell mine, in Whitehead Gulch, under the direction of J. H. Harrington. The officers of the Vermilion Mining Co. are expected to arrive from Cleveland, Ohio, next week, to make arrangements for the active working of the property this summer. The Congress mine is under lease to the Southern Exploration Co., which is crosscutting from the shaft on a small vein of ore, and drifting toward the main orebody. Truman Taylor is overhauling and testing the Silver Lake mill, with a view to making a better saving. The Ross Mining & Milling Co. has put 20 men at work on the Champion mine.

In the Telluride district, at a meeting of the Wild Boy Mining & Milling Co., J. M. Wardlaw, of Denver, was elected president, and W. M. Harrington, mine superintendent. The purchase of a mill was authorized and the superintendent instructed to start its erection as soon as the snow goes off. The Wild Boy mine is on Silver Mountain, between the Suffolk and the Alta & Gold King. The Morning Star Mining Co. will build a mill this season and treat the dump ores while developing the reserves. The company has water power, and an air compressor on the ground, which will be installed soon, and the property worked under the management of W. R. Vanderveer. At the Lewis mine, Manager Livermore has a force of men at work on development and sinking a main shaft.

Salt Lake City

May 2—Much interest is being taken in the visit here of John D. Ryan, who has been making a trip through the Northwest with a party of Eastern men. The party arrived in Salt Lake City from Montana, May 1, visiting the International smeltery, at Tooele, earlier in the day, and in the evening attending a banquet given in their honor at the Hotel Utah by Col. D. C. Jackling, vice-president and general manager of the Utah Copper Co. In a speech at the banquet, Mr. Ryan expressed confidence in the resources of the State of Utah as a field for investment, and paid a tribute to the work of Colonel Jackling. Mr. Ryan said in part: "This state was made before we saw it, and its resources are not excelled by any state in the entire union. The agricultural, mineral and other resources have hardly been touched and the era of mighty progression is just dawning. Colonel Jackling is a splendid illustration of the man from out of the West, who has demonstrated to the Eastern financier that his money is more than safe in the mining industry. Jackling has taken the hills and stripped them of their wealth, and is adding to the commerce of the world and state more than the early pioneers could ever dream of existing here."

Owing to a strike of the unskilled foreign workmen demanding an increase in wages, the Murray plant of the American Smelting & Refining Co. has practically closed down, pending a settlement, the only work done being that of keeping the furnaces in blast. Although the strikers are quiet and no trouble is expected, 10 deputy sheriffs have been sent to Garfield as a precautionary measure.

Joplin, Mo.

May 2—If any outsider ventured to comment critically on the methods or practice of the operations in southwest Missouri, he has usually been effectually silenced by flaunting the fact of the low-grade records of the district, and any expressions of surprise as to technique or equipment have been complacently received by the local operators. The fact of the low costs is to be admitted, but it should also be admitted that it is due largely to exceptionally favorable operating and economic factors and in the light of modern critical investigation of technical and business operations, it is probable that the low-cost boast and the complacency will both be disturbed.

Recently there has been a realization of the possibilities of improvement in local mining practice, and there is a probability that many of the cherished operating traditions of the district may soon pass. The small "tub" and the inadequate pumps; the single shaft and the aversion to precautions for safety, may soon all be reminiscences. Perhaps the fee owner may also be jarred loose from his medieval and often suicidal royalty demands. These changes are partly due to natural evolution and somewhat to an infusion of outside ideas, but it is admitted among the Joplin operators themselves that a change is working and for progress.

Toronto

May 3—Final action has been taken by the bondholders of the Amalgamated Asbestos Corporation, representing $6,500,000 of bonds, in connection with a slight modification of the plan suggested by the general committee for the reorganization of the company.

The resolution, which was unanimously approved, provides that out of the total authorized bond issue of $5,000,000, bonds to the par value of $3,000,000 be issued and that the total authorized issue of common stock be increased from $2,875,000 to $3,000,000, the difference between these amounts and the amounts suggested in the original plan, being authorized to provide for the payment of certain outstanding liabilities of the Amalgamated Corporation.

Cobalt

May 3—The work of preparing for the new addition to the Northern Customs Concentrator is being pushed as rapidly as possible and it is expected that the new machinery will be in operation in August. The addition will consist of 40 stamps and will cost approximately $75,000. When completed this will be the largest stamp mill in Canada. The increase in capacity was necessitated by the increased production of the different mines which are under contract, the only new ore being that of the Drummond mine.

Porcupine

May 3—At the time of the Porcupine fire, last July, a considerable sum of money was raised for the purpose of establishing a hospital for the miners of the district. The Relief Committee of the Toronto Board of Trade set aside $10,000 for this purpose, but on account of the difficulty of agreeing on a site, no action has been taken until quite recently. The Toronto Board sent a representative to the district to come to a final settlement, and a site has been chosen on Porcupine Lake, halfway between Golden City and South Porcupine. This matter has caused considerable dissatisfaction among the mine managers, who would have preferred a different site. In the Pearl Lake section, the old Bewick-Moreing clubhouse is being converted into a hospital to serve the residents of that section, while the Dome already has a completely equipped hospital.

Johannesburg

Apr. 1—The former general manager of the East Rand Proprietary Mines is being prosecuted for sending in false returns of gold obtained from mill and cyanide plants from 1909 to 1911. The present manager has reduced the tonnage milled per month from 200,000 tons to 144,200 and is milling ore above the average grade of the mine, the grade recovered being 33s. per ton, but the cost was raised to 22s. 8d. per ton. The proportion of payable ore to total ore exposed in the lower levels at this cost figure, will be only about 20 to 30%. At the yearly meeting of the company, the chairman was reëlected but the real control has now passed to the "Corner House" or "Eckstein" group. Awkward questions were skilfully dealt with regarding past management and the future prospects were declared to be encouraging.

Trouble is apparently brewing at the other end of the Reef. Numerous dismissals and changes of management have taken place recently. The controller of this group, Sir John Robinson, has always pursued a somewhat secret policy, and shareholders are alarmed because one shaft has already been closed down, presumably owing to the low-grade ore met with; it is freely rumored that the recent estimates of ore reserves are wrong, that there is no chance of the mine keeping 1000 heads of stamps employed, that probably the four old 100-stamp mills on the south section will be closed down and that all milling work will be concentrated on the large 600-stamp mill, of which so far, only about 300 stamps have been kept running. The closing down of the other mills will mean much unemployment and should the mine not come up to expectation, it will be another severe disappointment and will engender mistrust.

The Mining News

The Current History of Mining

Arizona

Cochise County

Shattuck-Arizona—It is reported that the directors have decided to build a 400-ton smeltery, probably at Douglas, Arizona.

Gila County

Warrior—A suit has been filed by the Warrior Copper Co., of Philadelphia, against the Warrior Development Co., of Duluth, and its president, Henry B. Hovland, asking $69,000 damages, and an auditing of the books. The Warrior Development Co., in October, 1909, acquired from the Warrior Copper Co., under a three-year bond and lease, the Black Warrior mine, northeast of Miami, and operated it until 1911, when the mine was closed down and relinquished to the owners. Before closing down, the shipments to the El Paso smeltery averaged 100 tons of copper silicate ore per day, assaying about 10% copper. The complaint alleges: That the mine was gutted, wrecked and left in dangerous condition, many of the workings being rendered useless and inaccessible; that false reports of the money received for ores had been made to the plaintiff company; that careless management and neglect had caused the loss by fire of a leaching mill, worth $25,000; that taxes had not been paid as the statements showed; and other serious charges.

Inspiration Consolidated—The survey for the possible site for the concentrator on Salt River, has been completed, and the engineers are engaged in surveying the Black Warrior camp site, north of Miami, for the same purpose. At the Inspiration mine, a small force has been put to work underground, and this will be gradually increased. The Joe Bush shaft has been equipped with skips and underground ore pockets and will be working soon. The 10x16-in., double-drum hoist at the Colorado shaft is being moved to the Scorpion shaft, which is 275 ft. deep and will be sunk by contract an additional 220 ft. Another 150-hp. boiler will be added to the power-house equipment at the portal of the main tunnel. At the Live Oak, the boilers have been blown in at No. 2 shaft, and sinking has been resumed. The shaft will be sunk from its present depth of 928 ft. to over 1100 ft. No. 1 shaft, now 470 ft. deep, will also be sunk an additional 180 ft. Men are repairing the road from the Inspiration mine office to the Warrior camp site.

Barney—Churn-drill hole No. 2 has been discontinued at a depth of 600 ft., and from now on only one machine will be used. This machine is at present working on hole No. 3, being drilled jointly with the Live Oak and Southwestern Miami companies, and has not yet passed through the Gila conglomerate.

Southwestern Miami—Holes 4, 5 and 6 are still in the conglomerate formation, and it will be six or eight weeks before any important developments may be expected.

South Live Oak—The machinery and supplies are beginning to arrive at Miami and are being hauled to the company's property, three miles west of Miami, where churn-drilling will soon be started.

Keystone—It is rumored that negotiations are in progress for the acquisition by the Inspiration Consolidated company of this mine, which lies between the Inspiration and Live Oak, on the basis of 3,000,000 tons of developed ore.

Castle Dome—L. D. McClure, manager for the South Live Oak Development Co., has secured for the men who promoted that company, an option on the Virginia or Castle Dome group of 35 claims, six miles northwest of Miami, on Porphyry Mountain. They are traversed by numerous faults and fracture zones, showing considerable iron and copper staining, and it is proposed to explore them by churn drilling.

Arkansas

Baxter County

A project to install a hydro-electric plant on the White River, at Cotter, is being financed by Henry L. Doherty & Co., of New York. Congress has granted the franchise and surveys have been made. This will supply cheap power to the zinc districts of northern Arkansas. Another project on the White River, near Hollster, Mo., will furnish power for several of the Missouri districts.

Marion County

Morning Star—Development will be continued and operations resumed at this zinc mine in the Rush Creek area, south of Yellville. The property has a 150-ton mill, but is not extensively developed. S. A. Hazelbaker is manager.

Iola—This zinc mine, north of Zinc, has been taken under bond by Clay Gregory, of Joplin, and associates. It has a 125-ton mill and is opened by a tunnel.

California

Amador County

The suit of Morris Jones, a farmer, who complained that the tailings from the quartz mines and the débris from the dumps had injured his land, is reported to have been settled by Jones filing a perpetual easement to the Kennedy, Argonaut and Zeila mining companies, giving use of his land.

Butte County

Oro Electric Corporation—This company, successor to the Oro Water, Light & Power Co., has placed $3,500,000 bonds on the market for the development of power projects. The company operates two hydro-electric plants with combined capacity of 4000 hp. It furnishes power to dredges, and has interests in dredge operations in Butte and Calaveras Counties.

California Extraction Co.—This company has announced that it will install two machines for the extraction of gold from the black sands in the dredge tailings.

Calaveras County

Surveyors are running lines for a new railroad, between Valley Spring and Rich Gulch, *via* Mokelumne Hill. If constructed, the road will open a marble quarry. There are also asbestos deposits in the vicinity.

Stocktonia—This is a new mining company, with head offices at Stockton, organized to develop a graphite deposit near Campo Seco. The capital stock is $25,000. The directors are: W. E. Stewart, R. H. Stewart, James Baker, F. E. Holton and T. A. Jordon.

Kern County

A part of the placer ground, recently acquired by Sidney Couburn, between Randsburg and Atolia, has been taken over by Charles Phelps, who will incorporate a company to work the placers with the process owned by the Gold & Platinum Extraction Co. A 1400-lb. test mill is to be employed for prospecting purposes, and a test run of 30 days will be made. If successful, a larger plant will be installed.

Buick Oil Co.—The suit of Ralph Arnold, formerly of the U. S. Geological Survey, for one-fourth interest in the 3,000,000 shares of stock of this company, is reported to have been settled by compromise.

Santa Barbara County

Western Gasoline Co.—The plant is operating to full capacity in the extraction of gasoline from natural gas on the Hall property. The result is about 300 gal. of gasoline from about 400,000 cu.ft. of gas. The gasoline is high gravity and commands a ready market. The New Pennsylvania also has a supply of gas which is furnished to this company which will average about 1 gal. of gasoline per 1000 cu.ft. of gas.

Union—This company is planning for the installation of a gasoline plant. One well on the Hobbs lease is reported to be good for 3 gal. of gasoline per 1000 cu.ft. of gas.

San Bernardino County

Considerable activity is being displayed in the Kramer-Barstow oil district. The Kramer Consolidated well is down 2947 ft. The Barstow Paraffin will drill near Barstow. The North American Petroleum well is north of Kramer. Mallery & Hutchinson are north of Barstow. The Santa Fé R.R. is sinking a water well east of Mojave.

Shasta County

Northern California Power Co.—The power line from Kennett to the Uncle Sam mine, installed last winter by the Sacramento Valley Power Co., is being taken down. The Northern California has absorbed the Sacramento, and will maintain its own line.

Sierra County

Sierra Standard—A wagon road is being built to this property, in Sailor Ravine, five miles above Downieville. Jason S. Frye is superintendent.

Miller—These claims, at Loganville, adjoining the Hayes Consolidated property, have been taken over by the same company which has that property under bond. Thomas C. Heide is in charge of both properties and is preparing to handle all ores at the Hayes Consolidated mill.

Siskiyou County

Forks-of-Salmon—This company has installed a large elevator on the Salmon River placers and is said to be handling large quantities of good gravel.

Tuolumne County

Mammoth—The new electric motor has been received and work resumed at this mine, near Jacksonville. This is one of the old properties recently reopened. The development demanded putting in commission the 10-stamp mill formerly operated on ore from the Republican, which is one of the group now belonging to the Mammoth.

Neuebaumer—Grading for the installation of a 5-stamp mill is in progress at this mine, at Tuttletown. The property is reported to be showing well.

Colorado

Boulder County

Golden Age Mining & Reduction Co.—This new corporation backed by Eastern men, has taken over the Golden Age mine near Jimtown. Under A. H. Martin, general manager, a 50-ton cyanide mill will be built and the dump, estimated at 50,000 tons, will be treated. The mine will be unwatered and fully developed for production.

Clear Creek and Gilpin Counties

Colorado Central—Work will be resumed under the leasing system by the Clifford Exploration Co., at favorable terms to the leaser. The Marshall and the Ocean Wave tunnels will be put in good order and the 600-ft. shaft repaired. The Waldorf properties are to be leased in like manner by the same company. It is predicted that within 90 days 200 men will be at work on these properties.

Buckeye—Good ore has been opened in this mine on Quartz Hill by F. E. McCoy.

Phoenix-Burroughs—In the lateral being driven from the Newhouse tunnel to reach the main shaft, a body of heavy sulphide ore has been opened. The vein is 12 ft. wide.

Bates—A local pool has leased this mine in Chase Gulch and is unwatering the shaft. The mine has been idle for 20 years.

Cripple Creek District

Colorado King Gold Mining Co.—This new company has been incorporated to take over the Blanche and the Madeline companies. Stock will be exchanged share for share in the new company. A. E. Carlton, of Cripple Creek, is president.

Portland—Leases are being granted at the north end of the company's estate on Battle Mountain, by Manager Frank Smale.

Trilby—The main oreshoot has been opened in a crosscut from the 1100 level, and has been leased to Oleson & Van Tilborg of Cripple Creek. The output is expected to reach 50 cars of mill ore per month.

Maggie—Carl Johnson, lessee, has sunk the shaft an additional 200 ft. and is drifting from the fifth level to get under the known orebodies.

C. K. & N.—Shipments of two cars per day are being made by the Rapp lease on the fifth level, and two other sets of lessees are making occasional shipments.

Stratton's Independence—During March, production totaled 3160 tons, averaging $19.04 per ton, and 10,500 tons of low-grade mine and dump ore were milled. The net working profit at both mine and mill was $18 250, and $1700 were spent on special development.

Gunnison County

There is a general talk throughout the district of replacing mules with mechanical haulage. Gasoline locomotives appear to be in some favor, especially if the exhaust can be properly controlled.

Belzora Bassick Mining & Milling Co.—It is reported that the company will install a mill this summer.

Gold Links Smelting & Mining Co.—The company may install a water-power plant this season, to develop a high-pressure current for use at the mines at Ohio City, seven miles distant.

Lake County-Leadville

Robert E. Lee—The lessees of this Fryer Hill mine are driving from the 500 level toward the Forest City where connection for air will be made.

Jonny No. 2—Shipments of medium-grade gold ore are going out steadily from the Barnes lease.

Hellena—The output of the experimental mill in Iowa gulch is about 45 tons per day and since the jigs have been repaired, the separation of the lead and zinc is said to be excellent.

Ella Beeler—The tunnel is in 785 ft. and 300 ft. of it are being retimbered by A. S. Sharp & Co., lessees. A stope is also being retimbered.

Elk—In this mine at the head of East 5th Street, the lessees have opened on the 225-ft. level 4 ft. of ore carrying lead and silver, and shipments to the smeltery are being made.

Luzerne—Good iron and silver ore is being shipped by Thomas Simpson & Co., lessees on this mine on East Fifth St. The lower levels will be prospected for carbonate-of-zinc ore.

Mineral County

Creede Mines Co.—The company will install a 30-hp. gasoline motor, weighing 9000 lb., about June 1. This motor is being designed by T. B. Humphrey, and will be built by the Vulcan Iron Works, of Denver.

Ouray County

Revenue Leasing Co.—This company has taken over under lease and option the entire property of the Revenue Tunnel Mines Co. Five subleases are being operated. Development of the Cumberland mine will be confined to drifting on two levels and raising to develop orebodies. A. G. Suydam is superintendent, at Sneffels.

Atlas Mining & Milling Co.—The company will soon change the present jig-back tramway to the Bleichert system. After the change it will be possible to hand-sort the coarse material sent to the mill with the elimination of both waste and ore of shipping grade, which now go together to the mill. Plans have been developed for increasing the mill capacity by the installation of another 10-stamp battery, and for another similar increase at a later date. Fred Carrol is manager, at Sneffels.

Barstow—This mine, at Ironton, has been developing the orebody found last year. With the opening of the roads and a flow of water for milling, the ore above the second level will be explored. Sinking began May 1, to explore the ore below the second level.

Camp Bird—Opening of the new orebody for stoping is being pushed, and meanwhile only 20 stamps are dropping.

SAN MIGUEL COUNTY

Ophir Gold Mines, Milling & Power Co.—The experimental work relating to the installation of the cyanide process has been completed, and work on the 150-ton plant may start this month. The process will be all-slime and agitation, followed by continuous decantation. A new adit level is being driven to the fifth-level workings, and will be equipped with electric traction.

Tomboy—During April, 9200 tons of ore were crushed, yielding a profit of $32,000; expenses were $43,500 and $3595 were spent on permanent improvement.

Idaho

COEUR D'ALENE DISTRICT

Silver Cable—The lower tunnel has been driven through the vein which showed about 4 ft. of low-grade milling ore where it was cut. This is satisfactory to the company, for in the upper workings, directly above this place, there is no ore. Drifting has started along the vein and in the short distance driven the ore has improved.

Caledonia—The orebody has been found in the drift from the raise opened from the lower tunnel. The ore contains principally wire silver, carbonates of copper and lead. The copper will average about 18% throughout the orebody already opened.

Cedar Creek—Some good samples of galena were brought in recently from this property. The samples were fine grained and soft. The shaft is down 100 ft. and work is still in progress. There is at present plenty of water for power and it is not likely that there will be any delays on account of water shortage.

Bear Top-Orofino—Since October, 1911, the company has shipped 26 cars of ore. One shipment of approximately 38 tons of concentrates, gross, assayed 5.15 oz. silver and 68% lead per ton. Freight and treatment charges were $12 per ton, and the net value $39.84 per ton, with a total net value of $1161. The company has a 125-ton mill, which is stated to be doing good work and all ore is run through. About 400 tons of concentrates per month are being produced and these are hauled three miles to the railroad. The shipping point is Bear Siding, one mile from Murray. Charles N. Mundell is secretary and B. G. Harmon mine superintendent.

Michigan

COPPER

Calumet & Hecla—The company has begun excavation for the addition to the electric power plant. The building will be extended about 80 ft. to accommodate the new 7500-kw., mixed-pressure steam turbine and auxiliary apparatus. This company has also started the driving of piles for the foundations for the new regrinding plant. There will be installed in this mill 64 conical tube mills for the grinding of the sand, together with their supplements of concentrating tables.

Algomah—No. 7 drill hole has encountered a copper-bearing formation at a depth of about 1000 ft. It is of good character and well mineralized. The crosscut from the 200-ft. level of the shaft is driving in the direction of this lode and is about 75 ft. from it. The lode is believed to be the same as that cut by holes Nos. 1 and 2 some time ago.

Adventure—Further developments on the lode that was cut unexpectedly by the crosscut from No. 5 shaft, continue to show copper in commercial quantities. Should this lode continue, this property can be put on a producing basis in a much shorter time than any of the newer companies, owing to the fact that it has a complete equipment at the old workings and a stamp mill that could be put in condition with comparatively little outlay. Developments are being watched with much interest.

Oneco—The shaft is over 1200 ft. deep and should cut the lode at about 1225 ft. When this is done, opening will be started from the 9th, 10th and 11th levels.

Copper Range—The company will extend its underground electric traction equipment and has purchased five 4-ton G. E. trolley locomotives.

IRON

Jones & Laughlin—At the Lake Angeline mine, in Ishpeming, ore is being forwarded from stockpile by steam shovel, and the Rolling Mill mine, at Negaunee, is shipping ore from the pocket at shaft No. 1; shaft No. 2 is now enlarged and timbered for over 330 ft. of the 620 ft. to the first level.

Negaunee—After three years of preparation, shaft No. 3 has started hoisting.

Oliver—On the Marquette Range, shipments are going forward from the Hard Ore and the Section 16 mines, at Ishpeming. At Negaunee, the Blue and the Prince of Wales, of the Queen group, are shipping. In the Gwinn district, the Stegmiller is shipping.

Champion—This old hard-ore mine of the Oliver company, at Champion, has been closed down and will be allowed to fill. The mine was opened in 1867, and has shipped ore every year since then, its total production being about 4,500,000 tons of high-grade, non-bessemer ore. The greatest vertical depth is 2300 feet.

Ravenna—At this M. A. Hanna exploration, in the Crystal Falls district, considerable ore is reported to have been found. The property is west of the Bristol mine, and the ore is similar to the large orebody of the latter. A shaft has been put down southwest of the Bristol and drifting on the 250-ft. level is in progress. The equipment is small and underground exploration will probably be continued.

Newport—This large mine, at Ironwood, owned by Ferdinand Schlessinger, of Milwaukee, is reported to have sold 1,000,000 tons of ore. A large quantity is in stock and it is not likely that the force of men will be increased.

Hiawatha—This Rogers-Brown mine, at Iron River, is shipping from the stockpile by steam shovel. The equipment is in good shape, and Capt. Bert Baumgartner is in charge underground.

Bristol—This mine, of Oglebay, Norton & Co., is unable to ship because of the cave-in, which wrecked the siding which served the property.

Hollister—This M. A. Hanna & Co. mine in the Crystal Falls district has been closed and the pumps pulled. The ore in stock will be shipped this season, but it is doubtful if the lease will be renewed. The ore contains a large percentage of moisture and a drying plant was installed in 1911 by G. C. Olmsted with a capacity of 300 tons per 24 hr.; the ore was dried by hot gases in an inclined revolving drum.

Montana

BUTTE DISTRICT

Butte-Alex Scott—The mine is shipping, at present, about 200 tons of ore per day to the East Butte smeltery, and on this basis of production, reserves are said to be sufficient to last for some years of continuous operation, without regard to future development work. In drifting on the 1000-ft. level, a body of first-class copper ore, 4 ft. wide and carrying good gold and silver contents, was recently encountered. It has been recommended by President N. F. Hugo that the payment of dividends be begun this year.

Butte & Superior—The new concentrator at the property is nearly completed. Ore crushing has started at the shaft collar and the concentrator bins are being filled. The capacity of the plant is expected to be about 1000 tons of ore per day, producing about 400 tons of concentrates per 24 hours.

Elm Orlu—Dispatches state that Senator Clark will build a concentrator three miles south of Butte on the Milwaukee railroad, and that a milling company with a capital of $100,000 was incorporated, May 2, for this purpose.

North Butte—Most of the high-grade ore being shipped now from the Speculator mine is being mined from the Snowball and Berlin veins. The Adirondack vein is becoming a promising orebody and has increased in width and grade with depth. On the 2200-ft. level the orebody averages about 6% copper and 7 oz. of silver per ton for a width of seven feet.

Pilot-Butte—The Pilot shaft is about 1000 ft. deep and will be sunk to the 2000-ft. level before a stop is made. The Snowball and Berlin veins have been developed by the North Butte company nearly to the end line of the Pilot property, and it is expected that they will be found in the Pilot. The mine will probably be in the producing class within a year.

BROADWATER COUNTY

The mines engaged in active mining and shipping in the Radersburg district are as follows: Butte & Radersburg, Keating, Ohio-Keating, Black Friday and Bonita; with the completion of the branch of the Milwaukee railroad from Three Forks to the camp, many of the properties will double their output.

Butte & Radersburg—An air compressor was installed recently, and the entire equipment has been modernized. An orebody, carrying good lead, gold and silver ore has been opened. A vein was encountered in sinking the shaft, and at 140 ft. had a width of 4.5 ft. and carried good gold and silver contents.

GALLATIN COUNTY

Spring Hill—Active development work will start soon at this mine, near Manhattan. The work is to be under the direction of Richard Trevethick, a Butte mining man, who will arrive soon. The property is owned principally by Manhattan men.

GRANITE COUNTY

American Gem Mining Syndicate—Work is expected to start soon at the sapphire mines of this company, near Phillipsburg. Joseph Sorenson has arrived from San Diego, Calif., to take charge of the work.

MADISON COUNTY

During the last week, negotiations have been closed for several properties adjacent to Virginia City, and the prospects are good for a prosperous season there. Mining men have lately been looking over the ground with the idea, it is rumored, of erecting a custom mill. Such a mill would be of great benefit to the district, as there are many low-grade mines, which need a cheap method of ore treatment to make them steady producers.

Bell—Mr. Bell, of Virginia City, has sold to S. J Bukvich, of Butte, property consisting of the Bell mine and a one-half interest in the Grand Union and Bell Fraction mines, three miles from Virginia City, in Alder Gulch. A large amount of low-grade milling ore is available, and the new owner is endeavoring to obtain a lease on the Grant mill. If unable to do this, Mr. Bukvich plans to erect his own 15-stamp mill.

Easton—Plans are being made to remodel the concentrating plant on this property, owned by Mr. Elling, of Virginia City, and to double its present capacity. J. H. Pankey, superintendent, has made a trip through Nevada, inspecting methods of milling, to obtain ideas as to the plant to be erected.

High Up—Professor Kerr, of Duluth, has finished a week's inspection of this group of claims, owned by E. W. Merritt, of Duluth. Recently a good body of milling ore was discovered in the property. Eastern men had the examination made.

Nevada

COMSTOCK LODE

Union Consolidated—The west crosscut on the 2500-ft. level has penetrated a fractured territory having the strike and dip of the east vein system, being full of quartz stringers. The west crosscut has been connected with the east crosscut from the westerly workings, and an active campaign of prospecting will be prosecuted on this level. Exploration will also be conducted on the 2200-ft. level, where a north drift, carried through the Mexican to the Union line in the vein, has never been driven into the latter territory.

Mexican—A shipment of five bars of bullion was made last week as a partial cleanup. The bullion shipments for the month will total between $38,000 and $40,000.

Consolidated Virginia—A mill run has been started at the Kinkead mill, of ore accumulated during the driving of the 3-compartment raise in the vein from the 2400-ft. level.

Ophir—Improvement in the formation is noticed in the southwest drift on the 2500-ft. level, more quartz in place coming in as the drift is advanced. The work is now about 80 ft. north of a point under the first oreshoot opened on the level above.

Crown Point—Ore shipments to the Yellow Jacket mill last week totaled 472 tons.

Imperial—Work has been started cutting out for a station at the 200-ft. level, from which the vein will be prospected.

ESMERALDA COUNTY

Goldfield Consolidated—The estimated April production was 28,317 tons, yielding $580,000 gross, and net, $385,000, with $195,000 operating expenses.

Pittsburg-Silver Peak—The company is doing its usual development of from 1200 to 1500 ft. per month and is milling from 15,000 to 16,000 tons of ore per month. The mill equipment, consisting of 120 stamps, followed by amalgamation with leaching of sands and filter-pressing of slimes in Merrill presses, is being increased by the addition of one 5x18-ft. tube mill for regrinding the coarser sands, four additional plates, 4½x16 ft., for amalgamation after tube-milling and by enlarging the 64 frame slime presses to 86 presses.

HUMBOLDT COUNTY

Nevada-United—Work will probably be resumed on the company's claims. Geological examinations have been made recently in an attempt to define the position of orebodies from development work.

LYON COUNTY

New Yerington—President C. N. Strevel of this company which took over the Yerington Copper Co., stated recently that the drift on the 250 level has opened some high-grade ore, carrying gold and silver, and also a body of lower-grade ore. The first car of the high-grade ore has been shipped to the smeltery and a second car will be ready soon.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended Apr. 25, are as follows:

Mines	Week	Year to Date
Tonopah Mining....	3,150	55,669
Tonopah-Belmont. .	1,800	36,076
Montana-Tonopah.	1,033	17,057
Tonopah Extension.	1,008	16,010
West End.......	750	11,889
Midway...	....	180
MacNamara.....	455	5,392
North Star.......	40	80
Totals........	8,236	142,353
Estimated value	$205,900	......

Keane Wonder—The new cable is being wagon-hauled over 26 miles of desert and mountain roads from Rhyolite, Nev., to the mine. The cable is over two miles long and weighs 15,000 lb. It is to be operated on the surface between the mine and the mill. There are distances between towers of about 1000 ft. where the elevation of the cable is about 1200 ft. from the surface.

WHITE PINE COUNTY

Campbell—Frank O'Kelly, manager for this estate, was a recent visitor in Goodsprings, and announced that work will be done on the properties this summer. The property here comprises about 26 patented claims, scattered throughout the district. No work has been done on the claims for the last five years, owing to a clause in the will of the late A. G. Campbell, which held the property for sale at a fixed amount. The May Kirby, which has a considerable tonnage of ore blocked out, will be worked by the estate, and leases will be granted on the remainder of the property.

Hoosier—H. J. Jarman has this mine under lease and has shipped several cars of lead and zinc ore during the last month. He contemplates the erection of a small concentrating plant to treat the mixed lead and zinc ore blocked out in the mine.

Giroux—Shipments started on May 1, at the rate of about 200 tons per day, under the contract with the Steptoe concentrator. The latter has provided storage for 2000 tons and a run will be made when this amount has accumulated. Shipments will be brought up gradually to contract requirements. The company is reported to have contracted with the Nevada Consolidated, for the latter to mine Butte & Ely ground owned by the former, and adjoining the Liberty pit.

New Mexico

GRANT COUNTY

Silver Cell—An option on this group of mines near Pinos Altos has been secured by George L. Rule, representing Oklahoma men, from Dimmick Brothers, and operations will start soon. The mines were discovered about 26 years ago and have shipped considerable bullion. The shaft is over 300 ft. deep and there are a number of tunnels and drifts. From time to time the mines have been rather fully equipped with machinery, including a smeltery.

New York

Benson Mines Co.—The company is arranging to electrify its iron mines at Benson Mines, and will install a complete new equipment of General Electric Co. apparatus to supply power both for crushing and grinding. The new machinery comprises two 437-kv.-a., water-wheel-type generators, two 12-kw. generators, six 300-kv.-a. transformers, one 450-kv.-a. generator, one 12-kw. generator and 16 motors ranging from 5 to 200 horsepower.

Oklahoma

Bartlesville Zinc Co.—This company has completed plans for an extension of the electrical equipment in its existing plant at Collinsville, and will install one 100-kw. turbo-generator set, one 25-kw. motor generator set, two 50-hp. motors, one 25-hp. motor, one 75-hp. motor and a switchboard. The apparatus will be furnished by the General Electric Co.

Oregon

Powder River Gold Dredging Co.—The company, which has acquired considerable dredging ground along the Powder River, south of Sumpter, has commenced work on the construction of a dredge.

Rainbow—This property, in the Mormon Basin district, purchased about a year ago by the United States Mining Co., one of the subsidiaries of the U. S. Smelting, Refining & Mining Co., has been under development for the last year. It has been decided to install a mill during the coming summer. Electrical power will probably be taken from the Eastern Oregon Light & Power Company.

Tennessee

Tennessee Copper Co.—The company will install a complete low-pressure turbine equipment for the Copperhill plant. The exhaust steam from the non-condensing power engines, steam pumps and other auxiliaries will be piped into a steam regenerator, so as to deliver a steady flow of exhaust steam to a Rateau-Smoot mixed-flow, turbo-blower, which will deliver 40,000 cu.ft. of free air per minute at a pressure of 3 lb. The turbine will be equipped with a surface condenser. The plant, which will be furnished by the Rateau Steam Regenerator Co., will be in operation in the autumn.

Utah

BEAVER COUNTY

Noonday—A vein of iron ore, carrying gold, silver and lead, in small amounts, has been opened on the 110-ft. level. Shaft sinking is in progress and will be continued to the 300-ft. level.

South Utah—The March production amounted to 298,999 lb. copper, the ore treated running 1¼% copper. Concentrates averaged 8.99% and the ratio of concentration was 14:1. The mill recovery was 55%.

Galena King—A car of lead-silver ore was shipped recently, making the second car for April. Bad roads have kept down shipments.

JUAB COUNTY

Tintic shipments for the week ended Apr. 25 amounted to 181 cars.

Opohongo—The winze from the 700-ft. level is down 40 ft., and two cars of the ore have been marketed. On the 1000 level, drifting is being done for a fissure, opened through the Black Jack at 1400 ft., and found to carry ore.

Mammoth—The copper ore on the 700-ft. level has been stoped to the level above.

Tintic Standard—Drifting northeast from the shaft is in progress on the 1000-ft. level. Iron sulphides and thin stringers of lead show in the face.

Tintic Mining & Development—The new electric hoist is in commission, and the shaft is sinking 5 ft. per day. Power is furnished by the Telluride Power Co.

Victoria—During 1911, 2843 tons of ore were mined, and net returns were $42,464. The balance on hand, Mar. 31, 1912 was $16,349. In September, 1910, the property of the Snowflake Mining Co. was acquired for $40,000. To meet this and other expenses, it was necessary to give notes for $60,000, which is the amount of present indebtedness.

East Tintic Development—One car of ore has been shipped recently and another will soon be ready. There is a good showing on the 130-ft. level.

Carisa—The shaft, damaged some time ago by caving, has been retimbered to the 700 level. Leasers are working on the upper levels.

Eagle & Blue Bell—Ore has been opened on the 1200- and 1300-ft. levels. On the latter both faces are in ore. Additional cables are on hand, and sinking will be resumed.

SALT LAKE COUNTY

Bingham Mines—The ore in the Dalton & Lark is coming from the Brooklyn orebody, which has been productive for so many years. This ore has been opened to a depth of 2000 ft. on its dip, and is still going down.

Ohio Copper—A record tonnage of 2700 tons for one day is reported, the daily average for the last week having been over 2000 tons.

Utah Metal—Both faces of the tunnel are in hard quartzite. The Bingham side is in nearly 1100 ft., and the Tooele side, 7400 feet.

Montana-Bingham—The tunnel is in 750 ft., the face being 350 to 400 ft. below surface. The face has been in low-grade ore for some distance, and possibly the work is near the Quinn fissure.

Michigan-Utah—Shipping ore has been opened in the Utah Mines Coalition property, in places ranging from the 750- to the 1000-ft. level.

Alta Consolidated—Carbonate ore is reported to have been opened 125 ft. above the main tunnel level, where the upper contact has been reached.

Bingham Copper—This company was petitioned into bankruptcy, Mar. 26. Stockholders have been requested to deposit their stock with the Utah Security & Trust Co., with a check for 5c. per share, which assessment will be sufficient to satisfy all claims against the company. Stockholders will be allowed until June 1 to make payment.

SUMMIT COUNTY

Park City shipments for the week ended Apr. 27, amounted to 3,147,140 pounds.

Ontario—Mill tests have been completed, and the work of remodeling the mill at a cost of about $80,000 will begin immediately. The mill will treat the low-grade ore developed during recent years, and the ore mined by leasers.

Thompson-Quincy—An incline shaft has been started about 30 ft. from the top of the raise, being driven from the 1600-ft. level. The raise is up about 350 feet.

Wyoming

Fremont County

Beck Mining Co.—This company is operating the Duncan mine, and has worked continuously through the winter. Mr. Beck, president, is in Denver closing contracts for the equipment of a cyanide addition to the mill, which will operate on the continuous-decantation system. By regrinding the sands, it is expected to increase the present capacity of 35 tons to 50 tons per day.

Carissa—It is reported that this company, at South Pass, will remodel its mill this summer, preparatory to resumption of mine operations.

Mary Ellen—This mine, adjoining the Duncan mine on the east, is being worked on a small scale, and is under option to Denver men, who may install a mill.

X-L Placer Mining Co.—The company completed its pipe and ditch line last summer, and is preparing to hydraulic the ground.

Canada

British Columbia

In consequence of the threatened landslide at Turtle Mountain, the inhabitants of the mining town of Frank, which is believed to be in danger of destruction, are preparing to remove to another townsite. The Canadian Coal Consolidated, Ltd., which operates the mines is arranging for the removal of 33 buildings to the new townsite.

Mining in the Lardeau district is practically at a standstill. Aside from assessment work, practically nothing is being done. Some properties contain surface indications which are stated to warrant development, but it is difficult to interest capital. Inadequate transportation facilities are a great drawback.

Silver Cup—As far as known orebodies are concerned, this mine is nearly worked out. At present a small force is engaged in cleaning up the mine, which will be abandoned unless further oreshoots are discovered.

Standard Silver-Lead Mining Co.—This company has recently been shipping about 750 tons per month of silver-lead ore and concentrates.

Van Roi—During the first four months of this year, the company shipped a total of concentrates as follows: Lead, 1110 tons, assaying approximately 200 oz. silver, 61% lead and 12% zinc per ton; zinc, 840 tons assaying about 75 oz. silver, 3½% lead and 46% zinc, per ton. About 5000 tons of ore per month are being milled.

Granby—The directors on May 7 considered several plans for financing the Hidden Creek smeltery, including the issuance of 10-year bonds, loans from banks and application of earnings from the old mine. No decision was reached.

Ontario-Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended May 3, and for the year to date, are:

La Rose	72.63	1,147.32
Coniagas	120.30	666.65
O'Brien	31.43	231.21
Right of Way	38.30	148.60
Chambers-Ferland	32.00	161.60
McKinley-Darragh	35.01	955.74
Nipissing	76.06	629.06
Hudson Bay		249.88
Buffalo	31.64	382.37
Crown Reserve	..	170.48
Cobalt Townsite	50.24	406.72
City of Cobalt		145.84
Trethewey	27.13	174.19
Colonial	..	20.00
Kerr Lake	61.31	292.79
Cobalt Lake	40.25	176.26
Drummond	..	300.32
Temiskaming	60.27	320.64
Beaver	30.35	132.34
Wettlaufer	......	111.21
Provincial	......	22.22
Casey Cobalt	....	24.50
Totals	706.92	6,869.94

BULLION SHIPMENTS IN OUNCES

Mine	Week	Year to Date
Nipissing	102,013.02	1,292,361.54
Miscellaneous	2,929.00	......

Temiskaming—A number of the men have stopped work on account of two union miners having been discharged.

Ophir—The directorate has been reorganized and work has been started on the sinking of a 200-ft. shaft on a large vein on the south end of the property. Mr. Gordon, consulting engineer of the Cobalt Lake, is in charge.

Cashman—This Elk Lake claim, lying east of the Moose Horn, has been sold for $35,000 to Ottawa men.

Buffalo—This company has acquired an interest in a property in Gowganda.

Ontario-Porcupine

North Dome—Good ore has been opened in the drifts on the 50-ft. level. This discovery may have an effect on the vote of the shareholders, which will decide whether the property is to be sold.

Dome Lake—This company has placed an order for a 10-stamp mill.

Rea—The stockholders will meet soon to discuss the financing of the property. Some still believe it has merit, but realize that the necessary development would call for a large expenditure. Some of the stores on hand at the mine are being sold.

Lucky Cross—The east crosscut on the 100-ft. level of this Swastika mine has intercepted a 12-ft. vein carrying good ore.

McIntyre—This company has shipped another bar of bullion weighing 144 ounces.

Pearl Lake—Negotiations are under way to relieve the financial difficulties of this company, and to enable it to resume work.

Little Pet—The 5-stamp mill is expected to be completed about May 15. The ore occurs in quartz stringers in the porphyry. The intervening porphyry carries from $2 to $3 per ton in gold.

Dome—This company, on May 5, will make another shipment of bullion.

McEaneny—On this property, belonging to the Crown Reserve, ore is being blocked out on the 100- and 200-ft. levels.

Quebec

East Canada Smelting—Pending construction of the Bleichert aërial tramway to Weedon, this company is stockpiling from 100 to 125 tons per day, taken out in development. All material for the 19,480-ft. tramway, which comprises 48 towers and two anchor and tension stations, is now on the ground. When the tramway is completed in June, production will be resumed at the rate of about 200 tons per day. Leland D. Adams is superintendent.

Mexico

Chihuahua

Veta Colorado—Work at both mine and mill has been completely suspended, due to inability to obtain supplies.

Presena—The new compressor has been installed, but work on the aërial tramway has been delayed by nonarrival of material. Work is being pushed as rapidly as possible under the direction of T. G. Hawkins.

Mina Maria—Robbers have again looted the property, this time taking all the provisions, clothes, etc., in the store. Operations at the mine will probably be suspended before long.

Sonora

Elsie—Four men were killed by a cave-in recently. Two others who were buried, were rescued alive.

Greene-Cananea—Revolutionary troubles are said not to be interfering with mine operations.

South America

Chile

Braden—Electric haulage is in operation at Nos. 3 and 4 Fortuna tunnels, and stopes are being opened. Miners receive the equivalent of about 75c. per day. All the Fortuna tunnels except No. 2 are stopped in low-grade material. At the Teniente mine the tunnels have been advanced in good ore. The first half of the third unit of the mill is expected to be ready for operation by May 15. At the smeltery, further adjustments and installations are expected to reduce costs considerably. The leaching plant should be completed by the middle of July.

Asia

Chosen

Oriental—Cable advices state that the April cleanup was $139,000. During March, the bullion produced was worth $126,994, and 24,295 tons of ore were crushed.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, May 8—The coal trade in the West is gradually shaking down into shape. Current trade is improving as the strike accumulations are being worked off by consumers, and the opening up of the Lake trade is stimulating production.

The seaboard bituminous trade is quiet, but recent developments in the anthracite region have unsettled matters, and there may be a better demand.

Rather contrary to expectation, the anthracite conference rejected the compromise agreement made by the subcommittee. The plan has been referred back to a special convention of the miners, and it will take a week or more to determine finally whether it will be accepted by them. The continued postponement has unsettled the trade.

The Pittsburg district shippers are not satisfied with the new rates on Lake coal and want a further adjustment, claiming that the West Virginia operators are still getting an undue discrimination in their favor.

Belgian Coal Trade—Imports of fuel into Belgium, three months ended Mar. 31, were 1,054,231 metric tons of coal, 282,774 tons of briquettes and 246,675 tons coke. Exports were 1,970,145 tons coal, 98,336 tons briquettes and 210,526 tons coke.

Iron Trade Review

New York, May 8—The iron and steel markets show much the same conditions as for several weeks past. The month so far has not shown much, if any, decrease in activity from April. Mills are generally busy and specifications are coming in freely. New railroad orders coming in freely also.

The tendency of prices continues to be to advance, and this week galvanized sheets are quotable $1 a ton higher as a minimum, while tinplate is quotable $2 a ton higher, a price of $3.40 having been named to jobbers for third quarter. The $3.40 price would probably be shaded by one or two mills in the case of large lots to canners, but the prospect is that if pig tin continues strong there will be a further advance in tinplate to $3.50 per box.

With contracts and specifications now on books the steel mills are assured of full operation at the present gait for at least three months. Presumably, however, the pressure will last for a longer time. There is actual new buying at the advanced prices of 1.20c. for bars and 1.25c. for plates and shapes, though there is not much as nearly all buyers are under contract at lower figures.

Railroad buying is to the front again, purchases of cars and rails having been particularly heavy in the past ten days. It is believed that a great deal more business has been practically arranged and will be announced from week to week.

Orders for cars placed thus far this year make a total of over 60,000, of which more than 20,000 have been placed within the past fortnight. The car shops have been operating in the past few months at between 50 and 60 per cent. of full capacity, and already have enough business on books to insure operations at this rate for the balance of the year.

Pig iron has sold well, both basic and foundry being in demand. Prices are again a shade firmer on new orders, and Southern furnaces are holding well up to their late quotations.

A reversal of a past trade current is seen in the export this week of 489,425 lb. tinplates from Baltimore to Liverpool. This may be a result of the stoppage of Welsh tinplate works by the coal strike, but it is an unprecedented shipment.

The Steel Corporation Suits—The taking of testimony in the Government suits against the Steel Corporation began before a special master in New York, May 6. A large number of witnesses have been called. The opening evidence related chiefly to the condition of the iron and steel trades at the time the Steel Corporation was organized, and it brought out nothing new. It looks very much as if the evidence would follow the lines of that given before the Stanley committee.

Baltimore

May 6—Exports for the week included 1,872,100 lb. steel billets and 489,425 lb. tinplates to Liverpool. Imports included 5994 tons pyrites from Huelva, Spain; 17,850 tons iron ore from Cuba.

Birmingham

May 6—Inquiries for pig iron are being received by Southern manufacturers in such tones as to indicate there will be a need for considerable tonnage during the last half of the year. The quotations are firm around $11@11.25 per ton, No. 2 foundry. Preparations are being made for the blowing in of two blast furnaces and the make is to be increased. The reduction of the accumulated stacks of iron continues steadily, and the general conditions are improving. There has been a little export iron moved again.

Cast-iron pipe interests in the Southern territory are melting iron in greater quantities than ever before. There is no end to the demand for pipe. The pipe interests have made arrangements for the greater portion of their probable needs during 1912 in the last few weeks, having purchased a large tonnage of iron. The improvements at the Dimmick plant, of the United States Cast Iron Pipe & Foundry Co., are being rushed, and a portion of this plant is going.

Some improvement is noted in the machine-shop and foundry trade in Southern territory. The charcoal-iron trade holds its own with quotations firm at $22@22.50 per ton. The scrap-iron market is strengthening up.

In steel a few orders are being received for rails, while fabricated steel, produced at the rolling mills, at Bessemer, is in strong demand.

Chicago

May 7—The iron market is firm, with pig iron especially strong in view of the continuing large demands of melters. In each of the last two weeks 30,000 to 40,000 tons has been sold and the furnacemen are asking about 50c. premium on many requirements for the last half generally, over the current quotations of $14.50@14.75 for Northern at the furnace and $11@11.25 Birmingham, or $15.35@15.60 Chicago, on No. 2 foundry iron, for second- and third-quarter delivery. The furnaces are well sold up and the melters are becoming more anxious about the future. Sales have ranged from 200 tons up into the thousands, the tendency being to buy more heavily than for many months past. Northern charcoal iron is not so strong but in good demand at $15.50@16.50. Sales now are chiefly of Northern foundry, the Southern sellers being inclined to hold off.

In the material market there is a gradually increasing demand for the leading lines. Structural steel is in demand for bridge and building work over a wide range of territory, at 1.43c. Chicago for material under 15 in. Railroad supplies are in increasing demand, light rails and track fastenings having a very good market and inquiries for standard rails being numerous. Bars are in lighter but still fair demand, soft-steel bars being sold at 1.38c. and bar iron at 1.20c. Chicago. Plates are rather quiet at 1.43c. and sheets are in like condition at 2.30c. for No. 28 gage, Chicago. The wire goods market is slowly increasing. General business conditions continue to improve and the outlook is good in many lines.

Cleveland

May 6—Iron-ore business is slow, season sales having about closed. The Pittsburg Steamship Co. has made charters for about 7,000,000 tons outside of its own boats.

Pig Iron—Sales have been good and there are many inquiries, mostly for small lots. Quotations, Cleveland delivery, are $15.15 for bessemer, $13@13.50 for No. 2 foundry, $12.50@12.75 for forge and $15.50@16 for Lake Superior charcoal.

Finished Material—The recent advances in price are being well maintained, but not much new business has been coming in, owing to the heavy contracts closed in April. Specifications, however, are large.

Philadelphia

May 8—Large sales of basic, foundry, forge and malleable pig iron have been made during the past few days. The well sold condition of many furnaces and the decreasing stocks have led makers to view with indifference some urgent inquiries for delivery during the third quarter of the year. The higher range of prices is being easily maintained. Large transactions in basic have been closed. The high price of coke continues to be a disturbing factor. Some pig-iron makers refuse to quote prices offhand for late delivery, but promise inquirers to do the square thing as soon as they can size up the situation. Malleable iron has done better than for several weeks. Additional sales of low-grade have been made at prices slightly higher than since Jan. 1 by about 25c. a ton. Basic is particularly sought after, but the actual sales do not correspond to the inquiry. Quotations may be fairly given at $15.50 for No. 2 X foundry, with a minimum of $15 for Southern No. 2. Gray forge, both Northern and Southern, hangs around $14.50 though more money is demanded for two or three Northern grades.

Billets—Billets have advanced supposedly $1 a ton, and business is being done on this basis, as all former quotations have been withdrawn. Both bessemer and openhearth are firm and makers have the advantage, as buyers have now very little material on which to go and come.

Bars—Bars have moved up fractionally and are safely quoted at a minimum of 1.30c., though much business which is coming in at a retail way is closed at 1.35@1.40c. The outlook for common iron is better than it has been for months.

Sheets—Sheet-iron orders are quite numerous, but for small lots in a piecing-out way.

Pipes and Tubes—Pipes are active for merchant purposes, and tube work is abundant. Discounts are unchanged.

Plates—The advance in steel plates has stimulated inquiry and at the same time seems to have checked the placing of business. As matters stand, the mills have a decided advantage and higher quotations are probable. For prompt deliveries an advance on small lots is already as good as made.

Structural Material—Increasing inquiries are crowding in the market. There is increased demand for small lots.

Scrap—Good grades of scrap are being picked up and all kinds are moving with freedom. Preference is shown for heavy steel melting scrap at an advance of 50c. per ton.

Pittsburg

May 7—Mills are placed under increased pressure for deliveries of bars, plates and shapes, buyers being very insistent upon quick delivery. The evidence is that the material is actually being consumed. The pressure for deliveries of sheets and tinplates has increased, though it is not as great as in the other lines. Pipe and wire products are relatively slack, the mills having no difficulty in making desired deliveries, and indeed not being under the necessity of operating at full capacity.

Pig Iron—There has been considerable quiet buying of pig iron, particularly of foundry iron in the Central West and of basic iron in the East. It is understood that a large tonnage of Midland iron has been sold to eastern furnaces. Forge has definitely advanced, two sales made last week aggregating nearly 3000 tons bringing $13, Valley, or within 25 cents of the price of No. 2 foundry. This is likely to advance; indeed there seems to be little offered at $13.25 and it is reported that $13.50 has already been paid. We quote: Bessemer, $14.15@14.25; basic, $13; forge, $13; No. 2 foundry, $13.25@13.50; malleable, $13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg. The bessemer average for April as compiled by a trade interest from actual sales, is announced at $14.25, Valley, against $14.0536 for March, and the basic average at $12.981, as compared with $12.76 for March.

Ferromanganese—The ferromanganese market for forward delivery has been quiet since the $2.50 advance of Apr. 29, but the price is well held at $46, Baltimore. Odd lots for prompt shipment are bringing premiums, prices running up occasionally to $50, Baltimore.

Steel—There is not a great deal of inquiry for billets or sheet bars, but the large mills are practically out of the market and turn down such inquiries as appear. There is a little material in the hands of brokers, and the small independent openhearth mills as a rule have a little steel to sell. Large consumers are well covered by contracts, but are not getting satisfactory deliveries and would like to buy additional tonnage on the outside if they could get the material without paying too large a premium. The Steel Corporation has bought a small lot of openhearth sheet bars from the Republic Iron & Steel Co., quite an unusual transaction, and due to its operating its Ohio mill at Youngstown partly on openhearth rails. We quote the market higher again, by $1 a ton, at $21.50 for billets and $22 for sheet bars, f.o.b. maker's mill, Pittsburg. Rods are nominally $25, Pittsburg.

Sheets—Some of the independent mills are now adhering to the recently advanced prices of the leading interest as a minimum, these prices being 1.95c. on black and 3.00c. on galvanized. Occasionally 1.90c. is quoted on desirable orders by some of the independents, but the 2.90c. price on galvanized, quoted as the minimum in the past two or three weeks, has disappeared, 2.95c. seeming to be the minimum. Specifications are good. We quote: Black sheets, 1.90@1.95c.; galvanized, 2.95@3.00c.; blue annealed, 1.40c.; painted corrugated, $1.35 per square; galvanized, $2.55 per square. The American Sheet & Tin Plate Co.'s charges, over prices for flat sheets, are 5c. per 100 lb. for corrugating, and 15c. per 100 lb. additional for painted, gages 25 to 28 inclusive.

St. Louis

May 6—The pig-iron market still continues quite brisk and strong. Buyers who did not place the last of their first-half requirements a month ago are coming in now and are trying to buy at $11@11.25, though $11.50 is being asked. Inquiries are coming in for third- and fourth-quarter delivery. No. 2 Southern foundry is readily bringing $10.50@11 Birmingham, or $14.25@14.75 St. Louis.

Coke is moving fairly well at $5@5.10 per ton, St. Louis.

Iron Ore Trade

Imports and exports of iron and manganese ore in the United States, three months ended Mar. 31, long tons:

	1911	1912	Changes	
Iron ore, imp.	332,205	441,280	I.	109,075
Iron ore, exp.	7,326	24,224	I.	16,898
Manganese, imp.	51,340	77,638	I.	26,298

The iron-ore imports this year included 48,695 tons from Spain, 71,517 from Sweden and 314,180 from Cuba.

The first cargo of ore to reach a Lake Erie port this season was one of 9000 tons from Escanaba, which reached Toledo, Apr. 25. The following day a cargo of 7951 tons, also from Escanaba, reached Ashtabula. No boats have come through from Duluth yet, as the ice at the Sault is slow in clearing out, but the first boats from Lake Superior are expected this week.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for three months ended Mar. 31, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1911	1912	Changes
Exports	$58,890,174	$64,728,283	1. $5 838,109
Imports	7,972,333	6,474,678	D. 1,497,655
Excess,exp.	$50,917,841	$58,253,605	1. $7,335,764

Increase in exports, 9.4%; decrease in imports, 18.8%. The leading articles of iron and steel were, in long tons:

	Exports		Imports	
	1911	1912	1911	1912
Pig iron	40,926	47,139	41,932	28,792
Scrap	19,373	24,328	4,599	2,313
Billets, blooms, etc.	68,182	51,984	13,191	4,407
Bars	36,401	41,442	7,840	4,707
Rails	105,527	81,039	. ...	942
Sheets and plates	74,768	111,033	661	525
Structural steel	46,748	55,043	.....	547
Wire-rods	3,886	13,920	4,465	3,857
Wire	46,811	43,719	.....	......
Nails and spikes	17,470	22,658	.....	.....
Tinplates	9,601	15,329	7,707	617
Pipe and fittings	32,199	48,930	.....	......

Imports of wire are not reported in quantities; values were $331,711 in 1911 and $152,726 in 1912. Exports of mining machinery in 1912 were valued at $1,541,180, a decrease of $184,594 from last year.

METAL MARKETS

New York, May 8—The metal markets generally have been rather quiet, with no material changes from last week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Mar. 1912	$ 7,453,589	$ 4,335,678	Exp.	$3,117,911
" 1911	505,615	4,119,063	Imp.	3,613,448
Year 1912	19,958,088	12,414,195	Exp.	7,543,893
" 1911	1,854,014	19,465,737	Imp.	17,611,723
Silver				
Mar. 1912	5,806,307	3,711,734	Exp.	2,094,573
" 1911	5,896,795	3,197,409	Exp.	2,699,386
Year 1912	16,955,988	11,850,220	Exp.	5,105,768
" 1911	16,001,842	10,646,781	Exp.	5,355,061

Exports from the port of New York, week ended May 4: Gold, $107,125, chiefly to Panama; silver, $734,233, principally to London. Imports: Gold, $366,099; silver, $264,055, largely from Mexico and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There is still a good demand for India and Egypt; outside of that most of the gold arriving went to the Bank of England.

Platinum—The market is reported steady, but rather inactive. The quotations are unchanged. Dealers ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Apr. 26, that the market is without change. The offer of small lots by the stárateli is beginning to increase, as operations are started at the placers which were closed in the winter. The stocks held by speculators are rather large, but they are in strong hands and not likely to be forced on the market. Quotations for crude metal, 83% platinum, are 9.90 rubles per zolotnik, at Ekaterinburg, and 38,000 rubles per pood at St. Petersburg—equal to $37.22 and $37.24 per oz., respectively.

Silver—Owing to large orders in London by the Indian Bazaars, the price of silver for the last week has been well maintained.

SILVER AND STERLING EXCHANGE

May	2	3	4	6	7	8
New York	61	60⅞	60⅝	60⅛	60¼	60½
London	28⅛	$28\frac{1}{16}$	$27\frac{15}{16}$	$27\frac{11}{16}$	27¾	27⅞
Sterling Ex.	4.8680	4.8690	4.8690	4.8680	4.8680	4.8675

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Apr. 25, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India	£3,123,700	£2,245,800	D. £877,900
China	802,800	630,000	D 172,800
Total	£3,926,300	£2,875,800	D. £1,050,700

India Council bills in London averaged 16.05d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

May	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
2	15⅞ @16	15.65 @15.75	45¾	4.15 @4.20	4.02½ @4.05	6.55 @6.75	6.40 @6.60
3	15⅞ @16	15.65 @15.75	45⅝	4.15 @4.20	4.02½ @4.05	6.55 @6.75	6.40 @6.60
4	15⅞ @16	15.65 @15.70	45⅝	4.15 @4.20	4.02½ @4.05	6.55 @6.65	6.40 @6.50
6	15⅞ @16	15.60 @15.70	45½	4.15 @4.20	4.02½ @4.05	6.55 @6.65	6.40 @6.50
7	15¾ @16	15.55 @15.65	45⅞	4.15 @4.20	4.02½ @4.05	6.50 @6.65	6.35 @6.50
8	15¾ @16	15.55 @15.65	45⅞	4.15 @4.20	4.02½ @4.05	6.50 @6.60	6.35 @6.45

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

May	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
2	69⅜	70⅛	74½	210½	206½	16½	25¾
3	69⅝	70⅜	74½	208½	204¼	16½	26
4	......	......	......	......	......	..	.. . .
6	$69\frac{9}{16}$	70¼	74½	208	204	16½	25½
7	69	$69\frac{11}{16}$	74	208¾	204½	16½	25⅝
8	$69\frac{3}{16}$	69¾	74	209¾	205¼	16½	25⅝

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market during the week of May 2-8 has again been characterized by absence of demand, the volume of business having been smaller than during the previous week. Domestic manufacturers seem to be overbought and the European market is temporarily so much out of tune with ours that we cannot sell copper to Europe except under peculiar conditions. There appears to be a considerable stock of cathodes in England for sale at about 5s. premium over standard copper, or at about 15.30c., which is 0.25c. less than the price here. One of the leading agencies has maintained its asked price at 16⅛c.; another at 16c.; but others have offered at 15⅞c and in the latter part of the week have openly quoted 15¾c., all prices delivered usual terms. Sales have been reported at 15⅞c. down to 15¾c., delivered, usual terms. The market for Lake copper has been but nominal, the business in this kind that has been reported being insignificant. At the close, Lake copper is quoted at 15¾@16c., and electrolytic copper in cakes, wirebars and ingots at 15.55@15.65c. Casting copper is quoted at 15¼@15⅜c. as an average for the week.

The London standard market has been quiet and weakish. On May 2, it was £59 7s. 6d. for spot and £70 2s. 6d. for three months. On May 3 it advanced 5s., but by May 7 had declined to £69 for spot and £69 13s. 9d. for three months, and closed on May 8 at £69 3s. 9d. for spot, and £69 15s. for three months.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 17@17⅛c. base, carload lots at mill.

Copper exports from New York for the week were 4246 long tons. Our special correspondent gives the exports from Baltimore at 1591 tons.

Visible stocks of copper in Europe on May 1 were: Great Britain, 34,690;

France, 6040; Rotterdam, 2750; Hamburg, 7370; afloat from Chile, 2050; afloat from Australia, 7000; total, 59,900 long tons, a decrease of 190 tons from the Apr. 15 report.

Brass Prices—The American Brass Co. announces the following prices, taking effect May 1: Sheets, high brass, 17c. net per lb.; low brass, 18⅝c. Wire, high brass, 16¾c.; low brass, 18⅝c. Rods, high brass, 16¼c.; low brass, 19⅜c. Tubing, brazed, 21½c.; open seam, 20⅜c.

Tin—The activity of last week abated considerably and gave way to a rather dull market. Consumers in this country seem to be afraid of present high prices and are covering their immediate wants only. There was some business done among dealers, and it is reported that lots of future tin have been resold from this market to London. The excellent consumption continues, and looking at the statistical position of the metal only, the present and even higher prices are fully justified. The close is firm at £209 15s. for spot, and £205 5s. for three months, and about 45⅞c. for May tin in this market.

Visible stocks of tin on May 1 were: London, 6288; Holland, 725; United States, excluding Pacific ports, 4880; total, 11,893 long tons, a decrease of 3800 tons from Apr. 1 report.

Lead—This has been the dullest of all the metals. The A. S. & R. Co. maintains its price at 4.20c., New York, but independent interests have sold at 4.15c. At St. Louis, sales of Southwestern Missouri lead have been made at 4.05c., and of Southeastern at 4.02½ cents.

The London market is unchanged at £16 10s. for Spanish, and 2s. 6d. higher for English lead.

Spelter—The market during the week of May 2-8 has been rather chaotic. Vexed by the operations of some of the smaller smelters, leading interests offered spelter freely and cut prices to effect business. In the aggregate several thousand tons were sold for deliveries ranging from May to August at prices varying considerably for the same deliveries. In our quotations we have generalized the market according to the preponderating business rather than giving the extremes. There seem to have been liberal supplies of metal available for all deliveries. Some of the leading consumers have not been in the market, claiming to be well covered for two months ahead and uninterested in later spelter at any terms that have yet been offered. The close is quoted at 6.35@6.45c., St. Louis, and 6.50@6.60c., New York.

In London the market is quiet and somewhat easier. Good ordinaries are quoted at £25 12s. 6d., and specials at £25 17s. 6d. per ton.

Zinc dust is quoted at 7¼c. per lb., New York, in carload lots.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Other Metals

Aluminum—The announcement that the English, French, German, Swiss and American makers have agreed upon the basis for a new syndicate has sent prices up materially abroad. The quotation in London has advanced from £54 to £64 per long ton, and the German price from 108 to 132 marks per 100 kg.—the latest prices being equivalent to 13.91 and 14.25c. per lb. This would be about 21 and 21¼c., duty paid, New York. The American makers have generally met the price at which imported metal can be laid down in New York.

Business here has been quiet. We quote 21@22c. per lb. for No. 1 ingots, New York.

Imports of aluminum into the United States for the quarter ended March 31 were 6,204,754 lb.

The Aluminum Castings Co., of Cleveland, O., which already controls 11 plants, has taken an option on a foundry property at Milwaukee, Wis., and purposes establishing another plant there for the manufacture of aluminum into finished forms.

Antimony—Business has been on a moderate scale, and prices are unchanged. Cookson's is 8@8⅛c. per lb.; Hallett's and U. S. are 7¾; while 6⅞@7c. is quoted for Hungarian, Chinese and other outside brands.

Quicksilver—Business is steady and prices here are unchanged. New York quotations are $41.50@42 per flask of 75 lb., while 60@62c. per lb. is charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. The London price is £8 5s. per flask, with £8 quoted from second hands.

Zinc and Lead Ore Markets

Platteville, Wis., May 4—The highest price paid this week for zinc ore was $54.50 per ton; the base price, 60% zinc, was $52@53. The base price paid for 80% lead ore was $53@54 per ton.

SHIPMENTS, WEEK ENDED MAY 4

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	948,110		
Cuba City	603,530		
Galena	560,900		
Benton	486,700		511,000
Hazel Green	440,000		
Platteville	432,200		
Harker	326,480		
Shullsburg	143,000	84,000	
Rewey	85,000		
Dodgeville	66,000		
Linden	65,270		
Montfort		80,000	
Total	4,157,190	164,000	511,000
Year to date	68,452,630	2,285,790	8,052,750

Shipped during week to separating plants, 2,412,140 lb. zinc ore.

Joplin, Mo., May 4—The high price for zinc sulphide ore is $59.50, the base, per ton of 60% zinc, $50@57.50 per ton. Zinc silicate sold on a base of $26@29 per ton of 40% zinc. The average price all grades of zinc, is $49.64. The high price of lead ore is $55, though a very large tonnage sold as low as $51 per ton. The average price, all grades of lead, is $52.74 per ton.

The year 1912 would have gone down in history as among the wettest in this mining region without the downpour of last Saturday night and Sunday. During 10 hours Saturday night 3.32 in. of water fell and Sunday night 0.20 in. The rain came on all portions of the district, flooding every stream and inundating many mines, overflowing high levees, washing out mill ponds and causing a large aggregate of damage. Even at the end of a week it is impossible to estimate with any degree of accuracy the extent of reduction in output. This week it will exceed 1000 tons and may reach very near that figure for another week or two.

SHIPMENTS, WEEK ENDED MAY 4

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,212,040	......	946,640	$110,679
Joplin	2,025,410	......	254,860	61,185
Galena	745,740	......	157,880	24,160
Duenweg	637,540	127,660	31,270	19,287
Granby	155,690	711,230	35,660	15,940
Oronogo	715,510	......	......	15,477
Alba-Neck	528,080	......	......	14,786
Miami	444,520	......	87,380	11,965
Jackson	375,110	......	......	9,375
Cave Springs	256,000	......	......	7,160
Aurora	173,840	121,190	......	6,335
Spurgeon	71,460	253,300	......	5,505
Carl Junction	123,380	......	......	3,455
Springfield	136,670	......	......	3,440
Lawton	122,340	......	......	3,180
Carthage	102,000	......	......	2,600
Wentworth	59,680	45,310	......	2,155
Quapaw	52,010	......	......	1,195
Ash Grove	......	......	42,440	1,060
Totals	9,937,020	1,258,690	1,556,130	$318,993
18 weeks	179,752,460	11,277,950	30,017,950	$5,303,227

Blende val., the week, $258,180; 18 weeks, $4,315,288
Calamine, the week, 19,713; 18 weeks, 163,381
Lead value, the week, 41,046; 18 weeks, 824,658

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.2
February	40.21	45.75	39.16	43.31	54.40	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	54.18
May	38.25	....	36.79	....	55.21	.
June	40.50	......	38.18	....	56.49	......
July	40.75	....	38.36	......	58.81	...
August	42.50	....	41.28	...	60.74	...
September	42.63	.....	41.29	...	59.39	......
October	42.38	......	40.89	......	54.72	....
November	45.40	......	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	......	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, May 8—The general trade continues to improve slightly, but with no important changes.

Copper Sulphate—Business is fair. Quotations are unchanged at $5.25 per

100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Aggressive buying by the manufacturers of insecticides is about over for the season, and supplies seem to have caught up with the demand. Prices are easier, $3.50@3.75 per 100 lb. being paid for white arsenic.

Nitrate of Soda—Business is good and prices are a little firmer. Quotations are 2.45c. per lb. for spot and 2.40c. for futures.

Messrs. Mortimer & Co., New York, report the position of nitrate in the United States on May 1 as follows, in long tons:

	1911	1912	Changes
Stocks, Jan. 1	12,790	9,000	D. 3,790
Imports, 4 mos	198,312	121,200	D. 77,112
Supplies	211,102	130,200	D. 80,902
Deliveries, 4 mos	194,522	125,600	D. 68,922
Stocks, May 1	16,580	4,600	D. 11,980
Afloat for U. S.	80,000	100,000	I. 20,000

Quantities afloat include all cargoes due to arrive at United States ports by Aug. 15 next.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, three months ended Mar. 31:

	Imports	Exports	Excess
Copper sulph. lb.	....	5,779,766	E. 5,779,766
Copper sul., '11	....	4,745,036	E. 4,745,036
Bleach, lb.	21,942,656	....	I. 21,942,656
Bleach, 1911	27,040,572	17,368	I. 27,023,204
Potash salts, lb.	189,818,817	265,208	I. 139,553,609
Potash salts, '11	255,703,617	934,331	I. 254,769,286
Soda salts, lb.	3,137,282	130,898	I. 3,006,384
Soda salts, 1911	11,170,684	170,506	I. 11,000,178
Acetate lime, lb.	....	15,378,365	E. 15,378,365
Acetate, 1911	....	18,590,384	E. 18,590,384
Nit. of soda, tons	105,565	2,162	I. 103,403
Nitrate, 1911	189,408	1,980	I. 187,428
Phosphates, tons	....	229,279	E. 229,279
Phosphates, '11	....	242,018	E. 242,018
Sulphur, tons	4,817	3,272	I. 1,545
Sulphur, 1911	6,478	453	I. 6,025
Pyrites, tons	195,286	....	I. 195,286
Pyrites, 1911	253,562	....	I. 253,562
Magnesite, lb.	39,859,695	532,150	I. 39,327,545
Magnesite, 1911	62,054,419	685,300	I. 61,369,119
Sul. ammonia, lb.	39,737,933	....	I. 39,737,933
Sul. am'nia, '11	84,773,245	....	I. 84,773,245
Arsenic, lb.	936,778	....	I. 936,778
Arsenic, 1911	1,137,495	....	I. 1,137,495

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 82,931 tons.

Petroleum

The monthly statement of the *Oil City Derrick* shows new wells completed in April as follows: Pennsylvania and West Virginia, 380; Lima-Indiana, 42; Kentucky, 11; Illinois, 69; Kansas-Oklahoma, 557; Texas-Louisiana, 104; total, 1163. In all the divisions there were 1163 wells completed, 242 more than in March. The new production was 64,728 bbl., an increase from the March report of 19,826 bbl. There were 205 failures among the completed wells, and 103 gas wells, a total of 308, leaving 855 oil producers.

On the last day of March there were 451 rigs up and 1200 drilling wells, a total of 1651. This was a decrease of 52 rigs and an increase of 112 in wells drilling.

The total petroleum production of Russia in 1911 was 9,435,000 metric tons; a decrease from 1911 of 186,000 tons.

MINING STOCKS

New York, May 8—On May 2 business on the Exchange was active on special lines, but rather irregular. Steel common recovered the small loss it had made the previous day, on the publication of the quarterly statement. On the Curb the copper stocks were strong and active, British Columbia and Giroux leading. Cobalts were strong and there were free dealings in other mining shares.

May 3 a heavy selling movement on the Exchange brought down quotations on all the prominent stocks. An attempt was made to turn the market later, but with little success. On the Curb, Greene-Cananea advanced but other coppers were heavy. The market for mining stocks generally was off fractionally.

May 4 the Exchange was rather quiet and heavy, dealing being confined to a few stocks. The Curb was dull, copper stocks being inclined to fractional recessions, while dealings in other mining stocks were light.

May 6 the Exchange was reactionary on large dealings, mainly of a professional order. Steel common was the most active stock, losing several points. Toward the close there was a slight upward turn. On the Curb almost all mining stocks were active, but on practically lower quotations, the coppers showing the most weakness.

May 7 the Exchange was heavy and prices weak. There was heavy selling of Steel common, and the copper stocks listed on the Exchange were also weaker. On the Curb trading was dull and mining stocks were in small demand, the coppers being again weak. May 8 conditions were much the same, with a little better demand for the outside mines on the Curb.

Boston, May 7—It has been a period of reaction in the mining share market, due to market reasons rather than to fundamental conditions. Hancock has been among the exceptions. The striking of what looks like the old Pewabic lode brought quite a bit of buying and caused a sharp advance of $4.12½ to $36.12½. Both Mayflower and Old Colony stocks have been active, but reacted moderately on profit taking. The drills at these properties are expected to encounter the Mayflower lode at any time now. No. 18 drill at Mayflower is 1350 ft. down.

Copper Range has broken an extreme of $9.25 to $55, since the annual report was issued a week ago. Granby has been a notably strong and active feature after a rather severe break. This is due to the fact that the director's are planning as to the best means to finance the

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Feb.	March	April
Alaska shipments	2,662,243	4,987,916	....
Anaconda	27,450,000	25,900,000	25,480,000
Arizona, Ltd.	3,020,000	3,150 000	3,400,000
Copper Queen	6,046,860	7,197,121	....
Calumet & Ariz.	4,452,004	4,652,000	4,104,000
Detroit	2,068,370	2,246,238	....
East Butte	1,410,000	....	....
Mammoth	1,722,954	1,939,310	....
Mason Valley	1,100,000	....	....
Nevada Con.	4,888,790	6,380,000	....
Old Dominion	2,039,000	2,432,000	2,167,000
Ray	2,140,000	....	2,612,500
Shannon	1,300,000	1,388,000	1,514,000
South Utah	283,838	299,000	....
United Verde*	2,250,000	2,250,000	....
Utah Copper Co.	8,612,739	8,160,000	....
Lake Superior*	19,000,000	19,750,000	....
Non-rep. mines*	8,000,000	8,400,000	....
Total production	98,476,798	....	....
Imports, bars, etc.	18,976,513	23,519,215	....
Total blister	117,453,311	....	....
Imp. in ore & matte	10,432,438	8,736,874	....
Total	127,885,749	....	....
Miami	2,475,996	2,755,000	....
Brit. Col. Cos.:			
British Col. Copper	860,003	....	... .
Granby	1,773,496	1,882,073	....
Mexican Cos.:			
Boleo	2,204,720	2,424,800	....
Cananea	2,948,000	2,834,000	....
Moctezuma	2,687,712	2,446,731	....
Other Foreign:			
Cape Cop., S. Africa	786,440	725,760	....
Kyshtim, Russia	1,055,000	....	....
Spassky, Russia	649,600	....	....
Famatina, Argen.	.. ..	....	....
Tilt Cove, Newf'd.	109,059	104,992	....
Exports from:			
Chile	6,720,000	3,584,000	....
Australia	7,164,000	8,064,000	....
Arrivals in Europe†	10,868,680	12,559,680	....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
IV, 1911	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326

VISIBLE STOCKS

	United States	Europe	Total
V, 1911	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191 945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158 323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757
V	65,066,029	134,176,000	199,242,029

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

new Hidden Creek smeltery. North Butte also proved disappointing by selling down almost $5.75 to $26. St. Mary's Mineral Land fell $8 from its recent high price. Lake Copper $6.25 to $38.25.

Curb trading has been light and prices generally heavy.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	....	$1.00
Alpha Con., Nev	May 29	June 19	0.05
Andes, Nev	May 28	June 18	0.05
Black Jack, Utah	Feb. 6	....	0.01
Caledonia, Nev	May 21	June 11	0.10
Cedar-Talisman, Utah	Apr. 20	....	0.005
Con. Virginia, Nev	Apr. 24	May 15	0.20
East Tintic, Utah	May 30	June 25	0.005
Ely Con., Nev	....	....	0.05
Exchequer, Nev	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Glen Dale, Utah	May 25	June 25	0.001
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0 05
Hancock, Mich	Mar. 28	....	1.00
Houghton Copper, Mich	May 17	....	1.00
Julia, Nev	May 15	June 5	0.05*
Lehi Tintic, Utah	Feb. 29	....	0.01½
Lower Mammoth, Utah	Mar. 16	....	0.01
Michigan Cop. & Gold, Utah	May 15	May 30	0.002½
New York Bonanza, Utah	May 8	....	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	....	1 005
Raven, Mont	Feb. 1	....	0.10
Savage, Nev	June 4	June 26	0 10
Southwestern Miami, Ariz	Jan. 15	....	1.00
Union Con., Nev	May 9	May 31	0.15
Utah Antimony, Utah	June 1	....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52 375	53.795	56.260	24 154	24.865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51 454	52.745	58.375	23.690	24 324	26.875
April	53.221	53.325	59.207	24 483	24 595	27.284
May	53 870	53.308	.....	24 797	24 583	.....
June	53.462	53.043	.....	24 651	24 486	.....
July	54 150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24 428	24.082	.....
September	53 295	52.440	.....	24 567	24 209	.....
October	55 490	53.340	.....	25.596	24 594	.....
November	55 635	55.719	....	25.680	25.649	.....
December	54 428	54.905	.....	25.160	25.349	.....
Year	53 486	53.304	. .	24 670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	14 094	12.680	14 337	55.600	62.760
February	12 256	14 084	12.611	14 329	54 974	62 893
March	12 139	14.698	12 447	14.868	54.704	65.884
April	12.019	15 741	12 275	15.930	54.034	70.294
May	11 989	.....	12 214	..	54 313	.....
June	12.385	.....	12 611	.	56 365	.....
July	12 463	.....	12 720	..	56 673	.....
August	12 405	.....	12 634		56.266	.....
September	12 201	.....	12.508		55 253	.....
October	12 189	.....	12.370	.. .	55 170	....
November	12.616	....	12 769	.	57 253	.....
December	13.552	....	13 768	.	62.068	..
Year	12 376		12.631	...	55.973	....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	....
February	41 614	42 962	August	43 319	....
March	40 167	42 577	September	39 755	. . .
April	42 185	43.923	October	41 186	. . .
May	43.115		November	43 125	. . .
June	44 696		December	44 655	. .
			Av. Year	42 281	...

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4.435	4 334	4 327	13 009	15.619
February	4 440	4.026	4 266	3 946	13 043	15 738
March	4 394	4.073	4 238	4.046	13 122	15.997
April	4 412	4 200	4 262	4 118	12.889	16 331
May	4.373	......	4 223	.....	12 984	....
June	4 435	......	4 292	.....	13.260	....
July	4.499	......	4.397	......	13 530	.....
August	4 500	......	4 406	......	14.260	....
September	4 485	.....	4 356	......	14 744	....
October	4.265	......	4 139	......	15.332	.....
November	4 298	......	4.181	......	15.821	....
December	4 450	......	4.332	......	15.648	....
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23 887	26.642
February	5 518	6 499	5 368	6.349	23 276	26 661
March	5.563	6.626	5 413	6.476	23 016	26.048
April	5 399	6.633	5 249	6 483	23 743	25 644
May	5 348	......	5 198	....	24.375	.....
June	5 520	......	5 370	.....	24 612	.....
July	5 695	......	5 545	......	25 006	.....
August	5 953	......	5 803	......	26 801	.....
September	5 869	......	5 719	....	27 750	....
October	6.102	......	5.951	......	27 256	.....
November	6.380	......	6.223	......	26.795	......
December	5.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14 75	$14.00
February	15 90	15.03	14 50	13.28	14 81	14.01
March	15.90	14.95	14 65	13.66	14 96	14 10
April	15 90	15.13	14 65	13.90	15 00	14 15
May	15 90	......	14 30	......	14 72	......
June	15 90	......	14 06	......	14 56	......
July	15 90	....	14 03	......	14 53	......
August	15 90	.. .	14 00	......	14 47	.....
September	15 90	... ..	13 57	......	14 40	. ..
October	15 43	......	13.44	......	14.34	.....
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	.....	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS May 7

Name of Comp.	Bid.
Acacia	.05
Cripple Cr'k Con.	.01⅝
C. K & N	.16
Doctor Jack Pot	.06
Elkton Con	.60
El Paso	.76
Findlay	.04
Gold Dollar	.16⅛
Gold Sovereign	.01½
Isabella	.12
Jack Pot	.05
Jennie Sample	.05½
Lexington	‡ 01
Moon Anchor	01
Old Gold	03½
Mary McKinney	.67
Pharmacist	.01½
Portland	90
Vindicator	73
Work	‡.01

SALT LAKE May 7

Name of Comp.	Bid.
Beck Tunnel	14
Black Jack	17¼
Cedar Talisman	.02¾
Colorado Mining	.17
Columbus Con	13
Crown Point	03½
Daly-Judge	6.25
Grand Central	68
Iron Blossom	1 20
Little Bell	40
Lower Mammoth	02½
Mason Valley	11 50
May Day	09¾
Nevada Hills	1 80
New York	04¼
Prince Con	1 37½
Silver King Coal'n	2.12½
Sioux Con	.04
Uncle Sam	.19
Yankee	‡ 10

TORONTO May 7

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6 90	Hollinger	12 00
Hudson Bay	‡70 00	Imperial	.04
Temiskaming	39	Pearl Lake	.17
Wettlaufer-Lor.	64	Porcu. Gold	37
Apex	04	Porcu. Tisdale	‡ 04
Central	‡5 56	Preston E. D.	.06
Crown Chartered	25	Rea	55
Doble	45	Standard	03
Dome Exten	51	Swastika	18
Foley O'Brien	20	West Dome	‡ 15

SAN FRANCISCO May 7

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.15	Belmont	10.25
Belcher	.52	Jim Butler	62
Best & Belcher	.07	MacNamara	.25
Caledonia	1.37½	Midway	.64
Challenge Con	.14	Mont.-Tonopah	3.40
Chollar	.07	North Star	.24
Confidence	.75	West End Con	2.20
Con. Virginia	.73	Atlanta	.25
Crown Point	.65	Booth	.10
Gould & Curry	06	C.O.D. Con	.10
Hale & Norcross	25	Comb. Frac	.13
Mexican	2 97½	Jumbo Extension	.43
Occidental	55	Pitts.-Silver Peak	1.35
Ophir	1.42½	Silver Pick	.13
Overman	1.15	St. Ives	.30
Potosi	.07	Tramp Con	‡.01
Savage	12	Argonaut	2.25
Sierra Nevada	.33	Bunker Hill	4 50
Union Con	1.17½	Cent. Eureka	1.00
Yellow Jacket	.97	So. Eureka	4.00

N. Y. EXCH. May 7

Name of Comp.	Clg.
Amalgamated	81¼
Am. Agri. Chem	60
Am.Sm.&Ref.,com	84⅛
Am. Sm. & Ref., pf.	108
Am. Sm. Sec., pf. B	88½
Anaconda	41¼
Batopilas Min	2
BethlehemSteelpf	70¾
Chino	28¾
Federal M. & S., pf.	41
Goldfield Con	4⅛
GreatNor.,ore.,ctf.	39⅞
Homestake	‡93
Miami Copper	25
Nat'nalLead,com.	56¼
National Lead, pf.	109
Nev. Consol	21⅛
Pittsburg Coal, pf.	87
Ray Con	18⅝
Republic I&S,com.	22⅛
Republic I & S, pf.	77½
SlossSheffi'd,com.	48
Sloss Sheffield, pf.	‡100
Tennessee Copper	42
Utah Copper	61
U. S. Steel, com	65½
U. S. Steel, pf.	109¾
Va. Car. Chem	51¾

N. Y. CURB May 7

Name of Comp.	Clg.
Barnes King	¼
Beaver Con	.46
Braden Copper	5¼
B. C. Copper	5¾
Buffalo Mines	‡1¼
Butte & Vipond	‡.53
Caledonia	‡¾
Con. Ariz. Sm	⅝
Davis-Daly	$1\frac{9}{16}$
Diam'field-Daisy	11
Ely Con	$\frac{5}{16}$
Florence	.76
Giroux	5½
Gold Hill Con	‡¼
Greene Cananea	8½
Greenwater	.06
Guggen. Exp	217
Inspiration Con	18¾
Internat. S. & R.	‡126
LaGrange Placer	‡2⅞
Kerr Lake	‡2⅞
La Rose	3¾
McKinley-Dar-Sa.	1⅝
Min. Co. of A. new	3⅛
Nev. Utah M. & S.	$\frac{1}{16}$
Nipissing Mines	7¾
Ohio Copper	1⅜
Pacific Sm. & M	$\frac{5}{16}$
Precious Metals	‡1⅜
Ray Central	$2\frac{5}{16}$
Red Warrior	‡1½
South Utah M. & S.	⅞
Standard Oil (Old)	‡880
Stand'd Oil of N.J.	383
Stand'd Oil Subs.	490
Stewart	1⅜
Tonopah	6⅞
Tonopah Ex	‡$1\frac{3}{16}$
Tri-Bullion	$\frac{11}{16}$
Tularosa	‡$\frac{13}{16}$
United Cop., pfd.	10
Yukon Gold	3⅜

LONDON May 8

Name of Com.	Clg.
Camp Bird	£1 10s 7d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 12 0
Mexico Mines	7 0 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 3 3

BOSTON EXCH. May 7

Name of Comp.	Clg.
Adventure	7¾
Ahmeek	295
Algomah	7¼
Allouez	41
Am. Zinc	29½
Ariz. Com., ctfs.	5⅛
Bonanza	.35
Boston & Corbin	6⅞
Butte & Balak	4
Calumet & Ariz	67½
Calumet & Hecla	475
Centennial	22
Con. Mercur	06
Copper Range	56⅛
Daly West	5⅝
East Butte	13
Franklin	12
Granby	53⅝
Hancock	35
Hedley Gold	17
Helvetia	1¼
Indiana	19¾
Island Cr'k, com.	46
Island Cr'k, pfd.	87½
Isle Royale	25
Keweenaw	2
Lake	36⅞
La Salle	6
Mass	6½
Michigan	3
Mohawk	60
New Arcadian	4½
New Idria Quick.	6⅞
North Butte	27
North Lake	6¾
Ojibway	4½
Old Dominion	51⅞
Osceola	112
Quincy	85⅛
Shannon	13
Shattuck-Ariz	21
Superior	32
Superior & Bost.	$2\frac{9}{16}$
Tamarack	36
Trinity	6
Tuolumne	3¼
Union Mines	‡3⅜
U. S. Smelting	35
U. S. Smelt'g, pf.	48⅞
Utah Apex	2¾
Utah Con	13½
Victoria	4½
Winona	5¾
Wolverine	105
Wyandot	2½

BOSTON CURB May 7

Name of Comp.	Last
Bingham Mines	2¾
Boston Ely	1¾
Boswyocolo	.08
Butte Central	6½
Cactus	12
Calaveras	1¾
Chief Cons	1¼
Corbin	2¼
Cortez	$1\frac{1}{16}$
Crown Reserve	3⅜
First Nat. Cop.	$2\frac{11}{16}$
Majestic	66
Mazatan	‡ 60
Moneta Porc	12
Nevada-Douglas.	3¼
New Baltic	3⅜
Oneco	2¼
Raven Copper	.30
Rhode Island Coal	11
San Antonio	‡3
S. W. Miami	7¾
South Lake	8¾
Trethewey	.60
United Verde Ext.	.42
Vulturo	‡5.00

‡Last quotation.

The Engineering and Mining Journal

Vol. 93. MAY 18, 1912. No. 20

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. ROB'T MCKEAN, Treas.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N W 7.

WALTER RENTON INGALLS, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE

Editorials:
- The Situation in Copper.......... 969
- The Advance in Aluminum....... 970
- Extraction Determinations in Cyanide Mills 970

By the Way.......... 971
New Construction 972
The Highgrade District.......... 972
Correspondence and Discussion:
- Sodium Sulphide as Cyaniding Precipitant....The Cañon Diablo Crater....Food Supplies for Miners....Underground Labor....The Camp of Highgrade....Research in Analytical Methods....Centrifugal Filter 973

The Searles Lake Potash Deposit. W. D. Hamman 975
Anaconda Copper Mining Co....... 977
American Iron and Steel Institute.. 977
U. S. Assay Offices.......... 978
Details of Practical Mining:
- *Improved Drill Post Collar....*Joplin Bucket Cars....*A Borehole Surveying Instrument....Fast Hoisting in Michigan....*An Ore Wharf in Chile....Tempering Drill Steel—II....*Graphic Solution of Skip Loads....*Temperature Correction Charts for Tapes 979

Details of Metallurgical Practice:
- *Argonaut Amalgamation Tables....Joplin Jigging Practice....*Movable Muffler for Gas Engine Exhaust 983

Notes from Current Literature:
- Water Analysis after Homestake Fire....Vertical vs. Incline Shafts....Treatment of Low-Grade Oxide Copper Ores....Manganese in the Caucasus....Chromax Bronze....Utilization of Lead Furnace Fume....Ancient Hard-Copper Tools....Cyanides from Aluminum Nitride....Tin in the Gay-Lussac Silver Determination....Heat Balance of the Blast Furnace....Waterproof Concrete Work....Making Titanium Alloys....Sulphate Leaching Process....The Air Lift Pump 985

Electricity and Chemical Action. Harry C. Jones 987
Lehigh Coal and Navigation Electric Plant 992
Cobalt's Production 992
Mine Hoisting Systems Compared. Bruno V. Nordberg 993
Talc Production in 1911.......... 996
*Canda Crusher Plate.......... 996
*Dredges on Upper American River. Lewis H. Eddy 997
Gold in Michigan.......... 1000
New Publications 1001
Personal, Obituary and Societies... 1002
Editorial Correspondence 1003
Mining News 1005
Markets 1011
*Illustrated.

The Situation in Copper

The last report of the Producers' Association was generally regarded as favorable and the market which was beginning to wabble has picked up again since its publication. The only criticism that is voiced pertains to the discrepancy between the production of the refiners and that of the smelters.

In 1910 the refinery production had attained a total of rising 125,000,000 lb. per month before the curtailment. Since December, 1911, most of the old producers have returned to their former maximums while the new producers have been contributing upward of 12,000,000 lb. per month. Consequently the actual production has been upward of 135,000,000 lb. per month. This figuring is confirmed by the individual monthly reports.

It appears therefore that we have learned how to add to our production without really doing so. On this theory the working of the law of supply and demand might be baffled, the price for copper might rise to 25c. per lb. stimulating new production, and yet the latter would be without effect. However, we do not think that any such thing will happen.

In the meanwhile the chief question of interest is, What has become of the increased production? The refiners to a man deny that they have accumulated any unusual quantity of crude copper.

We are inclined to think that the surplus unaccounted for is distributed in a variety of forms and places. What we call the smelters' statistics are in the main just that, but included in them is some production in the form of ore, e.g. the Alaska, Chino, and Ray products and also some foreign supplies. There may have been an increase in the stock of ore at the smelteries. This has been necessarily the case at the new Hayden works.

Some of the refiners have been increasing their capacity and in putting new plant into operation some copper has gone into the electrolyte, where it is permanently locked up.

The foregoing are two undoubted, partial explanations. For the rest, the statements of the refiners are probably to be taken *cum grano salis*. No one may be carrying any large accumulation of crude copper, but several may have a little more on hand than ordinarily, while there may be an increased quantity in the vats and in the between-products of the works, and perhaps an increased quantity of crude copper at the smelteries and in transit.

The increase in the production of refined copper is already overdue, but sooner or later it will appear. In the meanwhile valuable time has been gained. The question is, Can the gain be held? The rate of ultimate consumption will answer this. European consumption has certainly been well maintained and American has improved without doubt, but it is questionable whether the combined requirement from this market is equal to the production of the mines. Probably it is not. A great deal of the copper that we have exported has obviously been taken by speculative interests, who will aim to maintain the price until they have distributed what they are carrying and it is not unlikely that they will accomplish what they are planning. Pending that consummation the market is likely to exhibit such halting and irregularity as we have witnessed lately, with fitful spurts and slow relapses.

Proposed Arizona Legislation

We are informed that the Hall bill introduced in the Arizona legislature, which we commended last week, has been dismissed without discussion by the legislature, and that a very drastic bill, giving the mine inspector rather full judicial authority to punish by fine or imprisonment if he (the inspector) be not implicitly and summarily obeyed, has replaced the Hall bill and may possibly pass.

This bill, of course, departs from the fundamental conditions of the engineering committee. That committee proposed that the inspector should be a policeman, not a combination of policeman and judge, which ought not to be, as most sensible persons will agree. An inspector clothed with the police power of a state, as for example the inspectors of the health department in the city of New York, may have great power but when that is given the state assumes the responsibility to answer to citizens who may be improperly interfered with. Of course, even then the inspector is far from being a judge.

The Advance in Aluminum

A sharp advance in the price of aluminum abroad has followed the announcement that the large manufacturers of that metal in England, France, Switzerland, Germany and America have agreed upon the basis for a new convention, which is to put an end to the close competition and low prices which have been the rule since the old syndicate was dissolved two years ago. Although only a preliminary agreement has been made, there has been an advance in London of £10 per ton, and in Germany of 20 to 25 marks per 100 kg. A further increase in prices is expected. In this country the imports of aluminum for some time past have been very considerable—over 6,000,000 lb. for the first quarter of the present year—and the foreign market has governed prices here, the American producer meeting the prices at which imported ingots could be laid down in New York, duty paid.

It is claimed that there has been no profit, sometimes even a loss, at the prices which have recently prevailed. There is little doubt that in Europe they have been uncomfortably close to the cost of production. It is quite probable, however, that the advance in prices may not be carried much further. It would hardly be good policy to do so, since too high quotations might check the demand in certain directions, though in others—automobile construction, for instance—the metal has become almost essential. It seems quite probable at present that ingots may go up to at least 25c. here, in place of the level of 18@20c. which has prevailed for some time past.

The close of the meetings at Paris, in which the reconstitution of the syndicate was completed, was accompanied by assurances, made through the president of the Neuhausen company, that there was no intention of trying to force up prices to the high levels maintained by the old syndicate. The intention was to maintain prices which would enable the makers to secure a fair profit only and to recover from the losses resulting from the recent competition. Though the spokesman did not state it, there is a certain reason for this moderation. The basic patents which permitted a certain monopolization of the manufacture have nearly all expired, and there is nothing to prevent new companies from entering the business, should it promise high profits.

Extraction Determinations in Cyanide Mills

In most cyanide mills a sincere effort is made to keep a record of results obtained. Theoretically, it seems a simple matter to ascertain the percentage of extraction, for instance, since, unlike some metallurgical calculations, this one involves nothing more intricate than arithmetic. The difficulty, of course, lies in accurately determining the value of the factors on which the calculation is based, which in many cases is a real problem.

The metallurgical record should show the total ounces of gold coming to the mill in the ore, the quantity recovered in the form of amalgam, concentrate or bullion, and the amount lost in the tailings. For this information, tonnage determinations and assays are necessary and the methods employed are various.

Where automatic weighing and recording devices and automatic samplers are used these determinations are much simplified but such an arrangement is not feasible in all mills. The ingenuity of the individual operator, consequently, is called upon to work out a plan of his own. Sometimes the ore is brought to the mill in railroad cars and the weights furnished by the railroad company offer a convenient basis for figuring the tonnage treated. In other cases it is more convenient to calculate the tonnage from the number of sand and slime tanks filled; the volume of the tanks being known, and the specific gravity and moisture of the pulp being determined for each charge.

Some operators make no attempt to determine the amount of the gold in the crude ore, relying upon assays of the tailings and the bullion returns for their calculations. The disadvantage of this method is that it allows no means of checking the results. This is an important consideration, especially in mills using zinc shavings where there is always the temptation of crediting the boxes, after cleanup, with the gold not accounted for in other ways. The difficulty of obtaining the value and amount of used zinc put back in the boxes lends itself well to this procedure, and is one of the arguments in favor of zinc-dust precipitation.

The article by Mr. Nordberg, of which we begin the publication in this issue, was inspired by a paper published in the bulletin of the American Institute of Mining Engineers and starts off as a refutation of certain fallacies of that paper, but soon passes into a general summary of systems of hoisting. Being a contribution by a past master of this subject, an engineer who has built many of the greatest hoisting plants of this country, we think that his present expression of opinion is particularly noteworthy and will command the interest of all of our readers who have to do hoisting on a large scale.

The decision of Judge Lacombe of the U. S. Circuit Court, rendered on May 14, in the case of the Nipissing Mines Co., that the Government may not collect a tax on the net income of a mining company, but must allow for the depreciation in the value of the mine resulting from the withdrawal of ore, is a high legal indorsement of the theory that the dividends of a mining company are in part merely the reimbursement of principal.

An unusual feature of the Joplin ore market this week is that the base price of 60% zinc ore ranged from $2 to $4 per ton above that of lead ore. The base price of zinc was from $54 to $56, while lead ore sold at an average just over $52. One cause is a short supply of zinc ore resulting from recent heavy rains.

The effect of the coal strike in Great Britain on the iron trade is shown by the fact that on March 31 there were only 55 blast furnaces in operation, the usual number being from 240 to 250. The average number in blast for the quarter was 215. The production of pig iron in March was cut down to about one-quarter of the usual quantity.

By the Way

The promoters of Highgrade, the rechristened Hoag district in the northeastern corner of California, appear to be much concerned because the state mineralogist has suggested that their advertisements be confined to facts.

A curious accident is reported from Pittsburg. Twenty-two men were carrying a bar of iron 29 ft. long at the Pittsburgh Steel Co.'s Monessen plant on May 8 when a bolt of lightning struck the iron, twisted it into an "S" shape, knocked all the men unconscious, and internally injured two.

One of our daily contemporaries is fortunate in being gifted with second sight. Last Thursday it said confidently: "Copper prices on this side, however, will be advanced shortly. The next move will be to place the metal on the 16½c. basis, and from that level a gradual advance will take place."

The total number of shares in the Guggenheim Exploration Company is 207,933. At the last annual meeting 169,573 shares were voted, of which the Guggenheim-Whitney interests were supposed to control 92,698. Members of the Whitney family, however, owned only 44,663 shares and members of the Guggenheim family only 28,277 shares.

A shipment of a carload of pig iron was made from Heroult, Calif., to Salt Lake City on May 10. This iron is made from Pitt River ores in the electric furnace. It is notable as being the first California pig iron shipped out of the state; and also, we believe, as one of the first commercial shipments in this country of pig iron made in the electric furnace.

Bids have been asked for supplying 3,986,500 lb. of dynamite for use on the Panama Canal next year. This sounds like a large noise, but as a matter of fact indicates that the canal is approaching completion. Over 8,500,000 lb., or more than double the above amount, were bought for the canal work of the present year; in the eight years of digging, a total of 50,517,650 lb. of explosives have been used.

The sense of humor is not equally possessed. We have learned that some remarks in this column on May 4 have been misunderstood, so we make haste to explain. We have, upon several occasions, expressed our confidence in the statistics of the Copper Producers Association and our appreciation of their value, and we feel both just as much as ever. The sole point of our remarks was the futility of undertaking to forecast the monthly returns and our humor, if any there were, was directed at the prophets, not at the producers.

The Vieille Montagne company of Belgium in 1911 produced 108,568 metric tons of spelter, 4402 tons of lead and 98,108 tons of sulphuric acid. The net profit of the year amounted to £424,644, of which £189,144 were carried to the amortization and reserve fund, £27,187 paid for the expenses of administration, and £207,000 were distributed in dividends. This ancient, honorable and successful mining and metallurgical company is one of those that has learned that an amortization fund is a necessity of conservative financing. It will be observed that the distribution of profits as dividends in 1912 was less than one-half of the net operating profit.

The following contribution to the literature of the apex law is printed, as received, by the *Colorado School of Mines Magazine,* May, 1912: Dear Sir' As i am a Mineral prospector & do prospect locations from surface showings called apex of a lead or vain i believe if i understand aright—that the apex of a ore body holds good even if the angel or pich goes down so as to vertically be on anothers ground & apexes on the prospectors ground the prospectors are the rightful owner of the ore. Well i see there has bin efferts made by some advocator for the vertical ownership, that would do the prospector & ruin already a many a locator that holds good developed apex shoings—i hope this will meet your approval to advocate the apex-right May always hold good as a prospector locator i remain as ever for the apex law to hold all dips & angels."

The punishment of the illegal wire pools managed by Edwin E. Jackson was the most successful accomplishment of the Department of Justice in the prosecution of such offenders. In the trial of the suit against the U. S. Steel Corporation, now in progress, Samuel J. Bailey, assistant to Edwin E. Jackson, told how the "horseshoe pool" worked, especially in the case of government contracts. Whenever such a contract was to be let, Jackson decided what company should receive it, and notified that company what its bid should be. Then he sent a circular letter to the other members of the pool informing them of his decision, and adding that if they cared to make a tender they should bid according to a schedule of prices for the various kinds and grades of shoes which he specified. Some of the companies sent in bids at the higher rates, and the government officials supposed they were really getting competition. Jackson allotted a fair share of government business to each member of the pool every year. All business was taken by the component firms on a percentage basis, and if in the annual reckoning one firm fell below its allotment, it received so much per keg from the association for the number of kegs it fell short, and *vice versa.*

Reports of enormously rich discoveries in Bolivia were circulated last year and as the result a number of American miners went to that country. The American Legation at La Paz cabled on May 2 to the State Department at Washington that "many of these miners were now returning from the Tipuani River bringing unfavorable reports of the quantity of gold found there." There is gold in Bolivia but it will doubtless require the same arduous and indefatigable effort to deposit it in the pockets of the miners that is required elsewhere. Apropos of Bolivia, an American engineer wrote under recent date "Send your friends to buy tin mines in Bolivia. It is the best mining country in the world for rich mines, opportunities, altitude, and pneumonia—though the Gringos are peculiarly exempt from the last. What the west coast of South America needs most is a through line of American ships, thus giving us more direct transportation and other advantages. The real gold strike of the West coast is the one made at Putú, Chile, of which the JOURNAL has already made mention. Last week Putú took out a pocket of 62% gold ore weighing 58 kilos? They are hard after another pocket now. It will be a magnified jewelry shop if it keeps up."

The divining-rod salesman should not find a fertile field in Utah where supernatural visions and revelations are at the miner's elbow if he but placed himself *en rapport.* A Salt Lake paper records the dream prospecting of a Brigham City woman, who had a vision 10 years ago that a gold mine would be found by driving a tunnel into a certain prominent outcropping in the mountain two miles southeast of that beautiful little peach village. At the time her husband, the local district attorney, merely laughed the matter off. But the dream was repeated time and again and finally the attorney himself had a similar nocturnal visitation. It was no longer to be scouted, and the two went to the spot and began with their own hands driving an adit into the hills. When two miners last September visited the place, they found the plucky woman holding the drill while her sturdy worse-half dealt the blows which might mean future affluence. A 6-ft. vein is reported and 50 claims located, extending from Box Elder Creek to Three Mile Creek Cañon. A 2,000.000-share company has been organized with the head dreamer as treasurer. We only trust that she will be equally successful in dreaming real dividends into the pockets of shareholders. The legend of the discovery of the Beck Tunnel by revelation is well known. But, revelators like baseball pitchers have their off days and Mountain Lake, for example, proved no better than other prospects in the Cottonwoods that were not so favorably introduced.

New Construction

Inspiration Consolidated Copper Co., Miami, Ariz., has authorized construction of a 7500-ton concentrator, work to start when a site has been selected. Henry Krumb is consulting engineer.

Tonopah-Belmont Development Co., Nevada, is erecting a 500-ton mill at Tonopah, estimated cost, $435,000. Frederick Bradshaw, Tonopah, is general superintendent.

Northern Customs Concentrator, Cobalt, Ont., is adding 40 stamps and accessories at $75,000 estimate cost.

Shattuck-Arizona Copper Co., Bisbee, Ariz., will erect a 400-ton smeltery, at Douglas. John Olson, Bisbee, is superintendent.

Timber Butte Milling Co., Montana, organized by Senator Clark, will erect a zinc-ore concentrator at Butte.

Calumet & Hecla will construct another regrinding plant, at Lake Linden, Mich. Equipment will include 64 conical tube mills. Work has started. James Mac Naughton, Calumet, is general manager.

Porcupine Gold Mines Co. is constructing a 100-ton mill on the property, at Porcupine, Ontario.

Anaconda Copper Mining Co. will reconstruct its Great Falls smeltery in Montana, at an estimated cost of $2,500,000.

Osceola Consolidated Mining Co. will construct a steel rockhouse at No. 3 North Kearsarge shaft, in Michigan. Frank H. Haller, Osceola, Mich., is superintendent.

Munro Iron Mining Co. is erecting extensive mine buildings at the Rogers iron mine, in Michigan.

Granby Consolidated Mining, Smelting & Power Co. is erecting a 2000-ton smeltery at the Hidden Creek mine, in British Columbia. Estimated cost, $1,000,000. Jay P. Graves, Phœnix, B. C., is general manager.

International Lead Refining Co. will erect a lead refinery at East Chicago, Indiana.

Boston & Corbin Copper & Silver Mining Co., Montana, will build a 200-ton concentrator at the mine. H. E. Emerson, Corbin, is manager.

Butte & Superior Copper Co. is completing a zinc concentrator of 200,000 tons yearly capacity, at Butte. R. M. Atwater, Jr., Butte, is manager.

Old Dominion Co., Arizona, has let a contract to the El Paso Foundry & Machine Co., for a separate flue and dust chamber for the converter plant. Plans are being drawn by G. Caetani to increase the dressing works to 1000 tons capacity. George Hegardt, Globe, is superintendent.

Arizona Copper Co., Arizona, is constructing a smeltery at Clifton. Grading has been done. Norman C. Carmichael, Clifton, is general manager.

Calumet & Arizona Mining Co., Arizona, is erecting a new smelting works at Douglas. Repath & McGregor are designing and supervising construction. John C. Greenway, Warren, Ariz., is general manager.

Nipissing Mines Co., Cobalt, is erecting a low-grade mill. Work is well underway.

Ferdinand Schlesinger, of Milwaukee, owner of the Newport iron mine in Michigan, has purchased 425 acres of dock property in Hammond, Ind., as a site for one or more manufacturing plants to utilize ore and coal, from compies with which he is associated.

The Highgrade District

Fort Bidwell Correspondence

The first real excitement in this district occurred about 50 years ago, when a man named Hoag brought in good specimens of free-gold bearing quartz. He was tortured and killed by the Indians and no further interest in the country was taken until August, 1905, when a young sheepherder, named Lorenzo, brought in a piece of rock from what is now known as Discovery Hill, and showed it to the Kafader brothers who conducted a blacksmith shop. Immediately the five Kafader boys went into the hills and the boy showed them where he had found the rock. The vein stood up through the country and running through it were about 2 in. of white quartz, showing free gold in hand specimens.

Ranchmen Did Early Mining

This is what brought in the ranchmen, sheepmen and cowmen from the Surprise and Goose Lake Valley region. They knew nothing about mining, failed to follow the pay shoots which they uncovered on surface, and persisted in driving tunnels without any sense of direction. Much money has been spent by the ranchmen in this manner. There are few claims owned in the district in which there are less than four interests. About 500 locations have been made by prospectors and field men here.

The chief reason for this tunnel work is explained by the following incident: One of the above mentioned Kafader boys pointed out a place where he stated there is a vein that pans for over 300 ft., assaying about $15, remarking, "But there was no tunnel site and we will not work in a shaft because it is dangerous to work way down in the ground with a chance of a rock falling down upon one and maiming or killing."

Living Conditions Good

Living conditions here are good. A room and good board can be obtained for $1.50 per day. The small bank has $316,000 on deposit. 50,000 cattle are running through the hills together with large bands of sheep, and the ranchers are wealthy. Excellent flour costs $2.50 per 100 lb. and a good cut of meat, 12c. per lb. The New Bidwell hotel furnished the rates quoted above. There are from 8 to 10 ft. of snow on the ground and more coming down. The Sunshine, the much discussed and advertised mine of the district, is situated on a small hill on the north slope of Discovery Hill, at an altitude of 7800 ft. A 22-ft. shaft has been sunk near what appears to be the apex of the hill and a 42-ft. shaft has been sunk at a point 20 ft. north of this. A tunnel driven into the hill at the east end of this claim, following the high-grade ore into hill for 150 ft., gives backs that are estimated to be not in excess of 75 ft. About midway between the portal and breast of the tunnel a stope was broken out, 30 ft. high and 32 ft. long.

Fissure Veins

The vein is a fissure and stands at about 79°; the walls appear to be basalt on the foot and porphyry on the hanging. The fissure is regular, unbroken and from 5½ to 6 ft. wide. The pay streak is from 5½ to 6 in. wide, that is, it will about average this throughout. It consists of mud, talc and broken pieces of oxidized quartz; the remaining part being a coarse-grained, white quartz, with oxidized spots that contain the gold. The free gold can be seen in picked specimens. A fair sample of this high-grade streak assayed $491.60 per ton. Five feet of the vein, without this seam, assayed $24.40 per ton. In the breast of the tunnel, at an estimated depth of 75 ft., the high-grade seam for 5½ in. assayed $253 per ton and chipped samples from the remainder of the vein, 5 ft., ran $9.30. The material in the fissure appears not unlike the brecciated mass found in the Victor mine at Cripple Creek.

The Fort Bidwell Consolidated's Sugar Pine and the Big Four mine are among the older properties that installed milling equipment last year. Winter conditions, however, arrived before any satisfactory tests were obtained. These mills will operate on a fairly low-grade ore, with occasional high-grade streaks.

From what can be seen of the large dikes that traverse the country, it appears that the main vein systems should run north and south. Most of the field men now in the district feel that with proper mining and prospecting there is a chance to make a camp here.

The U. S. Geological Survey has just issued a large map of North America, 28x38 in., in three colors. It is on a scale of 158 miles to 1 in., and may be obtained from the Director of the Geological Survey, Washington, D. C., at 20c. per copy.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Sodium Sulphide as Cyaniding Precipitant

In the article "Cyaniding of Concentrate," in the JOURNAL of Apr. 27, 1912, E. M. Hamilton brings up the matter of precipitation and partial regeneration of silver-bearing cyanide solutions by means of sodium sulphide. The use of this substance for the purpose, though long neglected, seems to offer possibilities of convenience and economy in working; and it is to be hoped that the experiments of so accomplished a metallurgist will draw to the method the attention it seems to merit from cyanide operators engaged in the treatment of silver ores.

SILVER SULPHIDE INSTEAD OF BULLION AS SHIPPING PRODUCT

Some time in the latter part of 1909 and beginning of 1910, I instituted some experiments at La República mine, near Ocampo, Chihuahua, with the idea of ascertaining the practicability and economy of substituting sodium-sulphide precipitation for precipitation on filiform zinc, and shipment of the raw silver sulphides instead of melting to bullion. Conditions were peculiarly favorable for the substitution, from both metallurgical and economical standpoints. The predominant silver mineral of the República ores is argentite, occurring mainly as a replacement of blende and galena, and in such physical condition that it dissolves in cyanide solutions with great facility; in effecting solution, moreover, few other elements are taken into the solutions in appreciable quantity, the zinc minerals seeming to be almost inert. After taking out a high-grade concentrate on Wilfleys, the pulp delivered to the cyanide tanks was still of unusual value, varying from 30 to 50 oz. per ton; and the pregnant solutions entering the zinc boxes ranged from nine to 13 oz. per ton. Gold in the ores was negligible, amounting (to the best of my recollection) to less than one gram per 1000 oz. of precipitate. Skilled labor was dear, and hard to keep in such an isolated camp. Freights from the railroad on zinc, fluxes, crucibles, etc., were high (about $45 per ton), and the consumption was excessive; and smelting the precipitate in an inefficient wood-burning reverberatory was laborious and costly.

The work and patents of the late William Orr, of Denver, had come to my notice some years before. Although these related broadly to the regeneration of cyanide solutions by the precipitation of a certain percentage of the zinc acquired during passage through the extractor boxes, there seemed to be no reason why the method should not be operative with regard to the precipitation of silver from such solutions, the zinc, antimony, arsenic, etc., dissolved from the ore during treatment, being released at the same time. It was realized, of course, that if these elements were dissolved in important quantities, the purity of the silver sulphide would be seriously lowered.

At the time of my experiments, regeneration of the working solutions was of no particular advantage at República. Crushing was done in water, instead of in solution; no proper thickener had been provided above the Pachuca tanks, which were expected to perform, intermittently, the functions of settlers and agitators; the pulp settled slowly, and the tankage was limited; it was necessary, therefore, to leave so much water in the pulp that little return solution could be used in making up the charges for agitation; and the strength of the agitating solution was furnished principally by sodium cyanide added in the tanks, while at the same time a considerable quantity of precipitated solution was allowed to escape from the sumps. Our experiments were hence directed to ascertaining whether a high-grade shipping product could be obtained; and outside of one or two analyses to determine the cyanogen in the solution after agitation, little attention was paid to regeneration. With 125 to 130% sodium cyanide costing us about 25c. per lb., the importance of regeneration (if practicable) was not overlooked, but was left for the future, when the installation of thickening apparatus should enable us to cut off solution losses.

SULPHIDE PRECIPITATE ABOUT 80% SILVER

An old Hendryx tank, fitted with air agitation, was cleaned out, and tests were made of about five tons of our usual mill charge, using fresh solutions of the accustomed strength; portions of the pregnant solution, after extraction had reached its limit, were precipitated by means of sodium sulphide, and the precipitate was assayed. I have preserved no accurate notes as to the fineness of this precipitate, but to the best of my recollection it ran in the neighborhood of 800 fine in silver; the contaminants were not determined, but we ascertained that no copper had been brought down. On making a few calculations regarding precipitation costs, as compared with zinc, and also as to marketing such a precipitate (even under uncorrected assays, as is customary in Mexico), the economy was evident; and I felt encouraged to extend the tests to the entire plant for a short time, using our pregnant-solution tanks alternately, one filling while the other was being precipitated and pumped through the clean-up press. The precipitate was to be dried, screened, thoroughly mixed for sampling, and shipped in soldered kerosene cans to the refinery. I considered this a fair test of the metallurgical and commercial features of the problem; but in spite of its promise, the scheme incurred the disapproval of the consulting engineer of the company (himself a cyanide metallurgist of rather conservative type), and the experiments were dropped.

The chief objection to the new method seemed to be that some of the sodium sulphide might remain in the working solutions, with disastrous effect, or that the efficiency of the solutions might be affected, in some unknown way; and I argued in vain that this could be obviated (precisely as stated by Mr. Hamilton) by leaving a small quantity of silver unprecipitated—or, in case a tank should happen to receive an excess of precipitant, by running in pregnant solution until the silver was again in excess, or by using a lead salt at the sump, and thoroughly aërating before returning solutions to the plant.

ADVANTAGES OF SULPHIDE PRECIPITATION

Where solutions high in silver are handled, the sodium-sulphide precipitation seems advantageous; and if gold and copper are present, these may be removed by electrolysis when they have accumulated sufficiently in solution, as Mr. Hamilton remarks, and all loading of solutions with zinc avoided, unless dissolved from ores. In the latter case, of course, it would be precipitated with the silver. The cost of the precipitant, say 2 to 3c per lb., as compared with 8 to 9c. for zinc, is low, and it requires no preparation for use; the weight of silver precipitated, per unit of sodium sulphide, should probably be over double the weight thrown down per unit of zinc in practice; the action is quick, and the precipitate available without loss of time; the cleanup, if the precipitate is pumped through a press, dried and screened in a mechanical sifter, should be easy and quick, and the plant solutions would be kept free from fouling and maintained at a high standard of free cyanide. Whether electrolysis of the precipitated solution, for gold and copper, would render the cyanogen of the sulphocyanides available, is at least open to doubt; Clennell denies such regeneration.

Whether to market the sulphides in their crude state, or to smelt them to bullion at the mine, would be a matter of calculation in each case. Sampling the dried, screened and thoroughly mixed sulphides is easy, and offers the advantage that a single sampling (or one sampling and a check) may represent an entire month's output. This would reduce materially the cost of sampling, assaying, umpiring and representation at the refinery, as compared with the operations necessary to effect settlement for the number of bars representing an equal output in the shape of bullion. The treatment charge on precipitates (in Mexico, at least) is generally less than on bars, but most refiners insist on uncorrected assays of precipitate, while bars are sold on corrected assay. Even so, the total refinery deductions will differ but little on the two classes of material; but certain European refineries, I understand, will accept precipitates and settle on corrected assays. As a matter of fact, the loss in treating precipitate is practically nil in some refineries, where it is simply added to cupel charges from time to time. When the cost of smelting to bullion is added to that of marketing the bars, it is quite likely that in most cases the figures will much exceed the total costs and deductions in connection with marketing crude sulphides of the fineness which can reasonably be expected from this method. A sample shipment or so, with a little investigation as to local and European markets available to the particular plant, will settle this point.

Information regarding the regenerative features of this method may be found in the patents taken out by Mr. Orr, Nos. 687,258 and 689,017, dated respectively Nov. 26 and Dec. 17, 1901; also in the discussion which he carried on with Andrew F. Crosse, in the Engineering and Mining Journal, of May 30, June 13 and 20, Sept. 19 and Oct. 19, 1903. It is interesting to note, in this connection, that Mr. Orr claimed to have effected regeneration, in actual milling practice, at a cost of 3 to 5c. per lb. of cyanide, so regenerated, also, that a certain plant was run for over a month without the addition of fresh cyanide to the working solutions, after the installation of his method.

E. H. Webster.

Los Angeles, Calif., May 8, 1912.

The Canon Diablo Crater

The Cañon Diablo crater, referred to in the Journal of Apr. 13, 1912, p. 730, was investigated by G. K. Gilbert, of the U. S. Geological Survey, and the results published in the Bulletin of the Geological Society of America. Mr. Gilbert concluded that the crater, which is in a sandstone formation, without volcanic rocks of any kind, was formed by impact of a body from space. Numerous fragments of meteoric iron were found in the vicinity and some of these contained minute diamonds.

H. W. Turner.

London, April 23, 1912.

Food Supplies for Miners

In the Journal of Apr. 27, 1912, p. 837, are given some data on "Food Supplies for Miners," taken from the report of Arthur A. Cole to the Temiskaming & Northern Ontario Ry. From the data it would appear that the consumption of eggs per man per day was 2.03 lb. or about 1⅓ dozen! It might be well for the authorities in Cobalt to investigate this matter. Of course 2.03 eggs were meant.

The other data are interesting and agree closely with such facts in other camps. A close record over 18 months at a mine employing 21 men, showed that from 6 to 7 lb. of food supplies per man per day were used in the boarding house. By estimating quantities omitted in Mr. Cole's report and adding some others, such as sugar, etc., his figures will come up to the above.

When it is considered that the average man cannot eat more than 3½ lb. per day one realizes that the waste amounts to from 30 to 40%, and this is not the exception, but the rule. The average manager, as long as the boarding house pays, is content, and leaves the details to the steward or head cook. These men cannot be expected to worry much about the conservation of our natural resources.

U. R. Hessyl.

Montreal, Canada, Apr. 30, 1912.

Underground Labor

It would be interesting to know the comparative efficiency of the various races employed underground, as shown by actual records. General statistics appear from time to time setting forth the division of labor among the various races represented in one or more districts. While these are of considerable interest, the figures generally have given more of an idea as to wages earned and the social conditions existing. Figures applying more definitely to the actual operations in mining would be of more importance to mining men.

For instance, in the Lake Superior copper district, the underground labor is performed principally by the following races: English, Irish, Finnish, Italian, Austrian and Croatian; in addition, there are representatives of the smaller European countries as Servia, Bulgaria, Montenegro, etc., which could probably be classed under a general head. Now, of these races, it seems to be general opinion that the English use their brains to the best advantage. The Cornishmen, on other counts, however, are meeting competition from the Finns. In machine-drill work, the latter will break a large quantity of ground in a given time, but in so doing use powder unsparingly. The Cornish miner may not break quite so much ground but he will use considerably less dynamite. Operators' records on this, covering various mining districts, would have a distinct bearing on the class of labor to be sought for certain work. Again, the Italians, Austrians and Croatians, particularly the last two, have been found to be efficient workmen under competent direction; this has resulted, in the district above referred to, in the employment of large numbers of these men in tramming, mucking, etc. The figures showing the distribution of these races in the different classes of underground work and the efficiency with which they perform this work would be of more value to mining, I believe, than the average run of statistics, dealing with foreign labor in American mines.

J. E. Minturn.

Calumet, Mich., Apr. 29, 1912.

Research in Analytical Methods

Noting D. E. N. M.'s letter in the Journal of May 4, 1912, asking whether inventors of chemical methods ever work on quantities of materials unknown to them until after the determination is ended, it would appear that Salas or some assistant did so (*Bull.*, A. I. M. E., March. 1912), in the work on the effect of tin on the Gay-Lussac silver method. However, I think with D. E. N. M. that this is unusual.

F. Zeigfield.

Chicago, Ill., May 10, 1912.

The Camp of Highgrade

In the Journal of Apr. 11, some comments of W. H. Storms' on the camp of Highgrade are quoted. N. E. Guyot, on his side, says: "No mining engineer or expert mining man of standing dare turn down the camp of Highgrade—he would write himself down an ass." Isn't that going some?

Fred Smith.

New York, May 14, 1912.

Centrifugal Filter

In "Notes from Current Literature," in the Journal of Apr. 20, 1912, is described a centrifugal filter, which is claimed to be of recent origin. This description fits exactly a centrifugal filter which was installed in a chlorination mill at Florence, Colo., by a Mr. Koneman, about 20 years ago.

J. L. Wells.

Lordsburg, N. M., Apr. 25, 1912.

The Searles Lake Potash Deposit

By W. D. Hamman*

The Searles Lake basin in San San Bernardino County, California, occupies an area averaging 9 miles long by 3½ miles wide. The deposit, which is owned by a syndicate, was known to contain borax, salt and other sodium minerals. Potash is found as a solution in this basin and may lead to the profitable exploitation of all the minerals hitherto hindered by expensive transportation.

Recent press reports of the discovery of "millions of tons of potash" in California, aroused so much interest in the subject, that I hastened to visit the Searles Lake basin, to study the question of origin, extent and possible commercial potash industry on the Pacific Coast of the United States.

Situated in San Bernardino County

Searles Lake is in the extreme northwest corner of San Bernardino County, lying contiguous to Kern and Inyo Counties. While this basin has been known to geographers for a score or more years, its position on the map has shifted within a radius of 100 miles on maps of the desert region. This was due to the fact that the land has never been surveyed by the U. S. Government. However, the owners of the claims covering the deposit, have made private surveys and plats of the entire lake area. This region may be truthfully designated as "the land that God forgot," and Uncle Sam, until recently, thought "was not." As designated on these plats, the basin is mainly in T 25 S, R 43 E and T 26 S, R 44 E, Mount Diablo base line and meridian.

It is about 30 miles northeasterly from Searles station, on the Nevada & California R.R. (Southern Pacific), and about 40 miles from the terminus of the Santa Fé Branch line, at Johannesburg, from which point a stage runs to Ballarat and Skidoo every other day, passing along the west side of the Searles basin. The extension of one or both these railroads involves no serious engineering problems. The only question is whether the importance of the minerals in the deposit would justify the necessary expenditure, and I believe that a branch line will be constructed by the railroad companies, or the syndicate may provide its own transportation facilities.

The Searles Lake basin is about five miles wide in the center in an east-west line, and about 12 miles in length in a north-south extension, tapering to a point at the southeast extremity. The area will probably average 9 by 3½ miles, embracing from 20,000 to 25,000 acres.

The depth of the deposit is shown by a well on the original Searles tract, 790 ft. in depth, still in mineral. The outer edges of the deposit are shallow and possibly of small value. I saw one well near the northern limits, the casing of which was being pulled up, showing the presence of organic matter, the escaping marsh gas (methane) and sulphureted hydrogen being extremely offensive to the smell. This abandoned well is in a portion of the tract that, from surface crusts of salt and soda, looked as promising as any other portion of the lake. This convinced me that nothing but the sinking of a well could determine the value of the mineral below.

History of Searles Deposits

This deposit was originally located by John W. Searles about 30 years ago, at a time when hostile Indians were said to infest the region. The remains of the crude borax plant used by Mr. Searles are still visible. On the western edge of the basin can be seen the dismantled and abandoned Pacific Coast Borax Co.'s plant.

In the early days borax commanded a price of 40 to 50c. per lb., and this permitted a profitable business, even with the crude and costly methods of the elder Searles. The San Bernardino Borax Co. was organized by Searles, which continued in a modest way to manufacture borax, until it was absorbed by the Pacific Coast Borax Co., of which "Borax" Smith and Dennis Searles are the dominant characters. This company found the expense of freighting to Mojave, about 80 miles distant, too great to be profitable.

The discovery of a pure bed of colemanite near Death Valley caused the Pacific Coast Borax Co. to discontinue the manufacture of borax at Searles. The California Trona Co. was organized to take over the property for the manufacture of soda; a plant was erected and about 25 tons of soda were made, which is still at the works. The California Trona Co. had issued bonds on the property, which were sold in England. Soon financial difficulties overtook them and the English bondholders brought suit to foreclose the mortgage. S. W. Austin was appointed by the U. S. Circuit Court as receiver, pending determination of the suit, in order to hold the property intact and keep up the required annual labor. Meantime, the English syndicate bought up all the stock of the California Trona Co., so that it has now acquired the property by actual purchase, which will doubtless soon terminate the receivership.

The owners of the property claim to have expended $25,000 annually on the entire property, which has, no doubt, been sufficient to meet all the requirements of the law relating to assessment work. According to the plat shown me, wells were drilled on each quarter-section of the tract, aside from the expenditure for roads, buildings and equipment. It was impossible to verify these statements, but a number of wells were visible throughout the property, and I have no doubt statements were truthfully made. At present three camps are maintained on the property, one at the east and one at the south, but the main camp is at the soda works at the north end of the lake.

Basin Covered by Crust of Salt

The surface of the basin is covered by a crust mainly composed of salt mixed with small quantities of soda and borax. Near the edge of the deposit this crust is a mere shell, but in the center of the deposit the salt has crystallized into the mineral halite, which is 20 to 25 ft. thick. This salt, with present transportation facilities, is valueless, and will, perhaps, never be important except as a byproduct. Near the east side of the deposit is a big reef of carbonate of soda on the surface. This outcrops for about three miles and is several hundred yards in width. It is said to be 2½ ft. thick and 70% pure.

After the halite is penetrated in the body of the lake, at from 23 to 25 ft. depth, a stratum is found of well defined crystals, known as hanksite. This is a mineral compound composed of sodium carbonate and sulphate. These crystals, as brought up by the pumps, are more or less broken up, but I was able to get several well defined specimens of ideal symmetry whose physical properties are identical with the standard description of the mineral hanksite. These crystals are about an inch in length, hexagonal form, with short unit prisms at each end, like quartz. They are translucent and yellowish in color. Some borax crystals are found along with the hanksite crystals, and this stratum is said to average about 40 ft. in thickness.

Beneath the hanksite stratum is found the trona, a hydrous carbonate of soda in crystals of ideal symmetry. I was able to get several of the trona crystals, which I consider true mineralogical specimens. The trona crystals are said to be found in bodies from 10 to 20 ft. in thickness in the center of the lake. Trona is the mineral from which soda ash is made, and is considered more valuable than the hanksite, the sulphate being more readily soluble in surface waters than the carbonate or trona crystals. The mineral thenardite is also found in the bed of the lake, in perfect crystal form.

---

*President, Way's Pocket Smelter Co., South Pasadena, Calif.

Potash in Solution

The potash content of the deposit is not in beds, no potash crystals having yet been obtained. The potash solutions are found permeating and lying underneath the strata of soda crystals. The potash being so readily soluble will not separate and form crystals like sodium and boron salts. The Searles Lake potash, in a dissolved form, aside from its economic value, is new to science. The possibility of such a condition has not heretofore been discovered within the bounds of reason, and this fact makes the discovery of double importance.

Another curious scientific fact was brought to my attention by the managing director for the owners of the property, and that is the tendency of certain crystals to separate or congregate in families or groups within the deposit. It is related that in some wells a solid body of one class of crystals will be found, while in others the several crystal minerals are mingled together within the deposits.

As before stated, the potash solutions permeate the entire deposit, but are more abundant beneath the crystal beds. The explanation for this is that the soluble potash percolates through the crystal bodies like water through sand and gravel to reach a solid bed. Sodium sulphates are more soluble in water than the carbonates, and this fact seems to account for the hanksite and trona in distinct beds.

There are places in the deposits corresponding to air holes in an ice field, so that it is dangerous to travel over the lake. However, an automobile can go anywhere on the bed of the deposit, with perfect ease and safety. The broad tires furnish sufficient surface to withstand the weight of the car.

The heat on the lake in the summer sometimes reaches 140°, and all work must be done in the night. The laborers work with heavy rubber boots on, but the heat of the mineral solutions is such that it fairly cooks the workmen's feet, and they cannot stand it for any great length of time.

Large Holdings Necessary for Profit

Some people find fault with the mineral laws that permit corporations to hold so much land. While this criticism may be justifiable in some instances, it does not seem proper as regards the Searles Lake deposits, as this is no "poor man's proposition," and cannot be worked, except by a corporation with unlimited capital. Divide the area into a hundred, or even a dozen holdings, and it would be difficult to secure required capital to finance the venture, let alone construct necessary pipe lines and railroads to bring the commodities to market.

The action of President Taft in ordering the potash lands withdrawn from entry was, no doubt, proper, had the land been open for location, but it seems that he was without knowledge as to the prior appropriation of the entire Searles Lake deposit and the rights vested, which it seems may not now be disturbed.

The governmental experts' report of four to ten million tons of potash available in Searles Lake, may or may not be correct. Certain it is that the earlier press reports were entirely misleading, as they indicated solid beds of potash, which is absolutely erroneous. The impression also conveyed in dispatches from Washington indicated that Messrs. Cole and Free made the discovery, which, as previously noted, is apparently erroneous. It being quite generally known that the U. S. Government had experts in the field seeking potash, many persons, including myself, were misled into believing that the mineral was open to location. This caused a "rush" to locate claims. After days of hardships and privations, prospectors were brought to a painful realization that "somebody had falsified." Whether it was intentional or not does not change the fact.

Transportation the Problem

Whether the undertaking is an assured commercial success depends almost entirely upon facilities for transporting the several commodities to market. With a wagon haul of 30 miles to railroad and high rate of freight thence to market, success would be doubtful. It must be understood that to recover the potash requires that the other commodities, such as borax, salt and soda must, at the same time, be extracted. Salt and borax are too cheap commodities to be worth the cost of extraction, except as byproducts. Soda, the most abundant and valuable constituent in the deposit, if required to be freighted by wagon to railroad, would not seem to be a profitable business. With a railroad direct to the works, and a reasonable freight rate to market, soda manufacture would doubtless be profitable, and the salt and borax might carry the expense of production. The new element potash in this deposit makes a certainty of what before was a doubtful commercial proposition.

It is now thought practicable to pipe the solutions to tidewater, and there convert the valuable elements in solution into commercial products, which would, no doubt, be wonderfully profitable. A railroad would insure success, with proper connections and equitable freight rates. And since the owners are prepared to build a railroad of their own if necessary, it appears, on the whole, certain that another prospective California industry will soon be a reality.

The managing director of the English syndicate, puts it in this way, "with proper transportation facilities, the potash can be extracted, giving the salt, borax and soda as byproducts, free. Or these latter products can be extracted at cost, leaving the potash as a byproduct. In either case, the cheaper commodities must move to market on rates effective on such products, in other parts of the country."

Probable Methods of Extracting Potash

The usual method of extracting potash from a solid or crystalline compound, involves mechanical crushing of solids and subsequent dissolving of the several constituents, depending upon their relative solubility. Potash, being the most soluble of all the salts, is readily separated from its more refractory associations. The sodium chloride being next in the scale of solubility, then the sulphates, and lastly the carbonates.

The Searles Lake potash is already in solution, therefore no mechanical crushing is necessary. Its isolation from sodium, also partly held in solution, does not seem to offer any great difficulty. If it is decided to extract the potash on the ground, nature has provided all the heat necessary to evaporate the solution to its dry salts, the whole basin being one great "chemical bathhouse" for three-fourths of the year.

The element sodium is reduced to the metallic state by electrolysis, and inasmuch as cheap electricity is available in the upper Owen's Valley, power lines conveying the current passing within 25 miles of the basin, it seems probable that electricity will supply a most economical and effective agent in the manufacture of potash from the mineral solutions in the basin of Searles Lake.

The Pacific Coast states need potash fertilizers, perhaps more than any other section of the United States, especially as intensive farming is becoming an accomplished fact, and therefore this section would always be the chief market for the Searles Lake potash output. However, assuming suitable transportation by rail, or by vessel through the Panama Canal, such a product might be laid down in the Mississippi Valley, and perhaps even in New England, so as to displace the German imports of potash.

California is the only state which makes a commercial production of borax annually. The output for 1910, according to recent press bulletin of the U. S. Geological Survey, was 42,357 short tons, valued at $1,201,842. Less than 4 tons was imported. About one-half of the borax consumed is used in the enameling industry for making kitchen and sanitary ware.

Anaconda Copper Mining Co.

During the year ended Dec. 31, 1911, there were 3,844,070 tons of ore and 4603 tons of precipitates produced from the mines of the Anaconda Copper Mining Co. The reduction works treated a total of 3,154,036 dry tons of ore and cupriferous material at Anaconda, and 1,101,778 tons at Great Falls. Of this 3,756,235 tons were company ore, 499,077 tons were purchased ore, and 501 tons were precipitates from the old works. There were 191,573,783 lb. fine copper, 8,510,122 oz. fine silver, and 40,546 oz. of fine gold produced at Anaconda, and 67,833,313 lb. of fine copper, 1,221,439 oz. silver, and 8404 oz. of gold produced at Great Falls.

Mining Operations

Production was somewhat curtailed during the year on account of the low price of copper, but development was kept at normal, and advantage taken of the low production to do a great amount of repair work. There were 30.7 miles of development work performed, so that more ore was developed than was extracted. Sinking aggregated 3711 ft. The hoisting engines at the Mountain View, High Ore, Diamond and West Gray Rock shafts were equipped with new cylinders for the use of compressed air, and operated satisfactorily, and cylinders for the Leonard, Pennsylvania, West Steward and Original mines have been received and will be put in place as soon as possible. Twelve air-operated auxiliary hoists have been ordered also to take the place of the engines at the auxiliary shafts. Power, as far as possible, is being furnished by the Great Falls Power Co., and the use of steam abandoned. In 1910, the Parrot and Little Mina shafts were put out of commission, and in 1911 the East Gray Rock and Gagnon were added to this list. Gagnon ore will be hoisted through the Original shaft, and the East Gray Rock ore through the West Gray Rock. The Butte & Boston and Parrot operating departments have also been abolished. Fourteen electric motors for underground haulage were installed during the year.

A fire in the stopes, northeast from the High Ore shaft, was discovered on Jan. 14, and was not extinguished until Apr. 1, 1911. The Never Sweat shaft was out of commission from Sept. 13 until the end of the year, because of gas from the fire district, but cement bulkheads on several levels, and a fire wall from the 1800- to the 1400-ft. level, it is thought will do away with future trouble. No damage was done to the shaft.

Three electrically driven quintuplex vertical-cylinder pumps were installed on both the 1200- and 2200-ft. levels of the High Ore shaft, each pump having a capacity of 600 gal. per min., and power lines taken down an auxiliary shaft. The pumps will soon be started, and the steam pumps kept in reserve. The St. Lawrence, Diamond, Anaconda and Poulin water will be pumped through the High Ore shaft.

Skips are being found more economical than cages for hoisting, and the High Ore shaft has been equipped with skips and pockets on the 1600-, 1800-, 2200-, 2400- and 2800-ft. levels.

Concentration

Experiments were carried on during the year with a large centrifugal concentrating unit, which concentrated successfully, but could not be run continuously. A new machine will be constructed, and tried out in 1912. Experiments running back several years for the purpose of increasing the saving in concentration have been successful, and one full section of the Great Falls concentrator has been operating on this system. One unit of the Washoe plant is being changed to this method, and as soon as work is complete, corresponding changes will be made on the other sections. It is stated that capacity is increased as well.

ANACONDA BALANCE SHEET AS OF DEC. 31, 1911.

Assets.	
Mines, water rights and lands. .	$67,652,350
Building, machinery and equipment	15,938,493
Timber lands...	6,011,238
Investments.... . .	5,426,398
Insurance and prepaid expenses. . .	242,564
Materials and supplies... . .	2,537,218
Merchandise for sale....	1,919,179
Metals on hand	14,343,155
Accounts receivable and cash. .	4,072,194
	$118,142,789
Liabilities.	
Capital stock.....	108,312,500
Accounts payable...	4,751,688
Unclaimed dividends.	7,264
Dividend No. 45......	2,166,250
Surplus.................	2,905,087
	$118,142,789

Subsidiary Operations

In regard to subsidiary companies, the Belt, Mont., coal mines shipped 101,258 tons of coal to other departments, sold 9361 tons, and consumed 20,878 tons. The Diamondville, Wyo., mines shipped 310,355 tons, sold 197,495, and used 47,206 tons at the mines. The Washoe mines shipped 97,300 tons, sold 9791 and used 6429 tons at the mines. The three collieries produced a total of 800,073 tons. The sawmills at Hamilton, Hope, Bonner and St. Regis cut 89,782,204 ft. of lumber, of which 6,246,467 were used at the mills, 72,713,827 ft. were sold commercially, and 10,821,910 ft. went into stock.

The Butte, Anaconda & Pacific Ry. will electrify its system, and will probably extend from Anaconda to the Georgetown district. Among the mines tributary to this extension will be the Southern Cross Mine, for the purchase of which negotiations have been concluded by the Anaconda company.

Deliveries of copper, silver and gold for the year amounted to $38,918,637, profits were $8,043,719, and dividends $8,608,750. However, extraordinary repairs during the year amounted to $583,462, or more than this deficit. All this was charged to operating, but notwithstanding this, and the curtailment of production, the costs per pound of copper were lower than in previous years, while not all the economies of consolidation have been reached.

American Iron and Steel Institute

The general meeting of the American Iron & Steel Institute was to be held in New York, May 17. The program, as issued by Secretary James T. McCleary, provides for three business sessions. The morning meeting was to open with the presidential address by Judge E. H. Gary, to be followed by two papers: "Contract Obligations," by E. A. S. Clarke, president Lackawanna Steel Co., New York. Discussion by Willis L. King, vice-president Jones & Laughlin Steel Co., Pittsburg; James A. Farrell, president United States Steel Corporation, New York, and others. "Competition: Its Uses and Abuses," by Joseph G. Butler, Jr., vice-president Brier Hill Steel Co., Youngstown, Ohio. Discussion by John A. Topping, chairman Republic Iron & Steel Co., New York; Charles M. Schwab, president Bethlehem Steel Corporation, New York, and others.

At the afternoon session four papers were provided for, as follows: "Some Experiences in India," by Julian Kennedy, Pittsburg. "Electric Furnaces," by William R. Walker, United States Steel Corporation, New York. Discussion by Theodore W. Robinson, vice-president Illinois Steel Co., Chicago; Eugene B. Clark, American Sintering Co., Chicago; S. T. Wellman, Wellman-Seaver-Morgan Co., Cleveland. "Corrosion of Steel and Its Prevention," by Dr. A. S. Cushman, Institute of Industrial Research, Washington. Discussion by Louis J. Campbell, Youngstown Sheet & Tube Co., Youngstown, Ohio. "Metals and Alloys," by Dr. John S. Unger, Carnegie Steel Co., Pittsburg. Discussion by George B. Waterhouse, Lackawanna Steel Co., Buffalo.

The evening session, taking the form of a banquet at the Waldorf-Astoria, provided time also for a paper on "Mining Operations on the Mesabi Range," by William J. Olcott, president of the Oliver Iron Mining Co., Duluth; also for a discussion on welfare and safety work, including papers on: "Enforcement of Health Laws," by Dr. Thomas Darlington, New York; "Something Doing in Colorado," by Dr. Richard W. Corwin, Denver, Colo.; "Rendering Labor Safe," by Raynal C. Bolling, New York.

The important discussions provided for were on "Contract Obligations" and on "Competition." No provision appeared in the program for any discussion on labor conditions.

The second day, May 18, was to be devoted to excursions to various points of interest in and about New York.

U. S. Assay Offices

WASHINGTON CORRESPONDENCE

Strong protests against the abolition of the present unnecessary assay offices of the United States were made in Congress during the last week, in connection with the provision carried by the legislative, executive and judicial appropriation bill for consolidating the assay and mint service and doing away with the establishments no longer needed. The debate showed general opposition throughout the West to the change, and further vigorous discussion will be had when the measure comes up in the Senate.

Among the protests filed with the House during the debate was one from the Montana Mining Association. The arguments advanced against the abolishment of the assay office at Helena are essentially as follows: The U. S. Assay office at Helena for the last five years has treated an average of $1,986,887 of bullion. If this assay office were abolished, bullion would have to be shipped to Eastern points or disposed of to pawnbrokers or custom smelters at higher charges. This, it is claimed, would work a hardship to the small operator, who depends upon immediate returns from each cleanup to meet payrolls and to purchase supplies; small properties, now running on a close margin of profit, might thus be compelled to shut down. Resolutions on similar lines were also transmitted by other mining organizations.

The Southern bankers' views were expressed by the New Orleans banks, and may be summed up as follows: The gold assayed at the U. S. assay office at New Orleans was $950,000 in 1910 and $1,650,000 in 1911, and is steadily increasing, due to large shipments to this port from Central America. The appropriation for the fiscal year ending June 30, 1912, for this office, is only $21,300, of which less than $18,000 will probably be expended. If the department in Washington would permit the operation of the refinery in the New Orleans mint, which could be done at small cost, the expense of transporting bullion to the New York assay office would be saved.

As the policy of the government has been to foster and aid the Central American republics, some of which are of growing importance as gold producers, the cutting off of the small appropriation and closing of the assay office in New Orleans might be considered as discrimination and interfere with relations which have been established after considerable effort and a large expenditure of money on the part of the banks. The San Francisco bankers took a like view.

Copper Range Consolidated

The total copper production controlled by the Copper Range Consolidated Co. in 1911 amounted to 29,310,579 lb., a decrease of 3,546,113 lb. from 1910. The average cost of production was 9.47c. per lb., and the average yield of copper per ton of rock was 20.87 lb., as compared with 23.32 lb. in 1910, and 21.73 lb. in 1909. The Copper Range Consolidated Co. owns 99,659 shares of the Baltic company; 99,699 of the Copper Range Co.; 99,355 of the Tri-Mountain; and 92,470 of the Atlantic (acquired in 1911 and 1912); and about 39% of the Copper Range R.R. Through the Atlantic company it controls the Atlantic & Superior R.R.; through the Copper Range Co., one-half of the Champion Copper Co., and 61% of the Copper Range R.R.; and through various subsidiaries, 68% of the Michigan Smelting Company.

The Baltic Mining Co. in 1911 produced 15,370,449 lb. of copper, at 9.09c. per lb., and sold it at 12.54c. per lb. The total net profits were $530,215, from which $500,000 dividends were paid. There were 696,795 tons of rock stamped, at a total cost, including taxes, of $1.80 per ton. This rock yielded 25,254,160 lb. of mineral, and 15,370,449 lb. of copper, or 22.06 lb. of copper per ton of rock.

The Trimountain Mining Co., in the year ended Dec. 31, 1911, stamped 347,885 tons of rock, from which was produced 10,705,685 lb. of mineral, or 6,120,417 lb. of fine copper (17.59 lb. of copper per ton of rock). Costs were 11.55c. per lb. of copper, or $1.8585 per ton of rock, including taxes. The net profit for the year was $60,371, and no dividends were paid.

The Champion Copper Co. in 1911 stamped 734,392 tons of rock, at a total cost of $1.8645 per ton, including $0.1213 taxes. This rock produced 26,137,007 lb. of mineral (35.59 lb. per ton of rock), from which was produced 15,639,426 lb. of copper (21.296 lb. per ton of rock), at a cost of $0.0963 per lb. of copper. Dividends of $500,000 were paid, of which $454,589 came from net profits, the remainder from surplus. The Champion Copper Co. is owned half by the Copper Range Co. and half by the St. Mary's Mineral Land Company.

Control of the Atlantic Mining Co. was taken over by the Copper Range Consolidated Co., on a basis of one share of Copper Range for 10 shares of Atlantic stock. Since the Copper Range Co. assumed charge, no mining work has been done, but the railroad (Atlantic & Superior) and the mill are busy handling Superior rock.

Nipissing Mines Company

The report of the Nipissing Mines Co., Cobalt, Ont., for the year ended Dec. 31, 1911, gives the production as 5,197,042 oz. of silver, the total cost being 13.95c. per oz., the lowest cost so far obtained. The profit was 40.3c. per oz., or a total of $2,095,241, representing 74.29% of the value of the ore produced. The ore reserves are given as follows: Developed and partly developed, 3454 tons containing 6,127,000 oz.; mill rock on dumps, 80,000 tons, with 1,757,000 oz. Dividends to the amount of $1,843,297 were paid.

The mill for treating the high-grade mine ore was started Feb. 1, 1911. The process, devised by Charles Butters and G. H. Clevenger, consists essentially of amalgamation in cyanide solution in a tube mill, where more than 97% of the silver is recovered as amalgam. A further extraction is obtained by regular cyanide treatment of the residue. The cost of mill and refinery was $57,122. The first year's operation gave a substantial profit compared with shipping to the smelter.

A 200-ton mill is now under construction for the treatment of low-grade ore. The ore from sorting and jigging will go to the high-grade mill, while the rest will be treated in the new mill. It is proposed to crush in cyanide solution in a 40-stamp battery and all-slime the ore in four 6x20-ft. tube mills. The slime will be amalgamated, if found necessary, agitated in cyanide solution and then sent to a Butters filter. Merrill zinc-dust presses will be employed.

Japanese Iron and Coal

Statistics of Japanese iron and coal for 1910 are reported by Consul General Sammons of Yokohama, as follows:

Coal, 15,681,321 metric tons; pig and cast iron, 187,793; iron and steel by "Kera" direct process, 474; wrought iron, 19; bessemer and open hearth ingots and castings, 167,886 metric tons. Wrought and Kera-process iron show a gradual diminution for the last five years.

Russia's Oil Production

A correspondent of the London *Mining Journal* gives the statistics of Russia's oil production in 1910 and 1911 in metric tons, as follows:

Districts	1910	1911
Baku	8,120,000	7,870,000
Grozny	1,194,000	1,212,000
Cheleken	152,000	174,000
Maikop	22,600	129,000
Fergana	33,000	50,000
Total .	9,521,600	9,435,000

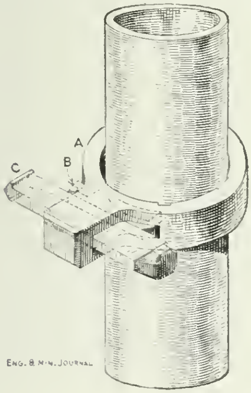
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Improved Drill Post Collar

By Albert Mendelsohn*

An improved post collar now being used in some of the copper mines of Lake Superior, is illustrated by the accompanying drawing. It does away entirely with the two bolts of the collar at present in general use, and can be loosened or tightened by a single blow of the miner's wrench. It consists of a cast-steel band *A* of diameter slightly greater than that of the post. A tool-steel gib *B* fits into a slot in the band, and directly over the gib a wedge-shaped key *C* of the same material is driven. The inner face of the gib is shaped to an arc of the same radius as the post and when the wedge is struck on its wide end the gib is forced tightly against the post.



Drill-post Collar without Bolts

An advantage of this collar over the one at present in general use is that time and work are saved, because there are no bolts to tighten and loosen. This time may not amount to much on a two-man machine, but with the introduction of the one-man "butterfly" drill and the attention to details necessary in running it, any device that will save two or three minutes per hole drilled is of importance. At present the miner using a one-man machine has to adjust nine bolts; the elimination of two is, therefore, no small item. Another advantage, and one which is of importance on one-man machines, is the fact that this improved collar can be rapidly loosened and tightened, and if necessary with one hand. In raising the machine on the post, if the post is wet or the machine too far in on the arm, the arm will not catch on the post. This means that the machine and arm must be held in the elevated position while the collar is loosened, slid up the post under the arm and tightened. In any case, speed is desirable under these conditions, and with a one-man machine it is imperative.

Incidentally, it might be mentioned that these collars were used with the two one-man machines with which four men recently drove 285 ft. of 6x7-ft. drift in one month; exceptional drifting for the copper country.

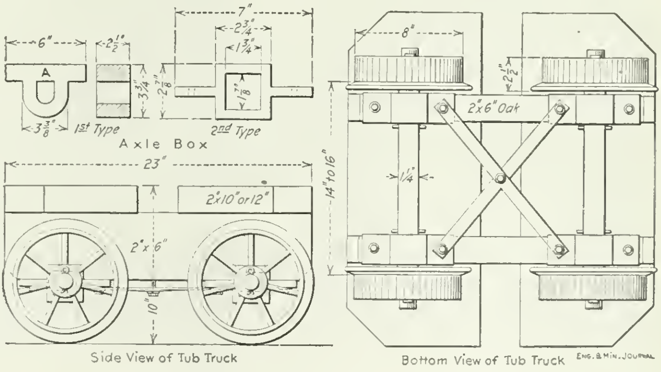
---

*With Superior Copper Co., Houghton, Mich.

Joplin Bucket Cars

With a few notable exceptions, the hoisting in the lead and zinc mines of Southwestern Missouri is done in buckets, or "cans" and "tubs," as they are called in the district. This permits the use of narrow-gage track, so that sharp curves can be laid around the pillars and through the "drifts," as the openings between the pillars are called. Because, as a rule, the tubs hold only about 800 lb., 1250 lb. being the maximum capacity, a light track can be used that is cheap to install and quickly and readily changed. In fact, in many of the mines the track, made of 8-lb. rails, is lifted up bodily, ties and all; the ties are usually 2-in. planks. This system is flexible, and admirably adapted to the conditions prevailing in the district. The hoisting system is excellent, and because of the simplicity of the hooking and tramming routine that has been evolved, these tubs can be hoisted on an average of a bucket in 35 sec. without great exertion on the part of the men. Indeed, more than 1000 tubs have been hoisted in one shift of 7½ hours by a single engine, and the hoistman dumps the tubs himself.

At some of the mines, cars have been used underground, but it is questionable whether they are cheaper in the long run than a tub system. The only advantage of the car over the tub is that it is more difficult for the shovelers to build "windies" in them. In the vernacular of the district, tubs loaded with boulders in such a way as to leave the maximum free space between them, are called "windies." When the distance is to be trammed is much over 250 or 300 ft., and bids fair to continue so for some time to come, the practice is to use mules.



Bucket Cars Used in the Joplin District

A tail-rope system of hauling the tubs is used at two of the mines in the district, it being considered cheaper than mules when the distance is over 800 ft., while at one of the mines a light-weight, gasoline-driven locomotive is to be used to haul the tubs.

Many excellent features are embodied in the construction of the tub cars. For instance, the wheels are mounted loosely upon the axles, and the axles are loosely attached to the truck by sleeve bearings, so as to admit of lateral as well as up and down movement of the wheels in respect to the truck. This is an important feature, because of the lightness and temporary nature of much of the track that is used in these mines. By the use of the sleeve attachment, the four wheels of the car stay on the rails, no matter how rough the track is. It is impossible for the truck to run on three wheels at rough places in the track which, with trucks of the ordinary type of axle, is a common cause of derailment.

The looseness of the attachment and the open bearing make the use of oil impossible, so cocoa butter is used to lubricate the axle and the sleeve bearings. This material, used for greasing cars, gave rise to the term "cocies," which is applied to the shovelers; the shoveler boss being called a "cocey herder," names which to the visitor are extremely puzzling until he hears the explanation of their derivation.

There are two types of bearings used on these tub cars, and likewise there are two types of axles. Some of the cheaper trucks are equipped with round axles and sleeves of the first type shown in the accompanying drawings, but the round axles, which are from 1¼ to 1½ in. in diameter, turned down slightly at the ends, frequently break just at the points where the holes are drilled to receive the pins that limit the side motion of the axle in the sleeves. At one mine, instead of using two pins, a piece of old pipe is put over the round axle to form the shoulders that limit the side play, and this pipe is fastened to the axle by a rivet through the axle halfway between the sleeves where the bending strain is least, and the axles are consequently less weakened by the boring. But probably 90% of the axles in the district are of square section, turned down for 3 in. at each end to receive the wheels. These axles seldom break.

The truck proper consists of two 2x6-in. pieces of oak fastened together by two crossed iron straps on the under side at the bearings, while the deck of the truck consists of two 2-in. planks, 10 to 12 in. wide, nailed to the two 2x6-in. pieces. The gage ranges from 14 to 16 in., but the latter is coming to be regarded as the standard.

A Borehole Surveying Instrument*

By John I. Hoffman†

The instrument now exclusively used on the Rand for surveying diamond-drill or other boreholes was invented by Mr. Oehman, and improved by A. Payne-Gallwey; it is illustrated in Fig. 1. The instrument is an electric-light photographic apparatus and consists of a gun-metal tube in two parts *A* and *A* connected by a coupling *O*. In the lower part of the gun-metal tube are placed a magnetic needle *B*, and a plumb-bob *C*, each independent of the other and each swung over a gimbal *D*. Above both the needle and plumb-bob is fixed a small electric lamp *E*, and all these parts are held in position and pressed against an insulated brass rod *F*, in the center of the coupling by a spiral spring *G*, attached to the bottom screw plug *H*. In the side of the tube are small screws, placed in a straight line parallel to the side, the ends projecting inside the tube about $\frac{1}{16}$ in. The cylindrical cases carrying the lamps and those carrying the needle and plumb-bob have a slot down the side, the projecting screws acting as guides for the slotted cases to slide in and keep them in position.

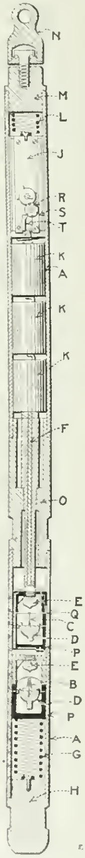


Fig. 1

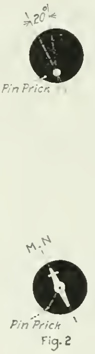


Fig. 2

Borehole Surveying Device and Photographic Records

The top part of the tube contains dry batteries *K* and a clock *J*, with a spiral spring *L* attached to it. The spring presses against the top end piece *M* of the tube, so that when the two parts of the tube are screwed together, all parts within are held rigidly together and contact assured by the spiral springs at top and bottom. To the top end piece a ball-bearing swivel is attached, in order that the instrument may be lowered on a wire if necessary.

The cases *P*, which carry the marine-compass attachments for the magnetic needle and the plumb-bob, are made of vulcanite for insulating purposes, the compass attachments being made of brass, the outer ring of which is held in position by two brass screws, on which the ring swings. On the face of each gimbal is a fixed pin point and around the edge is a recess ring which holds a disk of sensitized photographic paper in its place, the pin point holding it in position.

The plumb-bob is made of gold, attached to a fine silk thread hung from the center of a thin disk of plate glass *Q*, which fits into a recess in the top of the vulcanite case. Both the magnetic needle and the plumb-bob swing immediately above and almost touching the sensitized papers.

The watch is equipped with an extra wheel *R*, to which is attached a copper projection *S*, which, at a certain set time, makes connection with a copper spring *T*, attached to the frame of the watch, and completes an electric circuit, lighting the lamps above the plumb-bob and the needle and photographing a sharp shadow of each on the sensitized papers. When the two photographs are developed, the dip and direction can be read by making the pin pricks coincide. In Fig. 2 are shown two photographs taken from a borehole, where the dip was 25° and the direction N. 20° E. magnetic.

Fast Hoisting in Michigan

At the Empire iron mine of Oglebay, Norton & Co., at Palmer, Mich., the skips were recently used to assist in unwatering the mine, and some fast hoisting records were made. During the 10-hour day shift of May 1, the number of skips of water dumped was 1305, and on the 10-hour night shift 1339 skips. The average distance hoisted was 80 ft., the skips hoist in balance and the capacity of each is 45 cu.ft. A double-drum, geared or second-motion hoist is used.

When the unwatering was started, the method consisted of pumping the water out through a 3-in. pipe by compressed air conducted into the submerged end of the water line through a 1-in. pipe. It is believed that by this method, unwatering was done at the rate of about 150 gal. per min. Shortly afterward the skips were used and 1200 skips were hoisted per 10 hours, or 2 per min., or at the rate of 675 gal. per minute.

The speed of hoisting had to be reduced at the surface because it was necessary for the lander to unfasten the catches that kept the skips from overturning in the water. If automatic devices for doing this had been on hand, less time would have been lost.

---

*Excerpt from a paper entitled "Recent Practice in Diamond Drilling and Borehole Surveying," Bull. 91, I. M. M.

†Mining engineer, 216 Moorgate Station Chambers, London, England.

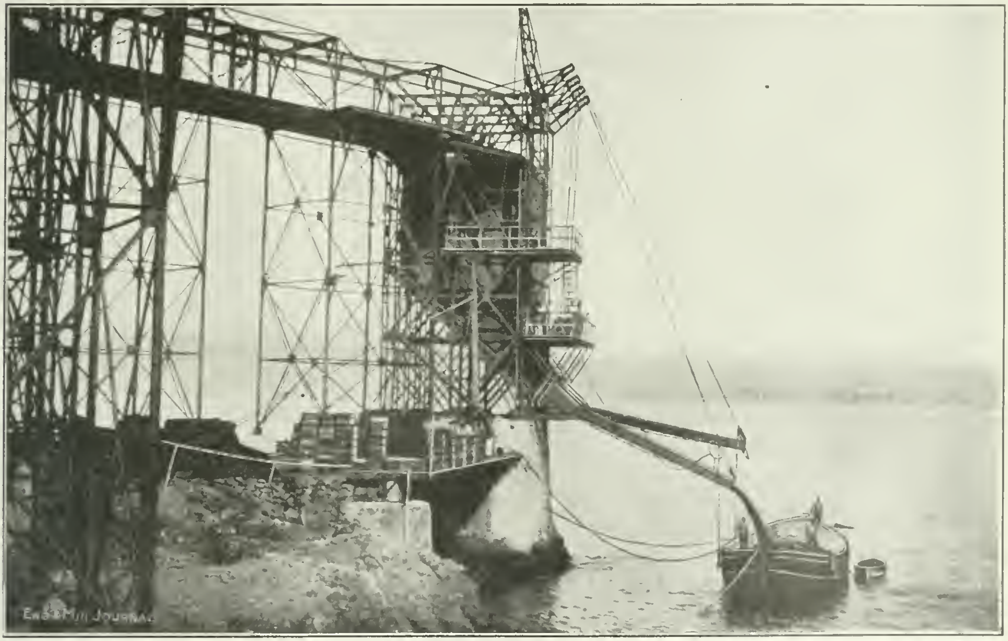
An Ore Wharf in Chile

By Alfred Gradenwitz*

The wharf shown in the accompanying halftone was built on the shore of the Bay of Michillas, Chile, for loading vessels with ore from the mines of the Compañia de Minas de Cobre, Michillas. At the end of the wharf is a large bin from which the ore is discharged through chutes to the vessels. Above the bin there is a rotary crane of 30 ft. radius and of two tons capacity, which is used for unloading timber, food stuffs and other supplies for the mine.

The ore is brought to the wharf from the Carolina mine over a Bleichert cableway, 3.2 miles in length. The greatest elevation passed over is 3020 ft. higher than the wharf. The cableway is supported by 50 towers; the capacity is 20 tons per hour, 80 buckets of 33 kg. capacity being used, which travel at a speed of 8.4 ft. per second.

Upon arrival at the angle station at the wharf, the buckets leave the traction cable and are moved by hand over a suspended rail to the bin, where they are dumped. The bucket is then moved around the circuit to the return cableway, where it is automatically coupled to the return traction cable. An "Automat" coupling device is used, which holds the buckets safely even on the steepest grades. The descending loads develop an excess of about 50 hp., which, at present, is absorbed by the braking mechanism, but which will, in the future, be used to drive crushers, or compressors and electric generators.



Ore Wharf on the Shore of Michillas Bay, Chile

Tempering Drill Steel—II

By Clarence C. Semple

The common method of tempering drills is that known as "drawing the temper." The bit, otherwise finished except for the tempering, is placed in the forge and the end heated slightly above the critical temperature or to about a full cherry red. The bit must also at the same time, be heated, though not to so high a temperature as at the end for from four to six inches back from the point. The end only of the bit is then plunged into the quenching trough while the steel is moved rapidly up and down until the end of the bit is black. This hardens the end of the bit. As soon as the end of the bit is black it is removed from the bath and the end polished. The heat in the upper, unquenched part of the bit immediately begins to flow toward the chilled end, softening the hardened steel in doing so. This flow of heat is accompanied by a surface oxidation which, at the low temperature of the first return of heat, takes place as a thin scale through which the heat of the inner steel shows as a straw or lemon color. As the temperature rises with the flow of the heat from the upper part to the end of the bit, the thicker the oxidized scale becomes, so that the color of the inner metal shows through in gradually darkening shades ranging through yellows, browns, purples and finally blues.

This return flow of heat softens or tempers the steel hardened by quenching and the degree of softening depends upon the temperature to which the returning heat is allowed to raise the end of the steel. In this way the hardness of the finished bit is controlled. The temperature to which the chilled end is allowed to rise is checked by plunging the entire heated portion of the steel into the quenching trough. This second quenching is done below the critical temperature and therefore has no hardening effect, its purpose being solely to check the return of heat to the end of the bit, which would otherwise soften the steel to more than the desired degree.

Razor blades are quenched at a light straw—when the return of heat has not been sufficient to greatly reduce the hardness of the steel. Such steel is brittle. Drills and picks should be tempered when the browns or first blues appear about a quarter of an inch above the edge of the bit. It is this final quenching color that the smith must determine by experience; if the drill is quenched at straw heat, the edge may be too brittle for drilling in hard ground and if quenched at too intense a blue may be so soft as to rapidly lose gage in anything but soft ground. Therefore if trouble arises from points cracking the quenching color is too bright; if the bits lose gage too rapidly the color is too dark. The happy medium must be determined from experience. However, the file test is preferable to the color indications. In that method the smith draws a small smooth file over the point of the bit as the heat returns and plunges the steel when the file just takes hold, but does not cut. The proper "feel" must be learned by experience. Once acquired the smith knows exactly the "feel" at which the steel should be plunged to stand up to the work required of it. The file should be reserved for only such testing.

---

*Regensburgerstrasse 3, Berlin, Germany.

If, in quenching, the drill is held stationary, that is not moved up and down or back and forth in the trough, a sudden change in hardness will occur at the water line and stresses will be produced which may cause the end of the steel to break off at the water line.

As the degree of hardness obtained is dependent upon the rapidity of cooling, the hardening and softening may also be done in one operation by heating the steel above its critical temperature and quenching in some slow-conducting liquid such as cylinder oil. It is then only necessary to bring the steel up to a cherry-red heat at the point and place it upright with the heated end submerged in a trough of oil until cold. Exactly the same intermediate hardening and embrittling effect will be produced as if it had first been hardened in water then tempered the desired amount. One maker of drill steel has even recommended hardening and tempering by this method then reheating the bit to the critical temperature and hardening and tempering a second time by the method of drawing the temper. It is questionable if the advantages obtained would warrant this extra labor.

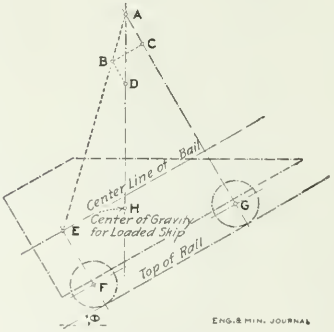
In the Transvaal and at certain large mine-drill shops in the United States the hardening and tempering are done in one operation, usually without reheating the drill after it has received its forging heat. The drills are sharpened in machine sharpeners so quickly that the steel is above the critical temperature at the end of the sharpening operation. The sharpened steel is then stood upright on a tray covered with water at 60° to 70° F. to depth of about one inch. The hardening takes place only where the bit is immersed in water and the heat in the upper part flows downward toward the cooling point and from the interior of the steel. This flow of heat prevents hardening of the upper and interior part of the bit to the same degree as the surface in immediate contact with the water. The formation of steam causes the surface of the water to play up and down enough to avoid cracking off of the point at the water line. It is to be noted that in this method the plunging is done on a descending heat. In some shops the sharpened drills are quickly reheated just at the points by an oil blast, the parts of the bits just back of the points being kept cool by an air blast. The reheated bits are then dropped into a trough of water where they are allowed to cool. In such methods success depends much upon the composition of the steel. The cooling takes place more rapidly on the outside than in the interior, so that there is a gradual reduction in hardness from the surface inward. It would seem that such methods of cooling might cause stresses in the metal, but it appears that satisfactory bits are obtained.

Various alloys are added to steels which influence their hardness, some adding both toughness with hardness, and the proportion of carbon has an important influence upon this property.

Graphic Solution of Skip Loads

BY F. W. COLLINS*

The pull on the bail of a skip used in an incline shaft and the load on the wheels can be determined graphically by the method illustrated in the accompanying sketch.



GRAPHIC DETERMINATION OF PULL ON A SKIP BAIL

In the sketch θ is the angle of inclination of the shaft; *AH*, a vertical line drawn through the center of gravity of the skip; *AG* is the center line of the front wheel drawn normal to the rail; *EF*, the center line of the rear wheel drawn normal to the rail; *E* is the point of intersection of *EF* with the center line of the bail; *A* is the point of intersection of *AH* with *AG*, the center line of the front wheel.

After completing this construction lay off on *AH* the distance *AD*, the weight of the skip and load, to any convenient scale, and draw *BD*, parallel to *AG*, and *BC*, parallel to the center line of the bail; then *BD* will be the load on the front wheels, *BC* the pull on the bail, and *AC* the load on the back wheels. The bail need not be parallel to the rails and may be hinged at any point.

Temperature Correction Chart for Tapes

BY H. J. RAHILLY*

The accompanying chart will often prove useful to an engineer when he is called upon to give accurate measurements, as in the setting of anchor bolts in concrete piers in cold or hot weather. The chart is made for a steel tape standard at 62° F., at a 16-lb. pull. The coefficient of linear expansion is taken as 0.0000065 ft. per Fahrenheit degree.

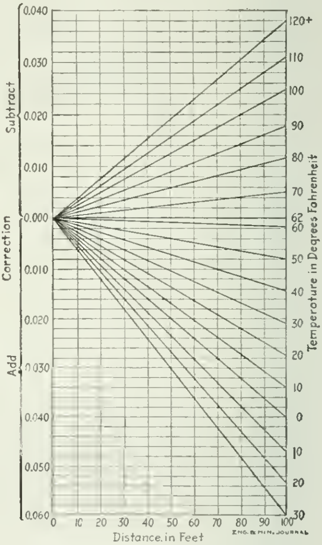


CHART FOR TAPE TEMPERATURE CORRECTIONS

The table requires little explanation. If, for instance, the temperature is 90° and the distance actually measured 70 ft., by following the 00-90 line out until it intersects the 70-ft. ordinate and then following the abscissa through this point across to the left, a reading of 0.013 ft. is obtained. This amount will be the increase in the length of the tape in 70 ft. at the temperature of 90° F., and should be subtracted from the tape reading. When the temperature is below 62° F. the correction should be added instead of being subtracted.

In driving the Laramie tunnel in Colorado the rock in the face was broken down on steel plates $\frac{3}{8}$ in. thick, $3\frac{1}{2}$ ft. wide and $7\frac{1}{2}$ ft. long. No. 5, D-handle shovels were used in loading the rock into the cars.

---

*Mining engineer, Hurley, N. M.

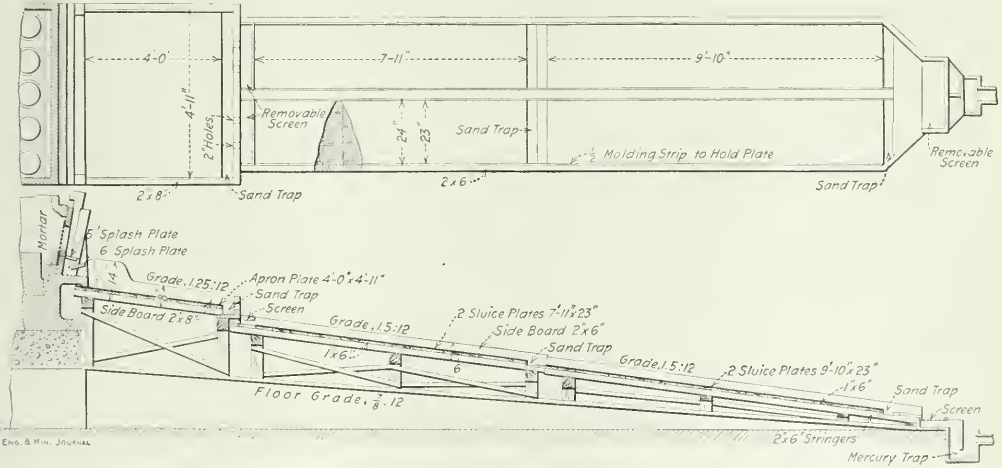
*Mining engineer, Douglas, Ariz.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Argonaut Amalgamation Tables

The type of amalgamation table used in the mill of the Argonaut Mining Co., on the Mother Lode in California, is shown in the accompanying illustration. The mill was built in 1897 and the mortars were set too low. The tables are portable, are built in three sections, and can be blocked to any desired grade. It is the intention of the manager to remove the lower sluice plates, which catch only enough gold to maintain themselves in good condition without being cleaned up at all, and to use two splash plates. Experiments are now being made with these extra splash plates and the results so far obtained seem to indicate success.



Amalgamation Tables in the Argonaut Mill, Jackson, Amador County, Calif.

There are 40 stamps in the mill, each weighing 1050 lb. and crushing five tons of ore per day through 16-mesh, brass wire-cloth screens; 40 to 45% of the pulp discharged will pass a 200-mesh screen. The batteries are run with "wash" not "splash" discharge, as then the screen is not crowded, and the pulp in the motar is thoroughly churned with the mercury that is added at the battery. This churning is conducive to good inside amalgamation, an inside chuck block being used, and while it causes a high loss of mercury better results are obtained in amalgamating inside the battery and outside and the plates have to be dressed less frequently.

The plates are dressed once each day and only the loose amalgam is brushed off. The brushing is done with whisk brooms, no scrapers of any kind being used. A thick coat of pasty amalgam is maintained on the plates.

Joplin Jigging Practice

By Claude T. Rice

The most interesting characteristics of Joplin milling practice are: The low cost, in certain mills being less than 20c. per ton, including supplies, power and maintenance; the excellence of the jigging practice; the poor quality of the table work; and the low recovery of the metallic constituents of the ore, rarely exceeding 65% and usually being close to 60%, which may be in part due to the ore being low grade.

The Joplin orebodies are replacements of cherty limestone by sphalerite, galena and secondary silica. These minerals are so associated that they are readily separable from the gangue and from each other after the ore has been crushed to relatively coarse pieces. The ore is quite free from iron-sulphide minerals, but marcasite is a constituent of the shale overlying the limestone in which the ore is found, and as some of the shale is broken down with the ore, there is a small amount of marcasite in the ore milled. However, the concentrates rarely contain more than 4% iron.

It is thus seen that the ore is particularly amenable to concentration by jigs, and why such excellent results are obtained by the use of these concentrators. The jigging practice consists of first concentrating roughly on "roughing" jigs, the hutch products going to the "cleaning" jigs; in treating such low-grade ore it is impossible to make a satisfactory recovery and clean the concentrates until they have been enriched in the proportion of about 5: 1. Some of the products from both roughing and cleaning jigs are treated in the sand jigs. Sizing and classifying are not essential to good jigging, as is proved by the results obtained at Joplin mills, in which the feed to the jigs consists of particles of ore ranging in size from ⅝ or ⅜ in. to slime, and where a high recovery is made of all free minerals larger than 1½ mm. in diameter. To successfully jig such an unclassified feed, it is necessary to use multiple-compartment jigs and different plunger strokes in each compartment. There is a large difference in the strokes in the different compartments of the same jig.

Usually there is one roughing and one cleaning jig in a mill, although in certain mills there are two roughing and one cleaning jig, while in a few others, two roughing and two cleaning jigs are used. In a few mills, where the jigging practice has been brought to high efficiency, sand jigs are used in addition to those above mentioned, but lately the tendency has been to concentrate both coarse and fine sands on tables. In certain mills, the chats—particles of ore composed of gangue and metallic minerals in about equal proportions—that pass a 3-mm. screen are fed to the sand jigs, while in certain other mills the coarser sand from the main settling vats is fed to the sand jigs.

The roughing jigs are 5- or 6-compartment machines, although some 4- and a few 7-compartment jigs are in operation. The 7-compartment jigs are used in mills wherein the ore treated contains much lead or the jig feed is rich. The grate area of each compartment or cell ranges from 30x42 in. to 36x48 in. The jig shafts make 90 to 110 r.p.m.; the stroke ranges from 5/8 to 1 in. In a 6-cell jig the extreme difference of stroke in the different compartments is 1/2 in. The bed of material on the grates is usually 5 in. thick; in some instances the thickness is 4 in., in others 6 in. The roughing jigs are operated with the hutch gates partly open, which tends to increase the strength of the suction stroke. There is a drop of about 3 1/2 in. from one compartment to the next, and the grates are set at an inclination such that the discharge is about one inch lower than the upper end.

The cleaning jigs are 6- or 7-compartment machines; usually there is one more cell in the cleaning than in the roughing jigs. The grate area of each compartment ranges from 24x36 in. to 36x48 in., 30x42-in. grates being the most common size. The bed of material is 4 to 5 in. thick; the shafts make 135 to 160 r.p.m., and the stroke ranges from 1/4 to 5/8 in. The drop from one compartment to the next ranges from 1 5/8 to 1 3/4 in. The grates are set at an inclination, as in the roughing jigs.

The sand jigs are 4- or 5-compartment machines; the grate area ranges from 20x30 in. to 30x42 in., 24x36 in. being the most common size. The thickness of the beds is usually 5 in.; the shafts make 150 to 190 r.p.m., and the stroke ranges from 1/4 to 3/8 in., 1/4 in. being the stroke usually preferred. The drop between cells is one inch.

Although the practice of setting the grates at an inclination results in unequal working of the current, because of the thick beds there is still enough thickness of zinc-ore particles at the head of the grate to clean the product going into the hutch. The beds of both roughing and cleaning jigs are supported by wooden or cast-iron grates, which are placed so that the direction of the slots is at right angles to the flow of pulp. The slots in the grates of the roughing jigs are 1/8 in. wide, in the grates of the cleaning jigs 1/16 in. wide, and in the sand jigs 1/16 to 3/16 in. wide. The feed to the roughing jigs contains an excessive amount of water.

In the best practice, both roughing and cleaning jigs make clean tailings, which are washed free from slime before being sent to the tailing pile. The reason for this practice is that because of the great quantity of water used, the fine particles of galena and sphalerite are carried through the jig by the rush of water, and have no chance to settle upon the beds. This washing is done by a crude settling-box, which is built at the end of the roughing jig, or, in some instances, a hydraulic classifier is used that is a part of the cleaning jig. The fine material that overflows is allowed to settle in a vat; the coarser portion is treated in sand jigs while the fine material is fed to tables.

Hutch products are drawn off through gates that are kept partly open, so that there is a uniform flow of the products from the jig compartments. The chats are drawn continuously through special gates from the bedded material on the grates. The lead in the ore is readily recovered, as the galena is freed from the gangue after coarse crushing; therefore no real lead middling is made. In certain mills a dirty lead concentrate is drawn from the first compartment and is set aside until enough has been accumulated to enable cleaning to be done with a thick bed of material on the jig grates. An obstacle to the recovery of more lead than is made at present is that the galena is crushed to fine flakes in the rolls. Spring rolls are used, operated with a choke feed, and the faces of the rolls can come in contact. This is why the quantity of sand made in Joplin mills is large, in spite of the fact that all crushing is done by rolls after reduction to 1 1/2 in. in Blake crushers.

The hutch product from the last compartment and the bed product from the last two compartments are fed to sand jigs in those mills in which sand jigs are used. The chats are drawn from a depth of 3 in. below the surface of the bed in the other compartments, and after being crushed in the chat rolls, are returned to the roughing jigs. Clean concentrates can be obtained from the roughing jigs only when the feed contains much galena, or when rich in sphalerite. In general, the Joplin ore is too poor to permit clean bed or hutch products being made by the roughing jigs. A small quantity of lead concentrate is sometimes obtained from the bed and from the hutch of the first compartment; it is fed to the cleaning jigs. In some instances all the bed products or coarse concentrates from the roughing jig are fed to the sand jig. A marcasite product is sometimes drawn from the grates; the marcasite being less friable than the sphalerite, which is therefore finer and goes through the grates.

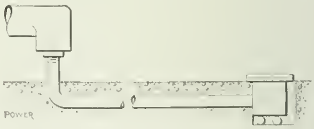
The enriched products from the roughing jigs that are not otherwise treated as has been mentioned, flow to a pyramidal box, where the excess water is removed, and they are then elevated to the cleaning jigs. If the pulp is rich, clean lead concentrate is obtained from the hutch and bed of the first compartment; otherwise a dirty lead concentrate is obtained, which is set aside until the accumulation is large enough to permit cleaning. However, throughout the district, little lead is recovered by the jigs. With the exception of the last two grates and the last hutch, zinc concentrates are obtained from the other compartments. In a few instances, a marcasite-pyrite-blende middling product is obtained, but usually the marcasite goes into the zinc concentrate. The chats from the last two grates and from the last hutch of both roughing and cleaning jigs go to a chat trommel, the oversize from which goes to chat rolls, the product from which is returned to the trommel. The undersize goes to the sand jigs.

The tailing from the sand jig goes to the main settling vats; middlings are drawn from the last two grates and the last hutch, and, after regrinding, go to tables. The other compartments make clean concentrates.

The capacity of a 36x48-in., 6-compartment roughing jig is 250 tons per 10-hr. shift. The capacity of a 30x42-in., 7-compartment cleaning jig is 75 to 100 tons. From 1500 to 2500 gal. of water is used per ton of ore treated. A large proportion of concentrates passing 2-mm. openings is recovered by the jigs. This product comes from the cleaning as well as from the sand jigs, because much blende that will pass 1-mm. openings is drawn into the hutches by the strong suction.

Movable Muffler for Gas Engine Exhaust

In many mills, situated in districts remote from coal fields, gas and oil engines have been found to be satisfactory prime movers. Where such engines are used it is customary to muffle the exhaust, and occasionally some difficulty is experienced in preventing leaks in the exhaust pipe. When an exhaust pipe leaks, the disagreeable fumes may escape into the engine room.



Gas-engine Muffler on Rollers

This leakage, according to *Power*, results from the inflexibility of the exhaust pipe, so that when expansion takes place, the resulting strain upon a rigid pipe may cause slight opening at the joints. In one instance the trouble was remedied by supporting the muffler upon rollers, as shown in the accompanying sketch.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Water Analysis after Homestake Fire

The Homestake mine waters, as compared with surface waters, show a larger percentage of lime and magnesia, and a much larger percentage of sulphates and chlorides (*Econ. Geol.*, Dec. 1911). The chlorides are partly the effect of percolation containing drainage, partly of the excreta of 1500 men and 50 horses working underground. During the fire in 1907 it was necessary to flood the mine to a point above the 300-ft. level, and in spite of the vastly increased influx of water, the percentage of sulphates and of total solids at least quadrupled. This was partly due to the heating of the ore, but still more to the opportunity for leaching freely through over 1,500,000 tons of pyritic ore, and a still larger quantity of broken rock used as filling. In unwatering the mine over 2,500,000 tons of water were raised, carrying 2788 tons of SO_3, or the total sulphur in over 2000 tons of pyrite. This water also carried over 1000 tons of alkali. The complete analysis, in parts per 1,000,000 was: SO_3, 1115; CaO, 442; KNaO, 427; MgO, 328; FeO, 28; Cl, 8; Fe_2O_3, tr.; Au, 0.0017. The 1,500,000 tons of broken ore must have contained about 120 tons of soda from the explosives used, some came from the excreta referred to, less than one-tenth from the incoming water, showing that most of it was leached.

Vertical vs. Incline Shafts

The question of relative economy of vertical and incline shafts was discussed by John M. Nicol (*Informes y Memorias Inst. Mex. Min. y Met.*, Vol. II, No. 6). In shafts for prospecting, the incline shaft offers the following advantages: (1) The vein can be followed, however much it changes, and no long crosscuts are needed to reach the ore for extraction purposes. (2) If the shaft is sunk on rich ore, the ore extracted will pay or partly pay expenses, giving a maximum of exploration work at a minimum of expenditure. (3) The vein is often softer than the country rock, so sinking is cheaper.

The disadvantages are: (1) The veins usually carry more water than the walls, and all the water of a region has to be drained with sinking pumps. (2) This is intensified by the cutting of sinking-pump valves by the quartz grit from the vein, while the cutting is usually less in sinking in slate or porphyry. (3) If the vein varies greatly in dip, there is difficulty in maintaining favorable track and hoisting conditions, and the shaft may become economically useless. (4) If a large amount of good ore is found on either side of the shaft, when sinking on the vein, it may require either extremely expensive timbering, or else allowing large pillars of ore to stand until the mine is worked out.

The advantages enumerated by Mr. Nicol for vertical shafts are: (1) The maximum depth is reached in a minimum time. (2) They can be driven more rapidly and timbered more easily than an incline shaft. (3) The pumping question is less difficult, as pumps can be suspended more readily. (4) Ore extraction can be done more economically. As to the last, however, it is now usually considered that self-dumping skips are an improvement on putting cars on a cage, and hoisting the cars, so that the last claim need not be seriously considered.

Treatment of Low-Grade Oxide Copper Ores

A recent patent (U. S. pat. No. 1,019,708) for the treatment of low-grade oxidized copper ores, or mill tailings, is that of J. W. Bennie of the Shannon Copper Co. This presupposes making a roast heap of copper or iron pyrites, which after ignition is covered with the fines to be treated. The idea is to convert the oxides, hydrates and carbonates into sulphites and sulphates. This conversion is assisted by iron sulphates or sodium chloride, so the pile is occasionally sprinkled with one of these substances in solution. It is attempted to make the roasting as complete as possible, and after it is entirely over, the pile is either leached *in situ*, or removed to tanks or reservoirs for leaching. The copper is precipitated from the leach, and the mother liquor furnishes the ferrous and ferric salts to assist in leaching the next lot of ore.

Manganese in the Caucasus

The manganese mines of the Caucasus are among the richest in the world, says *Daily Consular and Trade Reports*, May 7, 1912, 442,465 tons of ore being exported through Poti, and 129,233 tons through Batoum in 1911. About 15 to 20% is washed. The richest deposits are about 126 miles from these ports, at Tchiatouri, Kotais government. Ore reserves here are estimated at 1,070,000,000 tons, the ore lying in a horizontal bed between limestone below and sandstone above, and also in oölites. The area covered by rich deposits is about 44 square miles.

The mines have usually been worked in a crude way by the Georgian peasants, taken one to three miles in ox carts or by packhorses, at a cost of 55 to 85c. per ton, taken by narrow-gage railway 25 miles from Tchiatouri to Sharopan, and thence by the Trans-Caucasian R.R. to Batoum or Poti, 107 miles.

The washing plants have recently greatly polluted the Kvirili River, and it appears that a vigorous anti-débris campaign is being waged, which is to be met by impounding the washery water until the slimes settle.

Chromax Bronze

According to C. Vickers, in the *Foundry*, for March, chrome-nickel bronze is being manufactured in this country by the Naulty Smelting & Refining Co., Philadelphia, the product being known as chromax bronze. The proportions of the metal in the mixture are said to be as follows: Copper, 66.66%; zinc, 12.13%; nickel, 15.15%; chromium, 3.03%, and aluminum, 3.03%. The tensile strength of the alloy is said to be 79,000 lb. per sq.in., and there is reason to believe that this figure is not too high. The color of the alloy is white, and it takes a fine, silvery polish. The fracture is fine and dense, especially after being remelted. One test bar made from the first melt of new metal had a tensile strength of 66,670 lb. per sq.in., although after being broken it was found that the bar was unsound to the extent of one-third of its area. Chrome-nickel bronze, owing to its high melting point, has a denser structure and greater compressive strength than manganese bronze. It can be rolled into sheets and wire.

Utilization of Lead Furnace Fume

Lead-furnace fume from baghouses is ordinarily burned giving a whitish cinder of approximately the following composition, in the case of a fairly pure lead ore: $PbSO_4$, 55%; PbO, 44; ZnO, 1; Fe_2O_3, tr. This is ordinarily resmelted, attempts to use it as a pigment having proved fruitless, owing to its variable color. L. S. Hughes has attempted to convert this material into a pigment in the wet way (*Journ. Ind. and Eng. Chem.*, Apr., 1912). The first step was to convert the lead sulphate to hydrate, which was done by grinding in a ball mill with soda-lye solution. As this solution must be concentrated, the resultant sodium-sulphate solution was supersaturated, so that a strongly cemented mass resulted, which had to be broken out of the mill.

This was avoided by using a mill through which water could be run without stopping the mill. In this way the hydrate was washed out and then settled in tanks. The resultant lead hydrate was then found available in many ways: It could be converted into a basic salt with acetic or nitric acid, and precipitated with alkaline chromates; converted into oxide by heating; or the fresh hydrate mixed with arsenic acid for the production of lead arsenate.

Ancient Hard-Copper Tools

The copper-cutting instruments of the Tarascans, found in the Balsas River ruins in Guerrero, says the *Engineer*, Apr. 26, 1912, are so hard that they would turn the edge of a modern knife, and it has been claimed that these people, along with the Aztecs and Toltecs, possessed the secret of tempering copper. On the other hand, copper knives and axes, found at Atcopotzalco, are so soft that they can be cut with an ordinary pocket knife. Analysis showed that in all three localities the copper implements were of the same composition as the copper ores found therein. The blades from Guerrero, which are hard and apparently tempered, were made from the natural ore carrying nickel and cobalt, thus making the smelted alloy approach steel in hardness. Thus, the natural product gave an alloy of great hardness when heated and sharpened, while the other ores of practically pure copper, when smelted, resulted in implements which were soft and inferior in cutting value. Therefore, many archæologists of Mexico deny that these people possessed the secret of tempering copper, the sharp cutting copper implements being the result of Nature's handiwork.

Cyanides from Aluminum Nitride

The production of cyanides and cyanamides from aluminum or silicon nitride, or silicon carbide-nitride is described by Carl Bosch and Alwin Mittasch (U. S. pat. 1,022,351). A mixture of any of the above compounds is heated with soot, coal, pitch, or even a hydrocarbon such as acetylene, and an oxide, carbonate, or sulphate of an alkali or alkaline-earth metal. The reaction should be carried out at as low a temperature as possible, to avoid loss of nitrogen, and for this reason it is desirable to use mixtures of nitrides rather than pure compounds, as the mixtures will ordinarily melt at a lower temperature than will either constituent.

Tin in the Gay-Lussac Silver Determination

The end point in the Gay-Lussac silver titration is usually clouded when the bullion contains tin. This was investigated with a view to finding a prevention or remedy, by L. E. Salas (*Bull.* A. I. M. E., Mar. 1912). His results seem to indicate that the presence of tin has no effect on the volatilization or absorption losses in cupellation; that the addition of reagents such as barium sulphate, or albumen to carry down the interfering metastannic acid is of no avail; that a centrifuge will not settle it out; and that the necessity of making many additions of the decinormal salt solution aggravates the trouble. The effects of tin are minimized by the following procedure. For 1.0 gram of silver bullion containing 5% of tin, place 2 gram of tartaric and 3 or 4 c.c. of distilled water on the silver sample in the assay bottle. Heat until the tartaric acid dissolves. Cool thoroughly. Add 10 c.c. of 1:1 HNO_3, and keep cool while the silver dissolves. It is unnecessary to boil off the nitrous fumes after the silver dissolves, and the assay must not be boiled for any other reason. The amount of bullion taken must be such as to leave an excess of silver in solution after 100 c.c. of NaCl have been added.

Heat Balance of the Blast Furnace

In George Ralli's "Consommation de Combustible" the following figures are given as the apparent requirement per kilogram of charge in the furnaces at Mansfeld: As heat in the exhaust gases, 90 cal.; radiation, 12 cal.; driving off water, 18; slag, 450; matte, 22; jacket water, 35; decomposing carbonates, 32; total, 659 cal. At this plant the actual theoretical number of calories given by the coke is 1680; the furnace carrying 23% of coke.

In contrast to this, a similar calculation for the Elisseina (Bulgaria) matting furnaces shows a need for 700 cal., and a theoretical input of 730 calories.

Waterproof Concrete Work

The following conclusions were drawn by the Bureau of Standards after testing the effect of waterproofing compounds on concrete (No. 3, *Technologic Papers*, Bureau of Standards). Portland-cement mortar and concrete can be made practically water-tight or impermeable to any hydrostatic head up to 40 ft. without the use of any waterproofing materials, by care in selecting good materials and in proportioning them. The consistency of the mixture should be wet enough so that it can be puddled, the particles flowing into position without tamping. The mixture should be well spaded against the forms when placed, so as to avoid the formation of pockets on the surface. The ordinary materials used for waterproofing seem to be without any effect; probably one uses greater care when the waterproofing compound is used, which accounts for the improved results. In certain cases a bituminous coating may be of advantage; this is the only form of waterproofing recommended.

Making Titanium Alloys

Among the recent patents are a number given to A. J. Rossi for the production of titanium alloys. Probably the most interesting is the production of silico-titanium (U. S. pat. No. 1,019,526). Pure silica (white sand) and rutile are mixed with carbon in such proportions as to give the following reactions:

$$SiO_2 + 2C = 2CO + Si$$

$$TiO_2 + 2C = 2CO + Ti;$$

and heated in an electric furnace. By adding a metal or its oxide, and carbon to reduce it, a ternary alloy may be produced, of which the most promising would appear to be ferrosilicotitanium.

Sulphate Leaching Process

The Williams and Bradley patent (U. S. pat. 1,006,330) claims that the chief objection to leaching ores with sulphuric-acid solutions is the gelatinization of the silica of the ores. To overcome this, they use a solution containing about 0.3 to 0.5% of sulphuric acid, but considerable copper or zinc sulphate, or both. By this means, gelatinization is avoided, while a solution strong enough to electrolyze is obtained because of the zinc or copper, or both, already in the solution. Regeneration by electrolysis is carried on until the solution has about its original composition, and it is then used again.

The Air Lift Pump

Experiments by Davis and Weidner, at the University of Wisconsin (*Bull.* No. 450, U. of W.), indicate that with the air-lift pump, the maximum efficiency is attained at 63% submergence. With the same percentage of submergence, the efficiency increased as the lift was increased. Experiments were made up to 24 ft. Theory indicates, however, to a point's being reached above the limits of the experiment beyond which efficiency would decrease.

Electricity and Chemical Action

By Harry C. Jones*

Primary batteries convert intrinsic into electrical energy. Explanation of the primary and secondary cell. Electrolysis of the elementary gases possible. Chemical action impossible without electrolytic dissociation. Chemical action at a distance.

The reciprocal transformations of intrinsic and electrical energy constitute the subject matter of electrochemistry. That intrinsic energy can be transformed into electrical is exemplified in the primary cell. The Daniell cell is a machine for converting a part of the intrinsic energy of zinc into electrical energy.

Conversion of Electrical into Intrinsic Energy

That electrical energy can be converted into intrinsic is shown in every act of electrolysis of, say a fused salt. When an electric current is passed through fused sodium chloride, some of the electrical energy disappears, and a part of that which disappears is converted into intrinsic energy of sodium and of chlorine. The intrinsic energy of the sodium and of the chlorine is raised to the level at which it exists in these substances in the elementary condition. The elements sodium and chlorine are re-formed, the one at the cathode and the other at the anode, each with its original quantity and intensity or potential of intrinsic energy.

It should be said in advance that the developments in the field of electrochemistry during the last 25 years have been nothing less than marvelous. Indeed, a quarter of a century ago, the whole subject of electrochemistry was literally in its infancy. During this time entirely new electrochemical methods have been discovered and devised for separating the metals, not only from one another, but from their ores. The art of electrometallurgy has come into such prominence that many of the most valuable metals are now obtained almost exclusively by the electrical method. A new branch of quantitative analysis has grown up around the electric methods of effecting these separations.

Much of the remainder of these papers will be devoted to a discussion of the principles which underlie these recent and epoch-making developments.

Electrolysis of the Elementary Gases

The elementary gases, oxygen, hydrogen, chlorine, etc., have been known for a long time to contain two atoms in their molecules. One atom of an elementary gas was, however, looked upon as just like any other atom of that element.

Sir J. J. Thomson showed that this was not the case. He introduced hydrogen into a glass tube into whose ends platinum electrodes were sealed, and sparked the gas. Across the center of the tube a loosely fitting septum of aluminum was placed. After sparking the gas for some time, its spectrum was taken on the two sides of the aluminum septum. On one side the green line of hydrogen came out strong and the red line weak; while on the other side of the septum the red line came out strong and the green line weak.

This shows that the molecular hydrogen had been broken down into a positively charged atom and a negatively charged atom of hydrogen. One of these gives the strong green line and the other the strong red line.

Similar results were obtained with chlorine, so that it now seems fairly certain that in diatomic molecules of the elements in general we have a positive atom and a negative atom, and these two atoms have, of course, somewhat different properties.

Thomson went farther and showed that when the compound methane, CH_4, is electrolyzed, the carbon went toward one pole and the hydrogen towards the other. The hydrogen in methane can be readily replaced, one at a time, by chlorine, giving monochlormethane, CH_3Cl; dichlormethane, CH_2Cl_2; trichlormethane, $CHCl_3$; and finally tetrachlormethane, CCl_4.

An Ion not Always Charged with the Same Sign

When these compounds were electrolyzed, the chlorine went not to the positive pole, as it would have done if it were negatively charged, but to the negative pole—to the same pole that the positive hydrogen which it replaced went; showing that the chlorine which replaced the positive hydrogen was positive, and not negative, as it had hitherto been supposed that chlorine always is. The bearing of this experiment on one of the most important reactions known to chemists ought to be obvious. The hydrogen in methane is replaced or substituted by chlorine—positive hydrogen by positive chlorine. Now substitution is one of the most important and general of chemical reactions. When zinc is treated with sulphuric acid the hydrogen of the acid is replaced by the zinc. In what does this act really consist? A transference of the positive electrical charge from the hydrogen ion which has it but holds it loosely, to the zinc which takes it and holds it more firmly than the hydrogen.

Since the substituting atom or group, from Thomson's work, always has the same charge as the thing substituted in the molecule, it follows that this most important chemical reaction is purely an electrical act, a transference of the electrical charge from the constituent of the molecule which holds it weakly, to something which holds it more firmly and therefore takes it. The constituent which has lost the charge leaves the molecule, since there is nothing to retain it in the molecule, while the atom or group which has taken the charge is consequently drawn into the molecule.

Probably all substitution in chemistry, organic or inorganic, is then purely an electrical act.

Conductivity of Electrolytes a Measure of Dissociation

We have discussed the theory of electrolytic dissociation, and the way in which molecules of acids, bases and salts break down into ions. Further, it has been pointed out that the presence of ions is necessary for chemical action, and that chemical action is a maximum where there are a maximum number of ions present.

It is obviously a matter of fundamental importance to determine in any case the magnitude of the dissociation of any solution of any concentration of any given electrolyte. A simple method, and one that is fairly accurate, was worked out by the distinguished physicist, Kohlrausch, and every one must be familiar with the essential features of this method.

If a solution of any given substance is not dissociated at all, it means that it does not conduct the current, and, conversely, if a solution does not conduct the current it means that it is not dissociated.

We have maximum conductivity when we have maximum ionization. This statement must be clearly understood or it will lead to confusion. In order to produce complete dissociation we must have the solution very dilute. The above statement does not mean that a very dilute solution of an acid, base, or salt conducts the current better than a more concentrated solution, but it does mean that when the conductivity of a dilute solution is divided by the concentration expressed decimally, the resulting conductivity is greater than that of a more concentrated solution.

---

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

This holds up to a certain dilution, beyond which the conductivity does not further increase, no matter how much the dilution is increased. When this maximum, constant value is reached, it means that the dissociation of the solution is complete.

When the actual conductivity is divided by the concentration expressed decimally, the result is known as the molecular conductivity.

To obtain the dissociation of any solution of any electrolyte, it is only necessary to divide the molecular conductivity of the dilution in question, by the maximum, constant value of the molecular conductivity for the substance under investigation.

Space will not permit of a discussion of the details of the method—such as the units used, the concentrations employed, the apparatus required and the results obtained. For these details see "Elements of Physical Chemistry," fourth edition, pp. 377 to 419.

SULPHURIC BY NO MEANS THE STRONGEST ACID

A few results will, however, be mentioned. Hydrochloric, hydrobromic and nitric are among the strongest acids. Sulphuric acid at ordinary dilutions is only a little more than half as strong as those acids just mentioned. This may be a surprising result, since sulphuric acid has generally been regarded as one of the very strongest acids. The reasons for this are obvious after a moment's reflection. Sulphuric acid has a comparatively high boiling point. It is, therefore, not appreciably volatile at ordinary temperatures. Further, sulphuric acid has great power to combine with water.

Sulphuric acid, having a high boiling point, displaces acids with lower boiling points from their salts, e. g. hydrochloric acid from chlorides; and for this reason was regarded as a stronger acid than hydrochloric. This fact shows absolutely nothing as to the relative strengths of the two acids in question; the action is simply a result of their relative boiling points. Boric acid, one of the weakest acids known, will displace sulphuric acid from sulphates at a sufficiently elevated temperature, simply because it has a still higher boiling point.

The fact that sulphuric acid has great power to combine with water, has also led to a misunderstanding as to its strength. In the presence of organic matter it causes hydrogen and oxygen to combine and form water, with which it then combines—in a word it produces bad burns upon the body.

DISSOCIATION THE MEASURE OF AN ACID'S STRENGTH

The conductivity method as a measure of dissociation is the best general method for determining the relative strengths of acids and bases. An acid is a compound, which, in the presence of a dissociating solvent yields hydrogen ions. The strength of an acid simply means the number of hydrogen ions present in a given volume of its solution, at a given concentration. To measure the strength of an acid, we must therefore simply measure the concentration of the hydrogen ions, and this is just what we do when we measure dissociation.

Potassium and sodium and the other alkali hydroxides are among the strongest bases; with the hydroxides of calcium, strontium and barium next in order. The strength of a base simply means the number of hydroxyl ions present in a given volume of a solution of a given concentration of the base. To determine the strengths of bases it is simply necessary to measure their dissociation, the strength being proportional to the dissociation.

The conductivity method of measuring dissociation is applicable to all electrolytes, acids, bases and salts. Among the acids we find all degrees of strength represented—from the strongest like hydrochloric, to the weak organic acids, such as carbonic, hydrocyanic, etc. Similarly, we have all degrees of strength represented among the bases.

The salts in aqueous solution are, in general, strongly dissociated compounds. The exceptions are the halogen salts of mercury, cadmium and to some extent zinc.

The above definition of acids and bases applies to solutions of these substances, which is the condition under which they act chemically. When fused these substances conduct and are, therefore, somewhat dissociated.

NO SUBSTANCE IS ACID OR BASE UNTIL DISSOCIATED

The above definition would, of necessity, lead to the conclusion that pure, homogeneous substances are neither acids nor bases, but become such only when dissolved in dissociating solvents. We have already had examples illustrating this point. Pure, dry liquid hydrochloric acid, as we have seen, has no trace of acid properties; it will not act upon metals and will not decompose carbonates. It will not even turn blue litmus red. Similarly, pure, dry sulphuric acid will not color blue litmus red.

Further, when an acid like hydrochloric is dissolved in a nondissociating solvent like chloroform or benzene, it has no acid properties, as we have seen. These facts alone suffice to show the justification for the above definition of acid and base, and there are a large number of others which could be cited were it desirable, and did space permit.

RELATIVE DISSOCIATING POWERS OF DIFFERENT SOLVENTS

We have dealt thus far chiefly with water as a solvent, and have already referred to it as having the greatest dissociating power of any of the common solvents. We have, moreover, discussed the relation between the dissociating power of solvents and certain physical properties, as their dielectric constants and their own association, and have pointed out that these physical properties stand in about the same relations as the dissociating powers of these solvents.

It, however, seems desirable to go a little more fully into the dissociating powers of solvents, on account of the importance of this property both for pure science and for the industries. We have seen that chemical reactions depend primarily upon ions. The dissociating powers of the solvents in which the electrolytes are dissolved is what gives us the ions. Consequently, the dissociating power of a solvent is what determines primarily the chemical behavior of substances dissolved in it.

Water, as has already been pointed out, is not only the best solvent known, but has a greater power to break molecules down into ions than any other common solvent. Its great solvent power and its great dissociating power make it the most important solvent, many times over, in all chemistry. Indeed, water is by far the most remarkable compound in all chemistry. It is formed by the union of the hydrogen ion with the hydroxyl ion. The hydrogen ion is the one that gives all acidity, and the hydroxyl the one that gives all basicity. These are not only the most important ions in all chemistry, but they are the ions that have the greatest velocities in solution.

Water, with respect to its properties is, in general, an extreme substance. Take any given property. With respect to this it stands either at the top or at the bottom of the list of solvents, and usually at the top.

Again, take its property of expanding before freezing. If water contracted down to its freezing point, as most liquids do, the whole face of nature would be changed in one cold winter, at least in northern latitudes.

Concentrated nitric acid has considerable dissociating power, but can hardly be used as a general solvent, and the case of liquid ammonia has already been referred to. Sulphuric acid, concentrated, has also been shown to have a marked power of breaking molecules down into ions.

Among the common organic solvents methyl alcohol has the greatest dissociating power—in general—from one-half to one-third that of water.

Ethyl alcohol comes next with about one-fourth the dissociating power of water. The higher isomeric alcohols have less dissociating power than the lower or simpler members of the series, and this is a general fact in any homologous series of compounds. The simpler members, or those containing the smallest number of carbon atoms, have greater power to form ions from molecules, than the more complex members.

Acetone, which is a good solvent, has about one-fifth the dissociating power of water. It should be stated in connection with acetone, that in addition to its power to break molecules down into ions, it also has a marked power of forming molecular complexes from simple molecules dissolved in it. It has a great associating or polymerizing property, and this accounts for the abnormal results that are so often obtained in acetone solutions.

Formic acid, while not a common solvent, has high dissociating power. Indeed, it dissociates to about three-fourths the extent of water.

The remaining organic solvents have much less dissociating power than those mentioned above, and this accounts for the comparative chemical inactivity of solutions in these substances as solvents. The hydrocarbons and esters have about the least dissociation power of any known solvents, and solutions in these substances show little chemical activity.

The dissociating power of the different solvents shows why it is that we often have to be almost as careful about the solvent we use to get a certain result, as about the substance that we dissolve in the solvent.

AMPHOTERIC ELECTROLYTES

We have spoken thus far of liquid solvents breaking molecules of acids, bases and salts down into an equivalent number of positively charged cations, and negatively charged anions. This would leave the impression that the kinds of ions into which an electrolyte would dissociate, are fixed and determined by the nature of the electrolyte alone, and are independent of the surrounding conditions. This is not always true, and one exception, at least, must be discussed.

Take a compound like zinc hydroxide. In the presence of an acid it dissociates into zinc and hydroxyl ions, and as follows:

$$Zn(OH)_2 = \overset{++}{Zn},\ \overset{-}{OH},\ \overset{-}{OH}$$

It dissociates, under these conditions, just like any other base, and when treated with an acid the hydrogen ions of the acid combine with the hydroxyl ions of the base, and when the solution is evaporated a salt is formed. It should be stated that a salt is not formed when a dilute solution of an acid reacts with a dilute solution of a base, unless the salt is insoluble in the solvent in question. This will be seen to be the case when we recall that a dilute solution of almost any salt is completely dissociated into its ions. We get the salt only when we evaporate the solution, and drive off water which breaks the molecules down into charged parts or ions.

When zinc hydroxide is treated with a strong base, say sodium hydroxide, it no longer dissociates as a base, but as an acid, and in the following sense:

$$Zn(OH)_2 = \overset{+}{H},\ \overset{+}{H},\ \overset{=}{ZnO_2}$$

The hydrogen ions from the zinc hydroxide combine with the hydroxyl ions from the sodium hydroxide, and form water and sodium zincate.

There are a number of well known substances which behave like zinc hydroxide, dissociating as a base in the presence of an acid, and as an acid in the presence of a base. Such substances are termed amphoteric electrolytes. Aluminum hydroxide is another example in general chemistry, and there are many examples among the compounds of carbon.

The above discussion of amphoteric electrolytes brings out a principle which is fundamental and apparently general. Zinc hydroxide in the presence of an acid yields hydroxyl ions, while when a base is added to it, i.e. when hydroxyl ions are added to it, it no longer dissociates into hydroxyl ions. This kind of dissociation is suppressed, and the zinc hydroxide dissociates in an entirely different way giving no hydroxyl ions, but only hydrogen ions. The dissociation into hydroxyl ions is entirely suppressed by the addition of a large number of hydroxyl ions from the dissociated sodium hydroxide. The general principle illustrated by the manner of dissociation of the zinc hydroxide is that *the presenee of a common ion drives back the dissociation which yields that ion.*

If hydrochloric acid is added to a solution of sodium chloride, the dissociation of the latter is driven back, and driven back according to a well known law; the amount depending on the amount of hydrochloric acid added. This driving back of the dissociation is due to the presence of the common ion—chlorine. Indeed, the best method of purifying sodium chloride is based upon this principle. Prepare a saturated solution of sodium chloride and conduct in a stream of hydrochloric acid gas. The dissociation of the salt is driven back, i.e. more molecules are formed—but the solution is already saturated with respect to molecules of sodium chloride, and as more molecules are formed they are precipitated. A repetition of the above method of precipitating sodium chloride will give the fairly pure salt from a complex admixture with other things.

The above principle of the presence of a common ion driving back the dissociation which yields that ion, is almost as important for the industries as for pure science, as a little thought on this problem, in the light of the above facts, will show.

THE ACTION OF PRIMARY CELLS

The primary cell was discovered by Volta, more than a century ago, but it is only comparatively recently that we have come, even in part, to understand its action. So true is this that it is only for a few decades that we have known what are the chief sources of the electromotive force in such cells. Take as a type of the primary cell the Daniell battery, which consists of one electrode of copper immersed in a solution of copper sulphate, and the other electrode of zinc surrounded by a solution of zinc sulphate. The copper is the positive pole and copper separates from the solution upon the copper electrode. The zinc electrode dissolves, zinc passing into solution as zinc sulphate, or zinc ions pass into the solution.

There are three possible sources of electromotive force in such a system. At the surface of contact of the zinc with the zinc salt; at the surface of contact of the copper with the copper salt, and at the surface of contact of the two electrolytes with one another. Which is the chief source of the electromotive force of the cell?

The solution of the problem of the primary cell we owe largely to W. Nernst, now of the University of Berlin, utilizing the gas laws as applied to the osmotic pressure of solutions by Van't Hoff, and the theory of electrolytic dissociation of Arrhenius.

Given a metal, say zinc, surrounded by one of its own salts, say zinc sulphate. At the surface of the metal there exists a tension, known as solution tension, which tends to drive atoms off of the bar of metal into solution as ions. The metal atoms become ions by taking a positive charge of electricity from the remaining metal bar, which, consequently, becomes charged negatively.

OSMOTIC PRESSURE OPPOSES SOLUTION TENSION

Opposing the action of solution tension which drives atoms of the metal into solution, is the osmotic pressure of the metal ions in solution, which acts so as to drive metal ions out of the solution onto the bar. If these cations were driven onto the bar of metal, they would give up their charge to the bar, and the electrode would become charged positively.

What happens in any case depends upon which of these opposing forces is the greater. In the case of zinc the solution tension of the metal is always greater than the osmotic pressure of the zinc ions in any possible solution of any zinc salt. Consequently, a bar of zinc is always negatively charged whenever it is dipped into any solution of a zinc salt.

With copper exactly the reverse is true. The osmotic pressure of the copper ions in a solution of almost any concentration of a copper salt is greater than the solution tension of copper which is infinitesimal. Consequently, when a copper bar is plunged into a solution of copper salt, the bar becomes charged positively relative to the solution.

When the copper and zinc are connected metallically, and the copper and zinc salts by means of a siphon, we have a Daniell cell, and we can now see just how this works. Zinc, having a high solution tension passes into solution, and copper having such a low solution tension separates from the solution of the copper salt onto the bar. Copper, receiving the copper ions, is therefore the positive pole, and zinc, losing positive ions to the solution, is therefore the negative pole. The current flows on the outside from the copper to the zinc, and on the inside from the zinc to the copper.

E. M. F. OF PRIMARY CELLS CAN BE CALCULATED

Nernst has worked out a method for calculating the electromotive force of such cells. The method involves essentially the solution tensions of the metals used as electrodes, and the osmotic pressures of the cations of the electrolytes.

This method of dealing with the primary cell involves the existence of the force which has been called solution tension of the metals. It should be stated that the existence of this force has been demonstrated beyond reasonable question by experiments that have no direct connection with the primary cell as such.

The method worked out by Nernst for calculating the electromotive force of primary cells of the Daniell and several other types, cannot be more than mentioned in the narrow scope of these papers. Those interested will find it discussed in detail in my "Elements of Physical Chemistry," fourth edition, pp. 442-492.

Suffice it to say that the electromotive force calculated for such cells agrees with the results of direct measurements, otherwise the method would not be discussed here. The result is that the chief source of the electromotive force in primary cells is at the surfaces of contact of the electrodes with the electrolytes. There is a small difference of potential, or electromotive force at the surface of contact of the two electrolytes with one another, and another small difference of potential where the two metal electrodes come together directly or indirectly; but these are both so small that, under ordinary conditions, they are comparatively speaking, almost negligible.

SOURCE OF ENERGY IN THE PRIMARY CELL

The question that still remains, is what is the source of the electrical energy that is produced say in a Daniell cell? We start with zinc, copper, zinc sulphate and copper sulphate. After the battery has acted for a time we have less zinc and more copper than at the beginning. The source of the electrical energy that appears is the intrinsic energy of the zinc that has disappeared, over and above the intrinsic energy of the copper that has been formed during the action of the cell.

Certain forms of primary cells are simply machines for converting heat into electricity—they cool themselves as they act, but unfortunately no such cell thus far discovered, has the power to convert any large amount of heat directly into electricity. If it did, it would be a matter of tremendous technical importance. To convert large amounts of heat directly into electricity would be almost as important as to convert large amounts of intrinsic energy directly into electricity, since there is no difficulty in converting intrinsic energy directly into heat in any amount desired. The solution of the problem of converting heat directly, quantitatively and in large quantity into electricity remains for the future, and its solution will be nothing less than epoch-making for the industries.

The Daniell cell can convert only a relatively small amount of intrinsic energy into electricity and this not very economically.

THE SECONDARY CELL OR STORAGE BATTERY

There have been several forms of storage batteries devised. The best known of these is the ordinary lead cell. While some of the details of its action are not fully understood, yet the general principles which it illustrates are perfectly clear.

Such a cell consists of one plate of lead dioxide, the other of lead and the electrolyte sulphuric acid of a certain definite concentration (sp. gr. 1.2). When an electric current is passed into and through such a cell, lead dioxide is deposited upon the plate where the current enters and lead upon the other plate. Lead dioxide represents lead in the quadrivalent condition—each lead ion has four charges upon it, while lead in the form of sulphate has only two charges upon it. The action of the charging current, is then, to raise the valence of the lead from two to four—to raise the intrinsic energy of the lead.

When the accumulator discharges, exactly the reverse takes place. The lead dioxide and also some of the lead pass into solution in the sulphuric acid as lead sulphate.

The charging current, then, raises the intrinsic energy of the lead from the bivalent to the tetravalent condition; while in discharging the intrinsic energy of the lead is lowered from the tetravalent to the bivalent condition. In charging a storage battery we are converting electrical energy into intrinsic. In discharging we are converting intrinsic energy into electrical.

CHEMICAL ACTION AT A DISTANCE

The idea has long prevailed that in order to have chemical action we must have mechanical contact. We shall now see that this idea is erroneous, and not only shall we learn that we can have chemical action between two things that do not touch, but from what has already been said in reference to the solution tension of metals we can easily understand what takes place.

Take a bar of pure zinc and dip it into dilute sulphuric acid. If the zinc is sufficiently pure it will dissolve very slowly, and hydrogen will escape very slowly from the solution of the acid.

Wrap a piece of platinum wire around the bar of pure zinc and to the other end of the wire attach a piece of platinum foil. Let the bar of zinc pass through a cork which fits into the top of a glass tube three or four inches long. Close the bottom of the glass tube with a piece of vegetable parchment. Fill the glass tube now containing the bar of zinc with a solution of some soluble sulphate—say ammonium sulphate—and plunge it into a large beaker also filled with a strong solution of ammonium sulphate.

The platinum wire connected with the bar of zinc above the glass tube is led down into the beaker, and the platinum foil attached to the end of the platinum wire allowed to rest on the bottom of the beaker. If sulphuric acid is now added by means of a pipette, to the platinum foil, hydrogen will escape rapidly not from the zinc but from the platinum, and zinc will dissolve.

PROOF THAT ACTION TAKES PLACE AT A DISTANCE

The zinc thus really dissolves in sulphuric acid which does not touch it, but which is contained in another vessel The object of the vegetable parchment over the bottom of the glass tube is to keep the sulphuric acid in the beaker away from the zinc, at least for a time. That the sulphuric acid in the outer vessel does not at first touch the zinc, although hydrogen is given off at once from the platinum foil, can be very readily proved by introducing some blue litmus paper into the neutral solution of sulphate around the bar of zinc. The zinc not only dissolves in sulphuric acid which does not touch it, but dissolves much more rapidly than if the acid were added directly to the metal.

What is the explanation of these rather remarkable results? In the first place why does not pure zinc dissolve in acids when, as we have seen, zinc has a very high solution tension? The enormous solution tension of zinc is the very cause of zinc not dissolving in acids. The solution tension drives zinc ions into the solution with an enormous force. But in order that a metal should dissolve in an acid, the hydrogen cations of the acid must give up their charge to something and escape. If the metal has a very high solution tension tending to push its own ions into solution, the hydrogen ions of the acid cannot get up to it; and if the hydrogen cannot come up to and touch the zinc, they cannot discharge, since there is nothing to which they can give up their charge. Consequently, the zinc ions cannot enter the solution in any appreciable quantity; it being a fundamental condition of equilibrium in solution that there cannot be present in it any appreciable excess of cations or of anions.

Mechanics of Action at a Distance

Platinum is a metal with small solution tension. The hydrogen ions can easily come up to and give up their charges to the platinum. They do so and escape from the solution as hydrogen gas. The charge is conducted along the platinum wire to the zinc. The zinc atoms take up the charge and pass into solution as ions, pairing themselves against the SO_4 ions which were initially paired off against the hydrogen ions of the acid—the hydrogen ions in question having lost their charge escape as hydrogen gas.

Pure zinc, then, does not dissolve in acids not because it has not a powerful solution tension, but because the hydrogen ions of the acid cannot come up to it and give up their charge and escape. We render zinc "impure" and make it dissolve by bringing it in contact with some metal with a low solution tension, such as platinum, copper and the like, and for the reason pointed out above.

Another experiment illustrating even more strikingly "chemical action at a distance," is the following. Place a solution of ferrous chloride in one beaker and a solution of potassium chloride in another beaker and connect the two beakers with a siphon filled with the neutral potassium chloride. Dip a platinum electrode into each beaker and connect the two electrodes externally through a galvonometer. Under these conditions nothing will happen.

Iron Oxidized by Distant Chlorine

Now conduct a current of chlorine gas into the neutral solution of potassium chloride, and the ferrous chloride in the other beaker will be gradually oxidized to ferric chloride. The ferrous chloride in one vessel is thus oxidized by chlorine which is in an entirely different vessel, and which may be separated from the ferrous salt by a very considerable distance. This is an ideal demonstration of chemical action taking place between two substances that are some distances apart.

What is the explanation of the above experiment? The chlorine coming in contact with the platinum electrode takes up negative charges or electrons as they are called, from it. This electrode, having lost negative charges, is charged positively, and a current flows from this electrode over to the other electrode which is surrounded by the ferrous salt. The ferrous ions are ions of iron that have each two positive charges upon them. The iron ion, however, can carry three positive charges, as in the ferric condition. The bivalent ferrous ion takes a positive charge from the electrode immersed in it, passing over into the ferric ion, which carries three electrical charges. The iron is thus oxidized from the ferrous to the ferric condition, i.e. its valence is raised by chlorine which never comes near it.

This experiment is of great importance in connection with the whole subject of chemical valence. The valence of the iron is raised from the condition of two to three, and how? By adding an electrical charge to it, by adding one unit of electricity to it, and by doing nothing else. This alone would show the connection between valence and the electrical charges carried by the ions. This same fact is, however, emphasized over and over again in the treatment of valence from the only standpoint that is worth calling scientific, viz. Faraday's Law. It would lead us much too far to discuss this subject here. For the application of this conception to general chemistry, see my "Principles of Inorganic Chemistry" and "Elements of Inorganic Chemistry," published by the Macmillans, New York,

---

Vanadium has been found in growing vegetation in minute amounts. This is thought by some to account for its presence in certain coal beds in Argentine, Peru and Colorado.

Rail Production in 1911

The American Iron & Steel Association reports that the production of all kinds of rails in the United States in 1911 amounted to 2,822,790 tons, against 3,636,031 tons in 1910, a decrease of 813,241 tons or 22.3%. Rails rolled from purchased blooms, crop ends and seconds, and rerolled and renewed steel rails are included. Included in the total for 1911 are 205,409 tons of girder and high T steel rails for electric and street railways. In the following table the production of all kinds of rails is in gross tons.

	1910	1911	Changes
Bessemer steel....	1,884,442	1,138,633	D. 745,869
Open-hearh........	1,751,359	1,676,923	D. 74,436
Miscellaneous.....	....	7,000	I. 7,000
Iron..............	230	234	I. 4
Total.............	3,636,031	2,822,790	D. 813,241

Included in the miscellaneous rails rolled in 1911 are 462 tons of rails rolled from electric steel, and 6538 tons of rerolled steel rails which the makers were unable to classify as bessemer or openhearth rails. Of the total production of steel rails in 1911, 2,708,795 tons were rolled from ingots made by the makers and 113,761 tons were rolled from purchased ingots or blooms, crop ends, seconds or renewed or rerolled rails.

Rail production for six years has been:

1906..............	3,977,887	1909..............	3,023,845
1907..............	3,633,654	1910..............	3,636,031
1908..............	1,921,015	1911..............	2,822,790

The production in 1906 was the largest ever reported. The proportion of bessemer rails to the total fell from 51.8% in 1910 to 40.3 in 1911, while that of openhearth rails increased from 48.2 to 59.4%. The rapid increase in openhearth rails is shown by the following figures of yearly production: 1908, 571,791 tons; 1909, 1,256,074; 1910, 1,751,359; 1911, 1,676,923 tons. Rails from electric steel were reported in 1911 for the first time. Of the bessemer-steel rails last year, 1,053,420 tons were rolled by makers of domestic ingots and 85,213 tons by companies which did not operate bessemer converters. Included in the total by makers of ingots are 19,379 tons of rerolled rails. Almost all of the openhearth rails in 1911 were rolled from basic steel, and all were rolled by producers of ingots.

The following table gives the production of all kind of rails—including street rails—in 1911, classified according to the weight per yard:

	Under 45 Lb.	45 to 85 Lb.	Over 85 Lb.
Bessemer............	111,231	606,300	421,102
Open-hearth.........	100,755	461,387	1,114,781
Miscellaneous.......	6,538	9	453
Iron................	234	....	....
Total...............	218,758	1,067,696	1,536,336
Per cent. of total....	7.8	37.8	54.4

Considerably more than half the rails rolled were of 85 lb. to the yard or over. It will be seen also that the greater part of the openhearth steel was used for the heavier rails.

The Lehigh Coal & Navigation Electric Plant

Reference has been heretofore made to the great power plant which the Lehigh Coal & Navigation Co. proposes to establish near its mines for the purpose of converting the coal into electric power for transmission to other points. The preliminary investigations of the commercial and engineering feasibility of the plan were carried on over the past three years by the late William A. Lathrop, president of the company and Lewis B. Stillwell, of New York, consulting engineer. The execution was committed to a subsidiary company, known as the Lehigh Navigation Electric Co., organized last year, with office in Philadelphia.

That company has now closed a contract with the General Electric Company, Schenectady, N. Y., for three 10,000-kw., 11,000-volt, 3-phase 25-cycle, complete horizontal turbo-generating units with two 300-kw. turbo-excitor sets and one 300-kw. motor-generator exciter set, to be installed in its new main generating station. This contract provides for an initial expenditure of $3,000,000; definite plans are made for an eventual investment of $10,000,000, with an assured supply capacity of 20,000 kw. from the first installation of the three 10,000-kw. turbo-generators and a gradual enlargement to 100,000 kw. ultimate capacity. This is the largest electric power project undertaken since the establishment of the Niagara Falls plant.

The main plant will be at Hauto, in Carbon County, Penn., about 10 miles west of Mauch Chunk. This place was chosen because it was at the entrance to the tunnel which leads to the largest body of coal owned by the Lehigh Coal & Navigation Co. Another consideration was the abundant water supply. An existing reservoir is being increased to a storage capacity of 1,000,000,000 gal. and an area of about 400 acres by the construction of a higher dam. The water-supply needs of the ultimate plant will be some 300,000,000 gal. per day, most of which will be carried back into the reservoirs after condensation. To run the plant up to the contemplated maximum installation of 100,000 kw. capacity, it is estimated that 1,000,000 tons of coal will be needed yearly. This coal will be used practically as it comes from the mines, saving the expense of preparing it for market, and also utilizing the culm, which is now a waste product.

From Hauto the distribution of current for heat, light and power by means of high voltage transmission lines, reaching out through all eastern Pennsylvania and New Jersey, will penetrate a territory with 2,500,000 population. Among the first power consumers in the district, it is planned to supply the slate and cement industries in Lehigh and Northampton counties, all of which are in a territory from 20 to40 miles distant from the Hauto plant. Substations will probably be established at once at Coplay and Pen Argyl for stepping down and distributing the current to users. Within a radius of 50 to 75 miles from the main station there are some 20 large cement mills. The transmission lines will be strung largely along the Lehigh Canal and on the right of way of the Lehigh & New England R.R., which the company controls.

With the assistance of these companies a complete power census of the industries has been taken, and within the district which will be reached by the distribution system of the first section of the Hauto plant, over 100,000 hp. is being used now. The Lehigh Navigation Electric Co. has made up a schedule of prices, running from 0.8c. up to about 2.5c. per kilowatt-hour, according to the amount of power contracted for and the steady continuance of consumption, which will deliver its current quite materially under the cost at which the industries are able to produce steam power.

Under the laws of Pennsylvania the right of an electric-power company operating with steam to distribute energy is confined to a single township; accordingly, charters have been obtained in Lehigh, Schuylkill, Carbon, Northampton, Bucks and Montgomery counties for about 60 electric companies, one for each township into which the transmission lines may be carried. These companies will all be under the management of the parent company.

With the exception of the 8000-kw. plant of the Harwood Electric Company, which supplies current for lighting and electric-railway operation around Hazelton, using coal direct from its own mines, no attempt has been made heretofore in this country to generate electric current in the coal regions for public service. The Lehigh Navigation Electric Co. expects to have the first installation at the Hauto plant in operation before the end of the year. As the capacity of the plant is gradually increased, energy will be carried to Allentown and Easton, Penn., Trenton, N. J., and undoubtedly finally into Philadelphia. That city is within 80 miles, and New York is only 105 miles distant.

The Lena Labor Trouble

The explanations given to the Russian Duma by the Minister of the Interior and the Ministry of Commerce and Industry regarding the recent shooting down of strikers at the Lena Goldfields have been attacked sharply in the St. Petersburg press, the criticisms of which have been summarized by the *Evening Post*. The *Novoe Vremya*, the *Retch*, and the *Bourse Gazette* dwell on the discrepancies of the respective statements. While M. Makaroff contended that the labor movement bore a political character, and that the troops were compelled to fire in self-defense, M. Timasheff demonstrated the essentially economic nature of the men's grievances. M. Timasheff declared that the company systematically violated the law regarding the conditions of labor, notably by applying the truck system. The Ministry of Commerce and Industry had repeatedly censured the management. These violations of the law were the starting point of the labor troubles. The pledges given by the company to observe the law and the promises of certain concessions encouraged the hope of a peaceful settlement of the strike when the police authorities suddenly arrested the men's delegates on the plea that they were Socialists. The shooting followed. M. Makaroff tried to justify the shooting of 163 workmen because political convicts of Socialist proclivities were to be among the leaders of the strike, although he was unable to prove that they were responsible for a single illegal act.

Cobalt's Production

Special Correspondence

An interesting paper on the future production of Cobalt, was presented by Prof. G. R. Mickle, at the last meeting of the Cobalt branch of the Canadian Mining Institute. Mr. Mickle is provincial mine assesor, and as such, has access to information which is available to but few.

Up to July, 1911, there were 111 known producing veins, and of these 86, or over 80%, were in the Huronian formation. Of the remainder, 12 are in the diabase and 13 in the Keewatin. In 1907, there were 53 known producing veins in the Huronian, seven in the diabase and six in the Keewatin. Of the veins in the Huronian, 90% do not carry silver into the Keewatin. Of the total output of the camp, 97% of the silver is produced at a profit. Mr. Mickle stated that 56% of the known producing veins have been exhausted. The production to date has been 115.8 million oz., so that the total production will be 206.4 million oz. of silver. There are estimated to be 8,000,000 oz. in the dumps.

Mr. Mickle's paper will undoubtedly create a good deal of discussion as the future of Cobalt has been a live question for some time past. The production for last year was approximately 35 million oz., but in view of the decreased ore reserves, a gradual decline in the yearly production will undoubtedly take place.

Owing to the great borax deposits in the province of Antofogasta, Chile, the government is said (*Chem. Trade Journ.*, Feb. 17, 1912) to be considering an export duty.

Mine Hoisting Systems Compared—I

By Bruno V. Nordberg*

A discussion of the factors governing the economy and efficiency of steam, air and electric hoists, in which it is shown that the Ilgner flywheel is efficient only during continuous hoisting; the storage battery abandoned in European practice.

The conclusions drawn by A. K. Pauly in the paper he read before the American Institute of Mining Engineers, entitled "Electric Motors versus Compressed Air Engines for Driving Deep Mine Hoists,"[1] are based upon assumed conditions that do not frequently exist in actual practice and, particularly, not in metal mines. In isolated cases where such conditions exist neither the system of air hoist as described, nor the electric hoist is adaptable, as I shall endeavor to show later in this article.

It is stated, by Mr. Pauly, that many compressed-air engines are at present being replaced by electric motors. This statement is misleading because there are no engines in operation that are designed for the economical use of compressed air with the exception of those applied by the Nordberg Manufacturing Co. to the hoists of the Anaconda Copper Mining Co., at Butte, Mont. The machinery operated by compressed air so far has been old steam engines that naturally are uneconomical.

Why 90 Lb. Pressure Is Used at Butte

The statement to the effect that the practical limit of air pressure that can be carried on a compressed-air system operating hoisting engines is 90 lb. gage, is not correct, nor can this conclusion be drawn from what is said about the temperature change during the expansion of the air and the properties of the cylinder lubricant. The fact of the matter is that 90 lb. is the pressure used at Butte simply because this pressure is carried on the rock-drill system. By this arrangement it will be possible to connect the rock-drill and hoist systems together and concentrate all the air power in one plant. If there were any limitations of the air pressure due to the temperature drops during expansion and rise during compression, then such a pressure limit would not be a fixed pressure, but a certain multiple of the atmospheric pressure. If it be assumed, for instance, that 90 lb. would be the practical pressure limit at Butte where the atmospheric pressure is about 12 lb. absolute, then 106 lb. gage would be the corresponding pressure limit where the atmospheric pressure is 14 lb. absolute and, at sea level, the corresponding pressure limit would be 110 lb. gage.

The arrangement of reheaters described in Mr. Pauly's article is entirely impracticable for use on a hoisting plant. A reheater for that purpose must be based on entirely different principles from any of those suggested. A point is also made of the necessity of using cooling water in a compressor plant and the expense of providing such cooling water in some cases, as a disadvantage of the compressed-air system. The fact is that the quantity of cooling water required for the intercooler and jackets of an air compressor is small and, if the Ilgner flywheel transformer is used with an electric hoist, the bearings of the transformer should be water jacketed and water be provided for this purpose.

It is further stated that claim is often made that the air for the hoist may be taken from an existing compressor plant and that this claim seldom if ever has any foundation. In regard to this matter I would say that in a great number of cases this can be done simply by providing sufficient air storage and by remodeling the cylinders of the hoisting engines so that air can be used economically, and this is the proper thing to do whenever possible. If, in the future, more air is needed, the new compressor can be placed in the same power house or adjacent to the old compressors, by which centralization of power running expense is saved.

In comparing the flywheel of the Ilgner transformer with an air receiver for the purpose of storing power, the drop of speed of the flywheel is given as 30%, which is about twice as great a drop as used in German practice, so that the storing capacity of the flywheel, instead of being 50% of the total energy, only becomes about half that much. The Ilgner transformer requires attention, and is subject to wear and tear, which is not the case with air receivers.

Power from Lowering Unbalanced Loads

The statement that, when lowering unbalanced loads, power is automatically returned to the power system with an electric hoist, cannot be true, except in cases where the load is lowered immediately after an approximately equal load has been hoisted, so that the reduction in velocity of the flywheel during the hoisting period is made up during the period of lowering the load. This case seldom exists in practice. As a rule, most of the unbalanced hoisting is done during the less active periods of hoisting when, after long pauses, heavy loads of timber and tools are lowered into the mine. When this is done, the Ilgner flywheel is running at its normal velocity and, in order that it may absorb the power represented by the descending load, its velocity must be increased considerably above the normal. As the normal speed is high, it will be found impracticable to increase it. At Butte loads representing 66,000,000 ft.-lb. are sometimes lowered with the air hoists. As such a load is lowered in one minute, the equivalent work represented by the lowering is 2000 hp. Anyone interested can easily figure out how great an increase of velocity is required in a wheel of a given weight in order to store up 66,000,000 ft.-lb. of work. The normal rim speed of these wheels is at least 16,000 ft. per minute.

The statement that a system in which the braking is accomplished by compression of air in the hoist cylinders can only be done at the expense of simplicity of control, is not correct. The runners of the hoists in Butte, where such a system is used, declare that thereby the control is much simpler and that they like to run the air hoists better than the old steam hoists.

Work and Power Consumption Should Be Calculated Graphically

The well known equations and textbook matter expressing the interdependence of volumes, pressures and temperatures of compressed air are presented in Mr. Pauly's paper. Such equations, while they may have some academic value, are of little use for the purpose of calculating the work, power consumption, etc., entering the air-hoist problem. There is only one way in which this can be done and that is the graphical way, and I refer all who are interested in this subject particularly to the paper written by Hans Behr, of Johannesburg, South Africa, in his analysis of the return-pipe system. As with compressed air we have no condensation to deal with, all problems involving the expansion and compression of air can be treated graphically and exact results can be derived by graphical methods, if the pressure losses and temperature effects are known from actual practice.

Little explanation is given in Mr. Pauly's article as to how the diagrams showing the consumption of power for reheating the air were obtained, on which diagrams, I understand, Mr. Pauly bases all his deductions. These diagrams also give the power consumption of the electric hoist. The power for operating an air hoist is evidently arrived at by figuring the mean effective pressures by the equation

---

*Chief engineer, Nordberg Manufacturing Co., Milwaukee, Wis.

[1] Bull. 60, A. I. M. E., December, 1911.

$$M = aP_1 + \int_{a}^{1} p\,dv - Pb =$$

$$P_1\left(a + \frac{a - ak}{K - 1}\right) - Pb$$

where a is cutoff expressed in fraction of stroke; v and p, volume and pressure at any part of the stroke beyond the point of cutoff; P_1, the absolute pressure at admission; and Pb, the absolute pressure against which the engine exhausts. The conditions upon which this equation is based do not exist in a well designed air hoist, as the expansion even at the shortest cutoff is not carried below the atmospheric pressure. Devices are also provided whereby the effect of the clearance space is absolutely eliminated so that the clearance does not affect the efficiency. The curves 4 and 5 would, therefore, not apply to such a hoist. The frequency of hoisting, while not much affecting the power consumption of an air hoist, is the all-important factor covering the power consumption per ton hoisted or the efficiency of an electric hoist. No explanation is given how this is accounted for.

The statement that the temperature of the exhaust must be kept about 32° F. in order to prevent freezing of the moisture is not strictly correct, as experience shows that in a hoist a degree of expansion can be used with safety that would result in a theoretical final temperature of 10° or even 0° F. This temperature is, however, not reached on account of the heating effects of the cylinder walls, etc., upon the air, the specific heat of which is comparatively low.

THE CALCULATION OF OPERATING COSTS

In looking over the different calculations of power consumption and operating costs of air hoists and electric hoists, I find no itemized statement of the different charges. It is, however, apparent that in order to make a showing of the electric hoist against a compressed-air hoist, the latter has been arbitrarily loaded with an excessive labor cost. How the cost of power for the air hoist has been calculated is not clear, but I notice that it is arbitrarily assumed that this hoist has to be fitted with a 6000-cu.ft. compressor and a 1000-hp. motor. As a matter of fact, the experience in Butte would indicate that a compressor of less than half that capacity would be sufficient to do the work specified. It is, however, not necessary to go into the details of these operating costs, for the reason that neither the electric hoist nor the air hoist is the machine to use under the conditions given.

The conditions of hoisting upon which Mr. Pauly draws his conclusions are in short as follows: From an average depth of 2000 ft., 1200 tons of ore are to be hoisted per day, 275 days per year; the net load is 7000 lb., and the hoisting is in balance; 40% of the day's time is used for hoisting ore and 20% for shifting and other work; this nonproductive work to be 50% of that necessary for hoisting ore (productive work); hoist to be idle 40% of the day; coal of 12,000 B.t.u. per lb., costing $4.50 per ton, to be used.

From these data I deduce the following: The load is 3½ tons, therefore the hoist has to make 1200 ÷ 3½, or about 343 trips per day for hoisting ore; 40% of the total time of the day, 24 hours = 86,400 sec., or, 0.4 × 86,400 = 34,560 sec. = 567 min., is the actual time necessary to make these trips, so that each trip is to be made in 34,560 ÷ 343, or about 100 sec. The travel of the skip is 2000 ft., so that the average rope speed is 2000 ÷ 100 = 20 ft. per sec., or 1200 ft. per min. The maximum rope speed in this case can be taken at 1500 ft. per min.; Mr. Pauly gives 2200 ft., and the drum diameter 7 ft., coiling the rope in several layers. As the maximum rope speed only results in a drum speed of 68 r.p.m., a geared hoist, which is favorable for the electric equipment, can be used to good advantage, as thereby the cost of the motor can be reduced to a minimum. It is also clear that about 20 sec. can be taken for accelerating the load, making a rate of acceleration of about 1¼ ft. per sec. With such a low rate of acceleration, the hoist becomes very efficient, particularly as the loads and drums are light. The effective work done per trip averages here, 7000 × 2000 = 14,000,000 ft.-lb. as the total work in hoisting ore, or, expressed in effective horsepower distributed over the total time of 24 hours, shaft horsepower (14,000,000 × 343) ÷ (24 × 60 × 33,000) = 101 shaft hp. As the nonproductive work was assumed to be half of the productive work, or, ½ × 101 = 50½ shaft hp., the total work to be done during each day is 151½, or, say, 152 shaft hp. The effective work during a single trip when hoisting ore is (14,000,000 × 60) ÷ (100 × 33,000) = 254 effective horsepower.

As the nonproductive work was assumed to be half that of the productive work, and was to be performed in one-half the time required for productive hoisting, the effective horsepower of a single trip (unproductive) averages the same as that for the productive trip; that is, 254 effective hp. The ratio of work done per individual trip to the average shaft work is therefore: 254:154, or, 1.67:1. It would be highly desirable if such ideal conditions were possible in practical hoisting. In that case, there would be no difficulty in producing highly economical results with machinery of moderate cost.

The conditions actually existing in deep-mine hoisting are different. Instead of 40% being available for hoisting ore, only 20% is given for that part of the work, and usually the product is greater than 1200 tons per day. The load, instead of being 7000 lb., is from 5 to 10 tons and the acceleration from 5 to 10 ft. per sec., instead of 1¼ ft. per sec., which condition much impairs the efficiency. For this reason a geared hoist is seldom suitable for a deep mine. The nonproductive work is also in the majority of cases much greater than assumed by Mr. Pauly, and so is the ratio of the work done per individual trip to the average shaft work. This ratio is the measure of the regularity of hoisting and the principal factor governing the economy and the efficiency of the hoist and, on that factor, depends the selection of the type of hoist. The condition that 60% of the time is used for hoisting is also seldom found in deep mines. At Butte the conditions are about as follows: Hoisting loads, 5 tons, as against 7000 lb., as given by Mr. Pauly; hoist in motion 20% of time, as against 60% of time as given by Mr. Pauly; work per individual trip divided by average shaft work is 7½; average load of individual trip (nonproductive) divided by average shaft work is 8¾; maximum work (unproductive trip) divided by average shaft work is 30, as against 1.67 deduced from Mr. Pauly's data; acceleration 5 to 10 ft. per sec., as against 1¼ ft. per sec., deduced from the data given by Mr. Pauly.

The hoisting conditions vary so much that it is not possible to lay down any general rules or draw diagrams from which the power consumption or economy or operating cost can be determined, but every case requires careful study and renders different results governing the question, whether it would be more economical to operate the hoist by power directly applied or by power transmitted from a distance.

NO PEAKS IN LOAD AT ANACONDA

To develop the theory of the air engine, and by formulas and figures try to prove its efficiency in hypothetical cases, would be of little use. The fact that the air engine has been successfully operated, and its economy proven in four installations at the mines of the Anaconda Copper Mining Co., at Butte, and that 18 additional installations are now being made by the same company, is of some value as a proof of the efficiency of the air engines for deep-mine hoists. The compressors operating these hoists are driven by electric motors, and the power consumption of these motors is lower than what it would have been if an Ilgner transformer had been used instead of an air compressor as an equalizer of the loads; in addition, the load on the motors is perfectly steady, there being absolutely no peaks. Even the starting of the large compressors has no effect upon the electrical loads, as that is done by air. The advantage of an absolutely steady load on a power system, in which the electric power is transmitted 150 miles, is of considerable advantage.

Different Ways of Driving Hoists

I shall now discuss the different methods of driving hoisting engines in a general way, and analyze a few actual cases of electric hoisting engines as far as can be done with the incomplete data of the hoisting conditions available. The power may be either steam, water power, or, as in the practice in Germany, gas engines, operated by blast-furnace gas. Oil engines have no application in deep-mine hoists. Only steam power can be directly applied to a hoisting engine. All the other powers have to be indirectly applied by transmission from a distance. There are only two methods of transmission practicable in the case of a hoist. One is electric current (electricity as an independent power does not exist), the other is air under pressure.

Where the power is derived from gas engines operated with blast-furnace gas, electricity is the most common means of transmitting the power, and it is for this purpose that the electric hoist was originally designed, and it is in this connection that it can be used to greatest advantage. This mode of transmission of power is extensively used in mining in the province of Westphalia, in Germany. In that country it is the practice at many coal mines to convert a quarter of the total output into coke, which coke is used in blast furnaces. The gases from the blast furnaces furnish power that is transmitted electrically. The heat from the coke ovens at the mines furnishes steam power for the mines for hoisting and pumping. The mines that make no coke use electric power for these purposes. The electric hoist is thus by no means in general use in Germany, as is often supposed or inferred.

Storage Battery Abandoned in Europe

The electric current, when used for transmission of power, acts in many respects as an inelastic fluid. The actions and reactions between a generator and a motor operated thereby are the same as if they were connected by an inflexible shaft, so that any fluctuations in the power delivered by the motor produce a simultaneous and equal fluctuation in the power generated by the generator. Electricity cannot be stored. It can, however, be converted into chemical energy, which afterward can be reconverted into electrical energy. That is the purpose of the electric accumulator or storage battery. The conversion of electric into chemical, and back again into electric energy, cannot, of course, be accomplished without loss. This loss is from 15 to 30% of the energy stored[2], depending on the rate at which the battery is unloaded.

A storage battery requires good attention and great care, and is a delicate piece of apparatus. The first German electric hoists for deep mining were fitted with storage batteries; they are no longer in use, having been abandoned. The only hoist in Europe of any considerable size that was attached to a storage battery in the year 1907 was one at the Grangesbergs iron mines, in Sweden. I was told that this battery was expensive and hard to keep up, and the company was considering replacing it with an Ilgner transformer.

The fact that in Europe, storage batteries are much used for equalizing street-car loads, but have been abandoned for hoisting engines, indicates that there are grave practical objections to them where they have to handle the enormous fluctuations in a hoisting-engine load.

Ilgner Transformer Used at European Mines

The Ilgner flywheel transformer has in Europe superseded the storage battery as an equalizer of loads on hoisting engines. This device is well known. The electric hoists in the German coal mines, all of which are now fitted with this device, work under favorable conditions. Not only is the hoisting regular, the conditions being much like those given in Mr. Pauly's paper, but the hoisting is always in static balance and from one level. These hoists are not equipped with drums, but with the Koepe sheave and tail ropes. The tail ropes are sometimes made considerably heavier than the main rope, so as to reduce the power necessary for acceleration. Under such conditions the Ilgner transformer and its flywheel are not called upon to store much energy in order that the power delivered to it be kept constant, and even under favorable conditions, the flywheel must be heavy. Thus, the transformer wheels at the Matthias Stinnes mines, near Essen, are about 13½ ft. in diameter, weigh 40 tons each, and are run at a speed of 370 r.p.m. There are four wheels, serving four hoists of a size that in this country would not be regarded as large.

The energy that can be delivered by these flywheels depends on the drop of their speed when delivering energy. In the modern German hoists this drop is 15%. As much as 25% has been used, but it was stated to me that, by experience, they have been compelled to come down to 15%, so that less than 30% of the energy of the wheel can be converted into work.

The flywheels of the Ilgner transformers run at a rim speed of 16,000 to 21,000 ft. per min. As the factor of safety against bursting is not large, they must be practically perfect and free from internal strains. The bearings carrying the flywheel are heavily loaded and the surface speed is high, so that they have to be run on a film of oil which is pressed into the bearings by force pumps. The German practice is to install these pumps in duplicate so as to guard against the failure of lubrication. Furthermore, the bearings are always water jacketed.

It is evident from this that the Ilgner transformer is a fine piece of mechanism that requires considerable care and attention. The power to run this apparatus without load is considerable. It was stated to me when visiting the Matthias Stinnes hoisting plant, referred to above, that from 140 to 150 kw. was required to run the Ilgner transformer without load. It is therefore clear that during the periods when the hoist is at rest the Ilgner apparatus requires considerable power which, when the hoist is in motion only 20% of the time, greatly reduces the efficiency. It is also clear that with any system in which a revolving mass is used for the purpose of storing energy, no energy can be stored when the hoist stands still during long periods These periods may have a duration of from ten minutes to several hours. If, during this time, energy could be stored for use during active periods, then the power-generating plant can be much reduced in size and cost and the hoist can be operated even if the power generating plant is shut down for a short time.

Advantages of Compressed-air Hoists

Compressed air is the only practical transmitting medium whereby that can be accomplished. The compressed air can be stored in any quantity. The air-receiver system needed for this purpose is comparatively inexpensive and involves no waste of energy. Electric batteries are subject to local action, which dissipates some of the stored energy and gradually destroys the battery. Air can be kept in storage indefinitely and the air-storage plant does not deteriorate by use. In most cases air receivers can be cut in rock at a cost of $10 per cubic fathom and perfect equalization of the hoisting load can be accomplished by the air system and, if required, the reheating can be carried far enough so as to absolutely eliminate the loss occasioned by the heating of the air during compression and the subsequent cooling in the pipe lines and receivers. There are means whereby this can be done without using excessive air temperatures. It is, however, not necessary to go into any extraordinary refinements in design of the air motor in order that it may show up favorably when compared with an electric hoist. It is, however, necessary that means be employed to use the air expansively and to provide means to neutralize the effect of the clearance spaces.

The plant built by the Nordberg Manufacturing Co. and which I designed for the Anaconda Copper Mining Co. embodies all the features essential to the economical success of an air motor and the plant has proven to be economical and reliable in operation and in every way successful.

---

[2] Hütte, 20th edition, Vol. 2, p. 830.

Compressed air is needed in every mine for operating the rock drills. It is therefore only necessary to extend the compressed-air system in order to also operate the hoists from the same source of power that operates the drills. The drills are operated all the time and therefore increase the load factor of the system. The necessary centralization of the compressors and the installation of high-grade large units reduce the running expenses both in regard to power and labor of the whole installation. The Butte plant is being enlarged so as to include 10 of the largest hoists of the Anaconda Copper Co., and 12 additional hoists of medium size that are now being built.

As mentioned above, the storage battery is not used for operating hoists except in a few mining camps and, while it was the first device used to equalize the loads of electric hoists, it has been abandoned in all but a few instances. It is safe to predict that any system for operating electric hoists which includes a storage battery, will not be a success, either commercially or mechanically.

(To be concluded)

Engineering Frauds

A number of the commoner frauds perpetrated on buyers of machinery, which is to fill certain specifications, are discussed in the *Electrical Review*, Apr. 5, 1912. Test bars, which are to be broken off the main castings for tensile-strength tests, etc., are previously made and cast into the main piece. Or, in case the test bar is a true one, it may be given a heat treatment or preliminary stretching before machining to size.

Porosity in iron castings which are to be subjected to hydraulic tests can be concealed by rusting up the bad places with sal ammoniac, or a cored place is filled with copper-sulphate solution, and later, hydraulic pressure is applied, forcing the soft copper into the pores. Light peening with a hand hammer will cure mild cases of porosity. In bronze castings soft solder may be applied, or boiled oil may be forced into the pores under hydraulic pressure, where it soon oxidizes. Still more effective is to put a blank flange, or a small concealed valve on the pipe leading from the pump to the casting. A pressure gage communicating with the interior of the casting gets around this, but it is possible in boiler tests that the gauge may be directly connected with the pump inlet, and neither connected with the interior of the boiler. A boiler full of water conceals this.

Apparent steam consumption may often be helped out with a little superheat, or by a little preliminary adjustment of the vacuum gauge. An obvious method is to run water out of the measuring tank during the test, or ammeter readings may be falsified, by tampering with the shunt, or using leads of lower resistance than those with which it was calibrated.

In testing dynamos or motors, aside from thermometers which may read a few degrees high or low, it should be noted whether the thermometer put up to test the temperature of the surrounding air is hung, "for convenience," near a steam pipe.

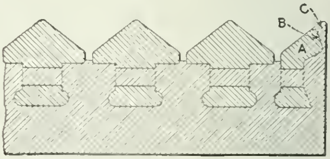
In conducting air-compressor tests, the method usually adopted is to measure the time taken to pump a reservoir of known capacity up to a given pressure, or by requiring the compressor to maintain a given pressure when the air is escaping through a sharp-edged orifice of known size. In both cases the temperature of the air in the reservoir should be noted, and this cannot be measured by holding a thermometer in the issuing jet, when the orifice method of test is used. When the reservoir test is being conducted, the usual method of fraud consists in having a quantity of water in the reservoir, thus reducing its capacity and shortening the time required to raise the air it contains to the specified pressure. The presence of water cannot easily be detected if the drain cock is fitted with an internal pipe terminating at a point above the bottom of the reservoir, so that air is always drawn from the cock when it is opened. Another method, largely practised when there are duplicate reservoirs, as in battleships, consists of slightly opening a junction valve for a few minutes and allowing air from another reservoir to enter the one to which the compressor is connected. By this means the compressor is helped to the desired extent, and if the trick is carried out unobserved, it is difficult of detection, as the gauge readings are not fine enough to make the transaction readily visible. When the output of a compressor is being gauged by the pressure maintained behind a sharp edged orifice, it is the inspector's duty not merely to measure the orifice, but to satisfy himself that there is no obstruction, temporary or otherwise, to the free flow of air to the orifice.

Talc Production in 1911

The talc output of the United States in 1911 declined slightly, according to J. S. Diller of the U. S. Geological Survey, the production amounting to 143,551 short tons valued at $1,646,018. The 1910 production was about 7000 tons greater. Over 40% of the total output comes from the State of New York; the remainder is derived almost entirely from the Appalachian States, though there are deposits in nearly every state of the Union. The imports of talc last year declined nearly 10 per cent. and amounted to only 7550 tons, most of which came from France and Italy.

The Canda Crusher Plate

A patent has been issued to F. M. Canda, vice-president of the Chrome Steel Works, for a particular design of bar, (U. S. pat. 1,015,871, Jan. 30, 1912) by which half corrugations may be made on the edge of the "Adamantine" tempered steel jaw plates made by this company. The crusher plates as previously patented by Mr. Canda, consisted of a plurality of hard ribs, usually of high-carbon steel and usually angle faced, and a cast metal base surrounding and interlocking with the lower portion of the ribs. Mr. Canda states that it is not practicable to produce edged ribs by cutting intermediate ribs down the middle; nor would there be sufficient body of the base metal outside of such edged ribs. He, therefore, devised for the edged ribs an angle bar of peculiar form, which is susceptible of being rolled readily and when in place in its plate has its base portion set at a considerable distance from the edge of the plate, while its face corresponds essentially to one side of an intermediate rib. When the plate is placed in the crusher, its edge is close against a cheek plate of the crusher, which prevents the rock from acting materially on the extension *C*, so that the extension though of soft metal is subject to relatively little wear. It will be noted that the edge surface *B* of bar *A* is beveled backward, so that the base metal outside of this edge helps to hold the bar in place.



Eng. & Min. Journal

Canda Crusher Plate

Plates of this type are made by forging and rolling down the special-shaped chrome-steel bars in mill lengths, which are then sawed to the proper length to make the different size jaw plates. These bars are placed face downward in a mold, and a soft low-carbon steel is cast around the base of the bars, interlocking and cast welding them into an integral plate. This method enables the bars to be hardened without risk of cracking the entire plate. The company states that such plates are giving excellent satisfaction by reason of longer service at a number of important mines

Dredges on Upper American River

By Lewis H. Eddy

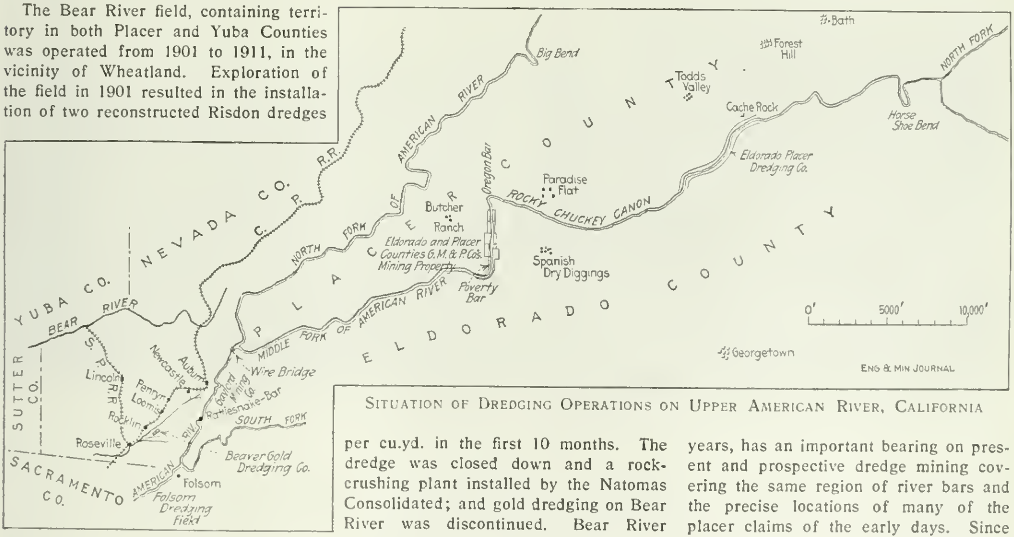
In 1911 two bucket-elevator dredges were operated on the American River in Placer and Eldorado Counties, California, and a third is to start this year. The gravels on the middle fork were worked by crude methods from 1848 to 1860 when operations were abandoned, facilities for deep digging being lacking. Operations were resumed in August, 1910, when the Cache Rock dredge was installed.

Two California-type bucket-elevator gold dredges are operating in the Placer-Eldorado Counties field of the American River district in California. One is working the bars and hydraulic tailings on both sides of the middle fork of American River in the vicinity of Cache Rock, about two miles south from Forest Hill; the other is within Placer County, about five miles west of the main stream of American River, and three miles south from Loomis. A reconstructed bucket-elevator dredge is in course of installation on the main stream of American River about eight miles south from Auburn, to work placer ground on both sides of the river. A new bucket-elevator dredge has been designed for installation to operate on both sides of the middle fork near Butcher Ranch.

Dredging on Bear River Abandoned

The Bear River field, containing territory in both Placer and Yuba Counties was operated from 1901 to 1911, in the vicinity of Wheatland. Exploration of the field in 1901 resulted in the installation of two reconstructed Risdon dredges from machinery shipped from Breckinridge, Colo. They were of 3½-cu.ft. bucket capacity and steam driven, and were found to be too light for the heavy ground. The initial installations were by the Bear River Exploration Co., whose holdings were later taken over by the Bear River Mining Co., which installed two new Risdon dredges especially designed, also equipped with 3½-cu.ft. buckets; and although one was changed to 5-cu.ft. buckets the result was not wholly satisfactory.

The company consolidated with the Oroville Dredging Co., Ltd., the two dredges were closed down, and in 1907 a 7-cu.ft. close-connected bucket dredge was built by the Yuba Construction Co. and installed in October of that year. The dredge handled about 64,500 cu.yd. of gravel per month, digging an average depth of 33.2 ft. at a cost of 5.41c. per cu.yd. in the first 10 months. The dredge was closed down and a rock-crushing plant installed by the Natomas Consolidated; and gold dredging on Bear River was discontinued. Bear River forms a part of the northern boundary of Placer County and the southern line of Nevada County. It separates the northwest corner of Placer from a portion of Yuba County, and flows into the Feather River about 15 miles south of Marysville.



Situation of Dredging Operations on Upper American River, California

The American River, including the middle fork which has its source in the Sierra west of Lake Tahoe in both Placer and Eldorado Counties and a portion of the main stream, flowing southwesterly forms the geographical line of separation and the line of definite topographical demarcation between Placer County on the north and Eldorado County on the south. The north fork has its source northwest of Lake Tahoe and flows southwesterly through the northern and central portions of Placer County to its confluence with the middle fork about one mile northwest from Auburn. These confluent streams form the main stream of American River which flows southwesterly between Placer and Eldorado; thence through the northwest corner of Sacramento County and empties into Sacramento River at the city of Sacramento. The south fork rises in Eldorado County south of Lake Tahoe and flows southwesterly through the approximate center of Eldorado and empties into the main stream of the American at the junction of Eldorado, Placer and Sacramento Counties.

Early Workings on Middle Fork

The interesting history of placer digging on the middle fork of American River, although embracing only about 12 years, has an important bearing on present and prospective dredge mining covering the same region of river bars and the precise locations of many of the placer claims of the early days. Since the abandonment of placer mining in about 1860 the upper-river claims were not worked until the installation of the Cache Rock dredge by the Eldorado Placer Dredging Co. in August, 1910.

The first exploration of the middle fork was made in June, 1848 by Mormon miners who had left the diggings on the south fork to search for hill deposits. Their initial work was at Spanish Dry Diggings in Eldorado County 12 miles north in a direct line from Sutter's mill, and about one mile east of the river where it flows in an almost direct south course from Oregon bar to Poverty bar. Thence they and others who followed them made their way to the stream bed, located and worked the placers and made their camps on both sides of the stream.

From 1849 to 1860 many thousands of miners earned wages or wealth working the placers with the crude methods of the time. The chief method was to strip off with shovel and wheelbarrow 15 or 20 ft. of the overburden that would pay $2 or $3 per day to the man, and then go to the bedrock for the richer material. In 1859 there was a string of 12-ft. flumes two miles long extending below Poverty bar; while the rocker and the long tom were also employed. That the gravel was exceedingly rich is evidenced by the record of $10,000,000 gold production from this stream in the first three years of operations. Following the abandonment of the placers the miners turned their attention to the seam diggings and hydraulic mines on both sides of the river along the hillsides.

The seasons for working the river bars were short, usually extending from about July to the middle of October. Much of the fluming operation was abandoned as early as 1855 owing to the recurrent destruction of the flumes by the winter floods. The miners gradually extended their operations to the north of the river adopting the drift and hydraulic methods. A considerable proportion of the mining in Placer County is still done by those methods, although quartz ledge mining is an important branch of the mining industry.

Deep mining on the Mother lode does not extend north beyond the summit of the Georgetown divide in Eldorado County, between the south and the middle forks of American River. The Forest Hill divide, formed by the region of mountains lying between the middle and the north forks in Placer County, contains a greater area of drift and hydraulic mines than quartz ledges. Both these divides are feeders to the middle fork of the American. There is geological evidence that the Mother lode extends in its north strike across and under the stream along the course of the placer claims from Poverty bar to Oregon bar; that the Mariposa slate underlies the auriferous gravels of the river, and is probably the actual bedrock.

Men who mined in the river bed 50 years ago declare that the bars were never bottomed by the operations of that period. So the long abandonment of placer digging was not, in the opinion of men competent to say, the result of working out, but of a lack of methods to go deep enough. The problem of deep digging in the river bars of torrential streams should be satisfactorily solved by the adaptation of the modern dredge to this character of work. The fact that gold dredging in California was chiefly confined to the flood plains and bars removed from the live-stream channels is no proof that torrential streams can not be economically and profitably dredged.

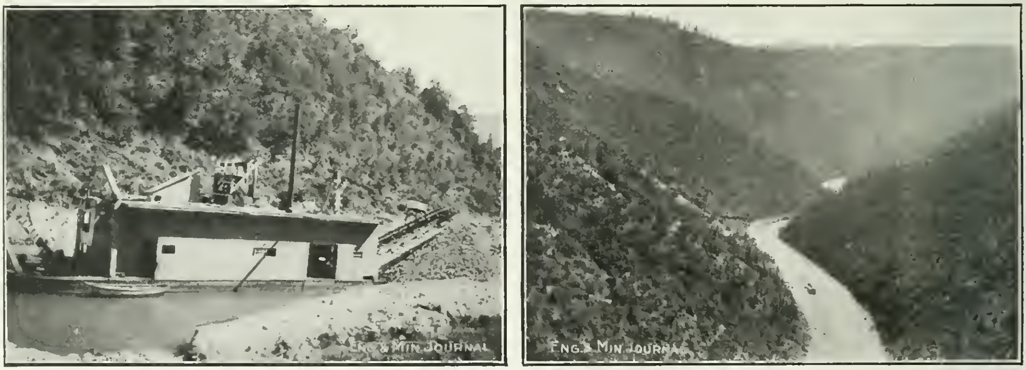
RISDON DREDGE AT CACHE ROCK

The adaptability of the modified and improved New Zealand type of stream dredge has been demonstrated by the almost continuous operation of the Risdon dredge at Cache Rock for the last year and a half. This dredge[1] is a 3½-cu.ft. open-connected bucket-elevator type digging about 30 to 35 ft. below the water line, with a capacity of 45,000 cu.yd. per month. It is electrically driven, the power transmission line extending from the power station at Horseshoe bend and along the southern bank of the river to the southerly end of the placer claims owned by the dredge company. The claims cover the stream and bars for a length of about eight miles and a width of 500 to 800 ft., in unsurveyed lands, of T.13 N., R.10 E., extending southwesterly from the vicinity of Cache Rock to the vicinity of Fords bar.

Prior to the installation of this dredge a suction dredge was operated on these bars for about one year in 1908-1909, by the National Gold Dredging Co. It was not successful, and the boat was wrecked by flood. The Eldorado Placer Dredging Company was then organized and installed the Risdon dredge. The head office of the company is at Los Angeles; W. J. Variel, manager; C. T. Schooler, Forest Hill, superintendent. The dredge is being operated in 1912 by the Cache Rock Dredging and Mining Co. of Oakland, under lease which includes the placer claims owned by the holding company. The Holmes system of gold-saving tables has been installed to displace the canvas plant. A. W. Copps of Alameda is president; C. T. Schooler, superintendent; George L. Holmes of San Francisco, consulting engineer.

The stream has a general southwesterly course from Horseshoe bend to the head of Rocky Chuckey cañon at Slug gulch; thence westerly and northwesterly to Oregon bar where it turns almost due south continuing for a distance of about two miles to Poverty bar situated about two miles southeast of Butcher Ranch. From that point the course of the stream is again southwesterly to its confluence with the north fork; and is covered with placer claims for a greater part of its length of six sectional miles west and two sectional miles south. Other portions of the river bed and bars are known to contain gold but are not workable by present-day methods. Gold has been produced from blasting the rocks in Rocky Chuckey cañon, which extends from Slug gulch to Todds valley ravine, in times of extreme low water; and the gravel and seam diggings on either side of the cañon have been profitably worked for many years.

The middle fork is torrential and generally tortuous from its source to the north fork. It has an average width of 75 ft. at low water and 150 ft. at high water. The river elevation at Cache



CACHE ROCK DREDGE OPERATING ON THE MIDDLE FORK OF THE AMERICAN RIVER, CALIFORNIA

---

[1] Eng. and Min. Journ., Sept. 30, 1911, p. 636.

Rock is 1100 ft.; at Poverty bar, 650 ft. The hill elevation at Cache Rock is 3300 ft.; at Butcher Ranch, 1800 ft. The hills forming the cañon pitch from 75 to 65°. The inclined tram at Cache Rock, which is used for the transportation of supplies and materials from the wagon road to the river is about one mile in length, at an incline of 65°.

Drift mining in the vicinity of Forest Hill and hydraulic mining between Oregon bar and Poverty bar followed the decline in placer diggings on the river. These mines were worked as late as 1890, and some of the richer mines are still in operation and are reported as being highly productive. The hydraulic and ground sluice mining of Red Hill and adjacent territory were profitable despite the short working seasons and small water supply. The ore was a soft vein-filling characteristic of the Mother lode; the gold associated with quartz was generally of a coarse and nugget character; that of the soft rock was fine and light, and little of it is believed to have been recovered.

Gravel Bed at Poverty Bar

High Water on Middle Fork of American River

Long Wagon Haul Necessary

The initial cost of construction of a dredge on this stream is increased by the necessary wagon haul from Auburn, the nearest railway station. The distance to Cache Rock is 22 miles; the rise in elevation for a distance of 20 miles from Auburn is about 1900 ft. Added to this is the cost of transportation by inclined tram for a distance of about 5000 ft. The cost of construction at Poverty Bar may be lessened by the difference in distance of wagon haul from Auburn to Butcher Ranch, but increased by the further wagon haul from that point to the river, a distance of two miles, and a drop in elevation of 1150 ft. Notwithstanding the added cost of construction and the necessity for short periods of idleness during the season of winter floods the operation of the dredge at Cache Rock is said to be profitable, and has induced another undertaking at Butcher Ranch. The per yard value of recovery is not made public, but based on the operation of the early placer mining by crude methods the gold content is believed to be greater than in the dredging fields of the flood plains and the shallow streams.

Poverty Bar to be Dredged

The Eldorado & Placer Counties Gold Mining & Power Co. has recently been organized with the purpose of installing a dredge at Poverty bar, and a hydraulic elevator on adjacent bars; and to work the hydraulic and seam mines on the west side of the river. A tentative design has been made for an electrically driven dredge to dig 35 ft. below the water line, working on a headline; and in general construction to follow the New Zealand type employed in river work.

One of the chief features of the design is the modification of the California type of inland dredges in hull construction. The bows of inland-type dredges are cut in so that the buckets may operate in the corners of the gravel beds as the dredge extends its work in an inclosed pond. In stream work the bows and the stern should be cut under so as to withstand the force of the river current. The design provides for a hull 87 ft. 6 in. long, 35 ft. wide, 7 ft. deep, and will require about 125,000 ft. of Oregon pine. The main gantry will be similar to that on the Lagrange dredge operated by the Hammon interests in Stanislaus County.

The digging ladder will be equipped with 85 close-connected cast carbon-steel buckets of 3½-cu.ft. capacity; the hoods of cast steel, the lips and bushings of manganese steel; 24 in. pitch, and weight 2800 lb. each. The form of the digging ladder will be of two 24-in. Bethlehem special I-beams, cross-beamed and trussed. The dumping hopper will be of steel, similar to the Lagrange, and extended down to and resting on the deck. The save-all grizzly will be built into the structure. The revolving screen and nozzle washers, and the Holmes type gold-saving tables will be used; the total area of gold-saving tables will be about 620 square feet.

The screen and tables will be under one roof; the pilot house will be dropped so that the winchman may stand on the floor of the boat and look out over the roof; thus shortening all connections to the winches, and making the boat structure as light as possible consistent with strength. The company purposes installing an electric power plant, taking the water from Lorn Lake ditch. The dredge design is by George L. Holmes of San Francisco, consulting engineer of the company of which the following are the directors: A. Tregidgo (president), Charles D. Clarke, Joseph Chettle of San Francisco; Fred Emerson Brooks of New York, Fred Searls of Nevada City.

The present gold dredging west of the main stream of American River in the vicinity of Loomis is on a tract of 80 acres in Secret ravine, a portion of which had been mined by drifting. The dredge was installed in June, 1911, by the Beaver Gold Dredging Company,[2] E. K. Hun, president; M. J. Martin of Loomis, superintendent. About seven acres have been turned over, the gravel paying 12 to 15c. per cu.yd. The dredge is a 4-cu.ft. bucket-elevator, built by the Risdon Iron Works. The land is flat and low; the elevation being about 100 ft. The dredge is worked on cable anchor, owing to the condition of the ground. The tailings are stacked with a belt conveyor in irregular piles. Whether the soil was capable of producing agriculture with proper drainage and cultivation had never been fully demonstrated, and the fact that it is not being replaced in its former or more favorable condition for agriculture is due to the terms by which it was acquired for dredging purposes.

---

[2] Eng. and Min. Journ., Sept. 30, 1911, p. 640.

The dredge for operation on the river east of Loomis and eight miles south of Auburn was to be installed about February or March, 1912. The dredge was reconstructed from the machinery of Eldorado No. 1 dredge, designed by the Union Iron Works Co., and put in commission at Fair Oaks bridge in 1905 by the Eldorado Gold Dredging Co. The company's holdings on the south side of American river in Sacramento County, 554 acres, were taken over by the Natomas Consolidated in 1909, and the dredge was shut down in May of that year. In the fall of 1911 it was dismantled. The present installation is by the Gaylord Mining Co., C. McCarthy, San Francisco, president; E. C. Gaylord, superintendent.

The Rebuilt Gaylord Dredge

The dredge was redesigned by the Union Iron Works. The digging ladder will be equipped with 6-cu.ft. buckets, to dig 37 ft. below the water line. The conveyor will stack 41 ft. above water line. The hull construction will be especially strong to take care of the large gravel. The machinery will be electrically driven, power to be furnished by the Great Western Power Co., transmission being by pole line from Loomis about six miles. The dredge company holds about 380 acres of placer claims covering both banks of the river at Rattlesnake bar. This ground was formerly worked by hydraulic methods, and the vicinity was known as the Whisky bar diggings. The bar is elevated above high-water level. The tailings can be so disposed as to meet the requirements of the Caminetti act.

There are other areas of placer grounds, formerly worked by drift and hydraulic methods that can be economically worked with the modern dredge, which is adaptable to various forms of digging. Construction cost requiring initial outlay of a considerable sum is an obstacle not easily overcome by the small owner of placer claims, and the high prices demanded for such claims have prevented the investment of capital by individuals and companies. In the stream digging and much of the inland drift grounds the small dredge equipped with buckets of 3½ to 4½-cu.ft. capacity are not only cheaper in initial cost, but more economical and can be operated at greater profit than the larger dredges. Experiments in the operation of small portable dredges for inland and dry digging are being made in other counties; and there are indications of complete success that will solve the problem of profitably working small holdings that can not be economically operated with the ordinary type of dredge.

Gold in Michigan

It may not be generally known that Michigan at various times in its history has experienced the excitement attendant upon gold booms. The following information, obtained from the advance sheets of "Mineral Resources of Michigan" soon to be published by the Michigan Geological Survey, should be of interest as indicating the extent of the gold occurrences, even though they have not proved of much commercial importance.

While gold was known to occur in the rocks of Michigan as early as 1864, the first discovery that led to any serious work was made by Julius Ropes, of Ishpeming, in 1880. As a result of this discovery the Ropes mine, the first mine in the State of Michigan, was opened about three miles northeast of Ishpeming.

The ore formation had a width of from 30 to 50 ft. and was made up of talcose slates, in which the ore occurred in lenses generally running transversely across the formation. These lenses were composed of narrow bands of quartz and slate and the minerals associated with the gold were galena, iron pyrites, gray and yellow copper ores. The average grade of the ore was between \$2 and \$3 per ton. In sinking a vertical shaft a better and stronger vein was encountered at a depth of 850 ft., the average grade being \$6 per ton.

Several Conditions Favored Cheap Mining

The mine had solid walls so that no timbering was required; the mine was particularly free from water; water could be obtained cheaply from the Carp River, about a mile distant. Machine drills were used in the mine and the overhand-stoping method was employed.

The ore was milled at the mine, the system including crushing by stamps, amalgamation in the mortars and on plates and concentration on Frue vanners. What concentrates were saved were shipped to Aurora, Ill. for treatment. The sticky nature of the ore made it difficult to stamp, so that only 65 tons could be treated per day. Notwithstanding this small capacity, a ton of rock is reported to have been milled for \$1.85 per ton. From the small territory worked, about 550 ft. on the trend of the lode, the gross production of gold and silver was \$605,057. This embraces the product from the commencement up to Jan. 1, 1896.

The Ropes mine was unfortunate in that it lacked sufficient funds to carry on mining work as it should have been done in order to secure the best results. Much time and money were expended in becoming familiar with the ore and when the best methods were learned, the money had been spent. The shareholders grew discouraged after paying a few assessments and in 1897 the work was abandoned.

Another venture was that of the Michigan mine, situated 2½ miles west of the Ropes mine. It was at its busiest in 1890 when there was a lively trading in its shares. The veins were in diorite, differing in this respect from the Ropes, and the trend was nearly east and west, the dip being nearly vertical. The gold where found was free milling, and little or no silver or any other mineral was present in the rock aside from the gold. Some of the ore was of specimen quality and it is believed that "high-grading" resulted in much loss.

The rock stamped easily and with ordinary Cornish stamps a large amount could be treated daily. In January, February and March, 1890, the mine produced \$12,675 in bullion. The total yield was valued at \$17,699. Two exploratory shafts sunk to a depth of 80 ft. showed that the grade of ore diminished to such an extent that work was abandoned. A little work was done in 1895 but nothing of value was accomplished.

Good specimens were found on the property of the Gold Lake Co. immediately west of the Michigan company and of the Superior Gold Mining Co. immediately east of the Michigan property; but the ore pinched out at comparatively shallow depths and little work was done. Other properties were worked more or less at the time the excitement was at its height, but in 1896 all work had ceased.

A promising territory at one time is known as the Dead River district, which begins in the Dead River Valley, starting about 8 miles north of Ishpeming and extending northward to Lake Superior. Following a discovery of gold in this district in June, 1890, a company was formed under the title of the Fire Center Mining Co. In 1892, a trial lot of rock of 254 tons was treated in the Ropes mill and \$2063 in gold or about \$8.12 per ton was produced. The gold was 697 fine and the percentage of saving in the mill, including concentrates, was 76.7. The Fire Center company ordered a Crawford mill which was set up but proved an utter failure. Two 100-ft. shafts were sunk but at this depth, as in the previous instances, the gold content had diminished to such an extent that work was abandoned.

The gross value of bullion produced from Michigan gold mines is given as \$625,329. Placer gold from fluvio-glacial deposits of the state were reported from a number of places, some of them being well authenticated. The source of the gold is doubtless in the gold-quartz veins which are known to occur widely distributed in the Archean formation of the Lake Superior region. No deposits of workable extent have so far been found.

NEW PUBLICATIONS

AMERICAN YEAR BOOK, 1911. Edited by Francis G. Wickware. 5¼x8, pp. 863. D. Appleton & Co., New York.

THE TEACHING OF PHYSICS FOR PURPOSES OF GENERAL EDUCATION. By C. Riborg Mann. 5x7½, pp. 304. $1.25. MacMillan Co., New York.

DIE BINAEREN METALLEGIERUNGEN. Teil II. By K. Bornemann. 7½x11, pp. 55, 13 plates; paper, 9.60 marks. Wilhelm Knapp, Halle, a. S., Germany.

REPORT OF THE DEPARTMENT OF MINES OF NOVA SCOTIA, 1911. Pp. 298, illus. Ernest H. Armstrong, Commissioner of Public Works and Mines, Halifax, N. S.

UEBER DIE BEDEUTING DER MIKROSKOPIE FUR DIE LAGERSTAETTENLEHRE. By R. Beck. 6¼x9½, pp. 16, paper; 70 pfennig. Craz & Gerlach, Freiberg, Germany.

NEW ZEALAND OFFICIAL YEAR BOOK, 1911. By M. Fraser, Government Statistician. 5¼x8¼, pp. 1005, cloth. John Mackay, Government Printer, Wellington, New Zealand.

REPORT OF THE COMMISSION APPOINTED TO INVESTIGATE TURTLE MOUNTAIN, FRANK, ALBERTA, 1911. Pp. 84, illus. Memoir No. 27, Canada Dept. of Mines, Ottawa, Canada.

DER "MABUKI"-PROZESS. Die Japanische Gewinnungsmethode des metallischen kupfers aus kupferstein. By Yoichi Okada. 6¼x9½, pp. 21, illus.; 50 pfennig. Craz & Gerlach, Freiberg, Germany.

L'INDUSTRIE MINIERE ET METALLURGIQUE EN ALSACE 40 ANS APRES L'ANNEXION. By Eugène Ackermann. 5½x8, pp. 143, paper; 2 francs. Leon Schmitt, Rixheim, Alsace, France.

REPORT OF THE BUREAU OF MINES, MINING AND MINE INSPECTION OF THE STATE OF MISSOURI FOR THE YEAR ENDING DEC. 31, 1910. Pp. 184. George Bartholomaeus, Sec'y, Jefferson City, Mo.

LE FONDAZIONI DELLE OPERE TERRESTRI E IDRAULICHE E NATIZIE SUI SISTEME PIU IN USO IN ITALIA. By Raffaele Ingria. 3¾x5¾, pp. 674, illus.; cloth, 7.50 lira. Ulrico Hoepli, Milan, Italy.

TRAITE PRATIQUE DE FONDERIE. Fonte — Fonte Malléable — Acier — Cuivre et Alliages. By A. Lelong and E. Mairy. Volumes I and II. 7x10½, pp. 659 and 512, respectively; illus. Ch. Béranger, Paris, France.

DIE GOLDERZLAGERSTAETTEN UND DER GOLDBERGBAU DER RUDAER ZWOELF-APOSTEL-GEWERKSCHAFT ZU BRAD IN SIEBENBUERGEN. 7¾x11, pp. 120, illus. Max Krahmann, Berlin, Germany.

REPORT OF THE DEPARTMENT OF MINES OF PENNSYLVANIA, 1910. Part I, Anthracite—Part II, Bituminous. Pp. 607 and 983, respectively. James E. Roderick, Chief of Department of Mines, Harrisburg, Penn.

STEAMING TESTS OF COALS AND RELATED INVESTIGATIONS, SEPT. 1, 1904, TO DEC. 31, 1908. By L. P. Breckenridge, Henry Kreisinger and Walter T. Ray. Pp. 380, illus. Bull. 23, U. S. Bureau of Mines, Washington, D. C.

THE GEOLOGY OF THE GREYMOUTH SUBDIVISION, NORTH WESTLAND, NEW ZEALAND. By Percy G. Morgan. 8½x11, 159 pp., illus.; paper. Bulletin No. 13 (New Series), Department of Mines, Geological Survey Branch, Wellington, New Zealand.

REINFORCED CONCRETE BUILDINGS. A Treatise on the History, Patents, Design and Erection of the Principal Parts Entering into a Modern Reinforced Concrete Building. By Ernest L. Ransome and Alexis Saurbrey. 6x9, pp. 235, illus.; $2.50. McGraw-Hill Book Co., New York.

THE STRENGTH OF REINFORCED CONCRETE BEAMS: RESULTS OF TESTS OF 333 BEAMS. By Richard L. Humphrey and Louis H. Losse. 7x10, pp. 200, illus.; paper. Technologic Papers of the Bureau of Standards, No. 2. Department of Commerce and Labor, Washington, D. C.

OIL FUEL. 5x8. pp. 149, illus. The Texas Co., New York.

This book contains a brief resumé of the various services to which fuel oil has been put: Steamship firing; metallurgical operations; factory use; as adjunct to coal in power stations during peak-load periods. Boiler tests are given under these various conditions, as well as much valuable information on fuel-oil use. In addition there are valuable thermal tables concerning coal, steam, piping, etc.

POOR'S MANUAL OF INDUSTRIALS, 1911. Second Annual Number. 6x8¾, pp. 2260. Poor's Railroad Manual Co., New York.

In this volume the section on railroads has been omitted, so as to allow several hundred new names of industrials to be added to the list. The book is divided into: (I) Light, water and power companies; (II) manufacturing and miscellaneous; (III) mining; (IV) telephone and telegraph. There are 94 pages to the index alone, from which we roughly calculate there must be at least 10,300 titles indexed, truly a monumental work.

ELECTRO-ANALYSIS. Fifth edition, revised. By Edgar F. Smith. 5½x7½, pp. 332, illus., leather. $2.50. P. Blakiston's Son & Co., Philadelphia.

The work of Edgar F. Smith on electro-analysis is so well known that the author's name constitutes almost a review of the book. The volume treats of the electrolytic determination of: Ag, As, Au, Bi, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Pd, Pt, Rh, Sb, Sn, Te, Tl, U, and Zn, the halogens, and nitric acid. We believe that Dr. Smith's book represents the coming analytic practice, and advise the chemists' getting used to electro-analysis as soon as possible, the present work being a good means to that end.

THE METALLURGY OF IRON AND STEEL. By Bradley Stoughton. 6½x9½, pp. 537, illus.; $3. McGraw-Hill Book Co., 239 West 39th St., New York.

This is the second edition of a book first published three years ago, and already well known to iron metallurgists. It is far from being simply a reprint, however, for nearly the whole book has been rewritten to cover recent improvements, especially in blast-furnace and openhearth steel practice, the duplex-openhearth steel process and electric smelting. The recent progress in metallurgy has been so rapid that this volume appeared necessary. Some minor changes have added to the convenience of arrangement and reference.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, VOL. III, 1910. 6¼x9¼, pp. 407, illus.; $6. Published by the Institute and for sale by D. Van Nostrand Co., New York.

Outside of the various official proceedings of the second semi-annual meeting, reports of committees, etc., this volume contains papers on the following subjects: The evolution of portland cement processes; the study of materials in chemical engineering; on chemical-engineering education; commercial manipulation of refractory elements for incandescent-lamp purposes; manufacture and uses of ozone; changes in industrial chemistry caused by electricity; on the corrosion of iron and steel; protal (a rubber substitute); chemical industries of Canada; underground water for industrial purposes; loss of coal in storage; nitric and mixed acids plant design; the Fitzgibbons boiler; manufacture of hydrated lime; bleaching oils with fuller's earth; and a symposium on sewage disposal.

STRAIGHT LINE ENGINEERING DIAGRAMS. By Manifold and Poole. 4¾x7¼, pp. 96, illus.; $3. Technical Publishing Co., San Francisco, Cal.

The idea of this book is well stated in the introduction. "Field engineers must frequently make rough-and-ready estimates for construction. They have neither time nor information available for careful calculation, yet the expenditure of large sums is based upon the accuracy of their estimates." The volume contains various diagrams, so arranged, that given two factors of a problem, represented graphically, a third is read off merely by placing a straight-edge between the known points. There are 44 of these diagrams, the principal subjects treated being as follows: Bearing power of piles; masonry arches; strength of concrete; wiring; costs of power; flow of water in pipes and canals; size and strength of pipe lines; stadia measurements; shafting; gearing; belting. There is also an appendix giving methods of resuscitation from electric shock, and care of burns.

SECOND SUPPLEMENT TO THE DIRECTORY OF THE IRON AND STEEL WORKS OF THE UNITED STATES. Prepared by the American Iron and Steel Association, James M. Swank, General Manager. $5. Philadelphia.

The elaborate directory prepared by the American Iron & Steel Association is issued at intervals of about four years, and during the intervals, supplements are issued to bring the information up to date. The present issue brings down to the close of 1911 all essential details concerning new iron and steel plants which have been completed or undertaken since the appearance of the "Directory" in 1908; also important changes that have since taken place in the ownership and equipment of plants that had previously been described. It also contains a complete list of the blast furnaces in existence or under construction in the United States at the close of 1911; and a list of the furnaces abandoned since 1908. There is also a new department devoted to the electrical and ferro-alloy plants which are identified with the iron trade or are largely dependent upon it.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Frank H. Probert has left Los Angeles for Salt Lake City to consult with D. C. Jackling, on matters in connection with Ray Central.

N. V. F. Wilson, recently at Irondale, Wash., has been appointed general manager of the Pacific Coast Steel Co. at San Francisco.

C. F. Rand, general manager of the Spanish-American Iron Co., has sailed for Cuba to inspect the mining operations of his company in that country.

Henry Bevan has been appointed general manager of the works of the Western Steel Corporation at Irondale, Wash., by the trustee for the bondholders.

Peter Donaldson, of Glasgow, Scotland, president and managing director of the Dayton Coal & Iron Co., Dayton, Tenn., has been inspecting the company's plant at that place and has returned to Scotland.

C. T. Brodrick is on his way from the Kyshtim mines in the Perm Government, Russia, to Boston, by way of Vladivostok, Yokohama and San Francisco. He expects to return to Russia, by way of London, in July.

John D. Ryan gave a dinner to 117 friends at Sherry's on May 8 in honor of U. H. Broughton, formerly president of the United Metals Selling Co., who is about to remove to England where he will henceforth reside.

Frederick E. Browne has closed his office at Salt Lake City for the summer, and has gone to Hart, in San Bernardino County, Calif., for the California Big Chief Mining Co. He intends to construct a stamp mill there for the developed ores of the company.

Henry M. Payne has become associated as mining and metallurgical specialist with the firm of Stephen T. Williams & Staff, at No. 346 Broadway, New York. He will leave New York about the end of May for the Yukon goldfields, expecting to return late in the summer.

John Harland Nelson has been elected professor of applied science of Worcester Polytechnic Institute, Worcester, Mass., to succeed the late Prof. Edward L. Hancock. Prof. Nelson has been at the head of the department of applied science at Case School of Applied Science, Cleveland.

George D. James, consulting engineer, of Salt Lake City, Utah, will leave shortly for an exploration of the regions tributary to the San Juan and Little Colorado rivers in Utah, Colorado and Arizona, with the intention to make connections with the Santa Fé R.R. at some convenient point in the vicinity of Flagstaff, Arizona.

OBITUARY

Howard W. Kemper shot and killed himself at Kingman, Ari., May 2. He had been prominent as a mining engineer in Mohave County for a number of years.

Edward Coleman Freeman died at Lebanon, Penn., May 6, aged 56 years. He was one of the largest owners in the Cornwall iron-ore banks in Pennsylvania, but had taken no active part in the management for some years.

Baron Denzaburo Fujita died at Osaka, Japan, Mar. 30. He was head of the Fujitagumi, one of the larger private companies in Japan. He was best known from his connection with the Kosaka copper mine, and from his activity in public affairs. Under his charge the Kosaka, originally worked as a small silver mine, was developed into an important copper mine, and methods were devised for treating successfully its complex ores.

Victor L. Mason, of Passaic, N. J., was killed by falling with an aëroplane, in which he was a passenger, at Brooklands, England, May 13. He was 42 years old. He was born and educated in Washington, was employed for some years in the War Department. About 1901, he removed to Passaic, when he was connected with a metal-stamping company. In recent years, he became an investor in many mining enterprises. He was vice-president of the Development Comapny of America, President of the Passaic Board of Trade and a director of the Imperial Copper Co., Tombstone Consolidated Mining Co., Poland Mining Co. and Gila Copper Sulphide Co. In New York he was a member of several clubs. He was in England on business.

Societies and Technical Schools

University of Missouri—The annual commencement address of the Missouri School of Mines will be given by James R. Finlay, of New York. Exercises will be held on the morning of May 31. The graduating class numbers 40 men.

College of the City of New York—A lecture, with illustrations, on "The Synthesis of Precious Stones" was given in the Doremus lecture theater of the College on May 17 by Isaac H. Levin, chief engineer and chemist of the International Oxygen Co., at the instance of Prof. Charles Baskerville.

University of Idaho—Apr. 20 to May 3 the upperclass miners spent at Rossland and Trail, B. C., on their annual mining trip. One week was devoted to the geology around Rossland and the other week was spent in visiting the mines and taking notes on the machinery used and also in studying the smelting processes at Trail. Professors R. S. McCaffery, D. C. Livingston, and C. Stewart accompanied the students.

Montana Society of Engineers—The annual meeting was held at Anaconda, April 11-13. Reports of the officers and committees were received and visits made to many points of interest. The following officers were elected: President, Robert A. McArthur; vice-presidents, John H. Klepinger and Reno H. Sales; secretary and librarian, Clinton H. Moore; treasurer and member of the board of managers of the Association of Engineering Societies, Samuel Barker, Jr.; trustee for three years, George A. Packard.

American Institute of Consulting Engineers—The officers of this body for 1912 are: President, Alfred P. Boller; vice-president, Alfred Noble; secretary and treasurer, Eugene W. Stern, No. 103 Park Avenue, New York. The council is as follows: Rudolph Hering, C. O. Mailloux, G. F. Swain, Alfred P. Boller, J. E. Greiner, C. C. Schneider, Alfred Noble, E. C. Shankland and Frank J. Sprague. The chairmen of committees are: On admission, Alfred Noble; on professional practice and ethics, Rudolph Hering; on legislation, Frank J. Sprague; on relations between consulting engineer, manufacturer, contractor and client, C. C. Schneider.

Royal Society of Canada—At the meeting at Toronto, May 14 and 15, a number of papers were read. In the Geological-Biological Section the leading paper was on "The Gold of the Klondike," by J. B. Tyrrell. The position, topographic features and bedrock geology of the Klondike area are first briefly outlined, and then the later dynamic geology of the country is discussed. Three great subdivisions or cycles of erosions are indicated, the first cycle being represented by the Dome Peneplain, the second cycle by the mature topography of the White Channel Period, and the third cycle by the more youthful valleys of the Recent Period. The growth of the valleys of the second and third cycles is considered and it is shown that they began as narrow gorges and subsequently extended their width by lateral stream planation. As incidents of growth pay-streaks are shown to have been formed in the bottoms of the V-shaped valleys, and where such pay-streaks now run beneath extensive flood-plains they represent the positions formerly occupied by the bottoms of old narrow valleys. The recognition of this law of the formation of pay-streaks is important to the placer miner in assisting him to find the gold on his claim, and also to the physiographer in furnishing him with a recognizable feature in the history of the growth of a mature valley. The extent to which gold has been concentrated into the gravels is shown to furnish some clue to the quantity of the precious metal which was contained in the rock from which it was originally derived.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

May 8—A demonstration of the thiogen process was made by Doctor Young, the inventor, at Stanford University on May 3, before representatives of the Department of Justice and the U. S. Bureau of Mines. The postponement and the transfer from the Penn smeltery to the university resulted from the damage done to the experimental plant by recent rains. The construction there was purposely temporary, in order to make corrections as the experiments progressed. The laboratory test demonstrated satisfactorily the theory of the process. The essential difference between the laboratory test and the experimental flue demonstration was, that in the laboratory apparatus the SO_2 and the oil gas were applied direct, while in the experimental flue the smoke containing the sulphur dioxide is taken from McDougal roasters and the hydrocarbon vapor is generated from crude petroleum. The Department of Justice was represented by Ligon Johnson and the Bureau of Mines by Dr. F. G. Cottrell. The smelters were represented by A. E. Wheeler and M. W. Krejei of the Amalgamated; E. N. Engelhardt of the Selby and Balaklala; G. W. Metcalfe of the Mammoth; C. B. Sprague, inventor of the Sprague process installed at the Mammoth; John B. Keating of the Bully Hill; M. E. Ditmar of the Afterthought. The Thiogen Co. was represented by John T. Overbury and H. G. McMahon, managers, and others.

The records of 441 suits against delinquent corporations by the State controller, through the office of the attorney-general, show that the largest amount sued for is $843.75, owed by the Vancouver-Midway Oil Co., a foreign corporation. Most of the delinquencies are less than $60. Evidently the delinquents are mostly small companies. Of the 441 suits, 359 are against domestic corporations and 82 against foreign corporations. One suit has been in the courts for some time and has developed some interesting features which may appear also in the trial of some of the recent suits. The Nevada-California Power Co., for a period of years has refused to pay all the demands of the license and tax collectors of the state and of Inyo County. The refusal was based on alleged unjustness of assessment on transmission lines. The lines cost $1200 for construction and were assessed at $1000 and then raised to $5000. The power company tendered payment of other assessments, but the tenders have been regularly declined. A settlement was reached through the office of the attorney-general and the county attorney, on a basis of payment of $17,823 for the years 1909 and 1910 and the suits were dismissed without costs. The new tax law makes the issue of tax assessment direct between the state and the corporation, so that hereafter similar complications cannot arise between the counties and the corporations. Arbitrary and unjust assessments of corporations by county assessors have greatly discouraged investments, especially in mining and power enterprises.

The Empire mines and the Pennsylvania Mines Syndicate, at Grass Valley, in Nevada County, have announced their purpose of abandoning the system of payment of wages through the company stores. The North Star Mines Co. has so far signified no intention of abandoning the system. The operation of company stores by or with the approval of the large mining companies in California is the exception rather than the rule. The existence of the system in Grass Valley is rather surprising for the reason that the commercial advantages of the town are not limited. The abandonment of the system was not the result of any expressed dissatisfaction. There is probably no district in California where the mine operators and their employees work in greater harmony than in Grass Valley and Nevada City, and this is particularly true of the mines that have operated company stores for many years.

Butte

May 8—The Anaconda company has begun the remodeling of one section of the Washoe concentrator, in which will be introduced a more perfect development of classification, which is expected to accomplish a very much better extraction of copper along with some increase in capacity. The improved system has already been worked out in the Great Falls concentrator and the remodeling of the Washoe will be on the lines determined at Great Falls. It is expected that the alterations to the first section of the Washoe concentrator will be completed early in the fall.

The Timber Butte Milling Co. was incorporated in Butte, May 2, by W. A. Clark, W. A. Clark. Jr., W. D. Mangam, Alexander J. Johnson and J. K. Heslet, with a capitalization of $100,000, divided into 1000 shares. The purpose is the erection of a new zinc concentrator for the treatment of the ore from the Elm Orlu and Poser mines. It has been decided to build the new works on the west side of Timber Butte, two miles south of Butte, as the ore and products can be taken care of entirely by the gravity plan, and a short spur will connect the plant with the Milwaukee railroad. Mr. Clark owns considerable land there, and it is a good site for a zinc smeltery, should Mr. Clark decide to build one. Funds amounting to $49,900 have been subscribed by Mr. Clark and his son toward the erection of the concentrator, and it is thought that the work will be commenced soon.

Fire was discovered in the stope on the 1700-ft. level of the Pennsylvania mine May 6. The morning shift was just going on. A hurried search was made and the timbers in an old manway were found blazing. After about two hours of hard work, the blaze was subdued.

Denver

May 9—The Western press is full of the fact that the zinc output of Colorado for 1911 was worth $5,696,188, a gain of 69% over 1910, and this is coupled with a statement to the effect that electric smelting with furnaces at or near the mines, is rapidly approaching the commercial stage (which is questionable), and that then this state will be exporting spelter instead of concentrates, which may become true providing power can be had at such rates as would render the operation profitable, but at present such is not the case, nor is the process of electric smelting yet developed. Zinc, however, has taken second place in the total output of metals from Colorado in 1911, and uranium and vanadium occupy for the first time a prominent position in the state's production. This came from San Miguel and Montrose Counties. The state commissioner of mines estimates that about 30 tons per day of roscoelite are being treated at the mill of the Primos Chemical Co., at Newmire in San Miguel County. The product is vanadic acid of about 1% metallic vanadium content and the output is figured on a basis of $2.50 per lb., making a total of $547,500 for 1911. During that year 1515 tons of ore were hauled by wagon from the mines in Paradox Valley, Montrose County, to Placerville and from there shipped *via* Galveston to Liverpool. The ore averaged 3.5% vanadium and brought $70 per ton, f.o.b. Placerville.

The Leadville Mines Pumping Co. is receiving much encouragement in its project of draining the mines of East Fryer Hill. Blank contracts have been drawn up whereby it is agreed that certain royalties will be paid the company as compensation for unwatering the mines, and that the properties will be worked; two of these have already been signed. The contract provides that if 95% of the claim owners sign, an electrical plant will be installed and pumping will begin on or before Apr. 1, 1913, thus giving claim owners plenty of time to consider the proposition and the company 11 months in which to install pumps in the Harvard or El Paso shafts. Aug. 1 is the date by which the 95% of the contracts must be signed, and when the company begins the installation of a plant with a capacity of not less than 1000 gal. of water per minute.

In Cripple Creek mines, the recession of water has been 141 ft. since connection was made with the deep drainage tunnel from the El Paso shaft, in November, 1911. The recession for April was 16 ft. It is estimated that the saving to the mines to date has been $1,000,000, or more than the entire cost of the tunnel.

Salt Lake City

May 9—An official of the company states that plans for a third lead stack to the International smeltery, at Tooele, have been drawn, and sent East for approval.

In spite of the frequent snows and rains of early spring, good progress is being made on the 10-mile branch road to Ophir, from St. Johns, on the Salt Lake route. Grading has been completed to within one mile of Ophir and rails have been laid for three miles out of St. Johns. The opening of the new line will mean much to the Ophir district, the chief mines of which are the Cliff, Ophir Hill and Lion Hill.

There is no change in the strike situation at Murray. The works are closed, and the furnaces banked, with no settlement in sight.

It is stated that by May 20, the 10th and 11th sections of the Arthur mill, of the Utah Copper Co., will be placed in commission.

Deadwood, S. D

May 10—Black Hills operators were much pleased at the action of the House of Representatives in placing the appropriations for U. S. assay offices in the bill under consideration. As is quite generally known, it was proposed by the appropriation committee to abolish the assay offices and it was believed that this would be done. The Deadwood office is convenient for the producers of this section, and to close it would work a hardship. In addition to the bullion business, the office is making assays to determine the gold and silver, for $1. It is now the only custom assay office in the Black Hills and is well patronized. During the quarter ended Mar. 31, the office purchased gold bullion worth $1,883,000, all of which was produced in the Black Hills district. Considering the severe weather prevailing during a portion of this period, this showing is gratifying.

The first strike of high-grade ore recorded this spring was made by Nickoli brothers, who have a lease on the Monarch property, in the Two Bit district. They are taking out ore from a small stringer, which will average well over $100 per ton. Many assays show better than $150. A shipment is being prepared, which will go forward soon.

As the first step in a reorganization and resumption of work, the Imperial company has paid $10,000 back taxes into the treasury of Lawrence County. The company will soon resume work on its property, in the Bald Mountain district, milling its ore at the plant in Deadwood.

Negaunee, Mich.

May 11—Navigation on the Great Lakes is in full swing. The Lake Superior ports, which were the last to get in operation, on account of ice in the narrow waterways at the Soo, are shipping iron ore, though not yet with mid-season activity. At Marquette, both the Duluth, South Shore and Atlantic R.R. docks in the city, and the Lake Superior & Ishpeming Ry. docks at Presque Isle, are loading boats with Marquette Range ore. The Cleveland-Cliffs Iron Co. and the Jones & Laughlin Co. are shipping over the L. S. & I. Ry.; the Oliver Iron Mining Co. and the Breitung-Kaufman mines are shipping via the D. S. S. & A. R.R. The Chicago & Northwestern Ry., with docks at Escanaba, gets some of the Marquette Range traffic, as this port is open for navigation two weeks before the Lake Superior ports, and its situation is convenient for shipping to Chicago; Escanaba gets practically all of the Menominee Range shipments over the C. & N. W. and Chicago, Milwaukee & St. Paul railroads.

The long-awaited extension of the Chicago, Milwaukee & St. Paul Ry., from Crystal Falls to Iron River, seems assured by the announcement that the contract for the building of 22 miles of line has been let to the Fleet Construction Co., of Dubuque, Iowa. The road will touch at the Chicagon and Rogers mines, in Bates township, and the station in Iron River will be erected near the Beta mine. This, with the Chicago & Northwestern Ry., will give the Iron River district two ore carrying railroads and better passenger service. The entrance of this railroad into the district has doubtless been influenced by recent mining developments which have been satisfactory.

Toronto

May 10—Owing to the increased use of concrete there is a great demand for water-washed gravel and sand, the sources of supply of which are the shores and beds of the lakes and rivers. In consequence the Ontario Department of Lands, Forests and Mines has issued regulations providing for the surveying and leasing of all lands under the large lakes and their connecting rivers, including the St. Lawrence and Lake Nipissing. These lands cannot be staked out and the sand and gravel taken, as could have been done under the Mining Act, but hereafter all such lands held by the Crown are to be leased at $1 per acre for the first year and 35c. per acre for subsequent years, no lease to be longer than 10 years. In case of competition for an area, tenders are to be called for and the lease given to the highest bidder.

Captain Janes, a member of the Canadian exploration party sent out under Captain Bernier on the S.S. "Arctic," states that two large coal fields, 100 miles apart, have been discovered in Baffin's Land. The coal, he states, can be dug from the surface with a shovel.

It was recently announced that the executive of the Lake Superior Corporation, of Sault Ste. Marie, Ont., had adopted a plan of consolidating its subsidiary companies into natural groups to be financed and managed independently. Arrangements have been made for the consolidation of what is known as the "steel group," comprising the following companies: Algoma Steel Co., Lake Superior Iron & Steel Co., Lake Superior Power Co., Fiborn Limestone Co., Cannelton Coal & Coke Co., and Algoma Iron Works. The new company will be The Algoma Steel Corporation, Ltd., with an authorized capital of $30,000,000, and an authorized bond issue of $30,000,000. Of the latter an immediate issue of $13,000,000 has been underwritten to provide for the retirement of notes outstanding, given to secure funds for extensions and improvements. The Lake Superior Corporation guarantees the bonds, but the new arrangement does not involve any additional charges on it.

Cobalt

May 10—Navigation in the Montreal River opened May 1, although the steamboat company is not running a regular service yet. The river is full of logs, and it will take about two weeks to clear the river of these. Next year, when the railroad is in operation, there will be no necessity for these boats, as the lower freight rate will take all this traffic away from them. At present, the minimum freight rate between the railroad at Latchford and Elk Lake, a distance of 50 miles, is 75c. per 100 lb., and on account of the portages, it is impossible to lower the rate and make a profit.

The Mining News

The Current History of Mining

Alaska

Alaska-United—During March 36,883 tons of ore were crushed yielding $90,818 gross and net $32,807. Operating expenses were $56,186; construction $1825; development 608 ft. The Ready Bullion ore averaged $2.82 and the 700 Claim, $2.17 per ton.

Alaska-Mexican—During March 19,215 tons of ore were crushed, yielding $57,347 gross and net $24,285. Operating expenses were $30,752; construction $2309; development, 306 ft. The ore averaged $3.01 per ton.

KETCHIKAN DISTRICT

Rush & Brown—Stoping is proceeding on the first and second levels of the sulphide orebody, and 1000 tons have been shipped this year. It is the intention to begin stoping on the magnetite-chalcopyrite orebody soon, when further development will be undertaken in this body on the first level. Development is also proceeding on the second level in the sulphide ore. The management contemplates the purchase of another locomotive and a compressor plant during the year.

Arizona

GILA COUNTY

The suit of the Arizona Eastern R.R. in condemnation proceedings against property owners along the right-of-way of the proposed extension of the line to the Inspiration mine, is now being heard at Globe.

Copper Reef—At the mine 15 miles south of San Carlos, the new engine and air compressor is expected to be finished in about 10 days, after which the driving of the tunnel will be resumed. The tunnel is about 1000 ft. long and it is proposed to drive it about 1800 ft. to cut four veins at a depth of about 1200 ft. Charles Saxman is superintendent.

Southwestern Miami — Churn-drilling continues steadily. Holes 4, 5 and 6 are 500, 420 and 400 ft. deep respectively. Hole No. 5 has passed out of the conglomerate into dacite and No. 6 has reached the schist. Hole No. 4 is still in conglomerate.

Barney—One drill is in operation on hole No. 3 which is hole No. 5 of the Southwestern Miami.

Radium Mines Co.—At the annual meeting in Globe, May 6, W. H. Mercer was elected president. The company owns 60 claims three miles north of Globe and the ground was a producer of silver ore in the early days. Negotiations are being conducted for the sale of the property.

Douglas Copper Co.—A small force of men is at work developing the 23 claims, eight miles northwest of Ray. T. C. Hendricks, of Globe, president, has gone east in the interest of the company.

Arizona Commercial—The retimbering of the Copper Hill shaft has been completed to a point below the fourth level.

South Live Oak—The exploration of the Schultze group of 16 claims three miles west of Miami has been started. An unusually large deep-well drilling machine is being used, the boiler, engine and derrick being mounted on separate trucks. The hole was started with a 17½-in. bit, the largest ever used in the district and it is estimated that a depth of 2000 ft. can be attained if necessary.

Needles—This group recently optioned by the Guggenheim interests consists of 27 claims and 13 adjoining claims three miles west of Miami. The Needles group is owned by Daniel R. Williamson and the deal was conducted by F. W. Hoar, of Globe. It is proposed to explore the group by churn-drilling. George H. Garrey, mining geologist and engineer for the various Guggenheim corporations, will supervise the work of exploration and Ralph C. Nowland, chief engineer for the Ray Consolidated Copper Co., will have direct charge of the drilling.

McMillen-Stonewall—After a month spent in examination and sampling, a group of Michigan men has obtained an option on the 600,000 shares of treasury stock of this company and are placing 125,000 shares on the market at 50c. per share to raise money for the development of the property. The Stonewall Jackson mine, 16 miles northwest of Globe, was a silver producer 30 years ago. It is hoped that low-grade silver sulphide ore will be opened below water level.

SANTA CRUZ COUNTY

Austerlitz—This mine, at Oro Blanco, has been sold to an Eastern company and the mill is being repaired for early operation. T. C. Woodworth is in charge.

YAVAPAI COUNTY

United Verde Extension—Reports state that the shaft has been unwatered and the pumps placed in readiness for active development.

YUMA COUNTY

Arizota Mining Co.—This company has been organized by South Dakota men and has secured 59 claims of 20 acres each, in the Harcuvar Mountains, 11 miles north of Wenden. The Arizona & Swansea R.R. is 12 miles north of the mine. The ores are said to contain copper and gold. No. 1 claim has a shaft 125 ft. deep and it is proposed to continue this shaft. Machinery will be installed. Seth Bullock, Deadwood, S. D., is president.

California

AMADOR COUNTY

East Eureka—The new 20-stamp mill at the Poundstone mine was commissioned May 1. The stamps weigh 1050 lb. each and drop 6 in., 100 times per minute. The mill is equipped with eight 6-ft. Pacific vanners. The whole plant including the hoist, is electrically driven by G. E. motors. The capacity of the mill is five tons per stamp. The machinery was built by the D. D. Demarest Co., at Altaville, Calaveras County. F. A. Davis, Sutter Creek, is superintendent.

South Amador—This mine, near the Hardenberg and owned by the latter interests, will be in charge of N. S. Kelsey of the Hardenberg. J. J. McSorley, it is reported, will undertake the development of the Alma at Jackson.

BUTTE COUNTY

United States Diamond Mining Co.—The suit brought by this company against the Oro Electric Corporation for $10,000 water damages is reported to have been settled by compromise. The plaintiff is developing blue rock near Cherokee where diamonds have been found. M. J. Cooney, of Oroville, is manager.

Leggett—No. 3 dredge, formerly owned by James H. Leggett, will resume operations under the ownership of R. S. Kittrick and O. C. Perry, when repairs are completed.

CALAVERAS COUNTY

Petticoat—This mine on the east belt, near Railroad Flat, is in operation under the management of A. T. Copely, of Los Angeles. The indebtedness has been paid. Sinking will be resumed in both shafts, one of which is 650 ft. deep. J. E. King is superintendent.

Boire—A Cox pan and other machinery will be installed to handle the gravel in this mine near Railroad Flat. F. W. Boire and H. W. Seaman are owners.

Inyo County

Santa Rosa—The purchase bond on this group of mines held by B. F. Edwards and W. J. Douglas, of Tonopah, and others, has been exercised and the property taken over by the Independent Silver-Lead Co. There are 18 claims situated three miles east of Keeler and eight miles from Cerro Gordo. The company contemplates the installation of auto trucks for transportation of ore to the railroad at Keeler. It is said that the West End company, of Tonopah, is interested.

Skidoo—During March, 1175 tons of ore were milled. Total receipts were $14,408; development, $1334; operating expenses, $8207, and $4865 net profit.

Nevada County

Pacific Gas & Electric—Surveys have been ordered in contemplation of the auxiliary power plant to be erected on Bear River. The construction of the new dam at Lake Spaulding is also being considered.

Oakman—The main drift is being continued and raising for stopes has commenced. The 5-stamp mill is being run steadily.

Red Ledge—Development work is being done on this and the El Capitan groups of claims. Trenching and underground drifting and crosscutting are being pushed. K. S. Twitchell is superintendent.

San Bernardino County

California Big Chief—This company, at Hart, will erect a 5-stamp mill this summer for the treatment of developed ores. Frederick E. Browne, mining engineer, of Salt Lake City, will have charge of construction.

Shasta County

Afterthought—No definite conclusion has been reached as to the reopening of the mine. Operations for the extraction of zinc may depend somewhat upon the result of the Bully Hill experiment and the solution of the smoke problem in Shasta County.

Mammoth—The 500 adit, in process of construction for over a year, is practically completed. It is 2641 ft. long, and, at 1063 ft. from the portal, has a crosscut extending north 860 ft. The main adit was constructed to tap the new orebody, while the crosscut extends under the old orebody. Two raises from the crosscut to the 300 level have been completed, and two more from the main adit have been started. The new level will be primarily for haulage purposes, but exploration work will be carried on from it. Up to the present, all ore has come out by way of the 300 level, having been transported in 5-ton cars. This method will be superseded by the use of 25-ton cars of the gondola type, and ore will be carried down to the 500 level from the sublevels above. A trial train of four cars and motor was run into the adit on May 1 with no accidents.

Siskiyou County

Highland—This mine has installed a 40-hp. gasoline engine and a 10x10-in. duplex compressor.

Tuolumne County

App—Another reported sale of this mine is current, but had not been consummated as late as May 7. The Tonopah-Belmont Development Co. has been making an examination for the last month, and it is generally understood that the company is satisfied with the character and extent of the mine; it is also learned in San Francisco that the consummation of the sale rests wholly with the proposed purchasers. This is the third time the mine has been examined under an option of purchase.

Magnate—It is reported that the Central Mother Lode Co. will reopen this mine for development. A proposition has been made to Jamestown men to take an interest in the property.

Colorado

Boulder County

Boulder Tungsten Production Co.—The property is equipped with a hoisting plant and compressor, and development is underway with two shafts in ore. The intention is to drive a tunnel to cut the main orebodies at about 500 ft. depth, and to build a 50-ton mill at the portal.

Chaffee County

The larger mines in the Buena Vista district are idle because of the condition of the metal market. Considerable difficulty is being met with in interesting outside capital and prospects will probably develop slowly.

Clear Creek County

Stanley—Drifting is in progress on the 400-ft. level but it is reported that the ore has not yet been encountered.

Oneida—During the last winter, this mine has been extensively developed, and large reserves of mill ore opened. The erection of a mill is contemplated.

Specie Payment—Shipments total about 200 tons per month and are being gradually increased. Manager Owen has been opening stopes and a larger tonnage will be produced.

Cripple Creek

Pride of Cripple Creek—This mine's April output was 10 cars of smelting ore.

Doctor-Jack Pot—The output for April was 10 cars of $30 ore.

Jefferson—The St. Paul Mining & Milling Co. has been organized to work this mine, on Victor Avenue, under bond and lease to W. J. Davenport, who is producing ore.

Kittie Wells—Two cars of $15 to $20 gold ore are being shipped to the Copeland smeltery by W. A. Thompson, lessee.

Gold Dollar Consolidated Co.—Fourteen sets of lessees are working at this mine, and the output for April was 36 cars of about 1-oz. gold ore.

Dante—This mine, under lease to Edwin Gaylord, will be equipped at once with a mill for treatment of the low-grade ores. Three sets of sublessees are working in No. 1 shaft.

Gunnison County

In the Ohio City district five large tunnels are being driven approximately parallel, by the following companies: Sandy Hook Mining & Milling Co., Belzora-Bassick, Gold Links, Raymond and Carter. The tunnels vary in length from 7000 ft. on the Carter to 1000 ft. on the Sandy Hook. All these properties except the Belzora-Bassick are equipped with mills, containing from 10 to 40 stamps each, with concentrating tables, amalgamation plates, etc. The ore is stated to be easy of treatment and of the same general character in all the mines.

Lake County—Leadville

Colonel Sellers—About 150 tons per day of zinc sulphide ore are being hoisted.

Sunday Tunnel—All the bins are full of ore, but the lessees have been compelled to suspend operations temporarily, because of the deep snow and bad roads.

Birdelia—In this tunnel, now in 1450 ft., a vein, said to be the Pickaway, has been cut in the granite. It carries low-grade silver ore.

Ibex—The total shipments of high-grade and medium ores and carbonate of zinc ores are about 7000 tons per month. At No. 2 shaft, on the Hahnewald lease, after months of prospecting work, ore has been found. At No. 5 shaft, the Garbutt vein is being developed and the lessees are shipping ore.

Henriette & Maid—Daily shipments amount to 250 tons of carbonate-of-zinc ore, and 50 tons per day of the same grade are being shipped by the Waterloo.

Ouray County

Great Western—This mine, at Ouray, for many years idle, is to resume operations under Blanchell & Pierson, lessees, who will mill the dump ore at the local smeltery. This mine is within the town limits.

Revenue Leasing Co.—The company develops its electric power from water-power plants. Ore from development work will be treated in the mill on the property. So far development has been in ore of satisfactory grade and width.

Silver Ledge—The mine, near Chattanooga, is being unwatered by Daniel McNaughton, superintendent, and the shaft will be sunk another lift.

Esmeralda—This mine is said to have accumulated a large amount of ore during the winter, and this will be shipped as soon as the trails are opened.

San Miguel County

Ophir—Active construction of the 150-ton cyanide plant is expected to start June 1. After passing the stamps, the ore will be reground in Hardinge mills. The pulp, after being thickened in Dorr thickeners, will be agitated in Pachuca tanks. The pulp will be separated from the solution and washed by continuous decantation in Dorr thickeners.

Carbonero—Operations have been handicapped somewhat by the heavy snow and bad trails, but production has been maintained.

Favorite—The mine is being operated at a profit by leasers. The vein is from 2 to 6 ft. wide and carries gold and lead. The ore keeps 10 stamps busy at the Suffolk mill.

Idaho

American Mines Co.—This company has been organized with a capital of $500,000 in 50,000 shares, and a lease and bond have been taken on properties in the Salmon River district, Idaho County. A. W. Paterson, Lewiston, is president.

Michigan

Copper

Hancock—No. 2 vertical shaft is bottomed in copper-bearing material at 3560 ft. The formation is generally believed to be not the Pewabic lode, but the west branch, which overlies the Pewabic about 60 ft., although the formation is highly mineralized and has the characteristics of the main lode.

Oneco—This company's shaft is down about 1250 ft. A station was cut at 1225 ft. and a crosscut started to explore No. 5 lode, from which a good drill core was taken about two years ago.

New Arcadian—At the annual meeting, held recently at Houghton, the old officers and directors were reëlected. It was also decided to start shaft sinking soon. This company has opened some promising formations with its drilling.

Quincy—No. 9, or Pontiac shaft, is down over 2000 ft. and is entering much better mineralization. At the 2300-ft. level, it will be connected with the drift from No. 8 shaft.

Algomah—The crosscut driving from the 200-ft. level has encountered a good amygdaloidal formation, about 550 ft. from the shaft. Drifting has been started in both directions.

St. Louis—This property, under the management of the Calumet & Hecla, is being opened by a shaft, where drifting is going on at the second level in both directions. Results are gratifying. Two drills are in operation, one about 250 ft. east of the shaft, in an endeavor to locate the Mayflower lode.

South Lake—R. M. Edwards, of Houghton, has been elected a director of this company, and will have charge of this development, which is expected to start soon.

New Baltic—During 1911, expenditures totaled $27,142, leaving a balance of $50,279, Jan. 1, 1912. President Beahan says that the year's developments afford liberal encouragement and justify continuing the work. Shaft-sinking amounted to 195 ft.; drifting and crosscutting, 1531 feet.

Iron

Norrie—A cavein, on May 13, buried 13 men, 2000 ft. underground. Two bodies were recovered soon after. A pipe was later driven into the cave and disclosed the fact that six were still alive. Forty workmen were in the vicinity of the cave, but the majority escaped.

Beaufort—This old mine, west of Michigamme, on the southwest quarter of Sec. 22-T. 48-R. 31, is to be explored this summer by independent interests, to whom an option for lease has been given by the owners, George Thoney and John McEncroe. The property has been operated intermittently since 1882, in conjunction with the Ohio mine, just to the east, and was last worked under the management of George L. Woodworth. The ore is a peculiar yellow ocher. The iron content is about 50% and the phosphorus is rather high.

Florence Iron Co.—This Ladenburg-Thalmann company, which has been operating the Florence mine at Florence, Wis., for a number of years, has conducted considerable exploration work in the vicinity, as the ore reserves in the Florence mine are small. Exploration in the vicinity of Keyes Lake was not successful, and diamond drilling has been conducted north of the old Commonwealth mine.

Lucky Star—Temporary buildings have been erected, including a dry and office, combination engine and boiler house, and a blacksmith shop. About 20 men are employed, 12 of whom are working in the shaft on three shifts.

Mary Charlotte—A vertical diamond-drill hole is being started on surface, about 300 ft. west of the Sunrise shaft. This territory has not been thoroughly explored, as the underground workings of the mine lie east of the shaft.

Missouri

Joplin District

The heavy rain last week raised Center Creek and Spring River to the highest point they have been for years and drowned out the Yellow Dog, Golden Glow and Minor Heir mines, at Webb City, and the Yellow Jacket.

Yellow Jacket—This mine, belonging to O. W. Sparks, has purchased the Sunshine mill, at Galena, and will erect it. The mine has been thoroughly drilled and a good body of ore has been indicated.

Blue Jay—A deposit of barite at this mine, at Thoms Station, has reduced the grade of ore so that it is impossible to work it profitably. This is one of the few instances where barite has been found in the district.

Engineers Drill Co.—This company, organized for drilling leases in the district, is drilling the Lily land, on the Mexico-Joplin tract, at Thoms Station, and has struck ore in the first hole. C. H. Plumb, of Joplin, is manager.

Federal Lead Co.—The company has been looking over the district and will probably take over the Hackett mine, west of Joplin.

Onandaga—Jamot Brown and associates have organized this company and will build a 250-ton mill on the Brown land at Porto Rico, near the Whitsett.

Perry County

Prospecting will begin soon in this county, drills being on the way. Surface indications are said to be good.

Washington County

R. J. Briscoe, of Potosi, is contemplating the installation of a hydraulic plant, at Tiff, for running barite ore, and J. W. Wood is consulting engineer for the work.

Point Milling & Manufacturing Co.—The company is installing tube mills, a roll crusher, classifier and slime pumps for grinding barite ore. A sulphuric-acid system in connection with the Hendryx agitators is being installed to dissolve the iron in the barite. J. W. Wood is in charge.

Montana

Butte District

North Butte—The crosscut connection with the High Ore mine on the 2800 level has been accomplished and crosscutting will be started on the same level to intersect the Edith May and Jessie veins.

Anaconda—At the Pennsylvania mine 470 ft. of drifting, 250 ft. of crosscutting and 70 ft. of raising were done during April. An average of 490 men were employed underground and on surface, and about 940 tons of ore per day were hoisted. The crosscut being driven south on the 1800-ft. level has advanced over 1500 ft. from the shaft, and an air fan has just been installed to drive air into the face. This fan is run by a 20-hp. electric motor. The air is forced from the fan through a 14-in. galvanized-iron pipe leading to within a few feet of the breast of the crosscut.

Davis-Daly—The shaft of the Colorado mine has reached the 1900-ft. level and a station cut. Drifting east and west has been started on that level. Fifty tons of ore per day are being shipped to the East Butte smeltery, the ore averaging 6% copper and 8 oz. of silver per ton.

Deer Lodge County

Butte & Anaconda—The company is preparing to operate on its property of 11 claims, two miles northeast of the Southern Cross mine in the Georgetown district. Joseph C. Keppler, of Anaconda, is president. D. E. McPherson, a Butte mining engineer, has been retained to take charge of operations.

Jefferson County

Washington—John D. Pope, general manager of the North Butte Mining Co., and associates have incorporated the Washington Mining Co. with a capitalization of 100,000 shares, par $5. The company will operate a property in the Wickes district.

Lincoln County

Montana Smelting Co.—This new organization of California men is about to commence operations at the Snowshoe mine, 12 miles from Libby, and Robert C. Davis, a Butte mining engineer, has taken charge of the property. He expects to have the mill on the ground ready for ore treatment by June 1. The mine contains silver-lead ore, and is opened by a tunnel and a 500-ft. shaft.

Hazel T.—The company has crosscut a body of silver-lead ore at 250 ft. from surface. The tunnel has penetrated the vein for 10 ft. without striking the hanging wall. The property is known as the Shaughnessy Hill group, comprising 11 claims, and John H. Town, of Libby, is the principal stockholder.

Nevada

Clark County

Quartette—Development work has been discontinued on company account and the main workings and adjacent properties have been opened to leasers whose ore is being treated in the company mill.

Comstock Lode

C & C.—The United Comstock Pumping Association has authorized the engineering department to prepare designs and specifications for new hydraulic pumps for the 2500-ft. station of this shaft. The pumps will be large, slow moving, plunger pumps, and will resemble a large steam pump, except that instead of having a steam piston and a water plunger, they will have power plungers driven by water, and a driven plunger that will lift the mine water 900 ft. to the Sutro tunnel drain. Three of these pumps will be installed, each having a capacity of 1500 gal. per min., two to be in constant use, and the third to be held in reserve. A large station will be cut out on the 2500 level for the new pumps. The new centrifugal, electrically driven pumps will be placed at the head of winzes, and will pump the water from the deep levels below the 2500. The association has just authorized a contract with the Truckee River General Electric Power Co., for an additional 1000 hp., which will make a total of 3500 hp. utilized by the association in pumping.

Crown Point—Run No. 6 has been completed at the Yellow Jacket mill, and one railroad car of concentrate shipped to the smeltery. The mill is now treating ore from the Yellow Jacket surface dumps.

Mexican—Additional clarifying presses for the new mill have been ordered and are on the road; when installed, they will increase the tonnage and percentage of extraction. Last week, the mill crushed 501 tons of ore of an average assay value of $25.49 per ton, and $12,000 gross value.

Elko County

Pavlak—After an expenditure of nearly $400,000 in developing the mine and building a mill, which was run intermittently for eight months, operations have been suspended, with $8000 owing for labor and a $50,000 mortgage on the property.

Clark-Fletcher—This mill has been closed for some time with debts of $7000 for labor, and a bill for supplies, with a balance yet to be paid on the machinery. The Bourne mine of this company has considerable ore in sight, running from $10 to $18 per ton and negotiations are pending, whereby Salt Lake men may remodel the mill.

Alpha—This mine recently changed hands after several examinations, the final one having been made by H. L. Hollis, of Chicago. The shaft will be equipped with a hoist, and a car and track have been puchased for the tunnel. The tunnel will follow the vein and meet the shaft at a depth of 300 feet.

Flaxie—This mine has a good showing of ore. At 85 ft. in a nearly vertical shaft, a drift was run 200 ft. along the vein showing ore.

Esmeralda County

Goldfield Consolidated—It is reported that a contract has been entered into with the Steptoe smelting works, for the treatment of a quantity of refractory ore, found in development, between the 950 and 1000 levels, about three years ago. The ore contains about 2½ oz. gold, 15 oz. silver and 4% copper, a total of about $70 per ton. The ore is not adapted to treatment in the mill. Shipments will be about one car per day.

Eureka County

Under the new name, Eureka-Nevada Railway Co., the Eureka & Palisade narrow-gage railroad resumed operation May 6. The road runs from Palisade on the Southern Pacific R.R., to Eureka. For the present a tri-weekly service will be given.

Humboldt County

F. C. Alsdorf, mining engineer, of New York, has resumed development of his copper properties in the Red Butte district. Boston men are reported to be interested.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended May 2, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,200	58,869
Tonopah Belmont	2,050	28,126
Montana-Tonopah	1,052	18,109
Tonopah Extension	1,012	17,022
West End	845	12,734
Midway		180
MacNamara	458	5,850
North Star		80
Totals	8,617	150,970
Estimated value	$215,425	....

Tonopah Merger Mining Co.—This company, under the management of John G. Kirchen, has resumed the sinking of the Golden Anchor shaft from the 830-ft. level, to open two veins known to pass through the property.

Tonopah 76 Consolidated—The company has commenced the sinking of a main working shaft on its property between the West End and Tonopah Extension mines.

Midway—The north crosscut from the 535-ft. level has opened a 12-ft. vein in virgin ground. The vein shows several stringers of ore, one 17 in. wide, averaging over $200 per ton.

Montana-Tonopah—A new Trent agitator has been installed in the mill, and is expected to increase the capacity and also secure a higher recovery from the better ores now being treated.

Keane Wonder—It is reported that Philadelphia men have purchased the holdings of Thomas B. Rickey in this mine and have acquired control. It is understood also that Homer Wilson will remain as manager. The production recently has been increased.

White Pine County

Smokey Development Co.—The company owns about 175 acres of land between the Federal Ely and the Chainman Consolidated companies. Churn drilling last year disclosed ore of varying thickness, some of which is of commercial grade. It has been decided to drive a tunnel in the hopes of developing the porphyry ore and of intersecting the contact at 400 ft. depth. The contact on surface is stated to have disclosed a good copper showing. The offices of the company are at 50 Congress Street, Boston, and S. Herbert Williams is president.

Ninety-Nine—This property is situated eight miles north of Goodsprings, and maintains a production of several cars of copper ore per month. It is the intension to increase the working force to 25 men soon. J. B. Jensen is general manager.

New Mexico

GRANT COUNTY

Philadelphia—This mine, near Hanover, has been taken over by a new company, the United States Copper Mines Company.

Cleveland—George H. Utter, owner, was recently in Denver, where he purchased crushers, rolls, trommels and jigs from the Hendrie & Bolthoff Manufacturing & Supply Co. These are expected to increase the capacity of the mill which may resume operation by June 10. Meanwhile assorted ore is being shipped.

Chino—Steam shovels are operating on the sulphide ore of the Hearst section, marking the initial treatment of this ore at this mine. The amount of sulphide ores handled is increasing.

SIERRA COUNTY

Bi-Metallic Mining & Milling Co.—Alfred G. Strum, president, has been visiting the properties near Lake Valley, which are being systematically developed.

SOCORRO COUNTY

Ernestine—The last 10-day cleanup in April yielded 10,135 oz. of bullion and 9800 lb. of concentrates. During April 3000 tons were milled, producing 28,700 oz. of gold and silver bullion and 31,000 lb. of high-grade concentrates. This property is now producing every 50 days, the price paid for the Last Chance mine by the present owners.

Oaks—In April 145 tons were treated from 128 ft. of development on the Pacific mine, which will be sufficiently opened to begin stoping within 30 days. At the Johnson mine, the full width of the new shaft is in ore, which is being transported to the Deadwood mill.

Socorro—Approximately 5000 tons were milled during April.

Oklahoma

Petersburg—This company, at Quapaw, has installed another centrifugal pump to handle the additional water caused by the heavy rains.

30-acre—This company, at Miami, has sunk two shafts to the ore, and will build a mill soon.

Standefer Brothers—The company is drilling the Palmer land, south of Miami, and has struck ore.

South Dakota

LAWRENCE COUNTY

Gilt Edge-Maid—Briquetting machinery will be installed in this company's concentrating mill, at Galena, in order to make a suitable product for the furnaces of the Black Hills Smelting Co.

Golden Reward—Construction work has been resumed on the roasting plant at the Asoria mine. The first unit will have a capacity of 75 tons per day. Wedge mechanical furnaces are to be installed. Oil from the Casper, Wyo., field, will be the fuel.

Titanic Gold Mining Co.—This company, which owns a large acreage in the Carbonate district, has elected directors, as follows: W. H. Bonham, I. A. Webb and W. S. Elder, Deadwood, S. D.; Col. E. Bright, Columbus, Ohio, and J. M. Rothwell, Martinsburg, West Virginia.

Mascot—This property, owned by J. Treber and A. T. Roos, of Deadwood, is under bond to Denver, Colo., men, who are conducting an examination.

PENNINGTON COUNTY

Mystic—Some minor changes are being made, and the dredge put in shape to operate. Work was suspended in December, on account of cold weather, after a 6-months' run, which was quite satisfactory for the first season. Better results are expected this season.

Mica—Harry Francis is filling a contract with a Denver concern for a limited amount of mica, which will be used in the manufacture of asbestos shingles. The mica is being secured from properties near Keystone. Only scrap is being shipped to the Denver plant, the better grades being stored.

Golden Summit—D. Canfield and associates, are sacking some high-grade ore for shipment to smelteries. The lower grades are being piled, and the 5-stamp mill will be started soon. The orebody is 5 to 6 ft. wide, with a 2-in. streak worth $2 per pound.

Utah

BEAVER COUNTY

Majestic—Work in the Harrington-Hickory is being done on two veins of lead-silver ore east and west of the shaft, 300 ft. apart. The work is above water level. A car of ore was shipped recently, and other shipments are to follow.

Red Warrior—It is thought that this property is on the same north-south ore channel as the Moscow. Both mines have been opened to about the same depth, and the lowest workings are about 1500 ft. apart. Shipments are being made from the silver-lead orebody opened in April below the 500-ft. level, the lowest one in the mine. The present output is stated to average two cars per month. Ten men are employed.

Old Hickory—Work has been resumed, and the workings are being cleaned out, preparatory to shipping copper ore.

Dippie—These claims are west of Copper Mountain. The shaft is down 30 ft., with ore in the bottom. It is expected that a car of silver-lead ore will be ready for shipment soon.

King-of-the-Hills—Work is being done at this property on the east side of the mineral range.

JUAB COUNTY

Tintic shipments for the week ended May 3 were 164 cars.

Eagle & Blue Bell—The shaft has about reached the 1350-ft. level, where about 400 ft. of drifting will be done to get under the orebodies on the 1200 and 1300 levels.

Black Jack—Repairs to the hoist have been completed, and prospecting is being done on the 300- and 600-ft. levels. Preparations are being made to continue a drift on the 300 into Dragon Consolidated ground.

Mammoth—The raise from the 700-ft. level has reached the 600, where drifting is being done to meet it. Later, raising from the 600 to the 500 will be undertaken. Shipments for the week ended May 3 amounted to four cars.

Beck Tunnel—Drifting is being done on the 175-ft. level of the No. 2 shaft, for the point where ore was found near the Uncle Sam line, and work is in quartz carrying ore.

Plutus—The Tetro claim has been leased to J. Lester Mangum and J. H. McChrystal. Lead-silver ore has been opened on the 400-ft. level. Royalties are stated to range from 25% on low-grade ores to as high as 50% on ores of higher grade.

Colorado—Shipments for the week ended Mar. 25, were reduced to four cars. The shipping ore has practically been mined out, present shipments coming from small stringers of rich ore. There is considerable low-grade siliceous ore in sight. There is stated to be about $100,000 surplus in the treasury, which could be applied to a search for new orebodies.

SALT LAKE COUNTY

Utah-Apex—Proceeds for March were: Gold, $4049; $14,500 from silver; $35,009 from lead. The total gross value was $53,557, and less smelting and freight charges of $15,410 and mining, milling and developing charges of $21,089, gave net returns of $17,089. The total profits were $20,109, including $3020 in royalties from lease ore.

South Hecla—Development work has been financed and operations resumed.

Cardiff—The new lower tunnel is in over 30 ft. The south drift from the main tunnel level is being extended, and there is lead mineralization in the face.

Summit County

Park City shipments for the week ended May 4 were 3,421,480 pounds.

Daly-Judge—Production for the first quarter of 1912 amounted to 18,319 tons of concentrating ore and 813 tons of shipping ore. There were marketed 5558 tons of lead concentrates and 184 tons of zinc concentrates, shipments of the latter beginning in March. The lead concentrates averaged $28.53 per ton; zinc, $25.09, and shipping ore, $29.81 per ton. Monthly development expenses were $7668; mining costs, $3.05 per ton; milling costs, 71c. Monthly earnings averaged $27,700. The balance on hand Apr. 1, after payment of dividend No. 4, was $469,700.

Tooele County

Cliff—Shipments are being made in spite of bad roads. Ore has been opened in a drift 550 ft. below the tunnel level in the Tony incline, 1250 ft. vertically below the surface.

Wyoming

Fremont County

Beck—The company's equipment at the Duncan mine includes a 15-hp. gasoline hoist, a 10x10-in. air compressor, both Fairbanks, Morse & Co., machines and a 20-hp. boiler to operate a Cameron No. 7, and a Cameron "Prospector" sinking pump. The shaft is 250 ft. deep, and there are four levels with a total of about 1275 feet of drifts and crosscuts. The mill contains a 7x12-in. Blake-type crusher, four 1350-lb. Nissen stamps with 50 sq.ft. of plate area per stamp. The mill is operated by a Fairbanks, Morse, standard 25-hp. gasoline engine. There is also a 10-hp. special gasoline engine, operating a 6-kw. generator for lighting.

Canada

British Columbia

Granby—During April, 103,464 tons of ore were shipped. Development included: Raising, 435 ft.; drifting, 440 ft.; diamond-drilling, 710 ft. Ore was received at the smeltery as follows: From Republic district, Wash., Surprise mine, 1628 tons; North San Poil, 292; Republic, 31; Snowstorm, Ida., 664; Granby, Phœnix, B. C., 103,464; total, 106,079 tons.

British Columbia Copper Co.—About 1600 tons of ore per day are being shipped to the smeltery at Greenwood.

Kingston—This mine, adjoining the Nickel Plate, has been taken over by A. Creelman for Eastern men. A small force is prospecting the copper showings, in an attempt to find suitable fluxing ore to use in smelting the gold arsenical ores. An aërial tram is to be installed, also power and air for mine purposes.

Apex—This property east of the Nickel Plate is being prospected by T. D. Pickard, of Vancouver. A power site has been located on the Similkameen River and a plant may be installed.

Pollock Mines, Ltd.—Tunnels and drifts have opened ore and a mill may be erected.

Nova Scotia

Dominion Steel Corporation—The output in tons for April was as follows; Coke, 42,495; pig iron, 25,610; steel ingots, 29,710; blooms 24,955; rails, 15,980; rods, 3965. The small output of rods is due to the closing down of the rod mill during part of the month.

Ontario

Kendall—On this Lake-of-the-Woods claim, which is being developed by the Canadian Homestake Co., three parallel veins have been uncovered, one of them running from 2 to 6 ft. in width. Samples taken at intervals for a distance of 300 ft. pan gold.

Ontario-Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended May 10, and for the year to date, are:

La Rose	33.75	1,181.07
Coniagas	31.10	697.75
O'Brien	32 03	263.24
Right of Way	......	148.60
Chambers-Ferland	......	161.60
McKinley-Darragh	....	955.74
Nipissing	66.38	695.44
Hudson Bay	...	249.88
Buffalo	.	382.37
Crown Reserve	20 45	190 93
Cobalt Townsite	68 27	474.99
City of Cobalt	....	145.84
Trethewey	....	174 19
Colonial	21.60	41.60
Kerr Lake	...	292.79
Cobalt Lake	....	176.26
Drummond	. .	300.32
Temiskaming	. . .	320 64
Beaver	....	132.34
Wettlaufer	..	111.21
Provincial	. . .	22 22
Casey Cobalt	.	24.50
Totals	273 58	7,012.52

Bullion Shipments in Ounces

Mine	Week	Year to Date
Nipissing	84,455 00	1,376,939 72

Cobalt Gem—The property is now being worked under lease.

Maidens Central—An effort is being made to finance this South Lorrain mine, so that work may be resumed.

Silver Queen—At the annual meeting held recently it was stated that there had been some negotiations looking toward the reopening of the property by a leasing company.

Paragon—A small plant is being installed at this Elk Lake property.

Syracuse—This Elk Lake company has let a contract for 100 ft. of sinking.

Nipissing—During April production totaled 380,937 oz., of silver, worth $225,145. Ore worth $220,683 was shipped. Good ore was opened in a raise on vein 122 above the first level. Work on the new low-grade mill is proceeding satisfactorily. The small sampling plant on May 1 started operation.

Ontario—Porcupine

Swastika—The management is now considering plans for a small mill.

Jupiter—The pool in these shares has been extended for another year. The date of the annual meeting is May 20, when it is expected that the old board will be replaced by Drummond supporters.

Porcupine Gold—The mill may be completed by May 20. A new vein has been encountered in crosscutting on the 20-ft. level, 30 ft. north of the Godfrey vein. The shaft is below 300 ft., where a station has been cut.

Crown Chartered—The main shaft has been completed to the 200-ft. level, at which point a new level will be opened. Additional machinery is being installed.

Scottish Ontario—Additional capital has been subscribed for this company, and active mining operations are expected to start soon.

Laughton—Considerable diamond drilling is to be done on these claims which adjoin the Hughes.

Hughes—A complete compressor plant will be installed soon.

Rea—At the annual meeting held in Toronto, all but two of the old directors were replaced. It is believed that this change in the directorate will result in the reopening of the property.

Three Nations—This company is considering the purchase of a 10-stamp mill.

Little Pet—Work on the small mill has been delayed for a short time.

West Dome—Part of the force has been laid off and work confined to the day shift, owing to the scarcity of fuel. Coal will have to be shipped in at an expense for freight exceeding the price of the coal.

Dome—A shipment of 120 lb. of gold was made to New York on May 7, being the result of the second cleanup from the plates.

McIntyre—A churn-drill hole, put down at the west end of Pearl Lake, has gone through several feet of quartz. The discovery is regarded as important. Shaft No. 1 is down 20 ft. and No. 4, is 40 ft. below the 200-ft. level. Stoping has been commenced from both shafts.

Mexico

Mexico

El Oro—During April the mill treated 17,810 tons of ore and 15,270 tons of tailings, yielding bullion worth $169,340. Working expenses were $90,510; development, $21,740, and $62,510 total profit from mine and railway.

Sonora

Greene-Cananea — April production amounted to about 4,600,000 lb., compared to 2,500,000 in March and February, when labor troubles interfered.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, May 15—The coal trade in the West has nothing new, except the beginning of active shipments for the Lake trade. Locally, the markets are rather dull and heavy.

The seaboard bituminous trade is also dull and heavy, and prices have declined. This is due to large shipments made last month, which have brought a larger suplpy to tide than can be worked off quickly. Some sales on demurrage have helped to bring prices down.

Scarcity of anthracite is beginning to be felt, though the approaching warm weather has prevented any pressure on domestic sizes. Steam sizes, however, are scarce and bring high prices. The miners' convention assembled yesterday, when the compromise conditions were submitted. Opinions differ as to their acceptance. It may be several days before the result is known. The foreign miners are getting uneasy, and there has been local rioting at several collieries, though the region is generally quiet.

Anthracite shipments in April were only 266,625 long tons, against 5,804,915 in April, 1911. For the four months ended Apr. 30 the total was 22,766,874 long tons in 1911, and 18,475,976 in 1912; a decrease of 4,290,898 tons, or 23.2%, due to the suspension of mining in April.

Coastwise shipments of coal from chief Atlantic ports, three months ended Mar. 31, long tons:

	Anthracite	Bituminous	Total
New York	4,738,476	2,841,152	7,579,628
Philadelphia	539,855	928,307	1,468,162
Baltimore	62,117	891,456	953,573
Newport News	....	677,133	677,133
Norfolk	....	1,225,363	1,225,363
Total	6,340,448	6,563,411	11,903,859
Total, 1911	4,302,037	6,480,418	10,782,455

Total increase this year, 1,121,404 tons, or 10.4%. New York covers all the harbor shipping points, including barge shipments to city and adjacent wharves.

IRON TRADE REVIEW

New York, May 15—The iron and steel markets continue active. Business continues to come in, and the indications are that the production of finished steel is at a high point.

The heavy orders for new cars referred to last week will require a large tonnage of plates, and ship-building orders recently placed on the seaboard will call for more. A large business in plates and shapes is assured. Structural steel is also active, while the jobbing demand for bars, wire and other small material is good. There seems little doubt that our steel production this year will reach a high figure. Prices are held at the higher level lately reached, with few exceptions.

Pig iron has not been quite as active, but orders have been good, and there is a tendency to hold prices more firmly. While ore quotations are lower, coke is higher, and there is not an overabundant supply. In the Connellsville region, there is beginning to be some scarcity of labor and it will be difficult to increase production as fast as it is needed. The coke question has deterred some merchant furnaces from going into blast, to meet the increased demand for pig iron.

The taking of evidence in the Steel Corporation suit has continued during the week, the testimony relating chiefly to the existence of pools and agreements before the formation of the Corporation, and to the organization of the various subsidiaries which made up the consolidation. With the exception of a few minor details nothing new was brought out.

The United States Steel Corporation reports that the total unfinished orders on its books on Apr. 30 were 5,664,884 tons. This is 360,044 tons more than on Mar. 31; 560,124 tons more than on Dec. 31, and is the largest total reported since Dec. 31, 1909. The increase in April was made notwithstanding an active production during the month.

Pig Iron Production—The reports of the blast furnaces, as collected and published by the *Iron Age*, show that on May 1 there were 241 coke and anthracite stacks in blast, having an aggregate daily capacity of 79,700 tons; an increase of 1800 tons over Apr. 1. Making allowance for the charcoal furnaces, the estimated make of pig iron in the United States in April was 2,399,000 long tons; for the four months ended Apr. 30 it was 9,025,700 tons.

Birmingham

May 13—While the sales of pig iron in the Southern territory have not been as active in the last few days as they were during the past four weeks, the market conditions are regarded as strong. The quotations are holding firm around $11 per ton, No. 2 foundry. A few sales have been made at that price for delivery during the last half of the year. A number of inquiries for iron during the last quarter of the year have been answered with a price above $11 per ton, in some instances as high as $11.50 per ton. There has been so much of the lower grades of iron sold by Southern manufacturers that care is being taken in handling business for the future; in fact one or two of the manufacturers are not accepting business for No. 3 and 4 foundry and gray forge iron. The make is holding up nicely. During the month of April Alabama produced several thousand tons more iron than the previous month and efforts are being made to make another increase in May. Two furnaces are in condition for operation and will shortly be lighted.

The cast-iron pipe trade is as active as it can be, and all plants are working on full time. New orders were recently received for a big tonnage. A few small orders for steel rails, fabricated and steel wire goods, are reported again and a fairly steady operation of the several plants in this section of the country is assured. The foundries and machine shops report no change in conditions. Mississippi floods will have some effect in these trades.

Baltimore

May 13—Exports for the week included 4,107,117 lb. structural steel, 334,378 lb. steel rails and rail fastenings and 1,242,423 lb. miscellaneous iron and steel to Panama. Imports included 678 tons ferromanganese from Liverpool; 2042 tons pyrites from Huelva, Spain; 12,100 tons iron ore from Cuba.

Chicago

May 13—The iron market remains strong, with the demand for nearly all products as good as it has been and in some cases better. Pig iron is relatively quiet, but firm; the advanced prices on Northern iron have quieted the demand somewhat, but the consumer is possessed of the idea that he is facing an advancing market, consequently it is a seller's market.

Northern No. 2 brings now $15 furnace, on all future business, and Southern No. 2 holds to $11, Birmingham, or $15.35, Chicago, with 25 or 50c. more asked on last-half sales that favor strongly the producer. In Northern charcoal iron, there is a large and steady demand, with the price a little higher, $15.75@16.25, and a few contracts made at $16.75 or slightly less.

As regards finished material, the structural market is stronger at 1.43c., with much business being done in bridge and building work throughout the territory tributary to this center, west and northwest chiefly. Railroad business is brisk in track fastenings and light rails, with orders for standard rails occasional and of fair tonnage, and many rail inquiries received. Bars are a strong line; soft steel at 1.38@1.43c. and iron bars at 1.20@1.25c. are selling actively. Billets are in very good demand, openhearth holding to $28. Plates remain quiet at 1.43c. for ¼-in. or less, and sheets are also quiet. Wire goods are backward, but in improving demand.

Cleveland

May 12—No ore sales are reported. Season contracts have generally been closed.

Pig Iron—The total sales in April were large, and the business keeps up, both in large and small orders. Demand is good, both locally and for shipment to other points. The quotations, Cleveland delivery, are $15.15 for bessemer, $13@13.50 for No. 2 foundry, $12.50@12.75 for forge and $15.50@16 for Lake Superior charcoal.

Finished Material—New business has been of a moderate order, but prices are quite firmly held. The specifications on contracts are heavy.

Philadelphia

May 14—Stocks at furnaces are a negligible quantity. Much heavier buying has been quietly going on for the past two or three weeks than makers and brokers permitted to come to the surface. The Southern furnaces have monopolized a good deal of this quiet business. It is given out today that we may look for a quiet period for a few weeks, but this conclusion is hardly borne out when consideration is taken of the numerous inquiries that have been slipping in for third- and fourth-quarter delivery. One fact that would keep iron up is that coke is considerably higher than a few months ago and another is that stocks are, as stated, practically nonexistent. Much depends upon the course that the users of steel irons will pursue during the next 30 days. The point on which the market hinges is the extent to which the requirements of the third and fourth quarters may be anticipated within the next few weeks. Foundry iron is gaining in strength. Furnace repairing necessities may lessen the output during the summer months. Basic iron is 25c. higher and forge is following suit. Quotations may be fairly given at $15.50 for No. 2 X, $14.75 for gray forge and $15.50 for basic.

Steel Billets—Inquiries for steel billets are crowding in and prices are liable to advance any day. Consumers are poorly supplied with stock excepting in two or three cases. The turn in billets to scarcity and high prices has taken this market by surprise.

Bars—The activity in car-building circles has turned to the advantage of bar iron and recent inquiries for large lots have already resulted in a marking up of quotations on small lots for retail delivery and jobbing demand.

Sheets—Sheets have been moving in larger lots, mainly through contracts placed by the larger consumers. Jobbers and smaller buyers are ordering freely and deliveries on contracts placed a few weeks ago are being urgently called for. Prices are pointing upward.

Pipes and Tubes—Tubes are particularly active under exceptional activities in boiler works. Cast pipe is remarkably active and some foundries have overloaded with work.

Plates—The extraordinary activity in the plate market is putting some buyers to considerable trouble who failed to specify fixed dates for delivery. Makers are taking advantage of the opportunity and some work in the smaller shops is dragging in consequence. The rush in car building is drawing out inquiries and contracts for large supplies of plate will be placed within a few days. Tank is also active and marine steel is under better inquiry than for many months.

Structural Material—But few good-sized orders have been placed, though this dullness is offset by known requirements for large quantities which are due in the market some time in June.

Scrap—Scrap continues active. Stocks are declining. Dealers are scouring the country and the supply is sufficient for pressing requirements.

Pittsburg

May 14—The pressure upon mills for delivery of bars, plates and shapes has increased, and the question of delivery has become one of considerable importance. Upon plates the mills are particularly well filled, most of the large mills having sufficient specifications for four to six weeks of steady rolling. The leading local interest is chary about incurring any fresh obligations upon plates this side of July 1, as it is already fairly well specified up to that date and some of its customers may increase their requirements further.

New business is relatively light all along the line, but in bars, plates and shapes the pressure for deliveries is such as to cause no uneasiness. In pipe, wire and sheets specifications continue fairly good, the various mills in these lines operating at from 75 to 95 per cent. of capacity. There is practically no fresh buying of wire products at prices currently quoted, deliveries being made on old contracts, some at $1 a ton, some at $2 a ton, below the present basis. Occasional reports of shading appear, but such transactions are believed to be simply extensions of old contracts.

Pig Iron—There is considerable quiet inquiry for basic and bessemer iron, but not a great deal moves in the open market. The Carnegie Steel Co. has purchased 15,000 tons of bessemer from the Brier Hill Steel Co. at $14.50, furnace, but special conditions are believed to have surrounded the transaction, inasmuch as there is bessemer still to be had at $14.25. Demand for foundry iron is light, but the furnaces operating are well sold up, and buying of a moderate tonnage would undoubtedly send prices upward. Production cannot be increased materially except by the blowing in of idle furnaces which would have to contract afresh for coke, paying perhaps $2.40, when the majority of the operating furnaces have old contracts at $1.55@1.65, so that higher prices would have to be obtained for pig iron to warrant an increase in output. We quote: Bessemer, $14.25; basic, $13; No. 2 foundry, $13.25; forge and malleable, $13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market has been quiet since the advance, consumers being well covered at old prices, but prompt metal is scarce. We quote prompt at $46@50 and forward at $46, Baltimore.

Steel—Consumers are calling for better deliveries of billets and sheet bars on their contracts, and are filing specifications unusually early. In some cases mills have asked that some of their June steel be shipped this month. While consumers are short of steel they are not in position to pay the higher prices now asked upon fresh sales, and so transactions are light. Steel is offered in a limited way by brokers. We quote the market approximately as follows: f.o.b. mill, Pittsburg: billets, $21@21.50; sheet bars, $21.50@22; f.o.b. mill, Youngstown; billets, $20.50@21; sheet bars, $21@21.50. Rods are about $25, Pittsburg.

Sheets—Prices of sheets have firmed a trifle more since last report, but are not quotably higher. The leading interest's prices are 1.95c. for black and 3.00c. for galvanized, and it is booking a fair amount of business in the circumstances, though the prices are being shaded by some of the independent mills $1 a ton. The leading interest and some of the independents are operating practically full, while other independents are operating at 70 to 90 per cent. of capacity. The industry as a whole is probably operating at between 85 and 90 per cent. of capacity. We quote: Black sheets, 28 gage, 1.90@1.95c.; galvanized, 2.95@3.00c.; blue annealed, 10 gage, 1.40c.; painted corrugated, $1.35; galvanized, $2.55. The American Sheet & Tin Plate Co. is now selling corrugated material on a weight basis, at its usual extras over flat sheets.

St. Louis

May 13—The pig-iron market seems to be on the up grade both in regard to demand and price. In fact, the general outlook is better than for several years past. The strengthening of the market has had a tendency to bring buyers into the market for future requirements. A number of inquiries for third-quarter delivery are coming in and quite a tonnage has been contracted for in the last week for both immediate and future delivery. Immediate delivery iron can be purchased for $11@11.25, Birmingham, or $14.75@15, St. Louis, for No. 2 foundry. A premium of 25@50c. per ton is being asked for last-half delivery. Northern No. 2 foundry is quoted at $14.50@15 per ton.

Coke is in better demand. Good foundry is bringing $5@5.10 per ton, St. Louis.

Iron Ore Trade

April shipments of Lake Superior iron ore were light, owing to the heavy ice still remaining at several points on the upper Lakes. The total shipments were, in long tons:

Port	1911	1912	Changes	
Escanaba.........	93,632	80,530	D.	13,002
Marquette........	14,838	......	D.	14,838
Ashland..........	41,337	8,288	D.	33,049
Two Harbors.....	54,157	32,571	D.	21,586
Superior..........	76,739	64,416	D.	12,323
Duluth............	51,042	18,237	D.	32,805
Total.............	331,645	204,042	D.	127,603

The movement of ore from Lake Erie docks to furnaces in April, was 1,314,627 tons, or 325,053 tons more than in April last year.

It is stated that the Great Northern trustees intend to organize a company to take over and operate the Mesabi lands now held by the Steel Corporation under lease, as fast as they are surrendered by the Great Western Co., the subsidiary which has been operating them for the Corporation. Whether the lands will be operated directly or subleased to other interests is not yet determined.

British Iron and Steel Trade

Exports and imports of iron and steel, and of machinery, in Great Britain, three months ended Mar. 31, are valued by the Board of Trade returns as below:

	Exports	Imports	Excess	
Iron and steel	£12,339,318	£2,909,896	Ex.	£9,429,422
Machinery...	7,812,470	1,622,483	Ex.	6,189,987
Cutlery and hardware..	3,142,505	1,967,128	Ex.	1,175,377
New ships....	1,175,729	....	Ex.	1,175,729
Total.......	£24,470,022	£6,499,507	Ex.	£17,970,515
Total, 1911..	20,041,066	5,867,377	Ex.	14,173,689

Increase in exports this year, £4,428,956; increase in imports, £632,130. The quantities of iron and steel were, in long tons:

	1911	1912	Changes	
Exports.............	1,095,567	1,287,091	I.	191,524
Imports.............	445,951	459,239	I.	13,288

Tinplate exports to the United States decreased from 7653 tons in 1911 to 580 tons this year.

Metal Markets

New York, May 15—The metal markets have been quite active, and remain rather strong, and inclined to be speculative in some lines.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January....	110	111	July........	112	......
February..	115	109	August.....	117	......
March......	112	111	September.	111	......
April.......	114	120	October....	112	......
May........	118	......	November.	111	......
June........	115	......	December..	110	......

Year 1909, 115; 1910, 115; 1911, 112.

Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Mar. 1912..	$ 7,453,589	$ 4,335,678	Exp.	$3,117,911
" 1911..	505,615	4,119,063	Imp.	3,613,448
Year 1912..	19,958,088	12,414,195	Exp.	7,543,893
" 1911..	1,854,014	19,465,737	Imp.	17,611,723
Silver				
Mar. 1912..	6,806,307	3,711,734	Exp.	2,094,573
" 1911..	5,896,795	3,197,409	Exp.	2,699,386
Year 1912..	16,955,988	11,850,220	Exp.	5,105,768
" 1911..	16,001,842	10,646,781	Exp.	5,355,061

Exports from the port of New York, week ended May 11: Gold, $24,490; silver, $1,555,259, chiefly to London and Paris. Imports: Gold, $400,692, largely from Mexico; silver, $178,653, chiefly from South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was no special demand.

Sales of gold bars for industrial purposes at the New York Assay Office in May were $2,406,879. For the four months ended Apr. 30 the total was $9,313,225, an increase of $310,647 over last year.

Platinum—The market continues steady and rather quiet, but with no change in prices. Dealers ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal, up to 10% iridium.

A considerable shipment of crude platinum was recently received at New York from Colombia.

Iridium—Prices are unchanged at $64 per oz. for pure metal, New York.

Silver—The market has ruled steady without special feature the past week, fluctuating between $27\frac{13}{16}$ and $28\frac{1}{16}$d Market closes quiet at 28d. in London.

SILVER AND STERLING EXCHANGE

May	9	10	11	13	11	15
New York....	60⅜	60⅜	60½	60⅞	60⅝	60¾
London......	$27\frac{13}{16}$	$27\frac{13}{16}$	27⅞	$28\frac{1}{16}$	$27\frac{15}{16}$	28
Sterling Ex..	4.8670	4.8675	4.8680	4.8680	4.8685	4.8680

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

An official statement, just published in London, gives the imports of gold into India for the calendar year 1911 as £22,389,000, against £18,023.000 in 1910. and £10,068,000 in 1909.

Copper, Tin, Lead and Zinc

NEW YORK

May	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
9	15¾ @16	15.60 @15.75	46¼	4.20	4.02½ @4.07½	6.55 @6.65	6.40 @6.50
10	15¾ @16	15.70 @15.75	46¼	4.20	4.02½ @4.07½	6.55 @6.65	6.40 @6.50
11	15¾ @16	15.70 @15.75	46½	4.20	4.02½ @4.07½	6.55 @6.65	6.40 @6.50
13	16 @16¼	15.80 @15.90	46½	4.20	4.02½ @4.07½	6.65 @6.70	6.50 @6.55
14	16 @16¼	15.85 @15.95	46⅜	4.20	4.02½ @4.07½	6.65 @6.75	6.50 @6.60
15	16 @16¼	15.95 @16.00	46⅛	4.20	4.02½ @4.07½	6.65 @6.75	6.50 @6.60

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

May	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
9	70¼	$70\frac{13}{16}$	75	210¾	206½	$16\frac{7}{16}$	25¾
10	$70\frac{11}{16}$	$71\frac{3}{16}$	75¼	211¼	206¾	16½	25¾
11	......	......	......	......	......	......	......
13	72⅛	$72\frac{9}{16}$	77	212½	208	16½	25¾
14	$72\frac{3}{16}$	72⅝	77	211½	207	$16\frac{9}{16}$	25¾
15	$71\frac{15}{16}$	72⅜	77	210	205½	16½	25¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, ± £1 = ± 21¾c.

Copper—The statistics published on May 8 were received favorably, especially from their showing of continued large deliveries, and a renewal of the demand was stimulated, following a sharp rise in the London standard market. This cleaned up all the cheap copper offered on May 9 and before the end of that day first hands made some small sales at 15⅞c., delivered, usual terms, which price was well established on May 10.

On May 13 a greatly increased demand developed which carried the market through the price of 16c., delivered, for which one prominent agency had been holding out and to 16⅛c., which two others had been asking. In the aggregate a rather large volume of business has been transacted, divided between foreign and domestic buyers, apparently preponderating with the latter, who have been interested both in the nearer and later deliveries. Lake copper was sold at 15¾@16c. up to the middle of the week; since then as high as 16¼c. has been realized upon special brands. The market closes firm at 16@16¼c. for Lake, and 15.95@16c. for electrolytic in cakes, ingots and wirebars. Casting copper is quoted nominally at 15½@15¾c. as the average for the week.

European speculators were favorably impressed by the American statistics and the more active market, and higher prices prevailed for refined copper. Standard copper on Tuesday reached £72 3s. 9d. for spot and £72 12s. 6d. for three months, and closes at £71 18s. 9d. for spot, and £72 7s. 6d. for three months.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 17⅛@17¼c. base, carload lots at mill.

Copper exports from New York for the week were 6762 long tons. Our special correspondent gives the exports from Baltimore at 2654 tons.

Copper production of Russia in 1911 is reported at 25,919 long tons, which compared with 22,600 tons in 1910; an increase of 3319 tons.

Tin—The market retained its firm undertone all through the week, even though the advance of Monday last was not maintained. The excellent statistical position of the metal becomes more and more apparent, and very bullish views on the future are being expressed by the large London interests. In this market the tendency to realize developed, and sales were made at below the importation point. The close is steady at £210 for spot, and £205 10s. for three months, and 46⅛c. in this market.

Messrs. Robertson & Bense report the arrivals of tin ore and concentrates at Hamburg, Germany, in April at 1363 tons; 1351 tons from Bolivia and 12 tons from South Africa.

Tin shipments from the Straits in April were 4290 long tons, an increase of 1150 tons over April of last year.

Lead—The cheap lead offered last week by second hands and certain independent producers seems to have been absorbed, and this week we have heard of no business at less than 4.20c., New York, which is the price of the A. S. & R. Co. Lead at St. Louis is quoted at 4.02½@4.07½ cents.

The London market is also firm, Spanish lead being quoted at £16 10s., and English 2s. 6d. higher.

Spelter—Several large galvanizing interests became buyers this week and entered into extensive contracts, the transactions amounting in the aggregate to many thousands of tons for June-July-August delivery. This large demand advanced prices. At the close, St. Louis is quoted at 6.50@6.60c., and New York at 6.65@6.75 cents.

The London market is unchanged, good ordinaries being quoted at £25 15s., and specials at £26 per ton.

Base price of zinc-sheets is $8.65 per 10 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7⅛c. per lb., New York, in carload lots.

Other Metals

Aluminum—Business is quiet but the market is firm. Some small lots of low-priced metal can still be had, but the higher level of prices seems to be well held. We quote 21½@22½c. per lb. for No. 1 ingots, New York.

The convention of European producers was organized on Apr. 27. Details of the agreement have not been published.

Antimony—Business has been fair, and prices are a little firmer. Cookson's is still quoted at 8c. per lb. and Hallett's at 7¾c.; but 7@7¼c. is named for Chinese, Hungarian and other outside brands.

Quicksilver — The market remains steady, with a fair business going. New York quotations are $41@42 per flask of 75 lb., with 60c. per lb. charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for exports. The London price is £8 5s. per flask, with £8 quoted from second hands.

Nickel—Large lots, contract business, 50@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Spanish Metal Exports

Exports of metals and minerals from Spain, two months ended Feb. 29, reported by *Revista Minera*, in metric tons:

Metals	1911	1912	Changes	
Pig and manuf. iron	13,328	9,241	D.	4,087
Copper	1,772	2,017	I.	245
Copper precipitate	2,516	2,195	D.	321
Lead	27,745	24,916	D.	2,829
Zinc	44	545	I.	501
Quicksilver	206	414	I.	208
Minerals				
Iron ore	1,531,901	1,411,792	D.	123,109
Manganese ore	8,118	5,837	D.	2,311
Copper ore	99,304	127,719	I.	28,415
Lead ore	495	614	I.	119
Zinc ore	21,812	24,545	I.	2,733
Pyrites	267,983	407,784	I.	139,801
Salt	81,270	76,003	D.	4,267

Pyritic ores are not classed as copper ores unless they carry 2.5% or over in copper; below that they are classed as pyrites.

Zinc and Lead Ore Markets

Platteville, Wis., May 11—The highest price paid this week for zinc ore was $56; the base price, 60% zinc, was $55. The base price paid for 80% lead ore was $53@54 per ton.,

SHIPMENTS, WEEK ENDED MAY 11

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton	1,089,200	....	596,550
Galena	1,060,400	....	....
Mineral Point	985,670	....	....
Platteville	573,570	....	50,000
Harker	390,680	....	....
Cuba City	321,860	99,600	302,400
Hazel Green	260,000	....	....
Linden	192,510	....	....
Shullsburg	......	416,900	....
Total	4,873,890	515,500	948,950
Year to date	73,326,520	2,801,290	9,001,700

Shipped during week to separating plants, 2,117,410 lb. zinc ore.

Joplin, Mo., May 11—The high price of zinc sulphide ore this week is $61, the base, per ton of 60% zinc, is $52@58.50. Zinc silicate sold at $26@30 per ton of 40% zinc. The average price, all grades of zinc, $54.50 per ton. The high price of lead ore is $54 and the average price $52.10 per ton.

Never before in the history of this district was zinc ore $7 per ton higher than lead ore, and seldom has zinc been even as high in price as lead ore. There is at

SHIPMENTS, WEEK ENDED MAY 11

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,225,710	......	1,207,070	$150,306
Joplin	1,414,180	......	225,850	45,355
Alba-Neck	1,921,320	......	47,860	30,852
Duenweg	769,920	63,670	......	21,741
Galena	741,020	......	18,340	21,200
Jackson	477,890	......	7,630	13,090
Miami	243,370	......	215,110	11,215
Cave Springs	387,380	......	......	10,845
Carl Junction	263,900	......	......	7,900
Spurgeon	56,940	128,440	157,550	7,305
Oronogo	176,900	.....	125,780	7,251
Granby	63,860	300,810	1,330	6,090
Lawton	123,850	......	......	3,465
Wentworth	84,080	......	......	2,828
Springfield	84,000	......	......	2,400
Aurora	60,950	......	......	1,700
Sarcoxie	58,460	......	......	1,578
Carthage	53,820	......	......	1,478
Totals	10,307,650	492,920	2,006,520	$346,599
19 weeks	190,060,010	11,731,270	32,024,470	$5,649,826

Blende val., the week, $286,841; 19 weeks, $4,602,129
Calamine, the week, 7,479; 19 weeks, 170,860
Lead value, the week, 52,279; 19 weeks, 876,937

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.56	$43.54	$56.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	64.18
May	38.25	....	36.79	....	55.21	.
June	40.50	......	38.18	......	56.49	
July	40.75	....	38.36	......	58.81	....
August	42.50	....	41.28	...	60.74	.....
September	42.63	....	41.29	...	59.33	.....
October	42.38	.....	40.89	......	54.72	......
November	45.40	......	43.25	......	57.19	..
December	44.13	.....	40.76	....	62.03	....
Year	$41.45	....	$39.90	....	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

present no competition in the lead-ore market. The local smelters are making no fight, permitting the St. Louis Smelting & Refining Co. to take the pick of the ore, and they are dividing the remainder.

Two weeks of fair weather was again broken yesterday and today with more rain. But for the extra stimulus of strong prices as an incentive to combat the constant disadvantages and damage from the surfeit of rain, the output could not be maintained on the present scale.

New Caledonia Ores

Exports of ore from New Caledonia, as reported by the *Bulletin du Commerce*, of Noumea, for the two months ended Feb. 27, were 3321 metric tons nickel ore and 10,033 tons chrome ore. Exports of metals were 687 tons nickel matte.

Chemicals

New York, May 15—The general market is more active than it has been.

Copper Sulphate—Sales have been on a good scale. Quotations are unchanged at $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Buyers are less pressing. The feature of the past few weeks has been the scarcity of supplies, largely due to the troubles in Mexico. This week the Anaconda Co. offered 75 tons for June delivery, which has eased the situation. Other American producers are reported in the market. Quotations are $3.50@3.75 per 100 lb. for white arsenic.

Nitrate of Soda—Business has been rather quiet and prices are a shade off. The market is quoted at 2.40@2.45c. per lb. for spot; 2.40c. for futures up to Aug. 1, and 2.37½c. for deliveries after that date.

Sulphur—In November last, the Treasury Department issued an order to the effect that sulphur mined in Hokkaido, Japan, and exported through Hakodate, should be held to be crude sulphur and admitted free of duty under paragraph 686 of the tariff act. This sulphur, which is of volcanic origin, is roasted in furnaces, and contains from 90 to 97% pure sulphur. At that time the sulphur from Bongo, Japan, was excepted from the order. Now the Board of General Appraisers has decided that the Bongo sulphur, being over 99% pure, is dutiable under paragraph 81 as refined sulphur. The Bongo sulphur is obtained from geysers, and is no nearly pure that it is not submitted to any artificial treatment. The board held that it was immaterial whether the heat applied to the sulphur was phenomenal or artificial. Imports of Japanese sulphur are made chiefly on the Pacific Coast.

MINING STOCKS

New York, May 15—On May 9, the selling pressure on the Exchange was relaxed, and there was some recovery in quotations. The market, however, was rather narrow. Steel common recovered from its recent low price. Business on the Curb was rather variable. Mining stocks were in fair demand and inclined to be strong, with the exception of the coppers, which were slow and heavy.

May 10 was marked on the Exchange by a general recovery in prices on dealings almost entirely professional. On the Curb, mining stocks were sluggish, the coppers gaining fractionally. Cobalt and Porcupine stocks were moderately active and firm.

May 11 the Exchange was not especially active, and quotations were stationary. On the Curb, there was a good deal of trading in coppers, on advancing prices. Other mining stocks were quiet.

May 13 there was a halt in the advances on the Exchange, and at the close the market was under some pressure. Trading on the Curb was active, with advances in coppers, and strength in other mining stocks. Lehigh Valley Coal Sales was in demand at high quotations.

May 14 the market was slow and prices on the Exchange remained steady. The Curb also was dull and changes were only fractional. The markets continued inactive on May 15, with no changes of importance.

Sales at auction in New York, May 10, included the following mining securities: La France Copper Co., $172,000 bonds, at 5% of par value; Ohio Copper Co., $15,000, first-mortgage bonds, at 48; United Copper Co., preferred, 7452 shares, at $5 per share; Caudle (Alaska) Hydraulic Gold Mining Co., 14,675 shares, at 1c. per share; Isabella Connellsville Coke Co., of West Virginia, 500 shares, $100 par, $500 for the lot; Wise Coal & Coke Co., 167 shares, $100 par, $15,160 for the lot; Western Development Co., preferred, 346 shares, $100 par, $125 for the lot.

Boston, May 14—Sharp recessions in the prices of Mayflower and Old Colony mining stocks during the week have tended to restrict trading in the mining-share list, although the market cannot be considered otherwise than a healthy one, particularly in view of the strength of the metal market. Stop-loss orders in these two stocks caused a break to $9.87½ in the case of Mayflower and to $8.12½ in Old Colony. The former made a high record at $18.50 on Apr. 23 and the latter one at $13.25 on May 1. Disappointment that drill cores at each property have not struck the lode at the expected depth has caused considerable selling of each. The Mayflower's No. 18 drill was expected to encounter the vein at a depth of 1400 ft., but today it was stated that the drill was down 1441 ft. Old Colony's No. 14 drill was expected to reach the vein at a depth of about 870 ft. but is now beyond that point. Partial recoveries have followed from the above recorded low prices.

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Feb.	March	April
Alaska shipments.	2,662,243	4,987,916	1,243,911
Anaconda..........	27,450,000	25,900,000	25,480,000
Arizona, Ltd.......	3,020,000	3,150,000	3,400,000
Copper Queen......	6,046,860	7,197,121	....
Calumet & Ariz....	4,452,004	4,652,000	4,104,000
Detroit..........	2,068,370	2,246,238	....
East Butte..........	1,440,000	1,480,000	....
Mammoth..........	1,722,954	1,939,310	....
Mason Valley......	1,100,000	1,140,000	....
Nevada Con........	4,888,790	6,380,000	....
Old Dominion......	2,039,000	2,432,000	2,167,000
Ray..................	2,140,000	2,300,000	2,612,500
Shannon............	1,300,000	1,388,000	1,544,000
South Utah.........	283,838	299,000	284,215
United Verde*.....	2,250,000	2,250,000	....
Utah Copper Co....	8,612,739	8,160,000	....
Lake Superior*....	19,000,000	19,750,000	18,250,000
Non-rep. mines* .	8,000,000	8,400,000	....
Total production.	98,476,798	104,051,585	....
Imports, bars, etc..	18,976,513	23,519,215	....
Total blister.....	117,453,311	127,570,800	....
Imp. in ore & matte	10,432,438	8,736,874	....
Total..............	127,885,749	136,307,674	....
Miami..............	2,475,995	2,755,000	....
Brit. Col. Cos.:			
British Col. Copper	860,003	....	....
Granby	1,773,496	1,882,073	....
Mexican Cos.:			
Boleo..............	2,204,720	2,424,800	2,149,280
Cananea	2,948,000	2,834,000	4,654,000
Moctezuma	2,687,712	2,446,731	....
Other Foreign:			
Cape Cop., S. Africa	785,440	725,760	....
Kyshtim, Russia...	1,055,000	....	1,545,000
Spassky, Russia....	649,600	....	....
Famatina, Argen..	....	....	....
Tilt Cove, Newf'd..	109,059	104,992	....
Exports from:			
Chile..............	6,720,000	3,584,000	5,495,000
Australia	7,164,000	8,064,000	9,408,000
Arrivals in Europe†	10,868,680	12,559,680	12,064,640

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
IV, 1911.........	118,085,223	52,407,650	62,129,599
V..............	126,962,544	64,543,953	61,978,557
VI..............	124,554,312	61,655,561	71,460,519
VII.	112,167,934	56,982,582	74,880,658
VIII..........	125,493,667	59,935,364	69,855,660
IX..............	115,588,950	57,311,584	50,824,011
X..............	118,255,442	64,068,307	60,084,349
XI...	111,876,601	68,039,776	67,049,279
XII...	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912.........	119,337,753	62,343,901	80,167,904
II..............	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326

VISIBLE STOCKS

	United States	Europe	Total
V, 1911	165,555,908	212,284,800	377,840,708
VI..	165,995,932	202,540,800	368,536,732
VII...	157,434,164	195,932,800	353,366,964
VIII.. ...	137,738,858	191,891,840	329,630,698
IX.....	133,441,501	191,228,800	324,670,301
X..............	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII ...	111,785,188	164,281,600	276,066,788
I, 1912....	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV.	62,367,557	136,819,200	199,186,757
V...	65,066,029	134,176,000	199,242,029

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

These rather severe declines had no particular effect on the copper-share list as a whole, for most stocks are selling at prices better than a week ago.

Curb trading has been light but prices hold steady to firm. South Lake weakened fractionally upon the $2 assessment levied last week.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich.	Jan. 22	....	$1.00
Alpha Con., Nev.	May 29	June 19	0.05
Andes, Nev.	May 28	June 18	0.05
Black Horse, Ida.	....	....	0 02
Black Jack, Utah,	Feb. 6	....	0.01
Caledonia, Nev.	May 21	June 11	0.10
Cedar-Talisman, Utah	Apr. 20	....	0.005
East Tintic, Utah	May 30	June 25	0.005
Ely Con., Nev.	....	....	0.05
Exchequer, Nev.	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Glen Dale, Utah	May 25	June 25	0.00
Gould & Curry, Nev.	Apr. 19	May 10	0.05
Hancock, Mich.	Mar. 28	....	1.00
Houghton Copper, Mich	May 17	....	1.00
Julia, Nev.	May 15	June 5	0.05
Lehi Tintic, Utah	Feb. 29	....	0.01
Lower Mammoth, Utah	Mar. 16	....	0.01
Michigan Cop. & Gold, Utah.	May 15	May 30	0.002½
New York Bonanza, Utah	May 8	....	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich.	Jan. 10	....	1 00
Raven, Mont.	Feb. 1	....	0.10½
Savage, Nev.	June 4	June 26	0 105
South Lake, Mich.	June 3	....	2 00
Southwestern Miami, Ariz.	Jan. 15	....	1 00
Union Con., Nev.	May 9	May 31	0.15
Utah Antimony, Utah	June 1	....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52 222	59 043	23.794	24.081	27 190
March	51.454	52 745	58.375	23.690	24.324	26.875
April	53 221	53 325	59.207	24.483	24.595	27.284
May	53.870	53.308	.....	24 797	24.583	.....
June	53.462	53.043	.....	24.651	24 486	.....
July	54.150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24.428	24.082	.....
September	53 295	52 440	.....	24.567	24.209	.....
October	55 490	53.340	.....	25.596	24.594	.....
November	55.635	55 719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	14.094	12 680	14.337	55.600	62.760
February	12 256	14.084	12 611	14.329	54.974	62 893
March	12 139	14.698	12 447	14.868	54.704	65.884
April	12 019	15 741	12 275	15.930	54.034	70.294
May	11 989	.....	12 214	.....	54 313	.....
June	12 385	.....	12 611	.....	56 365	.....
July	12 463	.....	12 720	.....	56 673	.....
August	12 105	.....	12 634	.....	56 266	.....
September	12 201	.....	12 508	.....	55 253	.....
October	12 189	.....	12 370	.....	55 170	.....
November	12.616	.....	12 769		57 253	.....
December	13.552		13 768	.....	62 068	.....
Year	12 376		12.634		55 973	....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	..
February	41 614	42 962	August	43 319	...
March	40 157	42.577	September	39 755	..
April	42 185	43 923	October	41 185	...
May	43 115		November	43 125	....
June	44 606	....	December	44 655	..
			Av. Year	42 281	.. ..

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4.435	4 334	4.327	13 009	15.619
February	4 440	4.026	4 266	3 946	13 043	15 738
March	4.394	4.073	4 238	4.046	13 122	15.997
April	4 412	4 200	4 262	4 118	12.889	16.331
May	4 373	.....	4.223	.....	12 984	....
June	4 435	.....	4 292	.....	13.260	....
July	4 499	.....	4.397	.....	13 530	.....
August	4 500	.....	4 406	.....	14.260	.....
September	4 485	.....	4 356	.....	14 744	.....
October	4.265	.....	4 139	.....	15.332	.....
November	4 298	.....	4.181	.....	15.821	.....
December	4 450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4 286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5.302	6.292	23.887	26.642
February	5 518	6.499	5 368	6.349	23 276	26 661
March	5.563	6.626	5.413	6.476	23 016	26.048
April	5 399	6.633	5.249	6 483	23 743	25 644
May	5.348	.....	5.198	.....	24.375	.....
June	5 520	.....	5 370	.....	24 612	.....
July	5 695	.....	5 545	.....	25.006	.....
August	5 953	.....	5 803	.....	26 801	.....
September	5 869	.....	5 719	.....	27 750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6 223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14.75	$14.00
February	15.90	15.03	14 50	13.28	14 81	14.01
March	15.90	14.95	14 65	13.66	14.96	14.10
April	15 90	15.13	14 65	13.90	15 00	14 15
May	15.90	.....	14.30	.....	14 72	.....
June	15 90	.....	14 06	.....	14.56	.....
July	15 90	.....	14.03	.....	14 53	.....
August	15 90	.....	14 00	.....	14 47	.....
September	15 90	.....	13 57	.....	14 40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14 25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15 72	.....	$13 94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS May 14

Name of Comp.	Bid.
Acacia	.05¼
Cripple Cr'k Con.	.01¾
C. K. & N.	.16
Doctor Jack Pot	.05¾
Elkton Con.	.62¼
El Paso	.79½
Findlay	.04
Gold Dollar	‡.16¼
Gold Sovereign	‡.01¼
Isabella	.12¼
Jack Pot	‡.05
Jennie Sample	.05
Lexington	‡ 01
Moon Anchor	01
Old Gold	‡ 03¼
Mary McKinney	.68¼
Pharmacist	.01¼
Portland	89
Vindicator	73
Work	01

SALT LAKE May 14

Name of Comp.	Bid.
Beck Tunnel	14
Black Jack	‡ 17¼
Cedar Talisman	02¼
Colorado Mining	.17
Columbus Con	‡ 13
Crown Point	03
Daly-Judge	‡6.25
Grand Central	.74
Iron Blossom	1 20
Little Bell	40
Lower Mammoth	02¾
Mason Valley	11.00
May Day	10
Nevada Hills	1.80
New York	04¼
Prince Con	1 42½
Silver King Coal'n	2 15
Sioux Con	.04¼
Uncle Sam	.19
Yankee	‡ 10

TORONTO May 14

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6 90	Hollinger	10 90
Hudson Bay	†70 00	Imperial	03½
Temiskaming	.37	Pearl Lake	13
Wettlaufer-Lor.	63	Porcu. Gold	36
Apex	03	Porcu. Tisdale	03
Central	‡5 56	Preston E. D.	06
Crown Chartered	22	Rea	45
Doble	30	Standard	06
Dome Exten	30	Swastika	19
Foley O'Brien	20	West Dome	12

SAN FRANCISCO May 13

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.17	Belmont	10.00
Belcher	.90	Jim Butler	.60
Best & Belcher	.06	MacNamara	.26
Caledonia	1.20	Midway	.61
Challenge Con	.13	Mont.-Tonopah	3.23
Chollar	.06	North Star	.22
Confidence	.87	West End Con	2.10
Con. Virginia	.72	Atlanta	.25
Crown Point	.65	Booth	.10
Gould & Curry	06	C.O.D. Con	.11
Hale & Norcross	23	Comb. Frac	.10
Mexican	2 80	Jumbo Extension	.42
Occidental	55	Pitts.-Silver Peak	1.35
Ophir	1 47½	Silver Pick	.12
Overman	1 05	St. Ives	.30
Potosi	.06	Tramp Con	‡.01
Savage	10	Argonaut	2.25
Sierra Nevada	.31	Bunker Hill	4.50
Union Con	1.05	Cent. Eureka	.94
Yellow Jacket	.92	So. Eureka	3.70

N. Y. EXCH. May 14

Name of Comp.	Clg.
Amalgamated	83½
Am. Agri. Chem.	61½
Am.Sm.&Ref.,com	86
Am. Sm. & Ref., pf.	108½
Am. Sm. Sec., pf. B	88
Anaconda	42⅞
Batopilas Min.	‡2
Bethlehem Steel pf	72½
Chino	29⅝
Federal M. & S., pf.	40
Goldfield Con.	4
Great Nor., ore., ctf.	42⅛
Homestake	93
Miami Copper	25⅝
Nat'nal Lead, com.	57
National Lead, pf.	109
Nev. Consol.	22
Pittsburg Coal, pf.	89
Ray Con.	19¼
Republic I&S, com.	24⅝
Republic I & S, pf.	80¾
Sloss Sheffi'd, com.	52
Sloss Sheffield, pf.	‡100
Tennessee Copper	43
Utah Copper	63
U. S. Steel, com	70⅝
U. S. Steel, pf.	111½
Va. Car. Chem.	52¼

N. Y. CURB May 14

Name of Comp.	Clg.
Barnes King	¼
Beaver Con	.46
Braden Copper	5¾
B. C. Copper	5⅜
Buffalo Mines	‡1¼
Butte & Vipond	‡.53
Caledonia	¾
Con. Ariz. Sm.	13/16
Davis-Daly	1⅞
Diam'field-Daisy	10
Ely Con	5/16
Florence	.70
Giroux	5⅝
Gold Hill Con	‡¼
Greene Cananea	9⅝
Greenwater	.06
Guggen. Exp.	225
Inspiration Con.	18¾
Internat. S. & R.	123½
LaGrange Placer	‡2⅞
Kerr Lake	2 11/16
La Rose	3½
McKinley-Dar-Sa.	1¾
Min. Co. of A. new	3⅛
Nev. Utah M. & S.	1/16
Nipissing Mines	7¾
Ohio Copper	1⅜
Pacific Sm. & M.	¼
Precious Metals	‡1⅜
Ray Central	2 5/16
Red Warrior	‡1⅛
South Utah M. & S.	⅞
Standard Oil (Old)	890
Stand'd Oil of N.J.	384
Stand'd Oil Subs.	490
Stewart	1¼
Tonopah	7
Tonopah Ex	2 3/16
Tri-Bullion	9/16
Tularosa	[illegible]
United Cop., pfd.	10
Yukon Gold	3⅜

LONDON May 15

Name of Com.	Clg.
Camp Bird	£1 11s 1d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 11 3
Mexico Mines	7 0 0
Oroville	0 4 6
Stratton's Ind.	0 3 1½
Tomboy	1 1 9

BOSTON EXCH. May 14

Name of Comp.	Clg.
Adventure	8⅞
Ahmeek	310
Algomah	7¼
Allouez	44½
Am. Zinc	30
Ariz. Com., ctfs.	5½
Bonanza	.45
Boston & Corbin	7
Butte & Balak	4
Calumet & Ariz	73
Calumet & Hecla	470
Centennial	24½
Con. Mercur	.06
Copper Range	59¼
Daly West	5⅝
East Butte	13¾
Franklin	13
Granby	55
Hancock	34½
Hedley Gold	16½
Helvetia	1⅜
Indiana	20¼
Island Cr'k, com.	48
Island Cr'k, pfd.	88½
Isle Royale	26⅝
Keweenaw	2
Lake	30¼
La Salle	6½
Mass	7
Michigan	3.
Mohawk	63½
New Arcadian	4¾
New Idria Quick.	6⅞
North Butte	28¼
North Lake	7
Ojibway	4¾
Old Dominion	56⅞
Osceola	116
Quincy	89
Shannon	14
Shattuck-Ariz.	21
Superior	33
Superior & Bost.	2⅝
Tamarack	43
Trinity	6½
Tuolumne	3½
Union Mines	‡3⅝
U. S. Smelting	38
U. S. Smelt'g, pf.	48⅞
Utah Apex	2⅝
Utah Con	13¼
Victoria	4⅛
Winona	6½
Wolverine	110
Wyandot	2½

BOSTON CURB May 14

Name of Comp.	Last
Bingham Mines	2½
Boston Ely	1 13/16
Boswyocolo	.08
Butte Central	6½
Cactus	12
Calaveras	1½
Chief Cons	1 7/16
Corbin	2¼
Cortez	1 5/16
Crown Reserve	3¼
First Nat. Cop.	2⅞
Majestic	65
Mazatan	‡ 60
Moneta Porc.	‡ 12
Nevada-Douglas	3½
New Baltic	3½
Oneco	3 5/16
Raven Copper	.30
Rhode Island Coal	07
San Antonio	‡3
S. W. Miami	8
South Lake	6¾
Trethewey	.60
United Verde Ext.	.35
Vulture	‡5.00

†Last quotation

The Engineering and Mining Journal

Vol. 93. MAY 25, 1912. No. 21

Issued Weekly by the
Hill Publishing Company
John A. Hill, Pres. Rob't McKean, Treas.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N. W. 7.

Walter Renton Ingalls, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page

Editorials:

Some Reasons Why Mining Languishes 1017
The Aluminum Suit 1018
Diamond Drilling 1018
By the Way 1019
The Aluminum Suit 1020
Sale of Nova Scotia Mine and Mill at Cobalt 1020
The Crystal Falls Iron District, Michigan 1020

Correspondence and Discussion:

Cartridges for Tamping Dynamite....New Kink in Iodide Copper Assays....Estimation of Ore Reserves....Food for Miners....Company Stores at Grass Valley....Oil Burners 1021
Cost of Mining a Ton of Ore. Heath Steele 1023
Cuyuna Iron Range 1025
Conditions at the Homestake 1025

Details of Practical Mining:

*An Underground Hoisting Station....Unwatering a Mine with Electric Turbine Pumps....*Volumetric Efficiency of Air Compressors....*Expansion Joint for Pipe Lines....Electric Signals for Underground Tramways....*Joplin Scraper and Loading Stick....Air Escape on Small Pump Columns 1027

Details of Metallurgical Practice:

*Built-up Wooden Water Tanks....*Self Filling Burette Attachment....Changes in Design of Rand Stamps....*Handling Broken Slag with Clam Shell Buckets....Filing Small Mine Maps 1031
The Cost of Doing Things 1033
Mine Hoisting Systems Compared—II.........Bruno V. Nordberg 1035
Aluminum Production in 1911 1038
Spelter Statistics for 1911. W. R. Ingalls 1039
*Utahnite Safety Explosive. Martin Fishback 1039
Electricity Applied to Chemistry. Harry C. Jones 1041
Copper Production in 1911 1044
*The Vulture Mine, Arizona. W. E. Defty 1044
Lubrication of Roller Bearing Mine Cars.........George B. Woodruff 1046
*Continuous Decantation Processes 1046
Technical Writing at Michigan College of Mines 1046
*Breaking Ground without Powder. G. E. Wolcott 1047
Reconstructed Gold Dredges in California..........L. H. Eddy 1048
Patents 1049
Personal, Obituary and Societies 1050
Editorial Correspondence 1051
Mining News 1053
Markets 1059

*Illustrated.

Some Reasons Why Mining Languishes

The United States Smelting, Refining & Mining Co., besides being a mining and smelting company, is one of the important exploration companies; i.e., it is constantly searching for new mines and for that purpose maintains an exploration department under the direction of a distinguished engineer, Sidney J. Jennings. The experience of this company in this branch of its business is illuminating as to several things, among them some reasons for the languishing of the mining industry that is the subject of complaint and discussion in certain of the western states. We do not think that the experience of Mr. Jennings is unique; indeed we recollect some figures given by H. C. Hoover that were of the same order; but Mr. Jennings is, so far as we know, the only one who publishes them regularly.

The following is an excerpt from his report to his company for 1910:

> During the year ending Dec. 31, 1910, 684 separate mining propositions were presented for the consideration of the exploration department of your company. An examination of the reports submitted, together with a knowledge of the districts in which the properties were located, was sufficient to warrant the rejection of 514. On 124 properties a preliminary examination was made by the engineers of this department, with the result that no further work was recommended to be done on these properties. On 46 properties, on which a preliminary examination had been made, further work was recommended and a complete examination of these properties was undertaken, with the result that two properties were reserved for further consideration, and it is hoped that satisfactory terms can be arranged for their purchase during the coming year.

We believe that one of the two properties referred to in the last paragraph was the Gold Road mine in Arizona, which was acquired by the company in 1911. The following is from Mr. Jennings' report for 1911:

> During the year under review, 921 properties were considered. This does not include propositions that were refused on the face of the statements made. An examination by the office nearest the property concerned, coupled with knowledge of the geology and working costs of the respective districts, was sufficient to warrant refusing 749 of the propositions submitted. A preliminary field examination of 144 properties was made, and 28 properties were subjected to a complete sampling and examination, with the result that one property was taken over.

Thus, it appears that out of 268 mines examined during two years only three were finally acquired, and this during a period when the mining industry was relatively inactive and the price of mining property relatively low, like other prices. It is not to be inferred from these figures that out of the mining property in the market 99% is valueless; rather do the figures point to the inability of buyers and sellers to come to terms.

The United States company is an important and active concern and it is a reasonable assumption that a large part of the mining property in the market is offered to it at one time or another. Its consideration of 1605 in two years, exclusive of what was summarily dismissed on the face of the vendors' statements, is indicative of that. Also the actual examination of 268 is indicative of a rather high proportion of merit. In that examination it developed, no doubt, that many properties had been misrepresented and could be rejected after a brief reconnaissance, but it is equally probable that many possessed fair prospective possibilities but had to be dismissed because of the exaggerated ideas of their owners.

Experience teaches that the common idea among mine owners is to demand all that a mine has actually developed, plus all probability, computed as to net value on the basis of what the large company can accomplish by virtue of its superior organization, knowledge, and command of capital. The standing upon such a demand is, of course, obstructive, because there is no use for a buyer to acquire a mine if he has to take all the chances and can only get his money back if all hopes are realized. The view of the purchaser is to pay for the ore developed plus a reasonable allowance for probability, figuring net value on the basis of what the owner can accomplish in his own working.

A reason why more mines are not taken over and exploited energetically by modern methods is the failure to reconcile the widely varying views of buyer and seller. Obviously the position of the average seller, as indicated in the foregoing paragraph, is quite unreasonable, and undoubtedly stands in the way of progress in mining. Here enters the question to which we have repeatedly referred, viz. Would it not be wise for the States wherein mining is becoming decadent to adjust their system of taxation so as to promote it? The conditions under which much mining property is held at present are not greatly different from those of much suburban real estate that is held out of use, by virtue of an unduly lenient system of taxation, awaiting a realization of unearned increment.

The Aluminum Suit

For a year or more the Department of Justice has been investigating the Aluminum Company of America, as the result of which suit against it was filed on May 16. The company, it appeared, had previously agreed to what the department wants of it, the filing of the suit being to make a legal record. The conditions in this case provoke a mixture of comment.

The Aluminum Company of America became originally a monopoly by virtue of patent rights. The Government does not deny the legality of this, nor does the Government insist that it was unlawful within itself for this company to acquire and hold 80 per cent. of the production of alumina used for making aluminum. Yet, if this be not unlawful on the part of the Aluminum company, why is there so much ado about the iron ore holdings of the Steel Corporation?

The Aluminum company is charged with entering into agreements with three important domestic companies, potential competitors, whereby those companies were restrained from engaging in the manufacture of aluminum and from selling bauxite to anybody except the Aluminum Company of America. Such an agreement was manifestly illegal and the Department of Justice has done right in abolishing it. Also, in abolishing an alleged agreement with the Neuhausen company, of Switzerland, preventing importations and exportations, although, of course, that agreement was of no great consequence, the Aluminum Company of America having no desire to export to Europe under the conditions of low price prevailing there, while, if the Neuhausen company restrained itself from exporting to America, other European producers did not, large quantities of European aluminum having been regularly brought into this country.

We find it hard to say whether the Government's brief in this case exhibits returning rationality, or disgusting hypocrisy, or a mixture of both. No attempt is made to dissolve this offender into its constituents (there never having been any constituents), but there is to be merely a specific injunction against certain illegal practices. If that be the correct procedure (and we think it is) why have not other concerns been treated in the same way? The claim that since the expiration of its patents the company has charged unreasonably high prices for aluminum is deceptive unless the whole truth be told.

The price for aluminum in this country during recent years has been the price in Europe plus the freight hither, plus the absurd tariff of 7c. per lb., bestowed by the beneficence of Congress. The Aluminum Company of America has simply met European competition under these conditions. Why should it have done otherwise, the honorable members of Congress, representing the people by whom they were elected, having conferred this special right? We wonder why the intelligent officers of the Department of Justice did not make some remarks about this and disclose all the facts of the case.

Diamond Drilling

Drilling has established itself as an important part of exploratory operations. Churn drilling has been found satisfactory in some districts, but in others conditions necessitate the use of diamond drills. The latter is true of the Lake Superior copper country, and during the last two years a larger amount of this work than usual has been done there. The annual reports of a number of the Lake companies have come to hand recently, and the costs indicated for this work are interesting.

In many ways drilling costs are perhaps not less subject to criticism than are other costs. In comparing the work in several districts, however, there is the advantage that such work is often done by contract, the contractors, through experience, being usually able to fix a price for the work that insures them a good profit. The fact that such work is done by contract, in itself indicates that in drilling more dependence can be placed on past costs than in many other operations connected with mining. If confined to one district, the comparison is still more valuable, and perhaps is more so than usual in the Lake copper district where drilling conditions differ principally in the depth of overburden that obtains on the various properties.

On the Indiana property, 3594 ft. of drilling were done in 1911 at a cost of $11,946 or $3.32 per ft.; the footage on the North Lake was 3210 ft. and the total cost $10,606, or $3.30 per ft. These costs per foot agree so closely as to indicate a contract rate of about $3.30 per ft. As compared to these, the reports of the Mayflower and Contact companies, both under the same management, but different than that of the Indiana and North Lake companies, indicate from the manner of recording payments, that the work is being done by the company. At the Mayflower, 7294 ft. were drilled in 1911, at a total cost of $17,562, or $2.40 per ft. The Contact report, including operations from May, 1910, to December 30, 1911, indicates a total footage of 4915 ft., the cost of which was $20,022, or $4.07 per ft. The conditions as to overburden here were severe and were likely responsible for this high cost.

It is interesting and commendable that Clarence H. Mackay maintains his interest in the Mackay School of Mines, of the University of Nevada, which has lately been manifested by the further gift, by himself and his mother, of $150,000 to the school. One of the most inspiring features of the school is the statue of John William Mackay, a wonderful piece of sculpture, facing toward Virginia City, whence came the fortune of the family. It is gratifying that Clarence H. Mackay remembers what he owes to Nevada and is so generous in helping her young men.

By the Way

The engineers of the American Smelting & Refining Co. performed a remarkable feat of rapidity in their construction of the Hayden smelting plant. Orders to begin were given on Aug. 16, 1911. Grading began on Sept. 1. The first reverberatory furnace was fired on Apr. 18, 1912, and the first charge put in on May 5, the first blister copper being made on May 15. A second reverberatory furnace is under construction.

A citizen on the R. F. D. has written requesting the name and address of some firm handling instruments for seeking buried treasures. "I have an uncle who died recently and left considerable money buried," he writes, "but I cannot find it." Since the efficiency of divining rods, electrometers, goldmeters, Spanish needles, etc., is confined mainly to the minds of the inventors we are compelled to recommend the old-fashioned shovel, backed by ardent desire.

From the dirt excavated for a new hotel building, at Helena, Mont., three men are washing three ounces of gold daily, says the Anaconda *Standard*. This ground was not mined when the Last Chance placer was operated, and the contractor who made the excavation for the hotel removed the gravel to some land he owns, near the old Montana Central depot. If the present yield is maintained, he will make more from washing out the gold than he did from his excavating contract.

When the first works were being built at Butte conditions were crude, skillful mechanics were rare, and rough work was the order of the day. No one recognized the conditions and necessities better than Marcus Daly. One day he observed a carpenter cutting a very crooked mortise. Becoming conscious of this inspection, the carpenter said apologetically: "Don't be worried, Mr. Daly, I'm going to fix this." "No, you aren't, replied Mr. Daly. "You'll just leave it be. There's another wood butcher over yonder who's cutting a tenon that'll just fit this."

The discovering of white metals having properties similar to platinum, seems to be a contagious ailment. Having ravaged British Columbia, it now appears in New Zealand. "It is stated that a plant has been erected at Taranaki, in New Zealand, at a cost of several thousand pounds," says the *Chemical Trade Journal*, "for the purpose of applying a new process to a certain type of ironsand, which is to be found in large quantities there, and from which a hitherto unknown white metal, having similar properties to platinum, is obtained. The process is being exploited by the Paparoa Iron Ore Company."

The recent decision of the Court of Appeals at Albany, maintaining the liability of promoters for fraudulent or misleading representations made to investors, should help to straighten out a matter which has long been in vexing uncertainty in this country, says the *Evening Post*. The English law has been notoriously stringent in holding promoters liable, and the British courts have enforced it with wholesome severity. That fact has not, of course, prevented gullible people from making foolish investments, nor has it done away with reckless speculation. But it is at least a protection to innocent investors, necessarily ignorant of details, to know that they are not without legal redress when deceived into parting with their money by the lies of unscrupulous promoters or their agents. One of the strong points in the Court of Appeals decision is the holding that, where there is a number of promoters, all of them "are liable for damages for the fraud of an agent employed by them to effect the sale of corporation securities, without reference to their moral guilt or innocence."

The Men and Religion Movement in New York seems to be drawing heavily on the mining districts for talent. The personality of its "social-service" expert, Raymond Robins, is graphically depicted in the *Survey* as follows: "First a barefoot boy, poor as only the poor of the South are poor. Then a young man, working at hard labor for $10 a month and his keep. A coal miner, at a dollar for a 12-hr. day, down in old mines without machinery or modern methods, often the whole day on his knees swinging a pick in a low room, at night too tired for more than a meal and a sleep—no fun, nothing but work and eat and sleep, with a growing taste for liquor "to forget it." Something within drives him west to a silver mine. There, as a union miner, he works eight hours a day, for $4—one-third less work, four times more pay. The sun shines on him every morning and every afternoon, instead of Sunday only. He reads hungrily everything he can lay his hands on. He is active in his union. But he does not join a church, for Herbert Spencer and other over-rich fare in his reading have given him a young thinker's scorn of this Christ he has never seen, and the other fellows do not know or talk about. At the first flash of the news from the North he is off to the Klondike, where he makes good. Storm-bound in a Roman Catholic mission on the Yukon, he spends two days with a priest, close-bound in a hut, before an open fire. There they talk, hour on hour. As they get down to the deeper things, Robins parading his unbelief, he sees, as the fire flares up, a something in the priest's face he has never seen before. This, he thinks, must be that peace of God which passeth all understanding. * * * Eventually he organizes a mission and becomes the minister of St. Bernard Congregational Church at Nome." The influence of the Western Federation may be seen in some bits from his creed: "It is inconceivable that a feudal workshop shall continue to exist side by side with a free church and a free state. A great tide of democracy—in industry—is sweeping over the whole world. * * * The sweep of the thing is irresistible, world wide, growing every day. The old vertical lines of social division—by income, profession, family—are gone. The new line is horizontal. Above it are all those who live by dividends, and below it are those who live by labor." Where do those who bought stock but do not get the dividends come in? The line, itself, can offer them no sanctuary; they are between the upper and nether millstones, obviously in the hole.

The Cornwall correspondent of the London *Mining Journal*, having been invited by T. Fiddick, of Camborne, to his lecture on "Why the Dowsing Rod Turns," took an opportunity of having a preliminary demonstration some days beforehand. "The instrument employed by Mr. Fiddick is a truncated octagonal cone of Jarrah wood, about 1½ in. diameter at the top end, ¾ in. at the bottom, and 3½ in. long, with a groove in each of the eight facets for the sliding in of various slips of metal. This cone is attached to a bar of the same wood (about 5 in. long by ¾ in. wide by ⅜ in. thick) by a supple piece of twine about 18 in. long. The operator takes the bar of wood in the right hand, letting it rest on the thumb and little finger, the other three fingers being above, and not touching the bar, the cone being allowed free play and hanging from the bar by the twine. When hanging vertically over any metallic-bearing substance, the Jarrah wood cone oscillates with a good swing in the direction of the greatest length of the substance. In the tracing of lodes the direction of the swing denotes the bearing, whereas if there is no metallic-bearing substance underneath, the cone remains stationary. With this also, as with the hazel twig, everybody cannot operate it. It some hands the cone remains stationary whatever there may be underneath. With an adept, a certain qualitative analysis of an ore can be discovered, for whereas if there is a tin lode underneath the cone alone will vibrate freely, but if strips of tin are inserted in the grooves of the cone, the instrument will not vibrate. The same obtains with the other metals, so that by the insertion of any metal strip, causing the cone to cease vibrating, this points to the fact that the stone contains that metal." If this be true, we do not see that there will be any further use for mining geologists, and not even for "Spanish needles."

The Aluminum Suit

In the United States Circuit Court at Pittsburgh, May 16, the Federal Government filed a civil anti-trust suit against the Aluminum Co. of America, which will be the basis for an agreed decree designed to restrain the so called Aluminum Trust from monopolizing the maunfacture of aluminum and its products. The company is charged with being a monopoly restraining interstate and foreign commerce in violation of the Sherman law. It is declared to have acquired a substantial control of the aluminum industry in the United States and to have charged unreasonably high prices and profits on its products. The dissolution of the corporation is not sought, but the court is asked to issue nine broad injunctions against alleged unlawful contracts, combinations, conspiracies, and practices.

The government concedes that the company's ownership of more than 90% of the known deposits of bauxite in the United States and Canada suitable for the manufacture of the metal is not within itself unlawful. It is charged, however, that the practical monopoly in both bauxite and the manufacture of aluminum which the company legally enjoyed upon the expiration of its patents for making aluminum in 1909 has been maintained by unlawful agreements and unfair methods toward competitors.

The history of the aluminum cooking-utensils industry in the United States, says the petition, is a history of shipwrecks "caused chiefly or contributed to by the arbitrary, discriminatory, and unfair dealings of the defendant."

The agreed decree, which will be entered within a few days, will follow the government's request for restraints upon the company. This agreement, obviating a prolonged battle in the courts, was the result of several weeks of negotiations with the officials.

The Aluminum Co. of America, incorporated in Pennsylvania originally as the Pittsburgh Reduction Co., has grown, it is pointed out, from a $20,000 capitalization in 1888 until its assets now are estimated at $27,000,000. A stock dividend of 500 per cent., or $16,000,000, was declared in 1909. In addition to its extensive raw material holdings, the government declares that the company produces practically 80% and consumes substantially 100% of the alumina used in making aluminum; manufactures substantially 100% of the crude and semi-finished aluminum for the United States and Canada; more than 70% of the aluminum cooking utensils in the United States; controls the manufacture and sale of over 50% of aluminum castings for this country, used primarily in the automobile industry, and more than 70% of all aluminum goods and novelties of general make in this country.

The defendant company is charged with entering into illegal agreements with the following foreign corporations or individuals. With the General Chemical Co., Norton Co., and the Pennsylvania Salt Manufacturing Co., forbidding these three potential competitors from engaging in the manufacture of aluminum and from selling bauxite to anyone except the defendant.

With the so called Swiss or Neuhausen Co. of Europe, the largest European aluminum manufacturer, preventing importations and exportations and dividing territory and trade so that the American company controlled the business on this side of the Atlantic and the European corporation on the other.

With Gustav A. Kruttschnitt and James C. Coleman, both of Newark, N. J., who are alleged to have agreed not to manufacture or sell aluminum east of Denver, Colo., for a period of 20 years from Nov. 16, 1910.

The company is alleged to have threatened, harassed, impeded, and discriminated against independents and to have attempted to impress competitors so completely that they were at the mercy of the defendant for their supply of raw material.

The court is asked to enjoin the defendant corporation against the continuance or repetition of any and all of these alleged unlawful contracts and practices, and from purchasing or combining with any independent concern engaged in the aluminum industry.

Sale of Nova Scotia Mine and Mill at Cobalt

Special Correspondence

The property of the Nova Scotia-Cobalt Silver Mining Co. will be put up for sale on May 20, by the assignee of the insolvent company. In the assignee's statement, recently issued, the liabilities are stated to be $245.045. The assets are placed at $288,396, and consist of buildings, mill, machinery, equipment, etc. The chief creditors are D. M. Steindler, M. B. Davis and J. A. Jacobs, of Montreal, to whom the company owes $146,098, the Nipissing and Kerr Lake mining companies, $48,685, and $11,053 to the British Canadian Power Company.

It is pointed out that mining operations having been unsuccessful, the company erected a mill to do custom work, the money for the undertaking being advanced by the directors. An aërial tramway was built to connect the mill with the Kerr Lake and Crown Reserve mines, when it was found that an expenditure of another $30,000 was necessary before the mill could be run at a profit. The directors agreed to advance this money and also $30,000 more for running expenses, on condition that the creditors would wait a sufficient time to get the mill running again, and would allow this $60,000 to be a first charge against the property. Some of the creditors would not agree to this, so an assignment was made.

The Crystal Falls Iron District, Michigan

In a recent publication of the State Geological Survey, R. C. Allen, state geologist of Michigan, summed up the Crystal Falls district as follows:

> It is the opinion of those who are in best position to judge, that the Crystal Falls district is vastly more important, from the standpoint of possible ore reserves, than heretofore generally believed, or than might be inferred from its record of production. The following is the estimated ore reserves of the district rported by J. R. Finlay to the Michigan Tax Commission, in 1911:

ORE RESERVES OF CRYSTAL FALLS DISTRICT ESTIMATED BY J. R. FINLAY

Mine	Reported in Sight Above Bottom Level	Total Tonnage Expected
Hollister	.....	......
Crystal Falls	42,000	500,000
McDonald	10,000	......
Mansfield	32,000	525,000
Fairbanks	......	......
Bristol	522,000	1,500,000
Armenia	50,300	550,000
Great Western	97,300	800,000
Tobin	135,300	1,800,000
Kimball	.....	.....
Dunn	67,000	117,000
Michigan	78,000	100,000
Hemlock	125,000	180,000
Channing	75,000	75,000
Youngstown	......	40,000
Amasa-Porter	.....	330,000
Alpha	.....	60,000
Neely	....	587,000
Hill Top	......	10,000
Monongahela-Carpenter	....	320,000
Extension Great Western	......	200,000
Totals	1,233,900	8,054,000

> From the above estimate it appears that the reserves are equal to about half of the total shipments, and that 21% of the reserves are in properties which have not reached the producing stage. Recent development work has added several million tons to the above estimates or ore reserves. The thickness of the iron formation is probably not more than 300 or 400 ft. As in the Iron River district the iron formation occurs in the Michigamme slate and at different horizons in the slate and presents, therefore, precisely similar, but not so great difficulties to successful structural interpertation.

Mr. Allen traces a practically continuous iron-bearing horizon for more than 30 miles from the Redrock exploration, north of the Amasa, through the Amasa mine southeast to the Hollister and Mansfield mines, back west and southwest past the village of Crystal Falls to the Alpha-Mastodon-Delphic area, five miles southwest of Crystal Falls, where the Nevada Land Co. has been diamond drilling. He further states that "along this belt there doubtless remain to be discovered many ore deposits in addition to those already known."

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Cartridges for Tamping Dynamite

In the JOURNAL of May 4, 1912, we find an article headed "Cartridges for Tamping Dynamite," and in this article we find a reference to a company which formerly manufactured tamping in the Joplin district. As we have for some time past been manufacturing tamping and are still manufacturing and supplying it to the miners here, we are a little in doubt as to whether you refer to our company or to another which ceased to operate some time ago. We have forgotten the name of the company, but are familiar with their product.

They used card-board cylinders, slit at intervals of one inch down the side. These cuts made the card-board cylinder quite weak, and in order to hold it together a piece of paper was pasted around it on the outside. The cylinder was filled with dry jig sand, and the ends of the paper which protruded about 1¼ in. past the end of the card-board cylinder, were doubled down to hold the sand in the cylinder. This made a rather expensive package: further, although we never expressed ourselves publicly while the tamping company was doing business, we did not think this tamping was a satisfactory or safe material.

We knew quite well what would happen if a miner cut open a dynamite cartridge and found a teaspoonful of jig sand in the dynamite. We therefore, could not see any advantage in having the miner himself ram sand into his dynamite after loading it in the hole, especially as it is not a safe proposition to run a tamping bar in and out a drill hole in which sand and powder crumbs are sprinkled all along the length of the hole, as is always the case where they split the dynamite cartridge, as they do in this district.

While the matter of tamping was being agitated in this district we undertook to put out an improved article, which was manufactured of fire clay mixed with a solution of hygroscopic chemicals. The purpose of the chemicals was not only to soften the fire clay and make it plastic, but to absorb moisture from the atmosphere and keep the tamping continually soft. The materials used for this purpose also kept the tamping from freezing. We packed the material in light paper shells colored red, in order that they might not be confused with dynamite in the semi-darkness under ground. This material met with favor and has not only been supplied to the miners in this district in large quantities, but has also been shipped to the Platteville, Wis., mining district and other regions.

N. P. ROOD,
President, Independent Powder Co.
Joplin, Mo., May 14, 1912.

New Kink in Iodide Copper Assays

I was interested in the article, "New Kink in Iodide Copper Assays," which appeared in the JOURNAL of Feb. 10, 1912. However, as a method for rapid technical work, I fail to see that the method as described is any improvement over the extremely simple procedure following, which is in daily use in a number of Western laboratories handling a large amount of control work: One-half to two grams of ore, depending on its richness, is taken to the usual fumes of sulphuric anhydride, cooled, diluted with 25 c.c. of water, and filtered into an eight-ounce beaker. After washing the precipitate, 25 to 35 c.c. of a saturated hyposulphite solution is added to the filtrate, a stirring rod is introduced to prevent bumping, the beaker is covered with a watch glass and the mixture boiled until the resultant black precipitate of copper sulphide and sulphur tends to settle (15 to 25 minutes). This is filtered through an 11 cm. S. and S. "Black Ribbon" paper, or its equivalent, which is a rapid operation, washed with warm water, and the paper and precipitate dried in a scorifier. The sulphur and paper are then burned off at a low red heat. The residual copper sulphide and oxide is brushed into a beaker containing 6 c. c. of conc. HNO_3 and 12 c. c. of water and the solution is boiled for 15 min., which gets rid of all the nitrous acid.

The solution is then cooled, diluted and neutralized drop by drop with ammonia, adding two or three drops in excess, the excess boiled out, acetic acid added and, after cooling, two to three grams of KI or its equivalent in KI solution added, and titrated in the usual manner.

As time savers are suggested the following: (a) When the lead percentage is not high, the first filtration may be omitted entirely, as the insoluble matter, being nearly white, does not interfere with the subsequent titration: (b) After neutralization with ammonia, the slight excess, instead of being boiled out, may be neutralized with acetic acid at once—saving a boiling and cooling. While I tried this latter procedure on about 150 controls run in triplicate, and secured excellent results, the ore was pure and of moderate grade only, so I would hesitate to recommend it in all cases.

No originality is claimed for any of the foregoing.

EDWIN POPPER.
Los Angeles, Calif., May 8, 1912.

Estimation of Ore Reserves

In the JOURNAL of Dec. 16, 1911, there is an article dealing with the estimation of the ore reserves of the Ray Central Copper Mining Co., in Arizona, which any mining engineer would, no doubt, be interested in reading. However, I personally believe that the article is lacking some of those ore-reserve details which distinguish the work of a mining engineer from that of a computing survey draftsman and sample recorder. Surely there are reasons other than appear in the article which have led the engineers to adopt the method described, and surely the engineers have not (without geological foundation) juggled the proportional values of information derived from ore exposed in drives, crosscuts and winzes, so as to have them conform to a rule, as embodied in the use of certain determining factors.

Everyone will agree with the authors in their statement that the personal factor of the mining engineer has a great influence on the conclusions arrived at. The estimation of the quantities and values of ore reserves would otherwise not require the attention of the mining engineer, but merely require a survey draftsman, while all engaged in such work would be at the same level of efficiency, with no inducements ahead for the mining engineer to utilize his mining and geological knowledge and experience, and thus excel. It seems hardly credible that any person would accept and rely on the conclusions arrived at by a computer, whose only recommendation was his mathematical accuracy, and if the system is as cut and dried as the article leads the reader to understand, then the estimations are now the work of a mere computer.

The methods used in compiling the plans, recording the assays, and obtaining check results are undoubtedly efficient, while the sample obtained should accurately represent the face sampled. The fact that a sample is cut from each wall, however, does not signify anything to the mining engineer, as the position and value of these samples should be determined by the general geological features of the orebody as a whole; the relation of the working sampled to the orebody; and the value of the information to be derived from the features exposed by the working; and if these items had been briefly outlined, the article would convey more useful information. The matter of conversion of volume units to tonnage is another item where many engineers allow themselves to be led into avoidable error.

It is quite as incorrect and quite as deplorable for the engineer to convert the volume units to tonnage by a conversion factor, for the use of which he has no other justification than the fact that other men on the field use it, as it is incorrect to guess the reserves of ore. The same engineer would, perhaps, be careful and accurate in his other work, but neutralizes his former accuracy by using a factor which may or may not be correct, but which, if wrong, misleads his employers. For the public generally does not care a cent whether he uses nine or 20 for his conversion factor, but takes the tonnage as estimated and relies on the practical and technical knowledge of the engineer. Some engineers haggle over the different methods of arriving at a conversion factor for volume to tonnage, but, in any case, the first factor arrived at is generally merely tentative, until substantiated by experience with that ore.

If the factor be used merely for the purpose of a single report, then the reasons for adopting that factor should be given, and most engineers will refrain from laying themselves open to adverse criticism by indorsing a report embodying any method known as unreliable. Further, the use of fixed factors to indicate the relative value of the sampling results of drives, crosscuts and winzes, as referred to above, and as plotted in the examples given in the article, may or may not be correct, but in many cases would lead to erroneous results. The mere fact that a set of results appears in the estimate a certain number of times should not deter an engineer from thus using them if the geological and mining data available warrant it, and, no doubt, these latter considerations have been considered but not described by the authors, though it is difficult to believe that the orebody is so homogeneous that the factors are fixed for the whole mine.

After a considerable experience in estimating and valuing ore reserves in wide orebodies of the disseminated type, I have personally come to the conclusion that the winze results must be only valued in conjunction with the geological features exposed in the winze. By this I wish to emphasize that, in the first case, the work of sampling, and secondly, the estimation of reserves, should be laid out to blend with the geological work, with due regard to the actual mining operations, and when this is done, not only will the sampling costs in many cases be considerably reduced, but the deductions which can finally be made will have the greatest economic value.

Finally, the work of sampling and estimation of values and quantities of ore reserves can no longer be regarded as work for the man who is merely conscientious or an efficient surveyor, but is a branch of the mining profession which warrants the employment of a man specially qualified both practically and technically.

These remarks have been made because I know instances of engineers who have been so utterly careless in this work, that their employers would have received better information from the combined reports of an underground foreman and an accurate surveyor. It is readily agreed that some of the deductions arrived at in ore-reserve work possess a large element of uncertainty, but it behooves the engineer to be as careful as possible, and have information sufficient to justify his conclusions and methods where the personal factor enters into the work.

To illustrate the value to a smelter, of careful work in this department, I have included the following: The Cobar copper mine has an output of approximately 1000 tons per day, and the ore is hauled from 15 to 20 individual stopes, and varies from 5% to 50% insoluble, and the copper from 0.8% to 10%. The engineer is able to take the haulage sheets each morning and estimate the probable percentage of insoluble and copper in the haul for the past 24 hours, and this estimate has been found to agree with the sample-mill result within 1% insoluble and 0.2% copper. The cost of sampling is about 1d. per ton of ore hauled. These results have only been obtained by special attention to that branch. In another case, a similar company employs a large staff of samplers and recorders, yet when the metallurgist calls for a certain variation in the composition of the ore to be hauled, almost invariably the resulting change has the opposite effect to that desired. This latter mine surely requires a doctor for that department, and must be experiencing an unnecessary financial loss.

If the authors of the article would supplement their remarks by another article illustrating the geological features of the orebody, and giving the reasons for the adoption of their methods of arriving at the various conclusions, with any results which have proved of economical value, the information would be of great value to other engineers.

A. Percy Penman.

Sydney, New South Wales, Mar. 28, 1912.

Food for Miners

I note in the Journal of Apr. 27, p. 837, an elaborate account of the food supplies for Cobalt miners in 1911. It seems to me that there is a grave omission in the list of supplies, for I do not see sugar or any substitute.

I kept a similar account of the food consumed by miners in Candelaria, Nevada, prior to 1893. I am sorry to say that I have no data with me, but I remember that the principal items were: Flour, 1 lb. per diem per man; meat, 1.5 lb.; butter, 0.25 lb.; sugar, 0.50 lb.; potatoes and vegetables over 3 lb., and including supplies of all kinds the total consumed per man per diem was between six and seven pounds.

It would be of interest to students of dietaries to know the number of calories in this Cobalt diet. Apparently it would be over 5000, which is a liberal allowance. I know from experience that the amount of food consumed depends largely on the cook, and there is probably no department of human activity where there is such a good chance for the introduction of scientific management as in the furnishing and preparation of food.

W. H. Shockley.

Ouchy, Switzerland, May 8, 1912.

Company Stores at Grass Valley

There is a paragraph in the Journal of May 18, in which your correspondent at San Francisco refers to company stores at Grass Valley. It may be worth while, for the sake of accuracy, to state that the North Star Mines Co. has never had, either directly or indirectly, any interest in any store.

W. D. Pagan,

Secretary and Treasurer, North Star Mines Co.

Grass Valley, Calif., May 20, 1912.

[The paragraph in question stated that the Empire mines and Pennsylvania Mines Syndicate at Grass Valley were going to abandon company stores, but that the North Star Mines Co. had not signified its intention to abandon the system. Evidently our correspondent was under the impression there was a North Star store; but under the circumstances it is hardly strange that there was no intention expressed of abandoning it.—Editor.]

Oil Burners

I see many new oil burners constantly commented on in the scientific press, and am reminded of a remark an oil refiner once made to me: "We never calculate on a new man's getting down to steady work until after he has invented a new oil burner."

Robert McKittrick.

New York, Apr. 16, 1912.

Cost of Mining a Ton of Ore

By Heath Steele*

> **The general average of low costs of mining is $1.40 per ton. In the case of large deposits where ore can be explored at small development expense the cost of underground mining may be as low as $1 per ton; a lower cost would in most cases indicate that mining is being done at the sacrifice of ore.**

Anyone who stops to consider the cost of mining a ton of ore cannot help being impressed with the wide difference between various claims or estimates for mining a ton of material, where conditions are practically the same. One would be led to believe that the wide range of costs was more the result of management than anything else, but this is not the case. The trouble is, that the figures given do not always represent the same items of cost. Some refer only to the bare cost of labor, supplies and power required to raise ore from stopes to the surface. Others state a cost that will include all underground charges, but leave out the surface expenses. It is not my purpose to debate the question of what items should be included in a statement of mining costs, for that is an old subject. But, before it is just to make a comparison between two cost records, we should be sure that both statements represent the total expense incurred for the same operations. Therefore, when giving mining costs, it is better to give the total expense of bringing the ore up to the point where reduction begins.

I have heard good miners make claims of mining costs, that I knew were only 25% of the cost obtained elsewhere under the same conditions. This, together with some estimates I have noticed in regard to future operating costs, caused me to look up the cost records of some, a few of which I submit herewith.

ANACONDA COPPER MINING CO.

Year	Number of tons	Cost per ton
1905	1,470,694	$3.67
1906	1,494,828	3.94
1907	1,110,203	4.70
1908	1,066,088	4.25
1909	1,282,681	4.30
1910	3,326,277	3.81
Total	9,750,721	$4.01

Here is a good place to call attention to the danger of taking a minimum cost record as a basis of estimating future profits. In the case of the Anaconda, it will be noticed that the low cost of 1905 had not been equaled up to the end of 1910. Had one based an estimate, in 1905, on an average mining cost of $3.67 per ton, their calculation of profits would have been over $3,300,000 above the actual profits.

Old Dominion

This Arizona company has been a steady producer of a large tonnage, and has made a constant effort to reduce its costs. The record is as follows:

	Per ton
1905	$5.66
1906	6.13
1907	6.33
1908	6.33
1909	5.08
1910	5.17

Pumping and development constitute about 29% of the mining cost at the Old Dominion.

Greene Consolidated

The costs of the Greene Consolidated Copper Co., at Cananea, have been:

	Per ton
1907	$3.28
1908	2.13
1909	2.22
1910	2.75

The Moctezuma Copper Co. works a large body of ore under most favorable conditions. Its cost of mining under average conditions is approximately $1.50 per ton.

The Utah Consolidated Copper Co., during the last eight years, has mined 1,970,000 tons of ore at an average cost of about $2.10 per ton.

Low Costs in Lake Superior District

Nothing can be said against the management of either the iron or copper mines of the Lake Superior district. The labor is as efficient as any, and the wage scale is much lower than many other districts in the United States. Other conditions are favorable for low costs.

In the "iron country" a low mining cost is absolutely essential to derive a profit from the ore. An average, obtained from the records of 15 of the largest iron mines, covering a period of five years, shows that their cost is $1.48 per ton. These mines have produced on an average of 6,000,000 tons of ore per year. With the exception of the Bristol mine, which has most favorable conditions for mining, its cost being 80c. per ton, the lowest mining cost of this group is $1.33; the highest is $2.24. Another set of figures, compiled for the same period, and including all the iron mines of Michigan, shows that their underground expense has averaged $1.34 per ton. To this must be added 13.2c. for exploration and development, 16c. for general expenses and 6.6c. for taxes, making a total average mining cost of $1.698 per ton for all the mines. The present mining systems are the result of over 50 years' operations, and their costs may well be considered as good examples.

Among the low-cost copper mines of the Lake Superior district is the Wolverine; for the year 1910-1911, its underground expense was $1.15 per ton, surface and general expense $0.134, and taxes and insurance $0.113, making a total cost of $1.397 for mining 400,000 tons.

The costs obtained at the Copper Range Consolidated properties were as follows: Champion mine, 5-year average, $1.30 per ton; Trimountain, 6-year average, $1.54 per ton; Baltic, 6-year average, $1.20 per ton. Taxes and insurance are not included in these amounts. The tonnage mined was a little over 10,300,000 tons.

The Atlantic Mining Co. was noted for its low mining costs, until the mine caved in 1906. Its mining cost in 1903 was 97.5c. per ton. In 1905 it had risen to $1.41, and for the early part of 1906, the cost was $1.60 per ton.

The above figures are sufficient to show what the costs are in the Lake Superior country. Let us now turn to a company handling one of the largest tonnages of any mining concern.

DeBeers Consolidated

The DeBeers Consolidated Mines of South Africa was the largest diamond-mining operation in the world up to the advent of the Premier mine. At this property over 4,000,000 tons of "blue ground" are mined per year; during the year 1910, 3,000,000 tons were hoisted from a depth approximately 1000 ft.; the remainder of the tonnage was hoisted from 500 to 750 ft. The company's report shows that the average cost was $1.07 per ton.

Alaska-Treadwell

It would be tiresome to give many more examples of costs, but the record of the Alaska-Treadwell will be interesting. Having heard its costs quoted at so many different figures, ranging from 75c. per ton upward, I was curious to know what it actually cost to mine at this property. The mine is situated on a fine harbor, the benefit derived from all-water freight, cheap power, good labor conditions and an excellent management has been the means of working one of the lowest-grade gold deposits in operation at a profit. The following figures were compiled from their annual reports, by proportioning some of their general charges to mining cost. No credits for rents or wharfage collected are included in these figures:

---

*52 William St., New York.

ALASKA-TREADWELL MINING COSTS

Year	Underground charges	General charges	Total mining cost, per ton
1907	$0.9977	$0.0660	$1.0637
1908	1.0318	0.1240	1.1558
1911	1.1138	0.1120	1.2258

From all data obtainable, it is evident that the average cost of mining a ton of ore at the Alaska-Treadwell is $1.15. To obtain this cost the shrinkage system is employed and only about 75% of the ore recovered. To effect a higher saving of ore the costs would be materially increased.

Conclusions

A general average of the low-cost mines is approximately $1.40 per ton. There is no doubt that in some cases the cost could be further reduced by sacrificing more ore, but by doing this, the life of the mine will be lowered. Just how much ore can be sacrificed, to secure a low mining cost, without reducing probable profits of the mine is, of course, a problem. It is safe to say, that all the profitable low-cost mines have solved this question.

Judging from these data, the minimum cost for underground mining operations, including all other necessary expenses, may be considered under ordinary conditions to range from $1 to 1.40 per ton for low-cost mining. With a large uniform body of ore, well explored so that a minimum amount of development work will be done, the costs may be as low as $1 for the entire life of the mine. If the total average is brought much below this figure, it is almost certain that it will be done at the expense of sacrificing more than 25% of the ore.

These costs are not intended to apply to flat deposits, such as coal and some zinc deposits, where all lateral work is practically in ore, and at no great depth from the surface.

Mexican Oil Export Tax

American capitalists interested in developing oil properties in Mexico are much alarmed over the report, which seems to be based upon reliable authority, that Mexico is about to levy an export tax on petroleum and its products, says the San Francisco *Chronicle*. As a large quantity of Mexican oil finds a market in the United States and Central America, the rumor is disquieting. The reason for the proposed tax is said to be the necessity of providing for the payment of the large war debt piled up by the Mexican Government. The report is to the effect that a bill will be introduced in the Mexican congress during this month providing for an export tax on petroleum ranging from 15 to 25c. per barrel.

The *California Oil World* of Bakersfield is authority for the statement that not a barrel of commercial oil is produced in Mexico by a Mexican company, and that there is only one British company, namely: The Mexican Eagle Petroleum Co., of London, Eng. All other oil producing companies are American, which include the Mexican Petroleum Co., East Coast Co., Southern Pacific, Waters-Pierce, Mexican Fuel, and Spellacy Brothers.

The Mineral Production of Germany

Advance sheets of the mineral production of Germany, as compiled by the Imperial Statistical Office, have been issued. The output of metallic ores for two years past has been, in metric tons:

	1910	1911
Silver and gold ores.....	6,646	4,890
Copper ore.............	925,957	868,600
Zinc ores..............	718,316	699,970
Lead ore...............	148,497	140,154
Manganese ore..........	80,560	87,297
Arsenic ore............	6,150	4,859
Pyrites................	215,708	217,459
Miscellaneous ores.......	10,813	10,357
Iron ore......	28,709,700	29,879,361

With the exception of iron ore there was a decrease in all the important metallic minerals. About 80% of the zinc ore was mined in Silesia and over 90% of the copper ore in the Halle district.

Nonmetallic Minerals

The production of nonmetallic minerals is reported as follows, also in metric tons:

	1910	1911
Coal................ ..	152,827,777	160,747,580
Brown coal (lignite).....	69,547,299	73,760,867
Graphite............	7,415	11,298
Asphalt...............	81,208	81,902
Petroleum...........	145,168	142,992
Rock salt	1,424,063	1,436,492
Kainit.....	4,249,667	4,425,597
Other raw potash salts..	4,062,004	5,181,379
Miscellaneous salts......	381	372

The production of coal in 1911 showed a good increase. Another feature of the statement is the increase of nearly 25% in raw potash salts.

Metallic Products

The production of metals and of byproducts of metallurgical works, excepting iron and steel, was as follows, in metric tons, except gold and silver, which are given in kilograms:

	1910	1911
Gold, refined, kg .	4,625	4,967
Silver, refined, kg.........	420,003	439,580
Copper	38,721	38,192
Zinc...... . .	221,396	235,776
Lead	163,432	164,974
Tin	11,394	12,412
Tin chloride ..	3,390	3,749
Arsenic.	3,066	2,981
Sulphur, refined . .	1,271	1,251
Sulphuric acid, commercial . .	1,384,126	1,461,281
Sulphuric acid, concentrated .	69,162	70,184
Iron sulphate .. .	18,677	17,002
Copper sulphate .	5,209	7,353
Miscellaneous acids, &c .	15,898	16,985
Mineral pigments . .	1,620	5,570

Tin, silver and gold include metal refined from imported ores. Lead in 1912 includes 3687 tons litharge. Copper includes black copper and bar copper—1042 tons—as well as refined copper.

Iron and Steel

Production of the blast furnaces and steel works was as follows, again in metric tons:

	1910	1911
Pig iron......	15,502,183	15,280,527
Castings, second fusion..	2,550,234	2,722,028
Wrought iron.......	381,519	316,842
Cement steel, wrought..	25,939	21,556
Steel ingots for sale ..	708,778	740,732
Billets, slabs, etc........	2,251,044	2,601,606
Finished steel..........	9,620,897	10,703,535

The division of pig iron in 1911 was as follows: Foundry iron, 2,786,437; direct castings, 94,622; bessemer pig, 377,051; Thomas or basic pig, 9,785,056; forge iron, 667,567; ferromanganese. ferrosilicon, spiegeleisen and all similar alloys, 1,547,480; scrap, cinder, etc., 22,314 tons.

Commercial Salts

The production of various salts in refined or commercial form is given as below, in metric tons:

	1910	1911
Refined salt.. .	668,980	645,991
Potassium chloride..	751,259	838,420
Magnesium chloride...	32,206	36,764
Glauber salts.. . . .	84,786	82,664
Potassium sulphate......	84,584	107,631
Potassium-magnesium sulphate.....	37,438	42,253
Magnesium sulphate... .	57,314	55,179
Aluminum sulphate and alum..............	22,648	23,674

The marked increase in potassium salts was due chiefly to the large export demand, especially from the United States.

Copper Production in Russia

The copper production in Russia in 1910 and 1911, as reported by a correspondent of the London *Mining Journal*, is given in the accompanying table, which shows that the production in 1911 was the largest on record.

RUSSIAN COPPER PRODUCTION
(In Metric Tons)

	1910	1911
Urals.........................	9,271	13,252
Caucasus......................	7,715	7,977
Altai	57	28
Siberia..........	3,211	3,735
Refineries........	934	917
Totals......	21,188	25,909

The increase in 1911 was largely due to the output of the Kyshtim company.

Graphite in the United States

In 1911 the United States imported 20,702 tons of graphite. The domestic production was 3618 tons of natural, and 5072 tons of artificial graphite, according to the U. S. Geological Survey. There are three general classes of graphite, the manufactured (an amorphous type), flake and natural amorphous. For crucibles (except the smallest sizes) the fibrous or flake graphite must be used, in order to get the required tensile strength. Ceylon is the chief producer of good graphite (36,056 tons in 1909), although Italy had a larger tonnage (44,875 tons) in 1909, but valued at only about one-tenth of Ceylon's. Some graphite is also brought into the country from Mexico, and recently Chosen has entered the list of producers.

Cuyuna Iron Range

Special Correspondence

The undertaking of extensive actual mining operations on the Cuyuna iron range is bringing to discussion the practical and technical problems involved, some of which are modifications in kind of similar problems met elsewhere in Lake Superior practice, and others are new problems.

Ore in Lenticular Beds

The ore lies in irregular lenticular beds, dipping from 60 to 70°, and in width varying from 50 to 400 ft. The foot wall is usually schist, and the hanging wall soft ferruginous slate. The ore is not continuous in width, but is banded with slate beds or beds of lean ore in places. In some parts of the district, belts of highly manganiferous iron ore occur in or with commercial orebodies. The orebodies extend downward from 200 to 600 ft., merging into low-grade hematite or iron carbonate at depth.

The ore is moderately easy to break, being hematite with minor amounts of limonite near the formation surface. Over all the district is a mantle of glacial material, mostly sand and till with a few scattering boulders, which is from 50 to 150 ft. deep. In some places this overburden is practically a quicksand down to the formation, and in others a clay hardpan forms the bottom of the mantle.

Sinking of Shafts Costly

The first problems were encountered in getting the shafts through the overburden. This has been successfully done in several cases, though not without unusual cost. It is necessary to concrete shafts and to anchor them in the solid formation. The operating shafts, of course, are sunk in the wall rock and the ore reached from them by drifts.

The ore is usually somewhat soft toward the top and the character of the bottom of the glacial overburden thus becomes a matter of concern both from the standpoint of safety and as affecting cost. Each mine has its own problem in this particular. However, it is likely that considerable timber will be required underground generally, and it will be necessary to resort to the caving system in most cases, so as to avoid carrying the yielding overburden.

Excessive Water a Problem

The water problem is also related to the varying nature of the overburden. In some instances, orebodies have been explored adjacent to the small lakes and protected from the lakes by beds of 50 ft. or so of sand and gravel. This condition suggests the necessity of draining the lakes, and, in fact, the Kennedy mine, on the North range, is considering the drainage by pumping of the fair-sized lake near it. Other orebodies are supposed to lie near or in the bed of the Mississippi River. There is now much water of saturation in the orebodies opened, which will, in time, be drained by the pumping, so that the normal water will be less, as operations have been under way for some time. At least this is the expectation.

Grade of Ore Varies

The varying grade of the ore in any orebody presents operating problems, and the question of the best mode of attack to recover the parallel beds of lesser width but of commercial grade, which accompany the main beds, has yet to be worked out.

The labor, fuel and transportation conditions are practically identical with those in the other Minnesota districts. Under the revised freight rate for the Mesabi ore to the Lake, a differential of 5c. against the Cuyuna district prevails, but this will likely be removed with the increase of tonnage from the district. Besides there are two independent railroads concerned in the traffic, the "Soo" line, a subsidiary of the strong Canadian Pacific system and the Northern Pacific, with its allied Cuyuna Northern road as a feeder.

The Cuyuna ores, because of their good physical structure, are classed as "old range," and are paid a preference of 20c. per ton over the fine, soft Mesabi ore.

No Market for Manganiferous Ore

There is some hope that the large bodies of manganiferous iron ore—20 to 30% of manganese—may be utilized. Apparently now there is no market for this kind of ore, and those who have given the question study do not consider it likely that there will be a market for it for the present at least.

Explorations in the Cuyuna district have disclosed the presence of many eruptive rocks as dikes or bosses, cutting and affecting the iron formation. The relation that these eruptives may have to the orebodies—their richness and local extent—is problematical but likely important. In fact, not until much more drilling is done and the iron formation opened up by underground work in many places can the physical problems of the Cuyuna deposits be competently known.

Conditions at the Homestake

Deadwood Correspondence

Electrification of the Homestake plant is progressing, and all of the 1000 stamps in the six mills will be operated by motors soon. The problem of handling cheaply the mine water by the new power has been solved by designating the Old Abe as the pump shaft, and to this shaft all of the underground water in the workings at Lead will be drained. The Homestake is not a wet mine, and provision is being made to handle 1000 gal. per min. The water will be pumped from the 500-, 800-, 1100- and 1400-ft. levels, to the 200-ft. level, from which point it will run through a tunnel to the surface. At this latter level there will also be installed a pump capable of lifting the water to the mills, in case it is needed. Sumps 23 ft. in diameter and 23 ft. deep are being cut on the levels mentioned, and these are roofed over with steel I-beams and reinforced concrete. On the roofs will be installed Worthington pumps, driven by Westinghouse motors. The pumps on each level will raise the water to the 200 level. The switch controlling the motors will be connected to a float resting on the surface of the water in the sump, thus governing the operation of the pump without attention from the pump men. This installation will do away with a Cornish pump that was installed at this shaft in the early days of the Homestake, and that has worked without serious hitch ever since.

The Old Abe shaft is being sunk with three shifts, it being the intention to make it the deepest working on the entire property. Sinking has been under way for nearly eight months. The Ellison shaft is now 1900 ft. deep, but the Old Abe will be sunk beyond that depth, as a part of the scheme for handling the mine water, as well as for development. In this connection it may be stated that some rich ore has been encountered in the lower levels in the Ellison. Specimens of extremely rich ore have been exhibited, showing free gold in profusion. The gold in these specimens is exceptionally heavy; not the ordinary leaf gold, or thin sheets, but, on the contrary, almost nugget-like in character.

Norwegian Electrometallurgy

The electrothermic iron and steel works operating in Norway in 1911 were as follows, says *Journal du Four Electrique*, April, 1912: Ulefos, which produced between 300 and 500 tons of iron from the Fahn ores; Hardanger, smelting first a 45% ore from Klodeborg; later, concentrates from Roedsand, producing 300 tons of iron for export, with a 3500-hp. furnace. Tinfos and Stavanger will probably begin work in 1912, Boeilifos in 1913.

The calcium-carbide syndicate still restricts production, but 60,593 tons were produced in 1911, against 50,579 tons in 1910. At Odda, 13,172 tons of cyanamide were produced from a carbide base. There were 5745 tons of ferrosilicon and a little ferrochrome exported.

Sarpsborg furnished most of the electric zinc exported, about 6573 tons, but at Trondheim, on the west coast, zinc is also being made. Unfortunately it is impossible to find out how much of the output results from smelting scrap, and how much comes from ore.

California Oil Dividends

California oil companies paid out in dividends during April $587,568, says the San Francisco *Chronicle*. In addition to this amount the Mexican Petroleum paid $80,000 on its preferred stock, making a total of all companies controlled in this State of $667,568. The list follows:

Amalgamated	$1 00	$100,000
Caribou	0 025	8,070
Central	0 015	15,400
Claremont	0 015	7,500
Columbia	0 01	9,992
Home	0 01	7,500
Homestake	0 10	1,000
Monte Cristo	0 025	12,500
*Mount Diablo	0 01	5,000
New Pennsylvania	0 005	2,500
Olinda Land	0 005	10,000
Paraffine	0 01	3,000
Record		10,000
Rice Ranch	0 015	4,500
San Francisco and McKittrick	0 10	5,000
Sauer Dough	0 02	4,000
Section 25	0 50	20,000
*State Consolidated	0 005	5,000
Traders	0 006	9,000
Union	0 006	183,387
Union Provident		90,768
United Petroleum	...	48,451
Western Union	0 01	10,000
W K	0.03	15,000
Total Calif. Cos.		$587,568
Mexican Pet., Ltd., pfd.		80,000
Total all companies		$667,568

*Unlisted.

Another Mining Experiment Station Proposed

Washington Correspondence

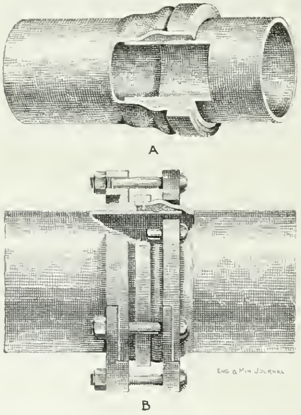
Representative French has offered a bill at Washington to create a mining experiment station at Moscow, Idaho. After providing for various officials and employees, and appropriating $25,000, the bill provides:

> Sec. 3. That it shall be the province and duty of said mining experiment station, under the direction of the Bureau of Mines, to conduct inquiries and scientific investigations concerning the mining, preparation, treatment, and utilization of ores and other mineral substances, with a view to improving health conditions, increasing safety, efficiency, economic development, and the prevention of waste in the mining, quarrying, metallurgical and other mineral industries, and as will facilitate the proper and efficient development of the resources of the public domain, and to disseminate information concerning these subjects in such manner as will best carry out the purposes of this act

Joint for Steel Pipe

The Matheson pipe joint, illustrated in the accompanying drawing and manufactured by the National Tube Co., was developed for steel or wrought-iron pipe and is similar to the familiar bell and spigot joint used with cast-iron pipe. When the pipe is manufactured one end is swelled into a bell, and around the edge of the bell a reinforcing band of steel is shrunk. The spigot end of the pipe is provided with a slight depression or groove that encircles the pipe near the spigot end.

In laying the pipe the spigot end is placed in the bell end of the adjacent length of pipe and molten lead is poured into the bell in exactly the same way that the joint of cast-iron bell and spigot pipe is laid. The lead filling can be calked when cool, the reinforcing band adding strength to the bell to resist any tendency to expand as a result of the calking. If the pipe is to be subjected to high pressure, a bolt-flange coupling can be used in conjunction with the lead joint as the accompanying illustration shows.



Matheson Plain and Flanged Joint

The advantages claimed, are that a strong tight joint is as readily obtained with steel as with cast-iron pipe and that for the same strength steel or wrought-iron pipe is lighter.

La Rose Mines, Ltd.

The total shipments of the La Rose Mines, Ltd., Cobalt, Ont., for the year ended Dec. 31, 1911, as shown by the official report were 3561 tons, containing 4,092,709 oz. of silver. The mine produced 3,691,797 oz. at a total cost of 19.2c. per oz.; the net profit was $1,269,086 or 64% of the gross value of the silver produced. Dividends to the amount of $627,000 were declared.

Development work amounted to 11,045 ft. and stoping to 13,589 cu.yd. The ore reserves are estimated as follows: High-grade ore, 1883 tons containing, 2,206,000 oz.; mill rock, 94,031 tons containing, 2,045,000 oz. The La Rose mine continued to be the main source of production; the Lawson and Princess together yielded nearly one-half of the total ounces produced.

Law Suit over Michigan Iron Lands

Negaunee Correspondence

An important law suit has been started, involving valuable iron-ore lands in the upper peninsula of Michigan. Julia M. Case, formerly of Marquette, has filed papers in Detroit, in a suit to recover $10,000,000 from J. M. Longyear, mine owner and operator, of Boston, and formerly of Marquette. N. M. Kaufman, of Marquette, reputed to own a controlling share in the Auditorium Hotel, in Chicago, has taken up Mrs. Case's suit and has paid the late Mr. Case's debts to Longyear for an interest in her claims. The suit refers to the operations of J. M. Case, deceased, and J. M. Longyear, who were partners in prospecting iron-ore lands 30 years ago. Mr. Case obtained the options and Mr. Longyear financed the projects. Later, in 1889, Case went to England to interest capital in a marble quarry and, according to Mrs. Case, obtained a loan of $30,000 from Longyear to pay some debts, giving him as security 17 deeds to property, situated in Marquette, Iron, Ontonagon, Gogebic, Baraga, Menominee and Alger Counties. Case died in London before completing his arrangements. The iron-ore lands, deeds for which were given as security, are now extremely valuable. Longyear has never given an accounting of the lands to Mrs. Case.

J. M. Longyear, in answer to the bill, is reported to have replied that he always intended to restore the residue of the property, after deducting loan, interest, cost of administration and moneys advanced, as a gift to the widow. But now, since N. M. Kaufman has joined the claim, he refuses to do so, because the latter has taken advantage of the widow's lack of acumen, and would be the beneficiary by his generosity. Mr. Longyear further claims that the lands were turned over to him unconditionally, he practically purchasing them outright, and that he has personally assisted both Mr. and Mrs. Case in many ways.

Mason & Barry, Ltd., operating the San Domingos mine, in Portugal, raised 412,023 tons of ore in 1911 as against 360,406 tons in 1910, and shipped 277,583 tons, including that from the concentration plant. Profits of £64,547 were realized, and dividends of 30% were paid.

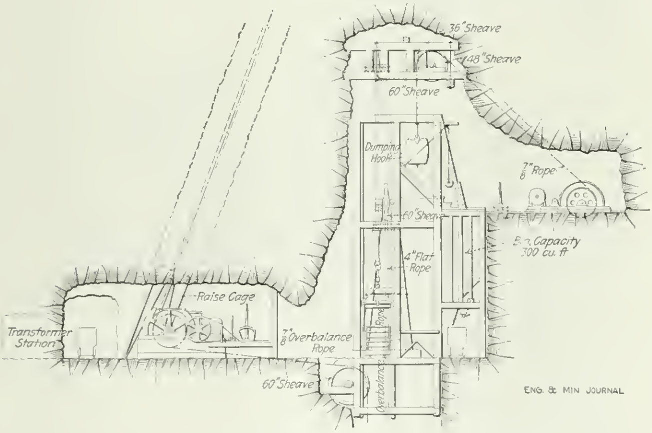
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

An Underground Hoisting Station

By S. A. Worcester*

The accompanying illustration shows the layout of a winze hoisting station in a mine in southwestern Colorado. The winze is nearly square in section and is divided into three compartments. The largest compartment is rectangular in section and is used for hoisting ore in cars of 2200-lb. capacity, two cars being placed tandem on the single deck of the cage. The 150-hp., electric, two-reel cage hoist occupies a large room excavated in hard rock at the west side of the station; it is not shown in the illustration. The flat rope from one of the reels runs over the large upper sheave at the left, thence down to the cage. The flat rope on the other reel runs over the lower sheave supported on an A-frame thence down the shaft to an overbalance weight. This weight is made of several sections and is similar to the ordinary elevator weight. It is so weighted that the work of the motor when raising the weight is the same as when raising the cage with its maximum load.



Winze Hoist Station in a Colodado Mine

The two other compartments are nearly square in section. One is used as a pipe and ladder compartment, the other is lined with planks throughout and is used only as a bucket hoistway for sinking operations.

This bucket is raised by the 75-hp., electric motor shown in the upper room on the right-hand side of the illustration. When the bucket has been raised above the level of the floor of this room the counterbalanced door is lowered and the dumping rope shown at the left of the bottom of the bucket is hooked into the ring at the bottom of the bucket. Upon lowering, the bucket turns over and dumps its load into the bin below from which the ore or rock is drawn into cars and hauled 2400 ft. along the vein then 2200 feet through an adit to daylight; thence it is conveyed 11,500 ft. by a Bleichert tramway to the mill. The operating levers of the hoist are placed near the winze so that the hoist engineer can attend to the dumping.

At the left of the illustration a third room is shown, excavated in rock, in which is shown a 50-hp., two-drum hoist. Above this room the position of an inclined raise is shown. The hoist rope passes up the raise for 500 ft., over a sheave, thence down to the cage. The 7/8-in. rope on the drum passes over a sheave at the collar of the winze, thence down the cage compartment to an overbalance weight that runs by the side of and is similar to the weight used on the cage hoist. The raise hoist is used for raising men, timbers and supplies to the upper levels.

Direct current for all these hoists, for other hoists in the mine and for the mine locomotives is supplied from a storage-battery plant at the surface. The battery is charged by rotary converters and a booster, the current being generated at a hydro-electric power plant several miles from the mine.

Unwatering a Mine with Electric Turbine Pumps

By Percy E. Barbour*

An article published in the Journal of Feb. 24, 1912, on the unwatering of a mine shaft with electrical pumps, recalls the interesting work of unwatering the Columbus Consolidated mine, at Alta, Utah, in the summer of 1911. This shaft is very wet, and has been flooded several times, and on one occasion was unwatered at an expense of about $30,000. On the last occasion the expenditure of such a sum was prohibitive, yet the mine had to be unwatered. Bids were asked for from contractors, and E. G. Stobel, of Salt Lake City, who had just returned from a six months' trip to European turbine-pump plants, undertook the contract for about one-fifth of the previous cost, his price to cover the cost of the pumps, which he designed and had built under his direct supervision in Salt Lake City.

The mine is opened by a tunnel, at the end of which is an incline shaft dipping about 45° to the 400-ft. level. Down to the 150-ft. level the shaft is a single-compartment 5x6 ft.; from the 150- to the 400-ft. level the shaft has two 5x6-ft. compartments. Between the 100- and the 150-ft. levels, the shaft had squeezed until the maximum opening left was .38 in. The pumps had to be built to pass through this small space.

Two specially designed, German-type, high-efficiency turbine pumps were used, one a single stage and the other a two-stage pump. The former was direct connected to a Westinghouse, vertical, 75-hp. alternating-current motor running at 1720 r.p.m. The other pump was direct connected to a 50-hp., horizontal Bullock motor, transformed to a vertical, and run at 850 r.p.m. Two pumps were used in order that the old motors on hand at the mine could be used, and thus reduce the cost of the pumping installation.

---

*Mechanical engineer, Victor, Colo.

*Manager, Uwarra Mining Co., Candor, N. C.

The single-stage pump was used as a sinker, and was set, together with its motor and starting box, on a steel frame on trucks to run down the skipway in the shaft, and was handled to the 200-ft. level by the hoisting engine and cable. Below this level a chainblock was used, and the pump was lowered at 5-ft. intervals. When the water had been pumped out to the 200-ft. level, the two-stage pump was installed as a station pump, and thereafter the single-stage sinker discharged into the suction of the two-stage station pump. A sollar was built over the shaft here, and mining on this level immediately resumed.

The suction pipe for the sinker was 8 in. diameter and 16 ft. long, equipped with the usual foot valve and strainer. The discharge connection was an innovation. To lessen the time and difficulty of making changes in the piping, the pump was connected to the water column by a short length of 6-in. rubber hose, guaranteed to withstand a pressure of 150 lb. per sq.in. This required piping to be done only every other time the pump was lowered.

The main water column was 7 in. diameter, and the average rate of discharge was 1200 gal. per min., by weir measurement. The total static head was 290 ft.; the friction head was 35 ft. The average vacuum was equivalent to 9 in. of mercury. The altitude of the mine was about 8000 ft. and the corresponding barometric pressure was equivalent to 19 in. of mercury. The average efficiency of the single-stage sinker was 73%, and of the two-stage station pump 77.5%, both high efficiencies for that altitude. The work was successfully done without any delay, except the burning out of one motor armature, which got wet. The pumps were so small and so easily handled that only two men per shift were employed during sinking for all labor required.

Not the least interesting feature of the work was the number of pumps recovered as the water was pumped out. At the 200-ft. level, four air-lift pumps of various types, two electric-sinkers, and one steam-driven standard sinker were recovered. At the 300-ft. level, one triplex power pump with 75-hp. motor, one duplex steam pump, three centrifugal pumps, one belted and two direct connected, three steam sinkers and two air lifts were recovered. At the 400-ft. level were two electric station pumps, one triplex power pump, three large sinking pumps, and two air lifts; 25 pumps in all.

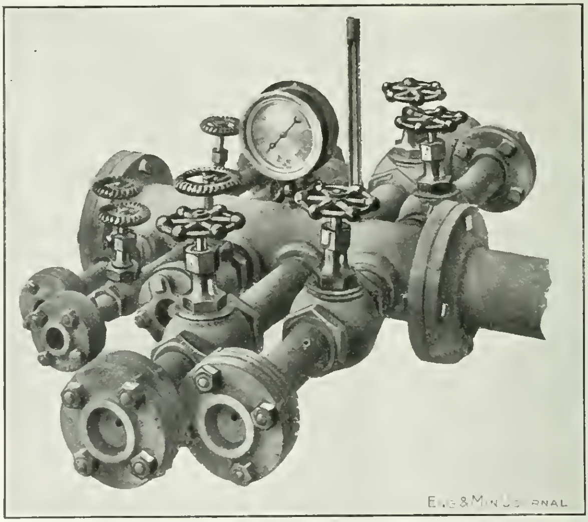
The cheap and easy solution of this problem rested solely on the minute details given to the design and construction of the interior of the pumps, which gave them large capacity and high efficiency. The reverse nozzle used reduced the velocity of discharge from the pump vanes without the loss of head, due to the usual excessive eddy currents and friction; these particular features are original with the Germans.

Volumetric Efficiency of Air Compressors

By F. D. Holdsworth*

The term "piston displacement" or "displacement capacity," commonly used by air-compressor builders as a measure of capacity, expresses the quantity of air which would be delivered by a compressor in which there were no losses to prevent a discharge of a cylinderful of air at every stroke.

Certain losses, however, are unavoidable. These include: the reduction of cylinder volume, due to the space occupied by the piston rod; clearance space at each end of the cylinder; leakage past the piston and the inlet and discharge valves; failure to completely fill the cylinder during the intake stroke due to loss of pressure through inlet ports and passages; rarefaction of the incoming air by absorption of heat from the air passages and piston. These losses materially reduce the quantity of air actually delivered; and the ratio between the actual delivery and the theoretical displacement, expressed in per cent., is termed "volumetric efficiency." This is sometimes measured from indicator cards by dividing the length of the atmospheric line included within the boundary lines of the card by the total length of the card. Results obtained by this method are misleading, as they invariably indicate that a compressor is being operated at greater efficiency than actually is the case. Compressors showing efficiencies, as calculated from indicator cards, as high as 95% have been found to have efficiencies of 85% or even less when the actual air delivered was carefully measured. For instance, a compressor, through faulty design of its inlet valves or having insufficient inlet-valve area, might have its cylinder filled with air at 2 lb. below atmospheric pressure, which would cause a serious drop in volumetric efficiency, yet with leaky discharge valves or with considerable absorption of heat through contact with heated surfaces, the pressure existing in the cylinder at the completion of the intake stroke might be almost or quite up to atmospheric pressure. An indicator card taken under such conditions would naturally lead to the conclusion that the cylinder was practically full of air and that its volumetric efficiency was correspondingly high.



Discharge Manifold Used in Determining Compressor Efficiencies

In order to determine with accuracy the quantity of air actually compressed and delivered, the quantity of air entering or leaving the compressor must be measured. The measurement of the entering air by a gasmeter, for instance, is a troublesome matter, owing to the large volumes to be handled and to the fact that the pulsations of the compressor might affect its accuracy. The calibration of such large meters is likewise difficult.

Measurement of the air after compression is, therefore, usually attempted. In small compressors the air is sometimes compressed into receivers of known capacity or is measured by allowing it to displace water in such receivers, the quantity of free air delivered being proportional to the amount of water displaced; but a much more convenient method and one which may be applied to compressors of large or small capacity, with equal accuracy and with inexpensive apparatus and preparation for test, is by discharging the compressed air through orifices of known area and determining the quantity of equivalent free air by calculation.

---

*Chief air-compressor engineer, Claremont plant, Sullivan Machinery Co., Claremont, N. H.

The apparatus for this method is shown in the accompanying illustration. It consists of a manifold, as large or larger than the discharge pipe of the compressor, with numerous branches with orifices of different diameters attached and equipped with valves. The one shown has eight orifices, ranging from 3/32 to ⅝ in. diameter. These orifices are carefully reamed holes in steel plates, which, for the larger sizes, are ½ in. thick, and for the smaller, ⅜ in. thick. The back or pressure side of the hole has its approach rounded to a radius 1/16 in. less than the thickness of the plate, leaving the remaining 1/16-in. length of the hole cylindrical. After the hole is thus finished, its actual diameter is carefully determined by micrometer and its area calculated.

The rate of flow through this type of orifice is obtained by the use of Fliegner's formula, the accuracy of which I have verified by carefully conducted tests in forcing compressed air contained in receivers of known volume through these orifices by displacing it with water. It is better to use a number of small orifices, as the formula is known to give unreliable results on orifices much larger than ⅝ in. diameter.

The manifold is tapped for a pressure gage and a thermometer well. An accurate pressure gage should be used, as it will be noted from the formula that the quantity of air discharged is directly proportional to the pressure and any inaccuracies in determination of pressure will materially affect the results. A reliable thermometer should be used and for a 2-stage compressor should have a scale reading not less than 300° F. Pressure and temperature are the only quantities required to be observed for use in the formula.

In preparing for a test, the main air line should be disconnected near the air receiver and the orifices attached at that point. All other outlets from the receiver or from the piping between the compressor and the receiver should be either blanked or protected by valves known to be tight, in order to insure that all the air furnished by the compressor will be discharged through the orifices. A thermometer should be placed in the path of the air entering the compressor as near the cylinder as possible. For determining the speed of the compressor, a revolution counter should be attached at some convenient point.

In making a test, the proper combination of orifices required to maintain the desired pressure is determined by experiment, and it is usually found necessary to run the compressor for about two hours, discharging through these orifices, before the pressure and temperature reach a maximum and remain fairly constant. When this point is reached, an observer, on signal, records the counter reading and another observer begins taking readings, at one-minute intervals, of the pressure and temperature at the orifices. The observer at the counter should then record the temperature at the compressor intake. At the end of 10 or 15 min., sufficient pressure and temperature readings will be obtained and the observer at the counter will, on signal, again read the counter; the difference between the last and the first counter reading will give the total revolutions for the interval of the test. Knowing the displacement of the compressor per revolution, the total displacement for the test period will be the product of the total revolutions and the displacement per revolution. The quantity of air discharged through the orifices, determined by the formula, using the observed data at the orifices, divided by the total displacement, will give the volumetric efficiency.

If accurate results are desired, the barometer reading at the time of the test should be known, which may usually be obtained from the nearest Weather Bureau station. This, together with the temperature at the compressor intake, should be used in the formula given below for reducing the pounds of air per second obtained from Fliegner's formula to cubic feet of free air per minute.

Fliegner's formula is: $G = 0.53 \frac{AP}{\sqrt{T}}$.

where G = flow in pounds per second; A = area of orifice in square inches; P = absolute pressure of the air behind the orifice; T = absolute temperature (F.) of the air behind the orifice.

The weight of a cubic foot of air is found by the formula: $W = \frac{1.325\,B}{T}$, where W = weight of 1 cu.ft. of air; B = barometer reading in inches of mercury; and T = absolute temperature (F.) at the compressor intake.

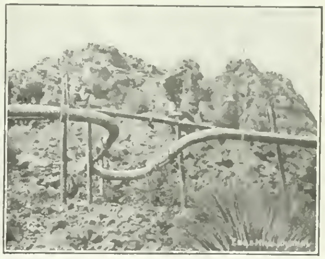
The following extract, from a test recently made in New York City on a 2-stage, direct-connected, motor-driven compressor to determine its volumetric efficiency, will serve to illustrate the use of the formula. The compressor had a low-pressure cylinder 26 in. diameter, a high-pressure cylinder 15½ in. diameter, each with a stroke of 18 in. The piston rods in each cylinder were 2½ in. diameter. The orifices used were as follows: 2⅝, 2½ and 1 5/16 in. diameter, having a combined area of 1.083 in. The observed data were as follows: Revolutions per minute, 188; gage pressure at orifices, 97 lb.; barometer, 30.1 in., or 14.8 lb.; temperature (F.) at orifices, 251; temperature (F.) at compressor intake, 41. Then, $G = 0.53 \times 1.083 \frac{97 + 14.8}{\sqrt{460 + 251}} =$ 2.407 lb. per sec. Then the weight of one cubic foot of air at the intake temperature was $W = \frac{1.325 \times 30.1}{460 + 41} = 0.0796$ lb., whence $\frac{2.407}{0.0796} \times 60 = 1814.4$ cu.ft. of free air per min. delivered by the compressor.

This quantity, divided by the actual displacement of the low-pressure piston, gave the volumetric efficiency in per cent. The displacement in this case at the observed speed, with allowance for the piston rod, was found to be 2070 cu.ft. per min. whence $\frac{1814.4}{2070} = 0.8765$, or the compressor actually discharged 87.65% of its displacement capacity.

Expansion Joint for Pipe Lines

By C. L. Edholm*

At a Western mine, the U-shaped pipe shown in the accompanying illustration is used in a long pipe line for steam to take up the expansion and contraction caused by changes in temperature. The bend is supported by iron posts in such a manner that the pipe can slide freely over the supports in contracting or expanding.



U-Pipe Expansion Joint for Pipe Line

The device not only takes care of all the expansion in the pipe line, but also reduces the vibrations that, if not checked in some way, would quickly cause leakage at all the joints in the line.

[This device is described, as it may not be known to some readers of the Journal; it is, however, a very common and extensively used joint for taking care of expansion in pipe lines. A similar device consists in bending a pipe into a complete circle of as great a radius as practicable. The circular pipe has an advantage over the U-pipe in that it can be hung on a single support; the resistance to the flow of fluid is probably greater in the U-pipe than in the circular pipe.—EDITOR.]

---

*4624 Figueroa St., Los Angeles, Calif.

Electric Signals for Underground Tramways

By W. S. GRETHER*

Fluorspar associated with galena occurs in a true fissure vein near the town of Rosiclare, on the Ohio River, in southern Illinois. The vein has been prospected or developed for a length of two or three miles and to a depth of 500 ft: it is from 3 to 20 ft. wide. In mining the ore is cleanly broken from the foot and hanging walls and not more than 10% of the ground broken is waste. The drifts are tortuous and not of uniform width which makes electric haulage impracticable on the 235-ft. or main working level.

The ore is mined by overhand stoping and the 1-ton tram cars are loaded from wooden bins situated 20 ft. apart along the single track in the drift. The cars are moved by men to the three-compartment shaft sunk midway between the ends of the vein; mules are used to pull the empties, 10 cars per trip, back to the loading bins. The excessive grade of the drift, 1½%, prohibits hauling the loaded cars with mules. Ore is trammed from either end of the mine, one end being called the south, the other the north workings. The caging at the shaft is often delayed on account of wrecks, lowering timbers, etc. The trammers in the ends of the workings perhaps 2000 ft. away are not aware of these conditions and formerly continued to bring cars to the shaft making matters worse on account of the limited switching facilities near the old station. To overcome this difficulty a simple electric signal system was installed.

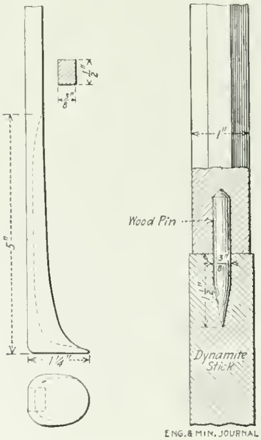
A switch and two 110-volt, 16-cp. lamps, one green and one white, are placed on the south side of the shaft, and similar equipment is installed in the south workings near the loading bins. Similarly, switches and red and white lights are placed on the north side of the shaft and in the north workings.

All switches are left open except when signals are being sent. When the cager wants cars at the shaft he closes the switch three times. The trammer, when ready to move cars to the shaft, answers with three signals. Likewise when the trammer wishes to push cars to shaft, he signals three flashes to the cager; if the cager is ready he flashes three in return. In this way blockades at the shaft are avoided and the trammer may utilize his time while waiting for signals in oiling cars or cleaning the track.

Joplin Scraper and Loading Stick

The ore in the Joplin mines is a mineralization of stratified beds. The roof is good and in stoping a system of drilling is used, in which a bench is taken up by a series of flat holes after the ore next the roof has been blasted out in a heading. In this bench work some of the deepest drilling in underground metal mining in the United States is done. Holes 18 ft. deep are not uncommon, 16-ft. holes are common, and 12- and 14-ft. holes typical practice in the bench portion, which is called the stope.

There are many cavities in the ore, the occurrence of which is due to the fact that the mineralization of the ore-bearing strata was a precipitation of zinc and lead sulphides between the cherts of a chert- or flint-bearing limestone. To break the heavy burdens, it is necessary to chamber the bottom of the flat holes in the so called stope, and because of the rapid wearing of the bits, it is often necessary to blast the hole for gage, so that one bit may follow another. This springing the hole is called "squibbing."



SCRAPER AND LOADING TOOL USED AT JOPLIN

The squibbing makes the bore of the hole ragged, therefore difficult to load. This and the occurrence of cavities, through which some of the holes pass, makes "railroading" of the powder to the bottom of the hole ahead of the loading stick impossible. A pointed tamping stick is therefore used, and in the best sticks this point is made of wood. A copper wire is inserted in the end of some sticks and a wire spike in others. The ground is flinty, so that the use of a wire nail in the tamping stick would be almost sure to be attended by sparking. A copper nail is sometimes used, but this is not considered good practice by the powder companies. The best practice is to use a tamping stick with a wooden point. In some of the sticks a point is made by sharpening the tamping stick itself, but it is preferable to insert a round piece of hardwood in an auger hole in the end of the stick and to sharpen this inserted piece of wood. The stick of powder is impaled on the point, so that it can be made to pass any irregularities in the bore and deposited at the bottom of the hole. This is important, especially in squibbing, as part of the hole may be lost if the squibbing-dynamite is not at the bottom of the hole when fired. The other end of the stick is used in tamping.

The practice of springing the hole for gage is attended by crumbling of the bore, a condition that is further aggravated by the existence of cavities in the ore. The scraping out of deep holes is a difficult operation, and it is, therefore, important that the machine man be able to keep the spoon of the scraper in its proper position in respect to the bottom of the hole. Instead of using round iron for making the scraper, as is characteristic of other districts in the United States, a piece of ⅜x½-in. steel is used for the shorter, and ⅝x½-in. for the longer scrapers. The spoon is made about 5 in. long, with a nose about the diameter of the steel used in the hole. When the wide side of the scraper rod is horizontal, the nose of the scraper is turned either up or down in the hole. It is, therefore, possible to pull the scraper with its load out of a hole, while if a scraper with a round handle is used, it is not uncommon to lose the load. It therefore seems well to make scrapers out of steel of rectangular section, no matter whether the holes are deep or shallow.

Air Escape on Small Pump Columns

At some of the mines in the Joplin district the pumps are operated intermittently. The water is pumped into the column pipe in the shaft and at the surface is discharged into a pipe through which it flows to the mill pond.

Where the difference in elevation between the collar of the shaft and the water in the pond is only a few feet and the pipe is only about three inches in diameter it is the custom to use a tee at the top of the pump column. The side leg of this tee is connected to the surface pipe, and a short piece of pipe is screwed into the upper leg. The length of this short, vertical extension of the column above the tee is sufficient to prevent any water being discharged over its top. The object of using the tee and the short vertical extension of the column is to permit air to escape at the top of the column which otherwise would have to flow through the surface pipe.

*Rosiclare Lead & Fluorspar Co., Rosiclare, Ill.

Details of Metallurgical Practice

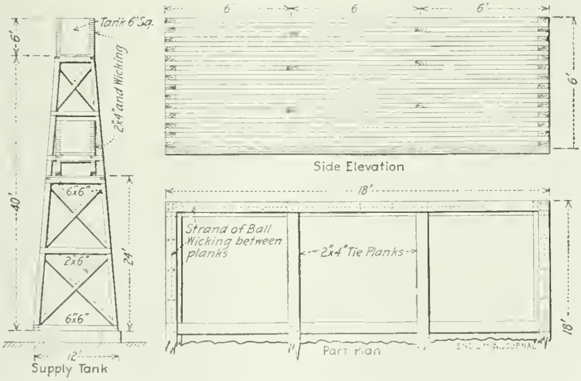
Records of Experience in Ore Dressing, Cyaniding and Smelting

Built-up Wooden Water Tanks

Water-tight tanks can be built cheaply and easily of planks in the same manner as the frame of a Cooley jig. This system is used in the Joplin district of Missouri for building the tanks that supply the boilers with water and for the mill-supply tanks. Some of the built-up boiler-supply tanks are as large as 16x16 ft. and about 6 ft. deep, while those at the mills are 6 ft. wide and as long as necessary to be of the desired capacity, their height generally being limited to 6 ft. As the object of these supply tanks is to regulate the pressure of the water going to the different devices in the mill so as to keep the head on each approximately constant, the mill tanks are not large.

The planks are nailed together on their sides with one or two pieces of cotton ball-wicking, such as is used in miners' oil lamps, in between the planks. These pieces of cotton wicking swell as they become wet and also entrap any sediment that may be in the water that tends to ooze through the cracks so that in a few days the tank is water-tight. As the walls are built up of thin planks laid on their sides they are much stronger than if planks of similar thickness but laid with their broad face toward the pressure were used. The smaller tanks are made with 2x4-in. planks all the way up the sides, but in the case of the larger tanks 2x6-in. planks are used for the bottom third of the walls and 2x4-in. planks for the upper two-thirds. The bottom of the tank is made of two or three thicknesses of plank with the joints broken, 1-in. planks being used in case three layers are used in making the bottom, and 2-in. planks in case two layers are used.

The side walls are tied together about every 6 ft. by building into the side walls about every 2 ft. in height a piece of 2x4-in. or a 2x6-in. plank which serves as a tie-rod owing to its being securely built into the wall at both ends. Both the side walls and the end walls in the case of a tank over 6 ft. wide are tied together in this manner. One piece of wicking seems to do just as well as two for making the walls tight. Of course the tank has to be set on cross timbers close enough together to give proper support to the bottom, but otherwise the tank is self supporting and self bracing.



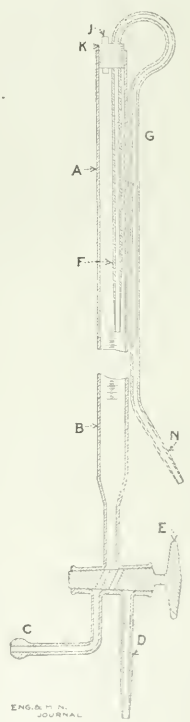
PLANK WATER TANK AND TOWER BENT

At some of the mills of the Flat River district tailings piles are built up to heights of 100 ft. The material is discharged upon the piles by belt conveyors or launders supported on a trestle the lumber for which is hauled up the side of the pile by a derrick or gin pole erected at the top. At the Leadwood mill of the St. Joe Lead Co., in order to prevent the ends of timbers cutting into the side of the pile and thus causing delays in hoisting, the ends are lashed in place in an old iron-wheelbarrow tray. This tray is then attached to the hoist rope and slides like a sled over the side of the pile effectually preventing the ends from being caught.

Self Filling Burette Attachment

By R. T. Wheelock*

A device is shown in the accompanying illustration for an attachment for a self-filling burette. Its purpose is to secure automatically the return of the meniscus of the liquid used to any definite point on the burette scale, for which the device may be adjusted. The illustration shows the device set for the return of the meniscus to the zero point at each refilling of the burette.



SIPHON ATTACHMENT FOR BURETTE

This device consists of a stopper *K*, and tubes *J* and *FGN*. Tube *FGN* is bent to form a siphon, with point *F* set as desired in respect to the burette scale. If a setting other than the zero point is desired, which hardly seems necessary, the arm *F* of the tube *FGN* would have to be made correspondingly longer, so that it would permit of adjustment. The bore of the tube *FGN* should be small, so that the siphon will operate with a minimum amount of solution.

---

*Superintendent, Enterprise Mining, Reduction & Improvement Co., Kingman, Ariz.

The tube *J* admits air, so that the siphon will clear itself and the liquid will not remain in the arm *F* and be drawn back into the burette when the cock *E* is opened. Its bore should not be over half that of the tube *FGN*. If properly adjusted and the relative sizes of the bores of the tubes are correct, the operation of the device is as follows: The solution enters the burette through the inlet *C* and rises to the zero point. If the bore of the tube *J* is sufficiently small, the air pressure in the upper part of the burette will cause the liquid to rise to tube *FGN* until it commences to siphon, at the same time rising but little above the burette. If the cock *E* is then closed, liquid above the zero point will siphon off, the air entering the tube *J* permitting the siphon to clear itself completely. The liquid passing through the siphon, a comparatively small amount, may, if desired, be caught in a suitable receptacle, and when convenient, be returned to the reserve supply.

Changes in Design of Rand Stamps

JOHANNESBURG CORRESPONDENCE

It has been stated that all the structural defects in the City Deep mill, in the Transvaal, were overcome without reducing the weight of the stamps and that crushing is being done at a cost of only 1s. per ton, which is a low figure.

In the Modder B mill, as the result of experience gained in the City Deep mill, changes have been made in the weight and in the design of the heads and shoes. The length of heads has been reduced from 49 to 36½ in. and the diameter from 9½ to 9 in. The length of shoes has been increased from 14 to 19¼ in., the diameter remaining 9 in. These changes tend to a greater variation of crushing weight from wear. The stem remains 13 ft. long by 4 in. diameter and the four-key tappet is 20 in. long and weighs 260 lb. against 248 lb. in the City Deep tappet, the diameter having been slightly enlarged. The total maximum falling weight has been reduced from 1978 to 1660 lb. It is apparent from this that, because of the experience with the City Deep mill, the engineers consider 1660-lb. stamps to be the most economical size to employ. With this weight there is no breakage of shoe shanks.

The 1000-lb. stamps, at the Albu mines, the West Rand Consolidated and Roodeport United mines, differ from these designs. The stems are 17 ft. long by 4 in. diameter and weigh 721 lb. The tappets are 18 in. long and with three keys weigh 250 lb., while the heads are only 28 in. long and the shoes 16 in. long, but the diameters have been increased to 9⅞ in. and weigh 535 and 350 lb., respectively. At the City Deep mill, because Laschinger's patented cam supports are used, only two camshafts have been broken to date.

Handling Broken Slag with Clam Shell Buckets

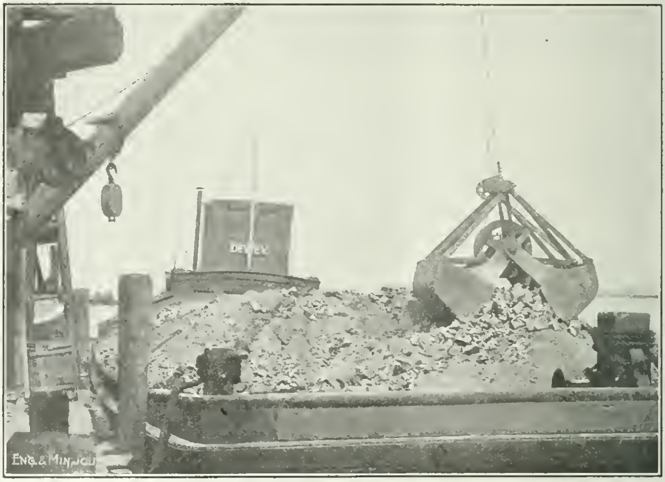
At the smeltery of the Balbach Smelting & Refining Co. at Newark, N. J., furnace slag is allowed to chill in small slag pots. It is then dumped and broken and, with the ashes from the boilers, is transported on scows to be used as filling material, for which there is a great demand in reclaiming low ground.

The mixture is unloaded from the scows by a clam-shell bucket operated from the well known mast-and-gaff rigging, and is discharged into a bin on the wharf from which it is drawn into wagons and hauled to the site of the filling.

Attempts were made to unload scows containing only slag, but trouble was experienced because the jaws of the bucket slipped on the hard, glassy slag and the bucket was forced upward on the pile without a load being gripped. This difficulty was overcome by loading the slag and ashes in alternate layers of about equal thickness, each layer being 12 to 18 in. deep. The ashes made a bed of soft, friable material underlying the layer of slag through which the jaws of the bucket cut without difficulty. The ashes also covered the lumps of slag thoroughly enough to offset most of the difficulties experienced in attempting to close the jaws of the bucket on such slippery material.

The bucket used is a modification of the Hayward, clam-shell, class "E," type, the shell or bowl being tray-shaped as shown in the accompanying halftone. This bucket is known as the ore bowl. It permits the material to slide into the bucket more readily than in the case of the usual type of handling hard slag in fairly large pieces.

The greater leverage obtainable by this shape of bowl increases the digging power of the bucket and by its use together with the system of loading ashes and slag in alternate layers a minor, but perplexing problem was satisfactorily solved.



UNLOADING SLAG AND ASHES WITH CLAM SHELL BUCKET

Filing Small Mine Maps

A convenient way to keep small mine maps in an office is to tack the top edge to a window-shade roller. A small strip of wood should also be tacked to the bottom edge to prevent tearing and to weight the map so that it will hang straight when unrolled. Each map is kept rolled up on its roller with the title plainly marked on the exposed edge. When wanted the map is taken from the cabinet and the roller is placed in shade brackets that have been tacked to the wall in some convenient and well-lighted place.

A hole bored in the path of a crack, which is extending through a piece of glass or a cast-iron plate, will ordinarily check the breaking at the hole.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

North Butte Costs

The North Butte Mining Co.'s annual report for 1911 states that its costs for the year amounted to 9.975c. per lb. of refined copper produced at its property at Butte, Mont. These costs consisted of 6.434c. for mining and development; 0.204c. for freight on ore; 5.693c. for concentration, smelting, refining and selling; 0.029c. for construction, and 0.173c. for general expenses and taxes; from these charges a credit of 2.558c. per lb. is deducted for gold and silver contained in the ore. The production was obtained from 420,230 wet tons of ore, which were equal to 410,694 dry tons, indicating an average of about 2.5% moisture for the ore as it comes from the mine. The cost of mining and development was $3.90 per dry ton, and freight on ore 12.4c. per ton.

The mine was operated 342.5 days during the year with an average of 835.1 men, making the average production per day 1220 tons, and indicating 1.46 tons of ore per day per man employed at the mine. This includes men engaged in performing 17,700 ft. of development work and 52,915 cu.ft. of stations and chutes for skips. In 1910 the mine operated 329.5 days and hoisted 1274 tons per day, employing 870.7 men, which gives practically the same tonnage per man per day as in 1911. The development work amounted to 18,709 ft., and 28,035 cu.ft. of stations and skip chutes were cut out during the year.

Tonopah-Belmont Milling Costs

According to the report of the Tonopah-Belmont Development Co. for the year ended Feb. 29, 1912, 87,349 tons of ore was milled containing an average of 0.269 oz. gold and 28.26 oz. silver, or $20.84 per ton. From this ore 651 tons of concentrate was produced containing 22.91% of the total gold and 23.53% of the total silver in the ore milled. By cyanide treatment 71.11% of the gold and 68.92% of the silver was recovered. In the cyanide treatment, 24,839 tons or 28.43% of the ore milled was leached as sand, the tailings from which averaged 0.0274 oz. gold and 3.707 oz. silver or $2.542 per ton. The extraction in sand treatment was 87.60%. Of the ore milled 61,862 tons or 70.82% was treated as slime by the agitation process and the tailings from this slime averaged 0.0116 oz. gold and 1.867 oz. silver, or $1.236 per ton, the extraction on the slime being 94 per cent.

The costs of milling were as follows: —Crushing and conveying, 7.721c.; stamp milling, 51.982c.; tube milling, 21.222c.; concentration, 10.879c.; elevating and separating, 3.609c.; leaching sand, 37.016c.; conveying and discharging sand, 8.65c.; agitating slime, 95.36c.; filtering and discharging slime, 20.036c.; precipitating, 22.94c.; assaying 6.155c.; refining 15.672c.; lighting 1.541c.; and for shift bosses, watchmen, surface and plant, 10.177c.; a total for direct costs of $3.13 per ton of ore milled. The indirect costs, including administration, office and storehouse, taxes and insurance, legal expense and traveling, depreciation, and general expense totaled 74.913c., making the total cost of treatment $3.87963 per ton of ore milled.

These costs indicate that the leaching of sand cost $1.29, and discharging sand 29c. or a total cost for sand treatment of $1.58 per ton of sand leached. The cost of treating slime by agitation was $1.35, for filtering and discharging slime, 28c. per ton, a total cost for agitating and for filtering slime of $1.63 per ton of slime treated.

Costs at the Osceola

The annual report of the Osceola Consolidated Mining Co., Mich. shows that the total cost of producing copper was 9.28c. per lb. during 1911. The costs for the last four years were; 1911, 9.28c. per lb.; 1910, 9.37c.; 1909, 9.47c.; and 1908, 10.25c. The yield of copper per ton of rock has been less each successive year for four years; in 1908 it was 17.1 lb. per ton; 1909, 16.9 lb.; 1910, 15.9 lb.; and in 1911, 14.8 lb. per ton. It will be noticed that the costs have been reduced although the grade has been lowered each year. This saving has apparently been made entirely at the mine and mill. In 1908 the cost of mining, transportation and milling was $1.45 per ton; in 1909, $1.36; 1910, $1.28; and in 1911, $1.14 per ton. These costs include all development work, which amounted to 5518 ft. in 1911. Construction from 1906 to 1910 inclusive averaged 0.57c. per lb. of copper produced, in 1910 the cost was 0.35c. and in 1911 0.49c. per lb. During 1911 the charges for smelting varied from $6.50 to $6.80 per ton of mineral smelted, or an average of 1.06c. per lb. of copper produced. Of the 1,276,790 tons of rock broken during the year, 30,194 tons or 2.365% was discarded by sorting, in 1910 the amount discarded was a little over 3.5 per cent. The Tamarack mill treated 63,499 tons of ore for the Osceola at a cost 27.28c. per ton.

Development Work in Cobalt District

During 1911, at the Cobalt Lake mine, 0.162 ft. of development was performed per ton of ore broken, and one ton of waste was mined for every 2.11 tons of ore. Apparently the amount of development work required to date for a ton of ore is 0.094 ft., distributed as follows: 0.027 ft. of drifts; 0.056 ft. of crosscuts; 0.004 ft. of raises; 0.003 ft. of winzes, and 0.004 ft. of shafts. The small amount of shaft work is accounted for by the shallow depth of the workings, only 291 ft. of shaft work has been performed to date.

At the Nipissing mine and adjoining property to Cobalt Lake, 8781 ft. of development work was done in 1911, according to the annual report, which is equivalent to 2.94 ft. per ton of ore produced. This consisted of 1.23 ft. of drifts; 1.2 ft. of crosscuts; 0.41 ft. of raises, and 0.1 ft. of shaft. In 1910, 1.20 ft. were performed for every ton of ore produced, which includes 0.67 ft. of drifts; 0.286 ft. of crosscuts; 0.160 ft. of raises, and 0.084 ft .of sinking. For the year 1909, the average was 1.32 ft. of development work per ton of ore produced, and in 1908 it was 2.92 feet.

According to the annual reports of the La Rose Consolidated Mines Co., 3429 tons of ore were produced in 1911, and 11,045 ft. of development work performed, which is equal to 3.22 ft. for every ton of ore. This includes 1.06 ft. of drifts and 1.72 ft. of crosscuts. A total, as given by a summary of work from 1908 to the end of 1911, indicates that about one ton is produced for every 1.99 ft. of development work.

Wages at Porcupine

The wages paid at the mines of the Dobie Mines, Ltd., in the Porcupine district of Ontario are as follows, according to the last annual report: In the mine—machine men, $3.85; machine helpers, $3.20; muckers, $3.10; single-hand miners, $3.60; double-hand miners, $3.50; topmen, $3; hoistmen, $2.85. At the surface—compressor men, $3.50; firemen, $2.85; blacksmiths, $4; blacksmith's helpers, $2.85; carpenters, $3.50 or $4; general surface labor, $2.85. All the above-mentioned employees work 9-hr. shifts.

The average number of men employed was 27½. Each employee was charged 60c. per day for board. The cost of running the boarding house was $6993 for the year, of which $5950 was collected from the men.

Temiskaming Costs

The Temiskaming Mining Co., Cobalt district, Canada, in its annual report for year ended Dec. 31, 1911, states that the total development work for the year amounted to 9224 ft., and that the total tonnage of ore raised to date was 59,290 tons. Adding to this the underground reserves of 88,557 tons indicates an average of one foot of development for every 16 tons of ore, of which 9.2% was shaft sinking; 8.1% winzes and raises; 69% drifting; and 13.7% crosscutting. The development work produced 16,925 tons of ore, or 1.84 tons per foot.

Some of the costs, based upon various tonnages handled, were as follows: Prospecting cost for the year was 57c. per ton of rock hoisted, of which labor was 63% and power 13.6%. Development was $15.60 per ft., or $1.64 per ton of ore, with labor constituting 63% of the cost and power 14.2%. Mining, including cost of timbering, was $1.85 per ton, of which labor was 66.5% of the total and power 13.5%. The total charge for hoisting was 53.8c. per ton, made up as follows: Surface labor, 15.4c.; deckmen, 10.4c.; supplies, 2.5c.; heat, 2c.; and fuel, 23.5c. Total cost of mining expenses was $4.60 per ton. Of the supplies for underground work, dynamite cost 33.7c. per ton of ore; fuse, 2.6c.; candles, 3c.; drill steel, 4.7c.; drill repairs, 21c.; and miscellaneous supplies and equipment, 23c. per ton of ore.

The ore is transported from the rock house to the mill by an aërial tramway about 300 ft. in length. The cost of operating this tramway is approximately 10c. per ton, of which labor is 7c. and power 0.06c. per ton. The total milling and rock-house expense is $1.68 per ton of rock treated, of which labor is 14c.; supplies, 15c.; and water, 29c. per ton. Electric power for the rock house is 4.7c., and for the mill 26.7c. per ton. The average running time for the mill was about 92.5%, and the wear on shoes and dies, which were of forged chrome steel, amounted to 7.28 and 2.44 oz., respectively, per ton of ore crushed. The recovery at the mill was 87.2%, and the ratio of concentration 33.2: 1; this has since been raised to 60 tons into one. The total cost of production, including all expenditures, was 16.4c. per oz. of silver. Based upon the total tons handled from the mine and dumps, the cost was approximately $8.35 per ton, and $29.74 per ton of marketable ore and concentrates produced.

Costs at Mohawk Mine

The Mohawk Mining Co. of Michigan, in its 1911 annual report states that 902,859 tons of ore were hoisted and 802,548 tons milled, producing 15,760,700 lb. of concentrates, or 12,091,056 lb. of refined copper. This indicates that 11.11% of the ore hoisted was discarded by sorting; that the ratio of concentration was approximately 102 tons ore into one ton of concentrates; and yield of refined copper per ton of rock stamped, 15.07 lb., or 13.39 lb. per ton hoisted. The cost of mining, transportation, and stamping was $1.406 per ton of rock stamped or 9.33c. per lb. of refined copper; smelting, freight, marketing and office expense, 0.81c. and construction 0.255c. per lb. copper; a total cost of 10.399c. per pound.

According to detailed figures given in the report, the underground cost was 81.6c. per ton of ore hoisted, or 92c. per ton of sorted ore. Of the underground costs, pumping and hoisting cost 3.58c. per ton hoisted; and power drills 7.2c. per ton; or 4.35% and 8.83% respectively of the underground charges. Surface expense at the mine, not including rock-house expense or construction, costs 7.76c. per ton hoisted; from which is deducted 1.19c. per ton for rents received; making a net charge of 6.57c. per ton. The total underground and surface charges for mining is approximately 89c. per ton hoisted, not crediting rents. The rock-house expense, crushing and sorting, is about 6.65c. per ton hoisted, or 7.5c. per ton stamped. Transportation of ore from the mines to mills 12.1c. per ton. Stamping was 21.9c. per ton stamped of which labor was 37.2%; fuel 26.9%; pumping 17.1%; electric light, power and teaming, 2.2%; and supplies 16.6 per cent. Development work consisted of 15,458 ft., or one foot for every 59.5 tons of unsorted ore; of which drifting and crosscutting was 94.5% or one foot for every 61.7 tons unsorted ore.

Great Boulder Perseverance Costs

The Great Boulder Perseverance Gold Mining Co. is in the Kalgoorlie district, Western Australia. According to the 1911 report, drifting cost $12.90 and crosscutting $13.80 per ft. From stopes having an average width of 12.94 ft., 266,247 metric tons of ore were mined at a cost of $1.71 per ton. The mill treated 243,109 tons at an average cost of $2.39. General expenses cost 17c., stope filling 0.18, and disposal of residues 13.6c., making a total working cost of $4.41 per ton. Of the mining costs, not including development, wages and contracts cost 92c.; explosives 15.6c.; drill parts and air lines 4.34c.; candles 1.82c.; and air for drilling 10.56c. per ton. Of the treatment charges, 11c. was for crushing, 56c. for milling, 68c. for roasting, 56c. for amalgamation and agitation, 42c. for filter pressing and 6c. for precipitation and smelting. The average value of the ore is about $5.89 per ton in gold.

Water Consumption at Detroit Copper Co.

According to the 1911 report of the Detroit Copper Co., Morenci, Ariz., 522.6 gal. of water were used per ton of ore milled. An average of 1737 tons of ore was milled per 24 hr. of actual running time, which was 95.32% of the total time. The total tonnage treated was 500,000 tons of 2.86% copper, producing 66,012.14 tons of concentrates assaying 15.876% Cu; this is equal to a 73.05% mill extraction and a ratio of one ton of concentrates for every 7.57 tons of ore milled. The water furnished to this mill is obtained from a pumping station six miles distant, which pumps the water from wells on the San Francisco river to a height of 600 ft., whence it is fed by gravity to the mill. A large portion of the water from the mill is returned from a settling system consisting of a steel dam, concrete tanks, settlers and a tailings pond.

Cost of Smelting at Copperhill, Tenn.

The cost of smelting per ton of ore is given in the Tennessee Copper Co.'s report for 1911, as $1.38326. The material treated was as follows: Tennessee sulphides, 436,285 tons; custom ore, 17,653; converter slag, 12,055; blast-furnace slag, 24,774; sinter, 12,586; quartz flux, 64,425; lime-rock flux, 32,283; Tennessee matte, 105,813; total, 705,214 tons; coke, 42,492 tons. From this it would appear that the actual cost of smelting was about $0.89 per ton of charge, and that of this, if we count coke at $3.50 per ton, about $0.33 would be for fuel. The cost of converting is given at 0.709c. per lb. of fine copper.

In the suit of the Government against the U. S. Steel Corporation, an official of the American Steel & Wire Co. testified as to the cost of drawing copper wire. The wirebars cost $320 per 2000 lb. and the finished product was sold for $345. Of that $25 margin, $5 went for freight, and $1.50 for discount. That left $18.50 for the entire conversion process, including profits. These figures correspond substantially to the common understanding.

Mine Hoisting Systems Compared—II

By Bruno V. Nordberg*

Where hoisting is regular, air and electric hoists cannot compete in economy with steam hoists. An example of low cost of electric hoisting is cited, but the efficiency is low.

In many ore mines working on well defined lodes extending to considerable depth it is customary to install large hoists designed for great depth, 3000 to 5000 ft., even when, in the initial stages of the development, mining is done at no great depth and the tonnage hoisted is comparatively small. In such cases hoisting is done at a slow speed and the speed is afterward increased as the increase in tonnage and the depth demand. With a steam hoist, the increase in tonnage and the depth simply require an addition to the boiler plant. If the hoist were operated by an air motor, an addition to the compressor capacity is required, all of which can be obtained at a reasonable cost and without any alteration in the hoist proper.

If an electric hoist were used in such a case, it would have to be provided from the start with a sufficiently powerful motor on its shaft to enable it to hoist from the ultimate depth and at maximum speed. This not only involves a useless initial investment, but must, of necessity, reduce the efficiency, while the mine is worked at little depth and hoisting is done at slow speed. For cases like this the air hoist is best adapted, particularly when several hoists can be served from a central compressing station. The steam hoist under such conditions is at a disadvantage as its economy is much reduced at a reduced piston speed, while the air motor is more economical at low than at high piston speeds.

The Steam Hoist at Copper Queen

I will now show that under the hoisting conditions given by Mr. Pauly, the best plan would be to run the hoist with directly applied power, that is, by steam. It was assumed that the coal could be obtained at $4.50 per ton and, as we have seen by analyzing the data for this hoisting plant, the hoisting is regular. The hoisting conditions are, in fact, almost identical with those existing at the Sacramento shaft of the Copper Queen Mining Co., at which shaft there is a compound condensing steam hoist, built by the Nordberg Manufacturing Co. The hoisting in the Copper Queen mine has been concentrated as much as possible at the Sacramento shaft so that the hoisting is regular, although the average depth at present is only 1400 ft. There are automatic arrangements at the Sacramento shaft for continuously weighing the ore, and the chief engineer of the company, Mr. Legrand, has made several tests to determine the economy of this hoist. According to these tests it has been ascertained that the steam consumption per shaft horsepower-hour is 31½ lb. It can be easily deduced from the above that if the hoisting depth had been 2000 ft., the steam consumption would have been much reduced and would have reached 28 lb. per shaft horsepower-hour. Let us, however, assume that this steam consumption is, in round figures (for 2000 ft. depth) 30 lb. per shaft horsepower-hour.

Steam and Electric Hoists Compared

In order to make a comparison of the operating costs of such a hoist with the operating costs of an electric hoist as by Mr. Pauly's example, and not introduce the uncertain factor of the cost of the boiler plant, we will take as the cost of steam, that used by the large mines at Butte, that is, $90 per boiler horsepower per year. This figure includes interest, depreciation, repairs, labor, coal and, in fact, all the expense of steam making and corresponds to about 38½c. per 1000 lb. of steam. We will now assume that the hoisting plant consists of a compound steam hoist with counter-current condenser and a cooling tower. The cost of such an engine with condenser and cooling tower erected and piped to the boilers, will be about $62,000. We will assume in the case of the electric hoist that the electrical-equipment cost is $53,800, as given in Mr. Pauly's paper, and that the drums and hoist parts as well as the foundation cost $13,200. This gives $67,000 as the total cost of the electric hoist.

I have in both cases assumed three shifts with one runner and one oiler on each shift, and that the fixed charges are 15% of the cost. The fixed charges used by Mr. Pauly in his estimate of operating costs would hardly be regarded as high enough by mining companies. The repairs and supplies I have assumed to be about as given by Mr. Pauly in the case of the compressed-air hoist and electric hoists. In Table I the operating costs of the steam hoist and electric hoist are shown.

If the mine is situated in latitudes where the engine houses have to be heated in winter, a steam plant is required for that purpose and the operation of the electric hoist should be charged with the steam for heating the engine house in winter. With the steam hoist, there is enough radiation to heat the engine house, which radiation is already included in the steam consumption of the hoist and the cost of the steam power.

From the above it will be seen that the saving in operating expenses by the steam hoist as compared with the electric hoist is over $11,000 per year. As a matter of fact, the steam hoist would use less than 30 lb. of steam per shaft horsepower-hour, so that, in reality, the saving should be even greater than in the statement above.

Conditions under Which Steam Hoists Are Cheapest

Where the hoisting is regular, as in Mr. Pauly's example, neither the direct electric nor the air hoist can compete in economy with a steam hoist, and both will show up poorly if the steam hoist is high-grade. That this is the case was found out in Germany several years ago. In that country compound hoisting engines are used in a number of mines, even in the Westphalian mining district where the electric hoist was first developed and where electric current is cheap. These German steam hoists have shown by test less than 26 lb. of steam per shaft horsepower-hour, and, with the cost of steam in Westphalia, the electric hoist will not equal such steam hoist in economy unless the electric current costs 0.6 pfennig or 0.15c. per kilowatt-hour.

Anyone interested in this subject of relative costs, is referred to Prof. A. Wallich's paper on this subject, read in 1907 before the German Society of Mechanical Engineers.

Data of actual performances of hoisting engines are meager in this country and it seems that few, if any, investigations have been made to determine their economical performance. During the last five years several such determinations have been made abroad, particularly in Germany, whereby it has been clearly demonstrated that a high-grade steam hoist is more economical to operate than an electric hoist under the hoisting conditions prevailing in the German coal mines; that is, when the hoisting is fairly continuous.

The German results agree closely with those obtained in South Africa and with those obtained at the Copper Queen mine in this country, but even under unfavorable hoisting conditions it would seem that the steam hoist is at least as economical to operate as an electric hoist under much more favorable conditions, as will be seen from the following:

The Atlantic Mining Company has a 32x72-in. duplex hoisting engine of the Nordberg standard type. It is designed for a depth of 5000 ft., runs noncondensing, and has its own boiler plant. The hoist is at the D shaft. The record for April, 1903, shows 19,000 tons hoisted during the month, or 731 tons per day; 215 trips were made per day, the average time of the trip being 90 sec.; 815 lb. of coal were used per hour. The horsepower at the shaft, that is, the horsepower represented by the net ore hoisted, times the vertical distance, 1920 ft., is 71 shaft hp., so that the coal used per shaft horsepower is 11.45 lb. per hour. R. R. Seeber read a paper entitled "Tests of an Ilgner Hoist," before the American Institute of Mining Engineers in March, 1910. This paper is a valuable contribution to our knowledge of performances of hoists and gives figures of actual coal consumption of an electric hoisting system operated by a compound condensing engine as prime mover and also of a steam hoist.

---

*Chief engineer, Nordberg Manufacturing Co., Milwaukee, Wis.

The electric hoist system comprises two hoists, which, both combined, lifted, according to Mr. Seeber's paper, 2096 tons in 16 hr. As the skips hold 2.7 tons of rock, we get

$$2096 \div 2.7 = 780 \text{ trips per 16 hr.,}$$

or

$$780 \div 24 = 32\tfrac{1}{2} \text{ trips per hr.}$$

As, according to the diagram embodied in the paper, the duration of the trips is from 50 to 100 sec. each, it is clear that the hoisting is practically continuous; in fact, more so than could possibly be the case if the same number of trips were made with a single hoist. It is stated that 1.79 kilowatt-hours are required per ton hoisted per 600 ft. lift on a 70° incline, which work requires:

$$(2000 \times 600 \times 0.94) \div (33{,}000 \times 60) =$$

0.57 shaft horsepower-hours and a power consumption of, $1.79 \div 0.57 = 3.14$ kilowatt-hours per shaft horsepower. It is further stated that 4 lb. of coal are required at the power plant per kilowatt-hour, so that the coal consumption is, $3.14 \times 4 = 12.56$ lb. of coal per shaft horsepower per hour. The efficiency of the electric system and the hoists, according to Mr. Seeber's data, is, $0.746 \div 3.14 = 23.7\%$, but if we include the friction of the driving engine, we get a total efficiency of about 21%. In other words, the result is the same as if we had a hoisting engine, the friction of which was 79 per cent.

It will be seen from this that the steam hoist at the Atlantic mine, while it hoisted intermittently, and from a comparatively shallow depth, used 11.45 lb. of coal per shaft horsepower per hour, or 8.8% less coal than the hoists at the Winona and King Philip mines, described by Mr. Seeber, which hoists during the tests must have been running continuously.

Hoists in the Lake Superior Country

The 32x72-in. Nordberg noncondensing standard hoist at Osceola No. 6 shaft hoisted 20,200 tons of rock per month, or 777 tons per day in the year of 1904. The hoisting time there is 20 hr. per day, 194 trips per day and 4 tons per trip. The depth measured vertically is 2830 ft. The hoist is in operation 32% of the total time; the shaft horsepower, 111; the coal per hour, 838 lb.; the coal per shaft horsepower-hour, 7.55 lb. Comparing this performance with that of the Winona-King Philip electric system of hoisting, we find that the Osceola hoist is by 40% more economical in coal.

The hoist at the Champion D shaft with which Mr. Seeber compares the economy of the electric system, was greatly underloaded at that time. The Champion D hoist is proportioned for a depth of 3000 ft. The data used by Mr. Seeber were taken from the performances of this hoist when hoisting from 600 ft. depth. At that depth it only requires about 21 turns of the drum on engine shaft to wind 600 ft. of rope. The production was 15,000 tons per month or about 577 tons per day. The skips held 2.1 tons of ore so that 275 trips per day would hoist the production. It is safe to assume that the average number of revolutions per minute of the hoist was not less than 20, so that about 60 sec. or less were used to hoist. The hoist was thus in motion $(275 \times 60) \div 86{,}400$ or about 19% of the time. This, and the fact that during so short a run with a large drum, little, if any use can be made of the expansion gear on the hoist, necessarily results in poor economy. A comparison between the performance of the electric system and a steam hoist operating under such conditions is, therefore, unfair and leads to wrong conclusions.

A comparison is also made in Mr. Seeber's paper, of an electric system under the favorable conditions given above and a geared steam hoist at the Winona No. 3 shaft. This latter hoist is of an uneconomical type, designed for preliminary operation in opening a mine. The steam cylinders have large clearance spaces and are not fitted with expansion gear. The saving in coal effected by the electric system over this hoist is stated to be 25% which, in this case, is small, and clearly demonstrates the inefficiency of the electric system. The hoists at Winona No. 4 shaft and King Philip No. 1 shaft to which the electric system was applied were originally steam hoists of the same type as the one at Winona No. 3, just described. One wonders what the object was to apply electric motors to these hoists. The saving of 25% of coal does not seem to warrant the expense of the electric apparatus including the motor, Ilgner transformer and the corliss compound engine that acts as a prime mover. The expense of this apparatus must have been considerable. If a greater coal economy was aimed at, the substitution of new steam cylinders with corliss valve gear for the originals would have decreased the steam and coal consumption in the ratio of 34:23, or about 34%. The cost of such a change would have been insignificant compared with the cost of the electrical apparatus.

If the work of hoisting 2096 tons in 16 hr. from 600 ft. depth, which Mr. Seeber uses in his comparison of steam and electric hoists, was done with compressed air, it would have required a compressor of about 1400 cu.ft. of free air per min., compressing to 80 lb. pressure, and if this compressor were operated by electric power, about 1.54 kilowatt-hours would be required per net ton from 600 ft. depth. These figures are based upon the performance of the air hoists at Butte. Mr. Seeber states that the electric hoist with Ilgner transformer required 1.79 kilowatt-hours for the same work.

An Electric Hoist in Coeur d'Alene District

The Hecla Mining Co., of Wallace, Idaho, has installed an electric hoist for which a low cost of operation is claimed. I have seen and examined a report of operating costs which has been quite widely circulated among mining men and, while this report gives the cost of power quite minutely in dollars and cents, it is not sufficiently complete to indicate the efficiency. In other words, the report gives the expenditures expressed both in kilowatts and dollars, but does not definitely state what the returns were for these expenditures, i.e., the work done at the shaft. There are, however, sufficient data in this report from which it can be seen clearly that the operating cost is low simply because the hoist performed little work and that, in reality, the cost is high in comparison to the work done.

During February, 1911, only 52½ hr. were used for hoisting ore, and the hoist was idle 93⅓ hr., running light and doing auxiliary work during 526⅙ hr. The work of hoisting ore figures on the average 179 shaft horsepower-hours, for which 14,149 kilowatt-hours was used, according to the figures in the report. The total energy used during the month was 40,400 kilowatt-hours, so that 26,251 kilowatt-hours, or 65% of the total energy, was consumed for the unproductive work and other losses. The report further states that, during January, 1910, the following work was performed: 3403 skips, holding 2.6 tons of ore, hoisted 900 ft. to surface; 1279 skips, holding 2.6 tons of ore, hoisted 600 ft. to surface; 999 cars, holding 1.1 tons of waste, handled from 1200 ft. to 600 ft., and 300 ft., and from surface to 600 ft., and 300 ft. The above statement of quantities hoisted during January, 1910, is followed by a statement that, during the preceding year (1909), the average monthly consumption of power was 45,790 kilowatt-hours. What the power consumption amounted to during January, 1910, is not distinctly stated.

NONPRODUCTIVE WORK

While the productive work is well defined, the nonproductive work is not, but it would appear that the work done between the surface and the 600- and 300-ft. levels consisted in lowering material. The productive work is as follows: 3403 skips of ore weighing 2.6 tons each raised from a depth of 900 ft., 8810×900, or 7,929,000 foot-tons; 1279 skips of ore weighing 2.6 tons raised from a depth of 600 ft., 3320×600, or 1,892,000 foot-tons; or the total productive work is 9,821,000 foot-tons.

The nonproductive work amounts to perhaps the equivalent to hoisting 999 loads of 1.1 tons through a distance of 300 ft. on the assumption that half the waste was raised from 1200 ft. to $(600 + 300) \div 2 = 450$ ft., or lifted 750 ft., and the other half was lowered from surface to $(300 + 600) \div 2 = 450$ ft. That would make the total nonproductive work equal to $1100 \times 300 = 330{,}000$ foot-tons, or the total work per month 10,151,000 foot-tons.

TABLE I. COMPARISON OF ANNUAL COST OF OPERATING STEAM AND ELECTRIC HOISTS

	Steam	Electric
Cost of power..........	$11,600	$19,992
Operators, 3@$5 per day	4,100	4,100
Oilers, 3@$2 per day....	1,650	1,650
Interest and depreciation, 15%	9,300	10,000
Repairs and supplies....	1,400	1,000
Electrician @ $200 per month	.....	2,400
Total cost for 275 days	$28,050	$39,142
Balance in favor of steam hoist		$11,092

The work expressed in effective horsepower at the shaft is thus $(10{,}151{,}000 \times 2000) \div (31 \times 24 \times 60 \times 3300) = 14$ effective hp. If, as might be inferred from the report, the monthly expenditure of power to do this work averages 45,790 kilowatt-hours, or $45{,}790 \div (31 \times 24) = 61.5$ kw. expended per hour per 14 effective hp. at the shaft, we get a power consumption of, $61.5 \div 14 = 4.4$ kilowatt-hours per shaft horsepower.

Now, the electrical equivalent of a horsepower is 0.746 kw., so that, apparently, the efficiency is, $0.746 \div 4.4 = 17\%$. The above shows how inefficient the Ilgner system is when operating on intermittent loads. From the report referred to it appears that observations have been made of the energy required for individual trips. These observations are interesting as they show the maximum obtainable efficiency with the Ilgner system of control as applied to an electric hoist. The figures given are those in Table II, in which the time of a hoisting period includes that of loading, hoisting and dumping one skip. From the data in Table II the powers and efficiencies given in Table III, all based on a load of 2.6 tons per trip, are obtained.

The figures in Tables II and III are the maximum obtainable efficiencies with the Ilgner system and they agree fairly well with results obtained from German electric hoists where the hoisting was regular and where the time lost between trips was a maximum. The German results show an efficiency of 50% or less.

ILGNER SYSTEM IS INEFFICIENT

The above shows that even under the most favorable conditions the Ilgner system is inefficient, but when the conditions are such as found in the regular hoisting practice in ore mines, of which those existing at the Hecla hoisting plant is a fair sample, the Ilgner becomes one of the most inefficient systems invented for transmitting power. We found that at the rate of hoisting during January, 1910, only 17% of the electric energy was converted into useful work. It would have been interesting if we had more particulars regarding the nature of nonproductive work in this case. All we can find out about it is that it consumes much energy. Mr. Pauly assumed in the example on which all his calculations are based that the nonproductive work was half the productive work. While the Hecla report does not give the ratio of the productive work to the nonproductive work, it indicates that the nonproductive was more than the productive work. At any rate, it shows that during February, 1911, the nonproductive work required 1.86 times the energy required for the productive hoisting. The fact is that this nonproductive work, which is performed mostly during periods when no ore is hoisted, is intermittent, is often done unbalanced, and some of it is negative, i.e., lowering material into the mine instead of hoisting. In many instances this negative work is considerable, in proportion to the positive work performed, and it is when handling this negative load, that the Ilgner apparatus is particularly at a disadvantage. It is claimed and even believed that when a load is lowered by an electric hoist, power can be returned to the flywheel of an Ilgner apparatus and stored for future use. The following considerations will be of interest in their bearing on this point and tend to show that the Ilgner apparatus is useless for the purpose of storing power under actual running conditions.

TABLE II. ILGNER HOISTING SYSTEM DATA

Depth in feet	Hoisting period in seconds	Kilowatt-hours per hoist
1200	60	4.5
900	47	*3.57
600	43	2.85

*Balanced hoisting.

TABLE III. EFFICIENCY OF ILGNER HOISTING SYSTEM AT VARIOUS DEPTHS

Depth in feet	Effective horsepower per trip	Kilowatts per effective horsepower	Efficiency
1200	189	1.43	52.2%
900	181	1.52	49.0%
600	132	1.80	41.5%

ACTUAL CONDITIONS UNFAVORABLE TO FLYWHEEL SYSTEM

In order that the Ilgner flywheel may give up energy, its speed must be reduced, as shown by Mr. Pauly in his paper. The energy thus given up by the wheel is in proportion to the difference of the squares of the highest and lowest velocities. In order that the wheel may absorb energy, its speed must be increased in the same ratio. If, now, a heavy load is hoisted, causing the flywheel to drop in speed and, thereby, assisting the motor on the Ilgner apparatus to drive the hoist, then the next trip can be made with a down-going or negative load, which, in driving the motor on the hoist, causes it to generate an electric current. The direct-current generator of the Ilgner apparatus becomes a motor which accelerates the wheel and restores its energy. These negative loads occur, however, most frequently when no ore is hoisted. They may occur when the flywheel is up to speed and several such loads may have to be lowered in succession. Bearing in mind that the whole energy of the lowered loads must be absorbed in the flywheel and that only part of the energy can be absorbed by the empty cage when it is hoisted to receive the next load to be lowered, it is clear that the velocity of the wheel under above conditions will steadily increase above the normal if it is to store up the energy. This is not possible as the normal speed already is high.

In a case like the Hecla hoist, conditions are particularly favorable for operation by compressed air. The power represented by the individual trip is about 190 shaft hp. The hoisting periods, to judge from the wattmeter diagrams, are of from 10 to 30 min. duration with 45 min. to 1 hr. idle periods between. The work distributed as shown by the wattmeter cards and with loads as given in the report referred to, can be done at an expenditure of power of not to exceed 35,000 kilowatt-hours supplied to the electric motor driving a small compressor, operating an air hoist. There should be a hydrostatically balanced air receiver on the system, which also should serve for the rock drills. On such a system there will be no peak loads and, as the compressor will be started with air, there will be no peaks incident to the starting of the compressor. When negative work is done by the hoist, air is compressed and part of the energy represented by the lowering of the load is returned to the system.

ECONOMICAL CONDITIONS FOR VARIOUS TYPES OF HOISTS

The conclusions that can be drawn from the above are as follows:

When hoisting is regular, frequent and

from a considerable depth, and fuel is expensive, the compound condensing type of steam hoist is the most economical.

When hoisting is irregular, the load factor small, and when several hoists can be supplied from a central source of power, compressed air is the proper transmission medium. In this case, the hoisting engine should be operated by air motors designed for the economical use of air, and the hoist system and rock-drill system should be combined. Where waste gases from blast furnaces can be used to generate power by means of gas engines, the electric hoist with Ilgner transformer should be used. It was originally designed for use under these conditions. Another proper place for the electric hoist with Ilgner transformer is in coal mines of shallow depth, where hoisting is regular and rapid. In such places, when several electric hoists can be served by a central power plant, it should be economical.

For deep mines, however, with the irregular hoisting conditions of rapid hoisting during short intervals, long pauses, handling unbalanced loads and lowering material and men out of balance, the electric hoist is at a great disadvantage. The modern electric hoist, while it is a perfect mechanism, and as such leaves nothing more to be desired, is, as I have shown above, even under the best working conditions, wasteful in power and, under the conditions existing in deep mining, one of the most inefficient mechanisms that has ever come into use, besides which, it is costly.

Traz-os-Montes Wolfram Mine

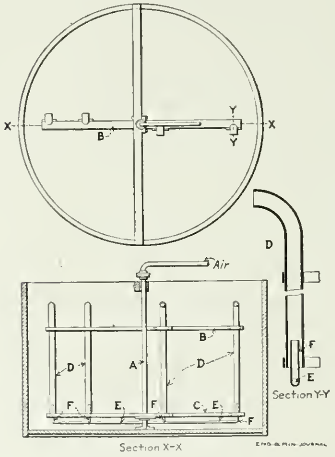
The Traz-os-Montes mine, in North Portugal, was developed entirely in 1911, but has already taken third place among the wolfram mines of Portugal, says *Revue de Chimie Industrielle,* Mar, 1912. The product shipped in 1911 amounted to 51,048 kg., of an average of 70% WO_3, while at times the contents ran as high as 73% WO_3, although only crude concentrating methods were employed. An analysis of a typical lot was: WO_3, 70.56%; SnO_2, 0.32; insoluble, 3.40; Cu, 0.05; FeO, 13.04; Al_2O_3, 0.89; MnO, 10.60; CaO, 0.20; S, 0.04; H_2O and volatile, 0.38%. There is no arsenic nor phosphorus. The average price received was 45.50 francs per unit. The wolfram is chiefly found in quartz stringers, but on one claim also disseminated in granite. There are 35 galleries, some 180 m. long.

The concentration, consisting of crushing and washing, is done by women, hand labor. Overseers get 50 to 60c. per day; common laborers, 36 to 38c.; women and children, 18 to 20c. per day. However, it is thought that a hydroelectric installation on the Rio Pinhaô will reduce the present costs. The ore is taken by rail from either Pinhaô, 17 km. distant, or Alambres, 9 km. distant, depending on which part of the workings it comes from, to Porto, where it is put on ships.

The climate is warm and healthful, and a good supply of wood exists. Transportation is by bullock carts to Alambres and Pinhaô, the costs being about $1.60 and $0.80 respectively, and the railroad haul to Porto costs $1.20 per ton.

The Hafer Pulp Agitator

A recent invention of Charles C. Hafer, of Phœnix, Ariz. (U. S. pat. 1,020,694), relates to an apparatus for agitating pulp and embodies the principle of the ordinary power-driven rotor agitator and the air-lift agitator. The accompanying illustrations show the apparatus installed in a pulp tank.



Hafer Pulp Agitator

In the center of the tank is mounted a hollow vertical shaft *A*, which carries the arms *B* and *C*, which in turn support the vertical pipes *D*, the latter being open at both ends. The lower ends of the pipe are near the bottom of the tank and the upper ends terminate in lateral horizontal bends to form jet nozzles. To the lower end of the central vertical shaft are connected small pipes *E*, which extend radially beneath the lower arm *C* and have upwardly extending discharge nozzles *F*, which project centrally into the lower ends of the pipes *D*.

In operation, the tank is nearly filled with pulp, air is then turned on from the compressor, whereupon it flows down the shaft *A*, through the nozzles *F* into the pipes *D*, from which latter it is discharged from the nozzles. The suction produced by the passage of the air upwardly draws in pulp through the lower ends and discharges it through the nozzles. As soon as the pulp is sufficiently thinned by the mixing, the pipes *D* commence to revolve as the result of the reaction due to the discharge at high velocity from the nozzles. The vertical pipes, therefore, revolve in the pulp and aid in the agitation.

Norwegian Iron Ore

A recent report, covering the production of iron ore in Norway, has been published by the *Morgenbladet,* of Christiania. According to this the Sydvaranger mines produced in 1911 a total of 265,000 tons, which was reduced by concentration to 115,000 tons, of which 90,000 tons were briquetted. At Salangen, north of the Lofoten Islands, a magnetic separation plant was completed; the only shipments were 23,653 tons of briquettes. From Ofoten only 6000 tons of concentrates are reported. At Rodsand, near Trondhjem, most of the year was employed in the erection of a concentrating plant, with a view of reducing the titanium contents of the ore. This plant has been so far successful that shipments have been made of concentrates carrying only 1.6 to 2% titanic acid.

The production of lump iron ore from six mines was 75,000 tons. Exports of iron ore for 1911 were 180,842 tons, of which 106,000 tons were briquettes, 7000 tons concentrates and 67,000 tons lump ore.

ELECTRIC FURNACES

At Ulefos 400 tons of pig iron were made in the electric furnace from Fohns ore, averaging 48% iron. The Hardanger works were completed, Nov. 1, and in two months made 300 tons of pig iron, using 3500 hp. A second furnace is now being erected. New electric furnaces are under construction at Arendals, Tinfos and Stavanger. At the last named place, a forge will be added to the smelting plant.

Aluminum Production in 1911

The consumption of aluminum in the United States in 1911 is given by W. C. Phalen, of the U. S. Geological Survey, as 46,125,000 lb. Bauxite ore, the present source of aluminum, is mined in Arkansas, Georgia, Alabama and Tennessee. The combined output from these states amounting to 155,618 long tons, valued at $750,649. The chief uses of bauxite are in the manufacture of metallic aluminum, of aluminum salts, of alundum which finds extensive use as an abrasive, and to a minor extent in the making of bauxite bricks and plaster compositions. The ore production increased about 5% last year.

Spelter Statistics for 1911

By W. R. Ingalls

My revised and complete statistics of the zinc industry in the United States in 1911 are given in this article. The report of spelter production is based upon official returns by all the smelters. Three smelters, one of them important, and the other two of but relatively small importance, have failed to report their receipts of ore in 1911, wherefore the statistics pertaining to the latter subject are less precise than for 1910. However, it has been possible to determine in other ways the approximate ore receipts of the concerns referred to, wherefore the figures are sufficiently accurate for ordinary purposes.

The total production of spelter in 1911 was 295,836 tons, of which 9030 tons is estimated to have been derived from dross, scrap, etc., (against 7793 tons in 1910) and the remainder from ore. This does not include the production of spelter by concerns which treat dross and scrap only, whose output amounts to 10,000 to 16,000 tons per annum.

PRODUCTION OF ZINC

(In short tons)

By Ore Smelters

States	1910	1911
Colorado	6,564	7,477
Illinois	79,570	88,681
Missouri & Kansas	112,182	106,173
Oklahoma	34,760	46,333
East	43,989	47,172
Totals	277,065	295,836

By Dross and Scrap Smelters

	1910	1911
	11,350	(a)13,500

Total Production of Zinc

	1910	
Ore smelters	277,065	295,836
Dross smelters	11,350	13,500
Totals	288,415	309,336

(a) Estimated.

In addition to this production there was an output of 254 tons of zinc dust in 1911. The importation of zinc dust in 1911 was 1713 tons, 296 tons being entered through Pacific Coast ports and the remainder through other ports.

In 1910 there were produced 3398 tons of spelter in bond. In 1911 the production in this way was 9598 tons.

Along with the increase in the production of spelter in 1911 there was naturally an increase in the production of ore. The striking features of the ore statistics are the decrease in the production in the Joplin district and the increases in Colorado, Wisconsin and Montana. The extraordinary increase in the case of Colorado is due to the large shipment of calamine from Leadville. This being of very low grade it does not make as much new spelter as would be indicated upon the face of the returns. The increased output of Montana is of course due to Butte. Further increases in the production of Butte in 1912 and 1913 are to be expected. Most interesting, perhaps, is the continued increase on the part of Wisconsin, the ore of which state is of high grade.

My statistics of ore production refer only to the ore received by the smelters, and do not include the ore received by manufacturers of oxides.

In 1912 there were seven zinc smelters who reported the production of sulphuric acid from blende roasting. The total amount of their output was 252,192 tons against 202,000 tons in 1910. The figures of sulphuric acid produced are reduced to the basis of 60 deg. B. Six of these smelters produced 115,310 tons of spelter against 100,791 tons in 1910. They received 71,168 tons of blende from Wisconsin and 107,995 tons from the Joplin district, besides less supplies from the Rocky Mountains. It is noteworthy that these works buy nearly the whole output of blende in Wisconsin and about 40 per cent. of the total production of zinc ore in the Joplin district. A noteworthy feature is the increasing use of western ore by some smelters making sulphuric acid. Several of the smelters in this group, however, continue to use only Missouri and Wisconsin ore.

PRODUCTION OF ZINC ORE

State	1910 (a)	1911 (a)
Arizona	7,568	6,395
Arkansas	190	860
California	(b)	3,754
Colorado	77,065	158,528
Idaho	10,248	9,667
Kentucky	179	575
Missouri-Kansas	289,913	268,500
Montana	33,514	56,593
Nevada	4,915	5,666
New Mexico	15,959	10,184
New Jersey	(b)	(b)
Oklahoma	1,640	8,750
Tennessee	2,775	3,439
Utah	27,318	19,933
Wisconsin	51,383	71,565
Others	46,905	44,896
Totals	569,572	669,305
Mexico	29,198	28,596
Canada	11,795	2,356
Grand totals	610,565	700,257

(a) Smelters' receipts; reports missing from three small smelters. (b) Included in "Others."

The total stock of spelter at smelters' works at the end of 1911 was 9323 tons, against 23,000 tons at the end of 1910. The deliveries into consumption are computed in the accompanying table.

DELIVERIES INTO CONSUMPTION

	1910	1911
Stock, Jan. 1	11,500	23,000
Production	288,415	309,336
Imports	3,452	1,637
	303,367	333,973
Exports, domestic	3,989	6,872
Exports, foreign	4,468	11,270
Stock, Dec. 31	23,000	9,323
Deliveries	271,892	316,508

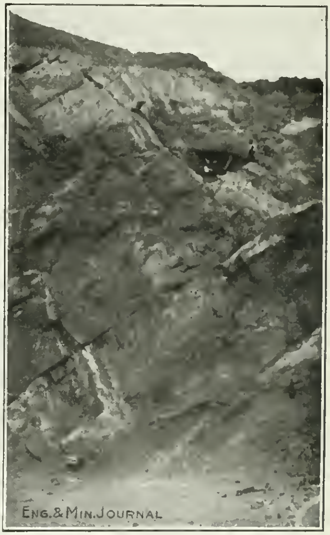
The phenomenal increase in the deliveries in 1911 is a mystery wherefor adequate explanation is still lacking.

The statistics of smelting capacity in the United States having been given completely in the Journal of Jan. 6, 1911, need not be repeated here.

Utahnite Safety Explosive

By Martin Fishback*

The formulas for the composition of "Utahnite" blasting powder are protected by a number of patents in the United States, Canada, Mexico, and other foreign countries. Although there is no particular secret about the composition and the method of mixing this explosive, it has been deemed prudent not to publish it at this time. As the "research" and experimental stage was passed a few months ago, and the "demonstrating" period has been nearly completed also, some information on the subject may be of interest to the readers of the Journal.



Preparing to Blast with Utahnite Safety Explosive

The explosion of this powder is effected by a spark, either from a common fuse or electricity, and then only when the powder is properly confined, as in a drill hole and covered and tamped with airtight material, preferably moistened dirt.

Powder Must Be Confined to Explode

The powder is put up in sticks or as loose powder, in any strength desired and to suit any condition. The sticks may be used in wet holes the same as nitroglycerin powders; in wet down holes no other tamping but the water is required. Tests have been made where sticks of Utahnite were suspended in water for 24 hours before using them for blasting, without any loss of the explosive strength being perceptible. The powder is impervious to concussion or jars, and a stick of it may be ignited and held in the hand with impunity; it must be confined to explode it. Therein lies the safety feature that the manufacturers claim for it. The powder is also unaffected by freezing temperature, and is a stable product.

---

*Mining engineer, P. O. Box 701, El Paso, Tex.

The resulting gases from its explosion, which is accompanied by little or no flame, are oxides of carbon. None of the obnoxious gases resulting from the explosion of nitroglycerin or black powder (oxides of nitrogen and sulphur) are present in the gases resulting from the explosion of Utahnite powder, and the gases as well as the solid residue after an explosion are inoffensive and noncorrosive.

Several hundred trial blasts have been made with Utahnite throughout the Southwest during the last few months, underground as well as on surface, with unqualified success. The powder can be made to work "quick" or "slow" to meet requirements, which together with the absence of flame on explosion, should insure for it a wide field among coal miners. The average result of one of the larger demonstration blasts made with Utahnite may be of interest, and will be described.

Blast at an El Paso Quarry in which 4000 Tons of Rock Were Broken by Utahnite

Demonstration at El Paso

The accompanying halftones illustrate a blast with Utahnite in the quarry of Mt. Franklin Lime & Stone Co., at El Paso, Tex., Mar. 7, 1912. The first illustration shows a vertical face in the quarry; it is about 50 ft. to the depression in the rock where the men can be seen loading the hole with Utahnite. A drill hole, 1¼ in. in diameter, was put down to a depth of 28 ft., 26 ft. back from this face.

The manager of the quarry intended to "spring" this hole with 350 lb. of dynamite so as to make room for not less than 600 lb. of black powder, which it was calculated would be sufficient to displace the solid and massive limestone in front of the hole, and for a distance of 30 ft. or more parallel to the face; in other words, that it would remove a volume of rock 26 ft. wide by 28 ft. deep by 30 to 40 ft. long, which would mean a maximum tonnage of 3000 tons.

When the hole was turned over to the Utahnite engineers there had been used in springing the hole 390 sticks of 40% dynamite, approximately 110 lb., which had produced a chamber in the bottom of the hole large enough to hold 250 lb. of Utahnite, and this amount was used to fill the cavity. An electric exploder was inserted down into the loose Utahnite powder, the hole carefully tamped with moistened dirt, and the charge set off by an electric battery.

The second halftone is a side view of the "moving of the mountain" when the charge was fired, and the third was taken a few minutes after the second.

The explosion sounded like a distant rumbling of thunder; no rocks were flying in the air, but a volume of solid rock material, 40 ft. long by 40 ft. wide by 30 ft. dep, seemed to suddenly displace itself and fall to the floor of the quarry, with an accompanying cloud of dust. The blast not only removed the 26 ft. in front of the hole, but an additional 14 ft. back of the hole, clean. The amount of rock displaced was not less than 4000 tons by actual measurement.

Cost Less Than with Black Powder

The comparative cost of this blast may be stated as follows: Black powder: Dynamite (40%) needed for springing, 350 lb. @ 14c., $49; black powder for blasting, 600 lb. @ 7c., $42; total cost, $91. Utahnite powder: Dynamite (40%) used for springing, 110 lb. @ 14c., $15.40; Utahnite (40%) for blasting, 250 lb. @ 14c., $35; total cost, $50.40. Amount saved by using Utahnite (beside time required for further springing) is therefore $40.60. In calculating the cost of powder per ton of rock displaced, the difference is still greater in favor of Utahnite. With black powder breaking 3000 tons the cost would be 3.033c. per ton; with Utahnite breaking 4000 tons, 1.26c. per ton. In other words, in this instance the powder cost per ton of rock displaced is nearly three times higher with black powder than with Utahnite.

Several plants for the manufacture of Utahnite powder will be erected throughout the country in the near future; some are already under construction on the Pacific coast, and one at El Paso, Tex., with more to follow in New Mexico and Arizona.

Tonopah Mining Co.

The report of the Tonopah Mining Co. of Nevada for the year ended Feb. 29, 1912, shows that the estimated ore reserves on Feb. 1, 1912, were 304,824 tons averaging $17.18 per ton. Dividends to the amount of $1,600,000 were paid.

The total mining cost for the year was $3.74 per ton of dry ore sent to the mill. The apparent reduction of 25c. below last year's total operating cost per ton is due principally to curtailment of development work and the cessation of pumping from the lower levels of the Mizpah shafts. These two items account for a reduction of 27.2 cents.

The mill treated 174,685 tons of ore averaging 0.286 oz. of gold and 26.05 oz. of silver. The percentage recovery is as follows: By concentration, 12.75% of gold and 19.75% of silver; by cyanidation, 77.5% gold and 70.81% silver; total, 90.25% gold and 90.56% silver. The milling cost was $2.74 per ton to which must be added $1.29 for freight and marketing. The total cost of mining and milling, together with $1.89 for metal losses in milling, was $9.63 per ton, which leaves a profit of $10.34 per ton.

By the substitution of two chilean mills for five Huntington mills the cost of grinding was reduced from 16.9c. to 11.7c. per ton of ore milled. The use of Johnson vanners for concentrating the fines was abandoned in September as cyaniding proved cheaper.

Electricity Applied to Chemistry

By Harry C. Jones*

A discussion of the electrolysis of acids, bases and salts, and of the possibilities of electrolytic separations. Commercial preparation of aluminum and of the carbides. The theoretical role of the carbides in natural-gas formation.

Ions are atoms or groups of atoms with one or more electrical charges upon them. It has been found that the different ions hold their charges with different degrees of firmness. The voltage that is just sufficient to cause a continuous loss of the charges by any kind of ion is known as the decomposition value of the ion. This is readily determined for any ion by measuring the voltage that is just sufficient to pass a continuous current through a solution containing the ions in question, that is just necessary and sufficient to effect a continuous decomposition or electrolysis of the electrolyte, which, when it dissociates, yields the ions in question.

Decomposition Values of the Ions

The method that was used by Le Blanc for determining the decomposition values of the ions, is described in *Zeitschrift für physikalische Chemie*, vol. 8, 12 and 13. It is based upon a somewhat different principle than that discussed above, but the above will suffice since the method actually used by Le Blanc is somewhat complicated.

A few of the results obtained by Le Blanc for acids, bases and salts will be given on account of their bearing upon the discussion which follows:

DECOMPOSITION VALUES OF VARIOUS SUBSTANCES

Acids	
Nitric	1.69
Sulphuric	1.67
Phosphoric	1.70
Monochloracetic	1.72
Dichloracetic	1.66
Malonic	1.69
Perchloric	1.65
Bases	
Potassium hydroxide	1.67
Sodium hydroxide	1.67
Ammonium hydroxide	1.74
¼ N methylamine	1.75
½ N diethylamine	1.68
⅛ N tetramethylammoniumhydrate	1.74
Salts	
Potassium nitrate	2.17
Potassium sulphate	2.20
Potassium chloride	1.96
Sodium nitrate	2.15
Sodium sulphate	2.21
Sodium chloride	1.98
Lithium chloride	1.86
Lithium nitrate	2.11
Calcium nitrate	2.11
Calcium chloride	1.89
Strontium nitrate	2.28
Strontium chloride	2.01
½ N barium nitrate	2.25
Barium chloride	1.99

The concentrations are expressed in terms of normal, i.e., a gram-molecular weight in a liter of solution, unless otherwise stated.

Electrolysis of Aqueous Solutions

The decomposition of aqueous solutions of acids, bases and salts has attracted attention as long as we have had at our disposal enough electricity to effect such decompositions. Indeed, Sir Humphrey Davy, at the beginning of the nineteenth century with the large voltaic pile of the Royal Institution of Great Britain, studied this problem. What we see, in general, when we electrolyze an aqueous solution of an electrolyte, is hydrogen given off at the cathode and oxygen at the anode; and the question is from whence do these substances come?

Present Views of Electrolysis

Only the view of electrolysis that is held today will be discussed, since the view that we held for nearly half a century is erroneous.

When we electrolyze an acid the hydrogen ions of the acid move to the cathode and find there other hydrogen ions from the dissociated water. The hydrogen ions from both sources give up their charges and escape as ordinary hydrogen gas. The anion of the acid moves to the anode and finds there hydroxyl anions from the dissociated water. Which kind of anions will give up their charge? Obviously the kind that hold their charge the less firmly. A study of the decomposition values of hydroxyl and other anions shows that hydroxyl loses its charge more easily than the anions of acids in general. The hydroxyl anions give up their charges to the anode, and the anions of the acid in question simply remain around the anode paired off against the hydrogen that was paired against the hydroxyl which lost its charge to the anode. When two hydroxyl ions lose their charges they react with one another, form water and oxygen which escapes.

In the case of some acids we have not only oxygen given off at the anode, but also something else. Thus, hydrochloric acid in hot, concentrated solution gives off chlorine as well as oxygen at the anode. This means that chlorine as well as hydroxyl has a low decomposition value and some of it decomposes and escapes.

The above account of what takes place in the electrolysis of strong mineral acids is in general, true, as is shown by the decomposition values given for such acids. The electrolysis of such acids consists in discharging hydrogen ions of a definite concentration around the cathode and hydroxyl ions of a definite concentration around the anode; and the decomposition values of acids are constant because the electrolysis of all such acids is essentially the same process.

The Electrolysis of Bases

Turn to bases. When we electrolyze a base, what takes place? The hydroxyl anions move over to the anode and find hydroxyl ions there from the dissociated water. The hydroxyl ions from both sources lose their charge at the anode, react with one another, form water and liberate oxygen. The cation of the base moves to the cathode and finds there hydrogen cations from the dissociated water. Which will give up its charge? Obviously, the cation that holds its charge less firmly. In this case it is the hydrogen from the water. Hydrogen gives up its charge and escapes at the cathode.

The electrolysis of a base is, then, the electrolysis of hydrogen and hydroxyl ions of given concentrations, and the decomposition values of bases should be constant, since there is the same process involved. And the electrolysis of a base is the same process as the electrolysis of an acid, since the product of the hydrogen times the hydroxyl ions in the two cases is a constant.

The low decomposition value of the hydrogen ion is a matter of fundamental importance for chemistry. If hydrogen held its charge firmly its charge could not be taken from it by metals, and acids would not have the properties that they are now known to have.

The electrolysis of a salt like potassium nitrate would take place as follows. The potassium ions move over to the cathode, find there hydrogen ions from the dissociated water, and the latter give up their charge; the potassium remaining around the cathode paired off against the hydroxyl of the dissociated water. The anions, $\overline{NO_3}$ move over to the anode and find there hydrogen ions from the dissociated water. The latter give up their charge and the $\overline{NO_3}$ pairs off against the hydrogen from the water. We have here also the decomposition of hydrogen and hydroxyl ions, but of smaller concentration than in the case of acids and bases. The decomposition values of salts are, consequently higher than those of acids and bases.

It is not necessary and space will not permit of a discussion of the older theory of electrolysis, which we now know to be in error. It is not even necessary to point out the differences between the older and the newer theory.

---

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

DECOMPOSITION OF WATER A PRIMARY ACT

It will be seen that the evidence for the theory of electrolysis of aqueous solutions now in vogue as furnished by Le Blanc from the decomposition values of acids, bases and salts is so convincing as to leave little to be desired. The theory may be summarized thus; in the electrolysis of acids, bases and salts in water, the decomposition of the water is a *primary act of the current,* and not due to the secondary action of the products of decomposition on the water.

This is, therefore, known as the theory of the primary decomposition of water, to distinguish it from the older theory of the secondary decomposition of water in electrolysis.

The electrolysis of fused salts is quite a different matter from the electrolysis of aqueous solutions of acids, bases and salts.

Most fused salts conduct the current, and undergo simultaneous decomposition. The fused salt is largely dissociated into ions. These move; the cation to the cathode and the anion to the anode. They there give up their charges and the anion and cation are set free. They may remain in the free condition, or there may be secondary reactions depending on the nature of the ions in question.

The electrolysis of fused salts is, as we shall see, fundamental in electrometallurgical operations.

ELECTROSYNTHESIS OF ORGANIC COMPOUNDS

When an electric current is passed through an aqueous solution of an acid like nitric, the cation hydrogen goes to the cathode, loses its charge and escapes, as we have seen. The anion NO_3^- goes to the anode. It remains around the anode paired off against the hydrogen ion from the dissociated water. The point is that the $\overline{NO}_3$ anion is stable, and does not break down into anything else.

This, however, is not the case with organic acids. When sodium acetate is electrolyzed, the anion of acetic acid—$\overline{CH\ COO}$ at the anode undergoes the following decomposition

$$2\,CH_3\overline{COO} = C_2H_6 + 2\,CO_2$$

ethane being formed. The anions of the aliphatic series of organic acids, in general, behave in this, or in some analogous manner. The result is that a number of organic compounds can be prepared by the electrolysis of salts of these acids. The general principle involved in the electrolytic preparation of organic compounds, is that the complex organic ions when they lose their charge, react chemically, either breaking down into simpler aggregates or react with one another forming various compounds. The important point is, then, the instability of the discharged organic complexes. In all such work the potential at the electrode is an important factor and must, of course, be taken into account. The reductions and oxidations that take place at the electrodes must also be taken into account. The nature of the material out of which the electrodes are made is also a factor. Just a few results will give some idea of the scope of this work.

Even the stable hydrocarbons lend themselves to same extent to this treatment. When ethylene in alkaline solution is electrolyzed at a certain voltage the following reaction takes place, the potassium salt of formic acid being, of course, formed.

$$C_2H_2 + 6\,OH = 2\,H_2O + 2\,HCOOH;$$

The following reaction takes place with methyl alcohol—

$$CH_3OH + CO = CH_3COOH$$

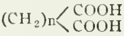
acetic acid being produced. A large number of other products can be obtained from methyl and ethyl alcohols, but space will not permit a discussion of these.

The general electrolytic reaction with organic acids has already been referred to—

$$2RCOO = 2\,CO_2 + R_2$$

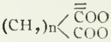
Take the formic acid series. From formic acid we can obtain by electrolysis carbon dioxide and water; from acetic acid, ethane and carbon dioxide; from propionic and ethylene, carbon dioxide and water; from butyric acid, propylene, isopropyl alcohol and a number of other more complex products. The higher organic acids of this series yield such a number of products that they will be referred to a little later.

The dibasic acids of the oxalic series can be represented thus:



$$(CH_2)_n\begin{cases} COOH \\ COOH \end{cases}$$

This gives the anion



$$(CH_2)_n\begin{cases} \overline{\overline{C}}OO \\ COO \end{cases}$$

which breaks down yielding unsaturated hydrocarbons. In a similar manner, a large number of carbon compounds are formed by electrolyzing members of other series of acids, but what is said above suffices to illustrate the principles involved.

ELECTROYLYSIS OF AROMATIC COMPOUNDS

The electrosynthesis of organic compounds is not limited to the aliphatic or marsh gas series of compounds. A large number of aromatic or benzene compounds have been prepared by the electrical method. We have the reduction of nitro-benzene to analine, with a number of intermediate stages. Among the intermediate products formed are azoxybenzene, azobenzene, hydrazobenzene, and benzidine. A large number of other nitrocompounds of the benzene derivatives have also been reduced electrolytically, but it would lead too far to discuss these in any detail. A considerable amount of work has also been done upon benzoic acid, its homologues and derivates.

The silent electrical discharge has been studied in connection with its action in the electrolysis of chemical compounds, and many substances have been prepared in this way.

No further space, can, however, be devoted to this phase of electrochemistry. For details, reference must be had to "Electrochemistry of Organic Compounds" by Walter Lob, translated into English by Lorenz, published by John Wiley and Sons, New York.

ELECTROLYTIC SEPARATIONS OF THE METALS

The different decomposition values of the different ions has been utilized to effect separations of one metal from another. Indeed, since this subject has been scientifically studied an entirely new branch of quantitative analysis has grown up, as far as the metals are concerned.

Given a mixture of salts of two metals whose ions have different decomposition values, i.e., lose their charge at different potentials. A current is passed through the mixed salts, having at first such a voltage that the ions with the lower discharging values lose their charges and are thrown down. After all of this metal is precipitated upon the cathode, the cathode is removed and the amount of this metal thrown down determined.

The metallic ions with higher decomposition value are then precipitated, by raising the voltage above that at which they lose their charge. The number of separations of the metals that can be effected electrically is very large; so large, indeed, that most of the metals can be separated from one another in this way.

The best way to gain any adequate conception of the number of such separations that can be effected, is to consult some work dealing in a comprehensive manner with this subject. See especially Classen's "Quantitative Chemical Analysis by Electrolysis." A few examples will make clear what is meant. Thus: iron can be separated from cobalt; from nickel; from zinc; from manganese; from aluminum; from chromium; from uranium; from copper; from lead; from bismuth; from cadmium; and from silver. Similarly cobalt can be separated from nickel; from zinc; from aluminum; from copper; from bismuth; from lead; from silver; and from mercury.

Nickel can be separated from zinc; from manganese; from copper; from lead; and from mercury.

Zinc can be separated from manganese; from aluminum; from copper; from bismuth; from cadmium; from lead; from silver; and from mercury.

Copper can be separated from cadmium; from lead; from silver; from mercury.

These are sufficient examples to show how widely electrolytic separations have been effected. And there are abundant examples of more complicated separations than those referred to above, where three or more metals have been separated quantitatively from one another by suitably varying the voltage, strength of current, nature of the salt, the temperature, etc.

Electrolytic Separations of Metals from their Ores

This is probably the branch of electrochemistry, which, all things considered, is the most important from the standpoint of the industries. Metals which were formerly regarded as "rare," and which were very expensive, are now made in large quantities and can be purchased at greatly reduced prices, due to the cost of production having been so greatly decreased. Take, for examples, metallic sodium, calcium and aluminum. A quarter of a century ago these were comparativey rare and very expensive, while to-day they can be obtained in large quantities and at a reasonable price.

The cause of all this change is to be found in the application of the electric current and electrolysis to the preparation of these substances from their compounds. A few examples will make clear the nature of the processes involved.

Take metallic sodium. It is readily prepared by the electrolysis of either the chloride or the hydroxide. When the chloride is electrolyzed vessels of porcelain or of iron lined with graphite are employed. The escaping chlorine gas comes in contact with porcelain or carbon, depending on the method employed. The chloride is fused by the application of external heat to start the process, and is then kept in a molten condition by the passage of the electric current through it.

Fused sodium hydroxide is used as the electrolyte in the Castner process. This is kept in the molten condition by an external supply of heat and also by the heat generated by the passage of the current. A disadvantage in using the hydroxide as the compound to be electrolyzed, is, that it is a much more expensive substance than sodium chloride. The cost of producing metallic sodium electrolytically, as given by Borchers is 2.30 marks per kilogram.

The same general methods are used with the other alkali metals as with sodium. Certain details are, of course, different for the different elements, depending on the properties of the particular elements in question. But the principles remain the same.

The elements calcium, strontium and barium were, until recently, prepared only in small quantities, and at correspondingly high prices. These elements are now prepared in much larger quantities and at greatly reduced cost by the electrolysis of their compounds, especially their halogen compounds. Metallic calcium is now obtainable at such a price that it is frequently used instead of metallic sodium in the removal of the last traces of water from alcohol.

Preparation of the Carbides

The application of the electrolytic method in the case of calcium is also interesting in connection with the preparation of the compound of calcium and carbon known as calcium carbide. When lime or calcium oxide is mixed with an excess of carbon in the form of charcoal and heated electrically to a very high temperature, the carbon and the calcium combine, forming calcium carbide which has the composition CaC_2. This compound is interesting and important on account of its composition. When we consider the inertness of carbon at ordinary temperatures, we may be surprised to learn that it has the power of combining with so many of the metals at elevated temperatures, forming compounds that are stable under so many conditions.

These compounds of the metals with carbon are, however, unstable with respect to water and break down as follows:

$$CaC_2 + 2H_2O = Ca(OH)_2 + C_2H_2$$

The acetylene thus formed is used as an illuminant, and the acetylene light owes its existence in most places to calcium carbide and the decomposition of this substance by water vapor. Since a comparatively inexpensive method of making calcium carbide has been worked out, the acetylene light has come into general use for certain purposes. According to Borchers, 1000 kg. of calcium carbide costs only 71 marks, or 1000 kg. of acetylene prepared from the carbide of calcium costs 178 marks.

Other metals combine directly with carbon at elevated temperatures, and form carbides having a very different composition from the carbide of calcium. Thus, aluminum forms the carbide Al_4C_3 which decomposes in the presence of water as follows:

$$Al_4C_3 + 12\,H_2O = 4\,Al(OH)_3 + 3\,CH_4$$

The carbide of aluminum is thus a different type of compound from the carbide of calcium, and yields an entirely different type of hydrocarbon. Aluminum carbide probably exists in large quantities well down beneath the surface of the earth. When the heated waters came in contact with it, it decomposes more or less in the sense of the above equation, and liberates large volumes of methane. Methane is an important constituent of natural gas, and according to the distinguished French chemist, now dead—Moissan—aluminum carbide must be taken into account in dealing with the question of the origin and formation of natural gas.

Preparation of Aluminum

We now come to the preparation of metallic aluminum. Twenty-five years ago it was often said that a clay bank would be a gold mine if we only had an economical method of obtaining the aluminum from it. This, like so many similar statements, has since been shown to have been a gross exaggeration.

Metallic aluminum was first prepared by Wöhler, by fusing together aluminum chloride with metallic potassium in a closed crucible. From this time to the present various methods for obtaining aluminum have been devised and used, but with poor success, until the electrolytic method was worked out. This consists of the following: Cryolite, a double fluoride of sodium and aluminum, having the composition $3NaF.AlF_3$, has a comparatively low melting point. This substance in the fused condition dissolves the oxide of aluminum. Some fluorspar is added to this solution; the whole being contained in an iron vessel lined with carbon. The mass is kept in the molten condition by the current, the temperature being about 980° Centigrade.

The anode is carbon, while the metal vessel serves as the cathode. The oxide of aluminum undergoes electrolysis, the oxygen combining with the carbon, and the aluminum remaining in the vessel. The cryolite remains unchanged, so that by renewing the supply of the oxide to the bath the process becomes a continuous one. The total production of aluminum has increased from about three tons in 1888 to about 20,000 tons per year, according to the best statistics available.

Electrolytic Refining

The electrolytic method is not only used in the separation of the metals from their compounds, but also in the purification of the metals. This is well illustrated in the case of copper. The impure copper is cast into plates which serve as the anodes. These are, indeed, known as "anode" copper. Thin sheets of pure copper are employed as cathodes, and the electrolyte is a mixture of sulphuric acid and copper sulphate. The pure copper is deposited on the cathodes, the impurities settling on the bottom of the containing vessels as a mud or slime.

The electrolytic method has also been used in separating a number of other metals from their compounds. These include silver, gold, zinc, cadmium, lead, chromium, etc. For details in connection with these methods reference must be had to some more comprehensive work.

Copper Production in 1911

We present herewith our revised statistics of copper production in 1911, together with the statistics of the American refiners in detail as compiled by the Copper Producers' Association. Our own system of reporting the smelters' production has been the same as in previous years, and no specific explanation is necessary now.

Our estimate of the world's production differs somewhat from reports by other authorities, largely because of the higher figures that we credit to Chile and Peru.

PRODUCTION OF COPPER IN THE UNITED STATES

(In Pounds)

State	1910	1911
Alaska	5,008,171	19,412,000
Arizona	299,606,971	300,578,816
California	45,793,894	36,806,762
Colorado	10,127,012	8,474,848
Idaho	6,216,461	3,745,210
Michigan	221,400,864	216,412,867
Montana	286,242,403	271,963,769
Nevada	63,877,500	65,385,728
New Mexico	3,632,351	1,518,288
Utah	125,042,381	138,336,905
East and South	18,195,450	19,656,971
Other states	1,106,525	1,564,207
Totals	1,086,249,983	1,083,856,371

PRODUCTION OF COPPER IN NORTH AMERICA

(In Pouuds)

Country	1910	1911
United States	1,086,249,983	1,083,856,371
Canada	52,492,282	56,370,754
Mexico	137,797,217	136,430,331
Cuba	7,799,764	8,274,563
Totals	1,284,339,246	1,284,932,019

REFINERS' PRODUCTION

(In Pounds)

Class	1910	1911
Electrolytic	1,151,624,597	1,156,627,311
Lake	221,400,864	216,412,867
Casting	32,193,196	22,977,534
Pig	46,903,463	35,920,626
Totals	1 452,122,120	1,431,938,338

SMELTERS' PRODUCTION

(In Pounds)

Source	1910	1911
North American ore	1,284,339,246	1,284,932,019
Foreign ore	41,976,733	34,392,091
Scrap	10,962,099	18,529,547
Totals	1,337,278,078	1,337,853,657
To foreign refiners	33,855,800	32,413,440
To American refiners	1,303,422,278	1,305,440,217
Blister copper imported	146,185,104	146,422,85
Total crude copper	1,449,607,382	1,451,863,068

CRUDE AND REFINED PRODUCTION COMPARED (*a*)

(In Pounds)

	1910	1911
Smelters	1,449,607,382	1,451,863,068
Refiners	1,452,122,120	1,431,938,338

(*a*) Owing to some uncertainty as to the counting of copper regained from scrap, it is unsafe to draw fine deductions from the comparison of figures in this table.

In our compilation of the world's production we base the figures upon crude copper, i.e., the smelters' production, and allocate it according to the country of origin. Thus, Chilean ore is smelted in the United States and Great Britain, but we credit the copper therefrom to Chile; similarly as to other countries. This method is, we think, both the safest and the most useful, but it is likely to give results that are a little too low.

The lessons of the statistics of 1911 have already been learned, wherefore there is no great use in reviewing them again. We may remark, however, that while the production of American smelters in 1911 exceeded that of the refiners, the difference is no doubt partially accounted for by copper marketed as sulphate and by scrap copper resmelted which the refiners do not count. A careful consideration of the statistics inclines us to the belief that there was no material surplus of crude copper at the end of 1911, whatever may have happened since then.

WORLD'S PRODUCTION OF COPPER

(In Metric Tons)*

Country	1910	1911
United States	492,712	491,634
Mexico	62,504	61,884
Canada	23,810	25,570
Cuba	3,538	3,753
Australasia	(*b*) 40,962	(*b*) 42,510
Peru	(*c*) 27,375	28,500
Chile	38,346	33,088
Japan	(*c*) 50,703	(*d*) 52,303
Russia	(*b*) 22,700	(*b*) 25,980
Germany	(*b*) 25,100	(*b*) 22,363
Africa	(*b*) 15,400	(*b*) 17,252
Spain and Portugal	(*b*) 51,100	(*b*) 52,878
Other countries	(*b*) 28,100	(*b*) 29,373
Totals	882,350	887,088

(*a*) The statistics in this table are our own compilations, except where specially noted to the contrary. (*b*) As reported by Henry R. Merton & Co. (*c*) As officially reported. (*d*) Privately communicated to us from Japan.

Fuller's Earth in 1911

According to a bulletin of the U. S. Geological Survey, the largest production and highest price in the United States of fuller's earth was in 1911. The principal use of this material is for filtering oils, fats, and greases. Although found in 15 states, only 13 firms in seven states were active producers. These states were: Arkansas; California; Florida; Georgia; Massachusetts; South Carolina, and Texas. The production was 40,967 tons, valued at $383,131. The imports were also the largest on record, 18,224 tons. The greatest domestic production was that of Florida, 27,658 tons.

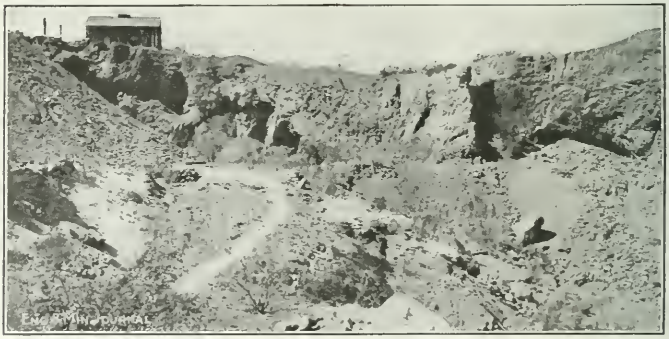
The Vulture Mine, Arizona

By W. E. Defty*

The Vulture mine forms an important portion of the mining history of Arizona. It is situated in Maricopa County, about 16 miles west of Wickenburg. The old mine has produced, according to recorded returns, over $16,000,000 in gold, and it is acknowledged that many millions more were produced that were not accounted for.

Discovered in 1863

The mine was discovered by Henry Wickenburg in 1863, and the first mill was erected in 1864 on the Hassayampa River at Wickenburg. This mill was hauled from Ehrenburg on the Colorado River, a distance of 168 miles. During the running of this mill, water had to be hauled to the mine for all purposes. In 1882 an 80-stamp mill was erected at the mine and water piped to it from the Hassayampa; the pipe line was 14 miles in length. With only spasmodic working of a portion of the mine and mill, the mine has practically been idle since 1890. However, there is now every indication that a new era has dawned for the Vulture.



Caved Ground over Old Workings at Vulture Mine, Arizona.

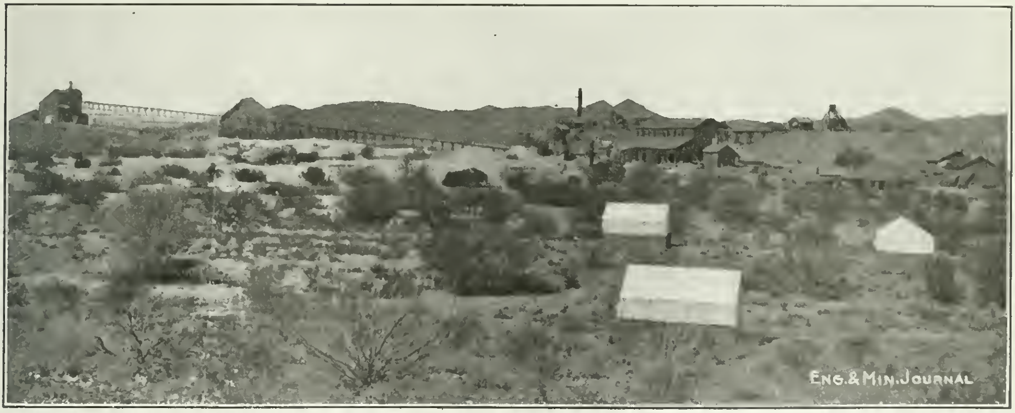
The present owners of the mine began work in 1908. They commenced by sinking two wells about 100 ft. apart, one 615 ft. deep and the other 495 ft. deep. These wells now supply all the necessary water for present operations. The equipment of the present mill includes twenty 1600-lb. stamps, crushing in cyanide solution, and amalgamating inside the mortars, a Dorr classifier, three Australian grinding pans, three Dorr pulp thickeners, 32x12 ft., and one Oliver filter now being installed. Three Wilfley tables are to concentrate the recently discovered ores. On all the works there are at present over 100 men employed.

---

*Mining engineer, Phoenix, Ariz.

Complex Fault System

During 1911, 3091 ft. of exploratory work was performed, and 605 ft. this year. The preponderance of this was in barren ground in search for the orebodies. The work consisted of drifting, winzes, and raises, from the 600-ft. and 770-ft. incline shafts, on the 350-, 450-, 525-, 600-, 750-, and 850-ft. levels. The main fault system which severed the vein, greatly upset the original plans of development. For solving an exceedingly intricate and complex fault system and the discovery of the new orebodies, Angus R. Mackay, manager, and W. Spencer Hutchinson, consulting engineer, deserve credit. The main faulting made a clean cut of the formations, displacing the vein downwards for 300 ft. almost on a vertical line. This necessitated a vertical winze on the 750-ft. level which was sunk 200 ft. northeast of the shaft and cut the vein at 100 feet.



The Vulture Mine at Wickenburg, Ariz. The New Mill is at the Extreme Left

On the 750-ft. level, 480 ft. east of incline shaft, ore was encountered, and for 100 ft. the drift has been in ore. A raise to the 600-ft. level is in ore 40 ft. above the 750-ft. level. This is the upper edge of the orebody, discovered on the 850-ft. level, and the features are encouraging for its being extensive. Samples from the workings returned $38 per ton in gold.

On the 850-ft. level, the ore was encountered in the drift 135 ft. east of the winze, a crosscut now constituting the face of the workings exposes the orebody 50 ft. in width. For 25 ft. next the hanging wall, average daily face samples, comprising 53 samples, gave a return of $11.20 per ton, and for 25 ft. next the foot wall, $34.86 per ton.

A drift on the foot wall is now being driven longitudinally on the oreshoot, a raise has been carried through 97 ft. to the 750-ft. level and the ore is proven to be solid between the two levels, so this places a large tonnage of ore actually in sight, in the new workings.

The character of the ore is white quartz, with pyrite, galena and chalcopyrite, frequently banded and occasionally heavily streaked or bunched with the sulphides. The dip at the widest point of the vein is 40° to 45° north, with a general strike slightly north of east. The vein has all the features and characteristics of strength and continuity. Although rather early for any definite commitment, it is reasonably conclusive that the present orebody is the sulphide base and a continuation of the main rich and oxidized oreshoot that made the mine famous. A soft plastic gouge accompanies the vein on both walls. It ranges from 6 in. to 1 ft. in width, occasionally wider, but it is generally thicker on the foot wall than on the hanging wall.

All the present orebodies are beyond the main faulting, northeast of the main shaft, and the ore is formed apparently along the line of this movement in close proximity in the areas, minor faulted or disturbed by and attendant upon the main movement which is northeast-southwest.

The country rock penetrated to reach the new orebodies is identical with that inclosing the old mine, viz., dioritic schist. Although there are igneous intrusions in close vicinity, none has apparently had any influence in the ore deposition, and none of these has made its appearance in the present workings. All the features attendant upon the new orebodies decidedly favor a bright future for the new Vulture mine.

Microscopic studies and electromotive force measurements indicate (*Bull. Soc. Chem.* 7, 621-2) that nickel and silver are completely nonmiscible.

Temiskaming Mining Co.

The report of the Temiskaming Mining Co., Ltd., Cobalt, Ont., for the year ended Dec. 31, 1911, shows that the net profit was $271,423, of which $224,999 was disbursed as dividends.

The main three-compartment shaft was continued 112 ft., which makes the depth from the collar 628 ft., the deepest working in the Cobalt district. The total development work was 3586 ft., and the stoping done, 187,250 cu.ft. The encountering of the diabase formation at depth led to a falling off in grade. Future production, therefore, will probably be from the ore-bearing area above this sill.

The amount raised was 24,783 tons of ore and 16,154 tons of waste. The total production was 1,213,754 oz., of which 667,011 oz. were obtained by hand sorting and 546,743 oz. were recovered at the mill. This is somewhat lower than the production of last year. The total cost of mining and milling was 29.8c. per oz. produced, or $10.42 per ton of ore. The company purchased a controlling interest in the North Dome Mining Co., Ltd., Porcupine.

North Butte Mining Company

The North Butte Mining Co. now owns 16 full claims and parts of eight others in Silver Bow County, Montana. During 1911, there were 420,203 wet tons of ore shipped, and 410,694 tons smelted, producing 24,816,669 lb. of copper, 1,134,300 oz. of silver, and 1281 oz. of gold. Ore reserves are given in the annual report as 710,920 tons, averaging 4.5% Cu and 4.25 oz. Ag per ton. The deepest shaft is the Speculator, 2896 ft. Profits were $641,858, and dividends were $492,000 (8%), for the year.

Lubrication of Roller Bearing Mine Cars

By George B. Woodruff*

Since roller bearings have become extensively used for mine-car axles the question of proper lubrication has received much attention. In the older types of bearings almost any kind of grease or low-grade oil was used as a lubricant, much of which was wasted because it never reached the surfaces which it was intended to lubricate.

With the advent of roller bearings, more care was exercised in the design and construction of the car wheel and its housing, special effort being made to secure proper lubrication. It was then ascertained that instead of daily oiling being necessary that the time between oilings could be increased to from three months to a year. But it was found that a better grade of lubricant was required than had formerly been used, and that more care was necessary in applying it. The greater expense of the higher-grade lubricant and time required to apply it was more than offset by the economy effected by the infrequency of the oilings and the saving of power made possible by the bearings being properly lubricated, especially on long hauls.

There are two classes of lubricants, the fluid and non-fluid. The latter class includes all kinds of grease. It has been found by experiment that a heavy grease or non-fluid oil becomes heavier and very sticky after having been subjected to the action of roller bearings for a long time, and that the admixture of dust and dirt that will eventually gain admittance even to the best constructed housing forms with the grease, a pasty mass than impedes the rollers, whereupon the rollers become blocked and slip. As soon as rollers begin to slip the axle, rollers, and housing wear rapidly. Furthermore the time required to apply the grease is greater than for liquid oil which can be applied with a squirt gun.

However, on fluid oil the action of the rollers has no appreciable effect and a large quantity may be stored in the oil recess of the wheel from which it will run out readily whereas grease would not. Fluid oil will take up more dust and dirt than grease before becoming a pasty mass. The double-spiral roller separates the dirt from the oil, forces the dirt through the spirals and collects it inside leaving the path of the roller clean and well oiled. A roller cannot do this if grease be used as a lubricant.

The oil used for lubricating roller bearings is not affected by low temperature and does not become practically a solid in very cold weather as is the case with most greases. The Standard Oil Co., makes from Pennsylvania petroleum a special brand of oil for roller bearings; it is an excellent lubricant for mine cars as well as for some other forms of mining machinery.

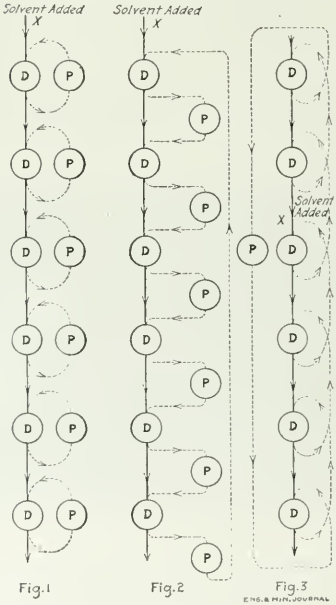
---

*General Sales Manager, Hyatt Roller Bearing Co., Newark, N. J.

Continuous Decantation Processes

In the recent specifications for a continuous leaching and decantation process, Rudolf Gahl (U. S. pat. No. 1,021,769) gives the three systems of leaching and decantation shown in the accompanying illustration. In each case each tank gives a thickened pulp and a solution.

In all the figures, *D* represents decantation tanks, and *P* precipitation tanks. In the first case, the pulp passes from tank to tank, while the solution forms a closed circuit around the decantation tank and its corresponding precipitation tank. Each leach of the pulp, i.e., each succeeding decantation-precipitation cycle, is made with a weaker solution. In the second case, the solution is precipitated after each leach, and goes back, in weakened condition, on the same ore. In the third case, the scheme is that of plain counter-current washing, and only the strong leach from the head tank is precipitated.



Decantation Systems

It will, however, be seen that the first two methods work out substantially as counter-current leaching, in spite of their apparent variation from this system. In practice, one would, of course, change the solutions from tank to tank, rather than the ore, while one may also question the efficiency of precipitation in very dilute solution, which is necessary in the first two cases.

Technical Writing at Michigan College of Mines

Negaunee Correspondence

At the beginning of the college year, 1911-1912, F. W. McNair, president of the Michigan College of Mines, engaged a young university man to instruct in "technical journalism." The plan was to treat the matter as an experiment for a year, no great stress being laid upon the work, and but two or three hours per month being spent in the classroom by a single student. The results have been satisfactory, and the college schedule for next year will include two regular courses, technical journalism and business correspondence, for which credit will be allowed toward a degree.

Object of the Courses

The rather pretentious title of technical journalism is meant to imply the writing of technical reports and articles which engineers are called upon to compile for mine operators and exploration companies, or to be given before other technical men. The course in business correspondence is planned to be a training in business forms and procedure relative to correspondence, and is aimed to correct the astonishing ignorance of mining-school graduates in these matters, many of whom do not know such a simple custom as the correct manner of folding a letter. The wise policy of the college in establishing such a course of instruction is quite obvious. The inability of many able technical men to convey their ideas on paper in a clear, concise and correct manner, has long been evident.

The idea of engaging a university graduate, one trained for teaching English rather than an engineer, is in line with the policy of the institution to present fundamentals, leading the student to reason their application to concrete problems, rather than to give rules of procedure for all cases, to be memorized and forgotten. Further, the instructor will absorb the engineering viewpoint quickly and will pick up readily technical terms with a knowledge of their proper applications. The present year's work of the instructor has consisted of an examination of reports on mines, mills and smelteries, which had been submitted to the respective departments of the college, following class trips to the places in question; also instruction to classes which were purposely divided into small sections, so that contact with the instructor became a personal one and individual criticism could be made of each student's work.

Breaking Ground Without Powder

By G. E. Wolcott*

A proposed method of breaking ground by driving wedges into the rock by powerful machines of the air-hammer type, no powder being used.

The idea of developing a powderless method of breaking ground in a mine first occurred to me when driving a raise from one of the lower levels of an Arizona gold mine, in which conditions differed from those in all metal mines only in degree. The dust was a little thicker, the temperature higher and the nauseating effects of the powder smoke more pronounced than is usually the case. Before I had finished the raise, I had plans formulated for breaking the rock without powder, and had started investigating its possibilities.

Channeling Machines Tried for Underground Work

A channeling method suggested by the use made of the channeling machine in quarry work was first considered and an article on the subject was submitted to several mining journals. The method was not proposed as one capable of immediate adoption, but as a basis for further investigation. It was hoped that through a discussion of the subject in the mining press a solution of the problem might be arrived at.

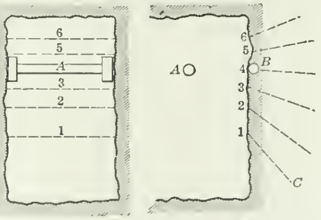
The discussion was not favorably received and only one journal published the article in anything like its original form. Such discussion as the article elicited was unfavorable as to the possibility of such a method competing with dynamite on the score of economy, which it would have to be able to do if it could hope for adoption.

I will not here describe in detail that proposed method as it has not been adopted in practice, but as the method finally successfully tried is a direct result of investigations into the possibilities of a channeling method I will summarize the method first proposed, which was briefly outlined in the Journal of March 18, 1911. In tunneling it was proposed to cut first a horizontal channel at the bottom of the tunnel to extend a short distance into the sides and a few inches deeper than it was expected to break to. Following this another channel was to be cut parallel to the first and at a distance above depending on the power of the channeling machine and the breaking qualities of the rock. Steel wedges were then to be driven into the upper channel by the same machine that made the channels; thus the block of ground between the two channels was to be broken.

I attempted to design, and in fact completed the design of a machine with which it was expected to perform this operation. The machine was never made for the reason that in experimenting along these lines a much better method and one more likely to succeed was suggested.

Channels Not Necessary if a Powerful Wedge Be Used

During my first work on the channeling method, experiments were undertaken to determine the possibility of using an air-hammer machine for cutting the channel, and to ascertain how far apart the channels could be cut and the ground between be broken out with a machine of a given weight and velocity of hammer. The experiments were not carried to a successful conclusion for the reason that during their progress a discovery was made which changed entirely the plan of attack. In channeling, two channels were made at such a distance apart that the machine used would not break out the rock between them. By applying a wedge between the channels, however, it was found that it could be driven into the solid rock and effectually break out the ground between the point of application and the nearest channel.



The Engineering & Mining Journal

Order of Making Cuts in Drifting

Considerable time elapsed before I realized the importance of this discovery. My first conclusion was that I could increase the distance between the channels. Next I decided that in tunneling I could dispense with all but a bottom channel, and finally I persuaded myself that no channeling whatever was necessary. In any underground working, there is always one free face to break to, which proves to be all that is necessary. Having arrived at this conclusion, the channeling machine already spoken of, upon which I had spent several months in designing, was discarded and a new machine embodying the results of the above experiments was started upon. The problem was now reduced to such simple proportions that the new design seemed to offer but few difficulties. The essential features necessary for successful work seemed to be a sufficiently large wedge properly shaped, means for holding this wedge firmly against the rock by air pressure and a hammer of sufficient size and weight to drive the wedge into the rock.

Air-feed stoping bars for holding air-hammer machines to their work in drilling were already in common use; the air-hammer machine was highly developed; drill steel had been brought to a high state of resistance through the requirements of air-hammer machines. It was, therefore, only necessary to combine these details in such a manner as to adapt them to the required work.

For experimental work a machine was designed which consisted essentially of a large air-hammer machine designed on the general lines of a piston machine with the air feed taking the place of the screw feed under the machine and so arranged as to either feed forward or draw back the machine by the turning of a valve.

The hammer cylinder was 3½ in. diameter; the hammer weighed 30 lb. and worked at about six inches stroke. The steel used was 2x2-in. Halcomb, No. 2 special, drawn to a wedge-shaped point at the end striking the rock, and hardened as in rock-drill practice.

The Proposed Method

In tunneling the proposed method of operation was as illustrated in the accompanying sketch. The machine being set up at *A*, a cut was to be started by driving the wedge in at *A* and following this as shown by the lines 2-3-4, etc., until the upper dimension of the tunnel was reached. The portion *C* of the face not removed from the first setup was to be left until the succeeding set-up at *B*. In this manner the machine could be kept near the top of the tunnel, permitting the broken rock to be removed beneath simultaneously with the breaking.

In operation the machine at once developed several defects and various difficulties were encountered which made it impossible to produce economic results. In driving the wedge into the rock it was found that there was always a tendency to deviate from a straight line and in order to prevent binding of the machine in the guides it was necessary to allow the clamps to remain loose. This caused a serious difficulty in the handling of the machine on account of the entire weight being on one side of the supporting column. The difficulty was especially pronounced with the machine pointed downward in taking up bottom. Outside of this trouble the air feed was found to be too weak to hold the machine to its work and the force of the blow was not sufficient to produce satisfactory results in tough ground.

---

*Mining engineer, Victor, Colo.

In spite of these defects, however, the results of the first work seemed to show that a machine of this type could be depended upon to break almost any ground. The broken rock was about as coarse as would be made in blasting, but containing less fine material. In operation the rock immediately in front of the bit was pulverized until the bit entered sufficiently to produce rupture by the wedging action and it was found to be essential that the wedge enter the rock from such a direction as to have a face to break to on one side of the bit.

The Field for Powderless Rock Breaking

The particular field where a machine of the type indicated can hope for success is in the driving of small tunnels in mine development work. The difficulty in breaking is here greater than would be the case in stoping, but there is less competition to meet and it is here that the noxious effects of powder fumes are most pronounced. In tunnel driving with powder, practical conditions usually limit the shooting to once per shift and the depth that can be broken in one round in a small tunnel is usually not greater than from three to four feet. With a machine of the type indicated the quantity of ground broken would be limited only by the capacity of the machine doing the breaking and the ability of the shoveler to take the broken rock from the breast. Moreover, as no time need be lost in blowing out powder smoke, work could continue 24 hours in the day without any loss of time.

The results achieved are far from conclusive as to the economy of such a process and it is hoped to present later more conclusive data from further experiments. If this presentation of the subject will stimulate investigation along the lines indicated it will accomplish the purpose for which it was written.

The cost of the Gary steel works up to Dec. 31, 1911, was $55,288,000. Construction was begun in 1906 and operation about Jan. 1, 1909. During 1911 the works were operated at about 50% of normal capacity, but earned $3,603,139 net.

Reconstructed Gold Dredges in California

By L. H. Eddy

The reconstruction of dismantled bucket-elevator dredges and the application of the dredge method of excavation and gold saving to dry-land operations are important and interesting features in the problem of economic gravel mining in restricted areas of medium- or low-grade gravels in isolated fields in California. Dredge mining for gold in the state has, in the last five years, been conducted on so extensive and profitable a scale, and at such a large initial cost for construction and installation, that the possibilities of economic and profitable operation of smaller fields have been generally overlooked until within the last year. The cost of construction, ranging from an average of $50,000 to $250,000 for new boats, has been prohibitive in the restricted fields. In many of these fields the operator is obliged to purchase a greater acreage of barren land than the gold-bearing portion included in the area or field prospected. In some instances only the mineral rights are purchased and the land reverts to the original owner, and in a majority of such cases the restoration of the land to its former or improved condition is not considered by the owner of sufficient importance to lessen the price demanded.

The dismantling of a dredge sometimes results from the low recoveries from the gravel; in other cases the cause is bad management; and in others the dredge is put out of commission and dismantled for the sufficient reason that the area has been entirely worked out before the boat is worn out. The essential adaptation of design to the particular character of the gravel is occasionally disregarded and results in failure and the necessary closing down of the dredge. Whatever the cause, the machinery of the dismantled dredge is no longer looked upon as fit only for the scrap heap, but quickly attracts the attention of the small investor or causes the operator to look about for another field of operation, where a reduction in the initial cost of construction may solve the problem of necessary economy.

Some Reconstructed Dredges

The reconstructed dredge, built of machinery shipped from Oroville and installed on a new hull by the Butte Dredging Co., was placed in commision at Jenny Lind on Calaveras River, in Calaveras County, Dec. 20. The boat is equipped with a new bucket line of 4-cu.ft. buckets, and some alterations and improvements have been made in the revolving screen, both spray pipe and nozzles being employed for the washing of the gravel. The former digging depth was 36 ft., and this has been reduced to 26 ft., the actual requirement being about 22 ft. Other modifications and improvements were made in accordance with the requirements of the character of the ground. The machinery is electrically driven with General Electric motors, using a total of 165 hp. This dredge, as originally installed and equipped, was operated for about eight years and outlived its field. The company holdings total 300 acres, but only about 50 acres are dredgeable. William S. Noyes, of San Francisco, is president of the company, and N. L. Parks, of Jenny Lind, is superintendent.

The Alta Bert Gold Dredging Co. expects soon to put a reconstructed dredge in commission at Trinity Center, Trinity County. This is a 7½-cu.ft. dredge, formerly operated on Scott River, near Callahan, Siskiyou County, and has been reconstructed by the Union Construction Co., San Francisco. The Union Iron Works, of San Francisco, is redesigning a 6-cu.ft. boat, built by this company in 1905 for the Eldorado Gold Dredging Co. at Fair Oaks bridge in Sacramento County. The reconstructed dredge will be installed and operated by the Gaylord Mining Co., at Rattlesnake bar on the American River south of Auburn, Placer County. E. C. Gaylord is superintendent.

The Northern Engineering Co., V. V. Clarke, of Seattle, president, is constructing a dry-land dredging machine at the Joshua Hendy Iron Works, San Francisco, to be put in trial commission in February or March, 1912, near San Francisco. The machine is designed to travel on rollers on the bedrock, and will be equipped with an excavating ladder with an up-and-down movement, and comes down the cut instead of going up. A reciprocating conveyor device is designed for saving the gold. The company contemplates also the construction of floating machines for use at Nome, for which several tentative orders have been secured. Placer lands, as near San Francisco as can be secured, will be purchased with the purpose of making complete practical experiments in the application of the dry-land machine.

Malay States Tin Output

The tin output of the Federated Malay States is given in the accompanying table, taken from *In Tinland*, Jan. 29, 1912. For converting in other weights, 1 picul = 139.48 lb. = 63.27 kilograms.

MALAY STATES TIN PRODUCTION

State	1910 Piculs	1911 Piculs
Perak	421,335	437,539
Selangor	240,192	231,175
N. Sembilan	34,698	29,230
Pahang	40,674	43,954
Total	736,899	741,698

Mining and Metallurgical Patents

A Classified List of New Inventions

A copy of the specification of any of these patents issued by the United States Patent Office will be mailed by "The Engineering and Mining Journal" upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COPPER

COPPER LIQUORS—Improvements in the Treatment of Copper Liquors. T. H. Thwaites, Peterborough, Eng. (Brit. No. 9174 of 1911.)

LEACHING—Method of and Apparatus for Treating Ores. Bradley Copper Process Co., Jersey City, N. J. (Brit. No. 12,305 of 1911.)

GOLD AND SILVER

CYANIDING — Filtering Apparatus. David J. Kelly, Salt Lake City, Utah, assignor to Kelly Filter Press Co., Salt Lake City, Utah. (U. S. No. 1,024,082; Apr. 23, 1912.)

CYANIDING—Improvement in Process in Precipitating and Recovering Metals from Hydro-metallurgical Solutions. C. W. Merrill, Berkeley, Calif. (Brit. No. 2801 of 1911.)

CYANIDING—Process for the Precipitation of Precious Metals from Cyanide Solutions. James Millar Neil, Toronto, Ontario, Canada, assignor to Alexander My Hay, Toronto, Canada. (U. S. No. 1,023,524; Apr. 16, 1912.)

IRON AND STEEL

ALLOY Consisting of Cast Iron, Copper and Platinum. James W. Donnell, Evanston, Ill. (U. S. No. 1,025,131; May 7, 1912.)

BLAST FURNACE. Max McMurray, Cleveland, Ohio. (U. S. No. 1,024,801; Apr. 30, 1912.)

BLAST-FURNACE TUYERES—Means for Replacing Tuyeres in Air-Blast Furnaces. Alfred Désiré Leduc, Rouen, France. (U. S. No. 1,025,531; May 7, 1912.)

FURNACE-CHARGING DEVICE. John W. Dougherty, Steelton, Penn. (U. S. No. 1,024,623; Apr. 30, 1912.)

GAS WASHING—Apparatus for Washing and Scrubbing Gases. Matthew White and James Henry White, Luton, England. (U. S. No. 1,025,729; May 7, 1912.)

MANUFACTURE — Improvements in the Manufacture of Ingot Iron and Steel. H. Hatton, Brierley Hill, Eng. (Brit. No. 16,601 of 1911.)

MARTIN-SIEMENS FURNACE — A Tilting Martin-Siemens Furnace. Ateliers de Constructions Electriques du Nord et de l'Est, Paris, France. (Brit. No. 637 of 1911.)

ORE TREATMENT—Method of Treating Iron Ores. Birger Fjeld Halvorsen, Christiania, Norway. (U. S. No. 1,024,623; Apr. 30, 1912.)

REFINING—Process in the Refining of Iron and Steel. K. A. F. Hiorth, Christiania, Norway. (Brit. No. 25,915 of 1911.)

SLAG REMOVAL—Means for Removing Slag from Hearth Furnaces. Karl Stobrawa, Gleiwitz, Germany. (U. S. No. 1,025,027; Apr. 30, 1912.)

LEAD, ZINC AND OTHER METALS

RADIUM—Improved Process for Treating Complex Radium Ores. S. Radcliff, Victoria, Australia. (Brit. No. 8936 of 1911.)

TIN—Detinning Machine. William M. Connor, Baltimore, Md. (U. S. No. 1,021,302; Mar. 26, 1912.)

TITANIUM ALLOYS. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York. (U. S. Nos. 1,023,331; 1,023,332; 1,023,333 and 1,023,334; Apr. 16, 1912.)

ZINC—Preparation of Zincate Solutions. Charles Ranson, Paris, France. (U. S. No. 1,023,964; Apr. 23, 1912.)

MINING—GENERAL

BLASTING FUSE AND CAP. Wesley E. Ingram, Austin, Nev. (U. S. No. 1,025,065; Apr. 30, 1912.)

DRILL—Portable Rock Drill. George H. Bibb, Silverton, Colo. (U. S. No. 1,022,578; Apr. 9, 1912.)

DRILL BITS—Machine for Forming and Sharpening Drill Bits and the Like. Harry Johan Hjalmar Nathorst and Gotthard Lundström, Gellivare Malmfält, Sweden. (U. S. No. 1,023,476; Apr. 16, 1912.)

DRILL EXTRACTOR. Benjamin F. Betts, Goldroad, Ariz. (U. S. No. 1,024,193; Apr. 23, 1912.)

DRILL-HOLE CLEANING ATTACHMENT for Hammer Drills. Daniel S. Waugh, Denver, Colo., assignor to Denver Rock Drill & Machinery Co., Denver, Colo. (U. S. No. 1,023,899; Apr. 23, 1912.)

DRILLING—A Hammer Drilling Machine Driven by Compressed Air for Drilling Rock or Coal. J. F. Ovenden, Cardiff, Wales. (Brit. No. 4955 of 1911.)

DRILLING—Core-Drilling Machinery. Coleman Arthur Terry, deceased, New York, N. Y.; Emma J. Terry, administratrix, assignor, by mesne assignments, to McKiernan-Terry Drill Co. (U. S. No. 1,025,333; May 7, 1912.)

DRILLING—Device for the Facilitation of the Exchange of Bores in Rock Drills. Frederik Christian Andreas Herstad, Finspang, Sweden. (U. S. No. 1,024,574; Apr. 30, 1912.)

DRILLING—Improvements Applicable to the Actuating Fluid Supply Connections for Rock-Drilling Machines. S. W. Smith, J. D. Innes, W. Ross and C. E. Horne, Boksburg, Transvaal. (Brit. No. 5462 of 1911.)

DRILLING—Improvements in Rock-Drilling Engines. J. G. Leyner, Denver, Colo. (Brit. No. 1933 of 1911.)

DRILLING MACHINE. John Prue Karns, Boulder, Colo., assignor to J. P. Karns Tunneling Machine Co., Boulder, Colo. (U. S. No. 1,023,654; Apr. 16, 1912.)

DRILLS — Improvements in Rock Drills. J. J. Purcell, Burke, Ida. (Brit. No. 12,465 of 1911.)

DRILLS — Lubricating Mechanism. Daniel Shaw Waugh, Denver, Colo., assignor to the Denver Rock Drill & Machinery Co., Denver, Colo. (U. S. No. 1,022,284; Apr. 2, 1912.)

DRILLS—Rotation Device for Hammer Drills. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. Nos. 1,023,517 and 1,023,518; Apr. 16, 1912.)

FLUME—Metal Flume or Trough. Emerson E. Holtz, Billings, Mont., assignor of one-fourth to Hugh B. Stridiron and one-fourth to Elmer Kowalk, Billings, Mont. (U. S. No. 1,022,138; Apr. 2, 1912.)

LAMP—Miners' Acetylene Lamp. Julius Bertha, Tyre, Penn. (U. S. No. 1,021,568; Mar. 26, 1912.)

MOUNTING FOR MINING TOOLS or Machines. William Prellwitz, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,023,595; Apr. 16, 1912.)

PROPS—Improvements in and Relating to Mining Props and the Like. Otto Gruenewald and Max Gorich, Cologne, Germany. (Brit. No. 4599 of 1911.)

PUMPS—Apparatus for Pumping Liquids. Henry M. Chance and Thomas M. Chance, Philadelphia, Penn. (U. S. No. 1,021,237; Mar. 26, 1912.)

TIMBER PRESERVATION—Preserved Wood and Process of Making Same. Carleton Ellis, Montclair, N. J., assignor to Copper Oil Products Co., New York, N. Y. (U. S. No. 1,020,643; Mar. 19, 1912.)

TUNNELING—Apparatus for Tunneling Rock. Harvey F. Sutton, Salt Lake City, Utah. (U. S. No. 1,025,029; Apr. 30, 1912.)

ORE DRESSING—GENERAL

CONCENTRATOR. Arthur R. Wilfley, Denver, Colo. (U. S. No. 1,021,961; Apr. 2, 1912.)

CONCENTRATORS—Improvements in Ore Concentrators. George Augustus Mower and F. W. R. Williams, London, Eng. (Brit. No. 1749 of 1912.)

CRUSHING—Grinding Mill. James B. Hoop, Portland, Colo., assignor of one-half to Whitney Newton, Denver, Colo. (U. S. No. 1,021,191; Mar. 26, 1912.)

CRUSHING—Improvements in or Relating to Machines for Grinding, Crushing, Mixing and the Like. C. E. V. Hall, West Bridgford, Nottingham. (Brit. No. 30,346 of 1910.)

CRUSHING—Pulverizing Mill, Benjamin C. Bradley, Canton, Ohio. (U. S. No. 1,020,389; Mar. 19, 1912.)

GRINDING—Vertical Tubular Mill for Fine Grinding. Charles Morel, Domène, Isère, France. (U. S. No. 1,024,414; Apr. 23, 1912.)

MAGNETIC SEPARATION—Improvements in Electro-Magnetic Ore Separators. F. Steinert and H. Stein, Cologne, Germany. (Brit. No. 1619 of 1911.)

MAGNETIC ORE SEPARATOR. Joseph Weatherby, New Cumberland, Penn., assignor to Andrew J. Dull, Harrisburg, Penn. (U. S. No. 1,024,539; Apr. 30, 1912.)

MAGNETIC SEPARATOR. Joseph Weatherby, Jr., and Andrew J. Dull, Harrisburg, Penn.; said Weatherby assignor to said Dull. (U. S. No. 1,024,045; Apr. 23, 1912.)

ORE CONVEYER AND CLASSIFIER. David J. Nevill, Denver, Colo., assignor to John Van Nostrand Dorr, Lead, S. D. (U. S. No. 1,024,647; Apr. 30, 1912.)

ORE SEPARATION—Improvements in Centrifugal Ore Separation. P. F. Peck, Chicago, Ill. (Brit. Nos. 7893 and 7894 of 1911.)

PULVERIZING MILLS—Improvement in Mills for Pulverizing or Grinding Slag, Ore, Rock or Similar Material. P. B. Bradley, Hingham, Mass. (Brit. No. 17,711 of 1911.)

SLIME CONCENTRATOR. Edward Carpenter Porter, Morenci, Ariz. (U. S. No. 1,024,359; Apr. 23, 1912.)

METALLURGY—GENERAL

ALLOY—Metallic Alloy of Vanadium, Aluminum, Antimony, Magnesium and Tin. Geza Hartmann, San Francisco, and Reinhardt J. Busch, Los Angeles, Calif. (U. S. No. 1,020,757; Mar. 19, 1912.)

ALLOYS—Process and Device for the Production of Alloys by the Employment of Metal Fusible at High Temperatures Only. Titan Gesellsch. mit Beschrankter Haftung and G. Meissner, Dresden, Germany. (Brit. No. 7663 of 1911.)

CHARGING FURNACES — An Improved Appliance for Charging Metallurgical Furnaces. E. Gottlieb, Frankfort a Main, Germany. (Brit. No. 14,027 of 1911.)

ELECTRIC FURNACE. Ernesto Stassano, Turin, Italy. (U. S. No. 1,024,657; Apr. 30, 1912.)

FLUE GASES—Means for Analyzing Flue Gases. Hearley Howell Wilson, Altoona, Penn. (U. S. No. 1,023,188; Apr. 16, 1912.)

GASEOUS FUEL — Improvements in the Production of Gaseous Fuel for Metallurgical and other Purposes. Alleyne Reynolds, London, Eng. (Brit. No. 29,367 of 1910.)

LADLE CAR. Erwin C. Sherman, Youngstown, Ohio, assignor to William B. Pollock Co., Youngstown, Ohio. (U. S No. 1,021,753; Mar. 26, 1912.)

REDUCTION—Process for Reducing Ores and Metals. William H. Kelly, Los Angeles, Calif. (U. S. No. 1,024,136, Apr. 23, 1912.)

ROASTING FURNACES — Improvements in Muffled Roasting Furnaces. H. M. Ridge, London, Eng. (Brit. No. 3981 of 1911.)

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

H. F. Lefevre sailed from New York for Honduras, May 17. He expects to return in July.

R. B. Lamb is leaving for an extended professional trip to Swastika, Porcupine, and Gowganda.

Richard B. Stanford left New Orleans, on May 19, for Honduras, to be gone about six weeks.

Kirby Thomas has returned from Minnesota, where he spent several weeks on the Cuyuna range.

James Heggie is superintendent of the new Hayden plant of the American Smelting & Refining Co.

James Marwick, of New York, was elected a director of the Batopilas Mining Co., succeeding Judge Howland.

J. B. Tyrrell, of Toronto, Ont., has been visiting Porcupine, before leaving on his trip to the Hudson Bay country.

Prof. L. E. Young, director of the School of Mines and Metallurgy of the University of Missouri, was in New York this week.

Lewis A. Riley, of Philadelphia, is acting president of the Lehigh Coal & Navigation Co., in place of William A. Lathrop, deceased.

Dr. John H. Banks, of Ricketts & Banks, New York, is now in North Carolina, making examinations of mineral and mining properties.

Juan Felix Brandes will be in New York for some time, preparing for a trip to Peru and Bolivia. His address is care J. W. Howard, No. 1 Broadway.

William J. Watson, of Ladysmith, Vancouver Island, has been appointed attorney in British Columbia for the Tyee Copper Co., Ltd., of London, England.

David J. Price, recently engineer for the Clearfield Bituminous Coal Cor., at Clymer, Penn., has been appointed an assistant engineer in the Bureau of Mines.

Hugh C. Watson, formerly with the Santa Gertrudis company at Pachucha, Mex., has accepted a position with the New Monarch Mining Co. at Leadville, Colorado.

Horace V. Winchell, who intended to sail for Europe this month, has been detained by an accumulation of professional work, and now does not expect to go abroad until July 23.

E. N. Zern has been appointed professor of mining at the West Virginia University, Morgantown, W. Va. He was recently professor of coal mining at the University of Pittsburgh.

Martin Schwerin & Co. have opened an office as mining engineers and geologists at 25 Broad St., New York, and will undertake examinations and management of mining properties.

Arthur Lakes, Jr., formerly of Denver, Colo., but now manager of the Ymir-Wilcox Development Co., of Ymir, B. C., is convalescent after having been in the hospital at Nelson, B. C., with a broken leg.

A. Travers-Ewell, formerly chief engineer of the Aporoma Goldfields, Ltd., Tirapata, Peru., has returned to the United States. He will open an office for the general practice of engineering at Globe, Arizona.

Walter Harvey Weed is now consulting engineer for the Callahan mine in addition to being appointed in the same capacity for the Interstate Silver Lead Mining Co.; both mines are in the Cœur d'Alene district, Idaho.

William Watson, vice-president and general manager of the Motherlode Sheep Creek Mining Co., has returned to British Columbia, to commence gold-milling operations at Sheep Creek, Nelson mining division, after having spent the winter in New York.

M. A. Newman and Roger L. Beals have opened offices for mining and metallurgical work in the Mills Bldg., San Francisco. Mr. Newman was, until recently, manager of the Cia. Minera Jesus Maria y Anexas, of San Jose de Gracia, Sinaloa, and Mr. Beals metallurgist for Minas del Tajo, Rosario, Sinaloa, Mexico.

Alfred Still, an English engineer and author of a number of works on electric power, has accepted the position of chief engineer to the mines and hydro-electric power plants of the Algoma Steel Co. in the Michipicoten district of Canada, making his headquarters at the Helen mine. He went to Canada a year ago as electrical engineer of the Lake Superior Power Co., Sault Ste. Marie, Ont., which is under the same control as the steel company.

Dr. D. D. Cairnes, of the Geological Survey of Canada, accompanied by three geological assistants, recently proceeded to Yukon Territory, going by steamer from Seattle, Wash., on May 2, to Skagway, and thence down the Yukon River to Dawson. During the ensuing fieldwork season the party will endeavor to complete the Survey's geological investigations along the 141st meridian—the Yukon-Alaska boundary—between Porcupine and Yukon Rivers.

OBITUARY

Sir Julius Charles Wernher, member of Wernher, Beit & Co., died, May 21, in London. Sir Julius was created a baronet in 1905 as a recognition of his part in the development of the mining industry of the Transvaal, in which he was one of the great leaders. He was born in Darmstadt in 1850 and in 1888 married Alice S. Mankiewicz. He had three sons, the oldest being Derrick Julius Wernher, who was born in 1889.

Sabwrosuke Mitsui died at Kamakura, Japan, Apr. 5, aged 62 years. He was born and educated in Japan, and spent some years in the United States studying mining methods. On his return to Japan he entered the mining department of the Mitsui family, later organized as Mitsui & Co., and rose gradually to be the head of the department. Under his administration the Miike colliery and other mines belonging to the company were equipped with modern machinery, and a large and efficient organization was built up.

Societies and Technical Schools

American Iron and Steel Institute—It is reported that the annual dues, which have heretofore been $50, have been reduced to $10.

Mining and Metallurgical Society—The New York section held its regular monthly meeting on May 16. J. R. Finlay and H. S. Munroe presented papers on the valuation of mines, which excited an animated discussion.

University of Nevada—At the commencement at Reno, May 12, it was announced that Clarence H. Mackay and his mother had jointly presented the Mackay School of Mines with $150,000 as an endowment fund.

American Institute of Mining Engineers—The investigating committee has been delayed in making its report and the adjourned meeting of the members of the Institute scheduled for June 3 will probably have to be adjourned again.

American Chemical Society—The New York Section has appointed a committee on occupational diseases in chemical trades as follows: Charles Baskerville, professor of chemictry, College City of New York, Chairman; E. C. Uhlig, chief chemist, Brookyln Union Gas Co., Brooklyn, Secretary; George P. Adamson, Baker & Adamson Chemical Co., Easton, Penn.; W. H. Bassett, American Brass Co., Waterbury, Conn.; Wm. F. Doerflinger, New York; H. M. Kaufman, Mutual Chemical Co. of America, New York; A. C. Langmuir, chairman of the New York Section, Brooklyn; Geo. A. Prochazka, general manager Central Dye Stuff & Chemical Co.; Geo. D. Rosengarten, Powers, Weightman & Rosengarten, Philadelphia; A. H. Sabin, consulting chemist National Lead Co., 129 York street, Brooklyn; Charles L. Parsons, Bureau of Mines, Washington. This committee will work in coöperation with the committee of the Association for Labor Legislation.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

May 16—A water commission act for submission to the legislature of 1913 has been drafted by the State Conservation Commission, and will be discussed at public hearings to perfect it before finally submitting it to the legislators. Provision is made for a commission of five, of which the governor and the state engineer are to be ex-officio members; the three others to be a lawyer, an engineer and a business man, to be appointed by the governor. Beneficial use is specified as the basis of rights to waters of the state. The commission is provided with power and is directed to institute such legal proceedings as to determine judicially what waters are unappropriated and to carry such proceedings to final adjudication. The right to underground waters is provided for without the necessity of filing notice, but such use is confined to the owners of overlying land and restricted to beneficial uses. Other waters must be appropriated under the provisions of the act. The filing fee for the appropriation of water for power purposes is placed at $250, and for other purposes at $10. The annual charge for use of the water for power is 20c. per theoretical horsepower, and 25c. for each miners' inch for other appropriations. Actual construction of a plant for the development and use of the waters sought to be appropriated must begin within six months. The proposed law makes no charge apply to hydro-electric plants already in operation, which comprise less than 10% of the total water-power resources of the state, but the charge will apply to any extension of present plants to be made by such companies. It is estimated that the fees and annual charges will add largely to the state revenues, as it is believed that under such a law the number of hydro-electric companies will increase, particularly in the mining districts. It is probable that open discussion of the proposed law will develop objection to the rate per theoretical horsepower and per miners' inch that the bill provides, especially if applied to small concerns in mining and like industries.

William Sproule, president of the Southern Pacific R.R., has been elected president of the Associated Oil Co., to succeed William F. Herrin. Mr. Herrin will remain as a member of the board of directors, and W. S. Porter is continued as vice-president and general manager. The election of Mr. Sproule is the carrying out of the Southern Pacific policy of having one head for all subsidiary companies. It is probable that the contemplated refinery at Avon in Contra Costa County will now be built. It is further believed that there is now less probability that the Associated will be taken over by any other large marketing concern, which was recently reported to be among the possible changes in the operation of the Associated.

Butte

May 15—The work of changing the hoisting engine at the Leonard mine of the Anaconda company, to use compressed air instead of steam, has been accomplished and operations resumed after a two months' shutdown. The next mine at which the change will be made is the Tramway, which will be shut down immediately for six weeks; as each change is made the experience acquired makes the workmen more expert, resulting in more rapid work. After the installation is completed at the Tramway mine, the Pennsylvania mine will undergo the same operation. The Leonard mine is the fifth to be changed successfully to the air system, the other mines in order being the Mountain View, High Ore, Diamond and West Gray Rock, all of which have worked successfully under the new motive power.

It is expected that the first 500-ton unit of the 1000-ton mill, being erected by the Butte & Superior at the mine, will be in operation by June 1, and the complete plant less than a month later. For some time the company has been gradually reducing its shipments of ore to the Basin mill, where the ore has been treated for about two years, under a lease from the United Copper Co., until at present only 200 tons a day are going there, while 350 tons per day are being put into the stockpile at the mine. This is to provide for the continuous operation of the mill during the time that the mine is closed down for the installation of a new hoist, which is to be done soon. The mine is at present 1600 ft. deep and the hoist now being used is working to its full capacity; the new hoist will have a capacity for hoisting from a depth of 3500 ft., using 5-ton skips. The result of development work in the mine is satisfactory. The vein on the 1200-ft. level has been drifted on, east and west of the shaft, the full length of the Black Rock claim, and the company owns 3000 ft. on the vein east of this claim, and 1500 ft. west of it, which are yet to be developed.

Denver

May 16—A district which is rapidly coming into prominence as a heavy producer of gold, silver and lead, and which it can be safely predicted within three or four years will rival any other camp in the state, is the Quartz Creek and Gold Brick district, north of Pitkin and Ohio City, in Gunnison County. There are two distinct systems of veins. One consists of about 7000 acres of uptilted sedimentaries, containing contact veins, the duplicate of Leadville and Aspen, which were worked in the early 80's and produced rich silver-lead ores as long as they would stand for long wagon haul to the railway, and until water, hoisting and pumping expenses, and lack of transportation facilities compelled the individual owners to cease work. The other is a system of parallel veins in the granite country to the west and adjoining the contact basin. These are developed by crosscut tunnels belonging to three companies, the Carter tunnel, 6600 ft. long, the Raymond, 3300 ft., and the Gold Links, 4000 ft. All three have mills at the tunnel portals and are running full capacity, and turning out bullion and concentrates.

The Gold Links has produced more than $500,000 from a stope 1600 ft. long and an average of 150 ft. high, and during the last three months produced $20,957 in gold and $23,000 in concentrates. The others are doing much the same, but the returns are not given out. The width of the ore in the chief vein being worked by these three companies, is 2 to 6 ft., the smelting ore carrying from 2 to 8 oz. gold per ton, about 10 oz. silver and 9% lead; the ore is galena and iron pyrite, carrying gold and silver, with some blende. The mill ore averages about $15, and is treated by concentration. The grade is uniform, and about three miles of this vein have producing mines on it. Other parallel pay veins have been intersected, but as yet have not been driven on. The Sandy Hook mine on the same series, north of the Gold Links, is building a mill, and the Belzora-Bassic is on the same vein system and producing.

This camp has only sprung into prominence within the last year, by reason of the almost simultaneous discovery of large bodies of unusually rich ore in the long crosscut tunnels, and as these have developed three strong parallel fissure veins, at a depth of from 1000 to 1500 ft. below the surface, which also produced the same rich ore on the surface in the early 80's, it will be readily understood how economically the ores can be mined and treated under present conditions, and how great the future production of the Gold Brick district will probably be.

Salt Lake City

May 16—The present indications are that the long-expected demise of the Consolidated Mercur, operating for many years in Tooele County, will occur soon. The last annual report showed plainly the desperate condition of the company's mines, but some hope was held out that more favorable developments might transpire. It was made plain, however, that in the event they did not, nothing less than the inevitable could happen. Apparently this is about to take place. A statement from the president to stockholders declares that unless some favorable development takes place during the next few months the ore reserves will be exhausted soon, and the company obliged to suspend operations before Jan. 1, 1913. In case a new property is not found before the company is compelled to discontinue at Mercur, it will be to the best interest of the stockholders to sell the machinery and equipment. At a stockholders' meeting, July 1, it is proposed to amend the articles of incorporation so as to empower the directors to sell any or all of the company's property.

Reports state that the strike at the Murray smeltery of the American Smelting & Refining Co., is not of particular importance as affecting that one property, whose operations are confined primarily to the treatment of lead ores. The strike, however, is said to be in charge of the Western Federation of Miners, and they are reported to be making an effort to extend the strike to the Bingham and Garfield mines, smeltery and mills. Such an extension of the strike might prove serious.

Negaunee, Mich.

May 18—The announcement by D. M. Philbin, of Duluth, manager of the Hill ore properties on the Mesabi Range, that the lands will not be leased again after the expiration of the contract with the U. S. Steel Corporation, in 1915, has been of considerable interest to independent companies. Several concerns had ceased acquiring new prospects, with the expectation that the independent organizations would be given a chance at the Hill lands. Exploration will be given a new impetus now that it is known that the Great Northern interests will mine their own ore, for which purpose a company is expected to be formed. It is believed that the Great Northern can start soon to develop its holdings, as only 1400 acres of the original lease of 48,000 acres, are being retained by the Oliver company, these being the lands on which development has already been done.

Toronto

May 15—It is understood that the Provincial Government will soon invite tenders for the Abitibi pulp limit. This is the first step in the development policy in northern Ontario, for which $5,000,000 was appropriated by the last legislature. The lease will necessitate the construction of a plant at Iroquois Falls and the development of the water power at that point. These falls are capable of developing a large power, and it is possible that the surplus energy may be sold to some of the mining companies. One of the large mining companies was considering the development of this power for its own use, only a short time ago.

Arrangements have been made whereby a number of British business men and manufacturers will visit Canada during the coming summer. Representing, as they do, an aggregate of about $250,000,000 capital, the results of this visit will be of practical benefit to the whole country. Arrangements have been made to visit all the important districts of Canada, and the Associated Boards of Trade, for Ontario, have arranged for a special trip to the northern part of the province, which will include Cobalt and probably Porcupine. The buying capacity of northern Ontario is astonishing, over $500,000 annually being spent for food supplies by the Cobalt miners.

E. T. Corkill, provincial inspector of mines for Ontario, has issued a report for the first quarter of 1912, showing a marked decrease in the number of fatal mining accidents. There were only eight fatalities during the three months as compared with 17 during the corresponding period of 1911. The number of nonfatal accidents was 46, but only two of these were sufficiently serious to involve permanent disability.

Cobalt

May 17—At the Nipissing property, the new method of prospecting the surface by an hydraulic giant is being used and so far the results appear to be satisfactory. A 3½-in. stream is used, the water being transported in a 14-in. spiral-riveted pipe. The pump is driven by a 650-hp. motor and has a capacity of 4800 gal. per min., giving a pressure of 170 lb. per sq.in. at the nozzle.

The Energite Explosive Co.'s factory, which is situated near Haileybury, was destroyed by fire on May 15. This company manufactures cheddite, which is used by many of the mines of northern Ontario. Only a small quantity of the manufactured powder was on hand at the time of the fire, but it is interesting to note that while this burned freely, there was no explosion. The fire was caused by a nail getting into the rolls, the resulting sparks igniting the chlorate, which is the base of the explosive and highly inflammable. A new and larger factory will be erected as soon as possible.

Porcupine

May 17—Several prospecting parties are outfitting in Haileybury and will start into northern Quebec to search for diamonds. It is stated that men coming down from this region found several stones which they sold at different points, and a determined effort will be made to find the precise region from which they came. At present little weight can be given to these discoveries. It has long been known that at certain points near James Bay, the geological conditions are favorable for the discovery of diamonds, as conditions much resemble those that exist in the South African field. Color is lent to this by the discovery at different times of diamonds in the glacial drift as far south as Wisconsin, but so far the search for the stones in the northern latitudes has proved fruitless.

Johannesburg

Apr. 15—An interesting discussion has been carried on recently before the Chemical, Metallurgical and Mining Society of South Africa, over a paper contributed by J. Chilton on the subject of "Accidents in Rand Mines." It appears that the number of accidents underground has been increasing rapidly of late, and it is said that three miners, black and white, are now killed every working day.

What none of the contributors to the discussion has cared even to mention, is the fact that over half the accidents directly or indirectly are due to the intemperate habits of the white miners. A large percentage indeed of the so called miners at present in these fields are either habitual or periodic drunkards and to this fact must be ascribed the great number of changes for which the mining houses and officials are blamed. Miners go below in a muddled condition after a carousal and endanger themselves and the lives of the natives under them. There seems no remedy except in improving health underground and living conditions on the surface, so that sober, married miners may be attracted to this field. The large-mill policy has also been blamed, for if the mill demands more ore than the mine can legitimately produce, careless mining must result. Many natives are not sufficiently instructed in the dangers to be encountered underground and often the workman has no real knowledge of mining, having graduated in a few months from farming or cab-driving or some similar occupation.

The Mining News

The Current History of Mining

Alaska

The S.S. "Tetlin," the first boat to leave Fairbanks this season, left for Fort Gibbon, at the junction of the Yukon and Tanana Rivers, on May 1.

The spring cleanup at Nome is in full swing, and is the earliest in the history of the camp.

Arizona

Gila County

Miami—In April, 83,465 tons of ore were mined, of which about 29,000 tons came from development work, 32,000 from square-setting next to capping, 14,000 tons from the shrinkage stopes, and 8000 tons from the old dump at No. 2 shaft. Development work amounted to 6602 ft., comprising 4492 ft. of drifting and 2110 ft. of raising, virtually all in ore. The erection of the steel tailing-tower is finished and it is being equipped with four 60-ft. bucket-elevators, all of different make, to make a test of their wearing qualities. In the concentrator, the 100-hp. motors that drive the intermediate crushing machinery are being replaced by 150-hp. motors, and a small experimental section is being run in connection with the sixth unit. Another water-tube boiler will be added to the power-house equipment, after which both compressors can be run to capacity and will furnish air for hoisting, that work now being done by steam generated in the hoist building. A diamond drill will soon be rigged up on the 570-ft. level, and the ground below that level explored. J. Parke Channing is still at the mine.

Superior & Boston—The mine is shipping ore to the Old Dominion smeltery, at Globe. The ore is all coming from the stope below the sixth level on the Great Eastern vein and local officials say that a car per day could be shipped if the cars could be obtained. Shipments were started on Apr. 22, and four cars were shipped during that month, the first three averaging 9½% copper and the fourth, 7½%. Six cars have been shipped up to date this month. Development work continues on the 12th level, where the southeast crosscut is being advanced.

Gibson—About 20 men are employed at the mine, nine miles west of Miami, and ore is being hauled regularly to Miami, whence it is shipped to the Old Dominion smeltery. Work is confined to the fourth and fifth levels on the Pasquale vein, and all ore is coming from five stopes on the fourth level. Crosscuts driven into the hanging wall have disclosed shoots of ore as wide and of as high a copper content as those now being stoped, and stoping will be started on these. The south drift on the fourth level is being advanced and drifts are being driven north and south on the fifth level. Shipments assay from 16 to 18% copper.

Duquesne—High-grade gold-lead ore is being hauled from the mine, seven miles northwest of Miami, preparatory to shipping to the El Paso smeltery. Four men are reported to be mining about 10 tons of ore per day. The last shipment assayed about 15% lead and over 1 oz. per ton in gold.

New State—The development of this mine, seven miles northwest of Miami, is proceeding under the supervision of John Shaw. Five men are employed and work is confined to the sinking of the shaft in which 4 ft. of lead molybdenum ore were recently disclosed. The shaft is 45 ft. deep and the vein is of varying width.

Inspiration Consolidated—Development is proceeding steadily and the number of men employed is being gradually increased. Shafts No. 1 and 2, at the Live Oak mine, are being sunk and preparations made to resume sinking at the Scorpion shaft. Ore from development is being extracted through the Joe Bush shaft. Tests on the concentration of the ores, that J. M. Callow has been conducting in the experimental mill for the last five months, are completed, and some of the results will probably be made public soon. The survey of the Black Warrior ground for a possible mill site continues.

Southwestern Miami—Three churn drills are in continuous operation.

New Keystone—Negotiations are pending for the absorption of this company by the Inspiration Consolidated.

South Live Oak—The large churn drill is running steadily, and is drilling a 17½-in. hole, which is now over 100 ft. deep, and in the granite-porphyry formation.

Old Dominion—The management does not expect to increase the production materially until the milling capacity has been increased. Appropriations have been made for construction work that will involve the expenditure of $600,000 during the next two years. The work includes the improvement and enlargement of the concentrator that will increase its capacity from 500 tons to 1000 tons per day, and the construction of a new crushing and sampling mill, all construction to be of steel and concrete. H. Kenyon Burch, designer of the Miami and other large concentrators, will have charge of the work. Skips will be substituted for cages, thereby increasing hoisting capacity. The shaft is being sunk from the 16th to the 18th level.

Graham County

Arizona Copper Co.—The directors announce that the issue of £500,000 of 5% terminable debentures, recently authorized to meet the cost of the new construction, has been taken up in full and that the lists are now closed.

Yavapai County

Pacific—The matter of erecting a 100-ton reduction plant has been under consideration for some time, but nothing definite has been done. Various estimates have been obtained and some tests made on the ore. W. V. De Camp, Crown King, is general manager.

Arkansas

Madison—Plans for the resumption of operations on this zinc mine, south of Zinc, are being made.

California

Amador County

Doctor Lynch and associates, of Sutter Creek, recently purchased a 5-ton Avery auto-truck, to do general freighting between the mines and railroad, at Martells. The experiment will be watched locally with interest.

Fremont—The company recently installed a 16x10x14-in. Ingersoll-Rand, duplex, one-stage, belt-driven air compressor, with a 100-hp. General Electric motor, to operate the drills and pumps, respectively.

South Jackson—The transformers recently received are in position. The two 75-hp. electric motors are ready for installation. The new plant should be in operation by June 1. The hoist is good for 2000 ft. The shaft will be of 3-compartment size.

Calaveras County

Hexter—The retimbering of the tunnel is about completed. It is expected to tap the lower gravel channel known to be in Stockton Hill. Steve Hughes, of Mokelumne Hill, is superintendent.

Great Eastern—William Weymouth, of Plymouth, Amador County, is reported to have taken an option on this mine at West Point. A large vein has been exposed and is said to extend across the line into Amador County.

Fresno County

Coalinga Royal—Well No. 2 is reported to have 40 gravity oil at 2900 ft. and below the salt water sand. This is the first well to drill through this sand.

Standard—This company has drilled through the brown shale on Section 28 and has paraffine oil, the only producer of this character of oil in the state.

California Oilfields—The company is preparing to deepen two wells to reach the paraffine oil in the Coalinga field.

Humboldt County

Klamath River—There are 1500 ft. of steel pipe line for use in conveying water for the hydraulic operations, and the intention is to install as much more this summer. The ground is full of large boulders and two Hendy giants are worked alternately, as the water has to be shut out of each digging while the rocks are being blasted. The flume and pipe line carry 2000 in. per min. C. A. Sample, Weitchpec, is general manager.

Cavanagh—This property, opposite the Klamath, was purchased in 1911 by C. A. Sample, but little work has been done. An electric pump will probably be installed this summer, to deliver 1500 in. per minute.

Inyo County

Wilshire-Bishop Creek—The mill machinery, which was shipped from the East, should arrive about June 1. The arrival of Algernon Del Mar and a crew of carpenters, indicates that the mill timbers will be ready in time. The stamps will be set on concrete. Underground development will not be delayed.

Kern County

Standard—Well No. 1 in the Lost Hills district has 30 gravity oil at 2140 feet.

Modoc County

Prospectors and investors are still going into Highgrade, and they who have been in for the last month are locating claims in the snow.

Nevada County

Little Nellie—A new orebody was recently found on the 370-ft. level. The mill has 15 stamps, two patent amalgamators, two Wilfley concentrators and four Johnson vanners. The mine is near the Iron Mountain mine, on the Iron Mountain Railway.

Gaston Gold Mining Co.—The 40-stamp mill is running at full capacity and 100 men are employed. The main shaft has been sunk to the 400-ft. level and a station cut. A raise is being driven to connect with this from the 500-ft. drain tunnel.

Iron Mountain Copper Co.—About 100 men are working and several thousand tons of ore per month are being shipped. The low-grade ore goes to the Standard Oil Co., and the high-grade to the smeltery, at Martinez. The best ore is reported as being stored near the site of the old smeltery at Keswick.

Plumas County

The auto-stage line from Keddie on the Western Pacific R.R. to the Greenville mining district is proving a winner so far as time and cost are concerned. The distance is 17 miles; the time is 45 min. for the daylight, and 50 min. for the night run by automobile. One of the auto lines has announced a rate of $1 for the trip, a reduction from the former $2 rate. The activity of the Great Western Power Co., in the Greenville district, is the answer to this competition. Freight as well as passenger rates will be affected and it was the freight rate demands that caused the passenger-rate reduction.

Shasta County

Noble Electric Steel Co.—The first shipment of California pig iron went to Silver Brothers, Salt Lake City, May 10. The furnace has a capacity of 12 tons per day. The iron ore is mined near the Pitt River.

Sierra County

Poker Flat—Work has been resumed after several months' idleness caused by water shortage. P. H. Dugan is superintendent.

Tri-Metallic—Ore has been uncovered at this Long Valley mine, carrying paying quantities of copper and silver as well as a good percentage of gold.

Tuolumne County

App—It is reported that the Tonopah-Belmont Development Co. has exercised its option on this mine.

Dutch—The unit of 20 stamps, added to the 20-stamp mill, was commissioned about May 1. The stamps weigh 1000 lb. apiece and have a crushing capacity of about five tons each. Eight Johnson concentrators were also installed. The new plant was built by the Union Iron Works, of San Francisco. The mill is electrically driven. At present the hoist is steam driven, but will be changed to electric power. C. H. Segerstrom, of Sonora, is manager.

Colorado

Boulder County

Alpine Horn—This property, at Sugar Loaf, is making regular shipments of ore to the Globeville plant of the American Smelting & Refining Co. The ore averages about 2 oz. gold. The new intermediate shaft on the property is down 140 ft. and is within 25 ft. of the 130-ft. level of the workings connected with the property of the United States Gold Corporation. The connecting of this shaft with the workings of the latter company will undoubtedly settle the litigation between the two mines involving the question of apex rights, which has been in the district court of Boulder County for nearly two years.

Clear Creek County

The Argentine Central R.R., from Silver Plume to the Waldorf and other mines on McClellan Mountain, will be sold on May 29 by the sheriff to satisfy judgments held by the bondholders.

The suit between the May Day and Idaho, in the La Plata Mountains, both celebrated for their rich ore, has been decided in favor of A. E. Reynolds, owner of the May Day. The Idaho is credited with one shipment of 1½ tons of ore that brought $35,000. The Incas mine in the same district is said to have produced $25,000 since its discovery in the autumn or 1910. These mines are in horizontal deposits in limestones and sandstones.

Santiago—About 1000 tons of $40 ore are now ready for shipment and ore hauling has been stopped owing to the tremendous snowfall of last week, which has made the roads impassable.

Rosebud—Work has been resumed and the crosscut tunnel is to be extended 100 ft., making a total length of 800 ft. Good ore has been opened on the Rosebud vein by a drift from the tunnel.

Gunnison County

In the vicinity of Pitkin, H. B. Heffner's tunnel on the National, on North Quartz Creek, is in 225 ft., and Elmer Wiley's tunnel, on the Morning Glory, is in 500 ft. A. E. Reynold's tunnel, in South Hall's Gulch, is in over 1000 ft. The Gold Belt Drainage & Transportation Co. is driving two tunnels with a good vein intersected in each, one showing copper ore and the other gold and tellurium ore. The Roosevelt tunnel, on South Quartz Creek, is also in 1000 ft. and nearing the Roosevelt vein, its objective point. In the Bowerman district, the Abe Lincoln mine and mill will be operated again, with G. W. Brown as superintendent.

Lake County-Leadville

Chieftain—The shaft and surface workings at this and the By Chance mines are being repaired, and underground work will be commenced soon. Denver men are interested.

Sierra Nevada—A good body of zinc ore has been opened by lessees Garrett & McDonald, in a winze below the tunnel level, and regular shipments are going out.

San Juan County

The shipments in April from Silverton over the Denver & Rio Grande Ry. were: Silver Lake mine, 837 tons of concentrates; Sunnyside, 675 tons; Iowa-Tiger, 648 tons; from the Gold Tunnel, 108 tons.

Bullion Bar—This group has been taken over by the Florida Mining Co., of which Samuel R. Piles and P. J. Nugent are the organizers. The property comprises 17 claims. They will be developed from a tunnel now in 800 ft. and to be driven 500 ft. further. Water power is available and the installation of an electric plant is planned. The character of the ores is copper, galena and tellurium, with high gold and silver contents reported present.

TELLER COUNTY—CRIPPLE CREEK

Blue Bird—The mine continues to hold its record for increased grade of ore with depth and stoping is being done at the 1600 level. The output is about two cars per week. The shaft is being sunk to water level.

Midget—This property will be developed, under lease to Owen Roberts of Cripple Creek, who will sublet it to lessees after he has cleared the mine from foul air and mine gas. A 20-hp. motor will be installed to drive the fan for this purpose.

Portland—Manager Thomas Crowe expects to increase the tonnage this month; while the Battle Mountain mill is classed as of 300-ton capacity, he is said to be treating between 400 and 500 tons per day.

Elkton—The shaft is 106 ft. below the ninth level and will be continued for 14 ft. more, which will give 120 ft. of stoping ground for 1000 ft. in length and enough backs of ore to permit present production for two years.

Ajax—The Clancy-process mill is operating at full capacity, treating 140 tons per day of low-grade mine ore.

El Paso—During the last three weeks three cars of high-grade smelting ore have been shipped by the Darnell lease.

Hoosier—On the 100 level a new oreshoot is being drifted on. The ore, when sorted, carries about 1 oz. of gold per ton.

Trilby—The oreshoot at 1000 ft. is better grade than at the 900, running from $12 to $30 per ton.

Jo Dandy—The output is from three to five cars per week.

Idaho

CLEARWATER COUNTY

Sprague Co., Ltd.—This company has been operating a 3¼ open-connected Risdon dredge, for five years, in the vicinity of Pierce. The ground is being worked for the third time. It was worked originally by white men in the early 60's, and again by Chinamen in the 70's.

Idaho Co.—This Chicago company has constructed a dredge and will operate this season, near Pierce.

Illinois

Reports state that an artesian well, sunk by the city of Joliet, to increase its water supply, yielded shale oil when the pumps were put on.

Maryland

Baltimore Copper Smelting & Rolling Co.—The strike has caused considerable local feeling. According to W. H. Peirce, the company raised wages 10c. per day during the week of May 11, which was followed, without warning, by a strike for a 50c. increase. It was estimated that about 1500 of the 2800 men employed went out, of whom about 400 returned in the next three days. It was rumored that it had been planned to dynamite the works. The works have been equipped with searchlights, and an armed guard of 20 men provided. Rioting occurred on May 16, and it is believed that Andrew Seibert, of the county police, will die of injuries received.

Michigan

COPPER

Hancock—The shaft has passed through the lode encountered recently and believed to be the West branch, which overlies the Pewabic lode but a short distance, and has found it to be about 25 ft. wide, with 8 ft. well mineralized with mass and heavy copper. This lode will be fully developed. Shaft sinking continues to the main lode, at an estimated depth of about 3585 feet.

Isle Royale—"A" shaft has been unwatered and drifting will start toward the Houghton company's mine, in hopes of opening the West lode. This shaft was put down to a depth of 950 ft., and considerable lateral work was done, but without developing anything of a consistent nature; the developments on the West lode at the Superior and Houghton Copper Co.s, add to the possibilities of the tract. The hearing in the injunction case of G. Hyams, restraining this company from purchasing a portion of the stamp mill at Point Mills, and the Tamarack from selling its small mill, will be resumed at Calumet this week, being an adjournment from Marquette.

Winona—The second head at the mill has gone into commission, and the property is now in shape about to double its production, the underground forces being gradually increased. Experimental work is being done with the Peck concentrator, to reduce the tailing losses, which, owing to the characteristics of the rock, are particularly high.

New Arcadian—The company's new shaft will go down in the northern part of the tract in Section 17, and it will be possible to sink about 4000 ft. Ground is to be broken soon, and as the company has its own complete surface and hoisting equipment at the old workings that can be easily moved to the new shaft, good progress can be made in getting the shaft down to the copper-bearing lode that was reached by hole No. 22, and which this shaft will develop.

IRON

J. R. Thompson, of Ishpeming and J. S. Kennedy, of Ironwood, and associates have taken over the leases on the Hennepin, Pence and Snyder mines on the Gogebic Range, near Hurley, Wis., and will develop and mine. Mr. Kennedy, who formerly managed the mines for Jones & Laughlin, will continue in charge with Captain Barnaby, of Ironwood, in immediate charge. J. R. Thompson will act in an advisory capacity, making occasional trips from Ishpeming.

Norrie—The recent cave-in occurred on the 20th level near the shaft. Seven men were instantly killed and their bodies afterward dug out by the rescuing party. Six men were entombed back of the fall of rock where they had retreated for safety. A pipe was driven through the dirt by rescuers and communication set up. After several hours' work the men were rescued.

Tilden—At this mine of the Oliver Iron Mining Co., at Bessemer, the shaft house, engine house and warehouse at shaft No. 6 were destroyed by fire recently. The loss will total $75,000. Mining has been suspended until new installations are made. When the fire occurred, miners escaped through the underground connection with No. 9 shaft.

Empire—More men are being employed at this Oglebay, Norton mine, at Palmer, and from 75 to 100 men will be worked during most of the season. The ore is mined by the milling system and is hoisted through a shaft from which two levels are operated at 100 and 200 ft. depth. The ore is dumped into a crusher and elevated on a belt carrier to the loading pocket, about 100 ft. from the shaft.

Kloman—At this mine at Republic, recently opened by the Jones furnace interests, a trial was made of the new furnace, but it was interrupted to make some alterations.

Minnesota

White Iron Lake—This property, on the Vermilion Range, near Ely, has made a contract with the Jones step process company for a plant to be erected at the mine. A test of the ore has been recently made at Negaunee. The mine has developed a large tonnage of banded hard hematite and some magnetite ore. James LeBrec, of Superior, Wis., is president.

Armour—These mines, on the Cuyuna Range, have just made a first shipment of ore and will continue as regular shippers. The ore went over the new "Soo" line. Rogers, Brown & Co. are the operators.

Barrows—This property, near Brainerd, on the Cuyuna Range, is sinking a working shaft to bedrock, through about 100 ft. of sand. M. A. Hanna & Co. are the operators.

Missouri

JOPLIN DISTRICT

Aberdeen—This mine at Four Corners has started operation of the mill and is making one ton of jack per hour.

Sitting Bull—The cave-in at this mine has necessitated the sinking of a new shaft, which is being done rapidly.

Mohawk—A shaft is being sunk on this lease at Thoms Station to work an extension of the Sitting Bull run.

Montana

BUTTE DISTRICT

Butte & Superior—An average of 95 tons of ore per day is being hoisted from the 900-ft. level; 75 tons from the 1000; 25 from the 1100; 125 from the 1200; 100 from the 1300, and 150 from the 1400-ft. level. It is estimated that at present there are blocked out about 2,000,000 tons of ore, containing an average of 20% zinc; 7 oz. of silver, and gold and lead worth 75c. per ton.

East Butte—During April about 1,000,000 lb. of copper were produced at 9c., and sold at 15.75c. per lb., bringing net earnings to nearly $70,000, an increase of about $10,000 over any previous month. Most of the ore being mined at present is coming from the 800-ft. level, and the average of all ore hoisted is about 6% copper. Only two furnaces are being used at the East Butte smeltery, and these are being doubled in size. When this work is completed, together with the mechanical charging device under construction, the output will be materially increased.

Ophir—Work has been started on the erection of a 200-ton milling plant at this mine of the Butte Central Copper Co. The machinery and equipment will be furnished by the Colorado Iron Works Co., of Denver. The erection of the plant will be done by the Butte Central company under John E. Rothwell, of Denver. The plant will be run by electricity, and the waste water from the mine, of which there is an ample supply, will be used for concentration purposes. The mill will be of the latest approved cyanide-treatment type, in connection with concentration. The management hopes to finish the erection of the plant within four or five months.

JEFFERSON COUNTY

Elkhorn—This silver mine in the Elkhorn district has been closed permanently. It was reopened five years ago, old stopes worked and several new bodies of ore found. The old dumps have also been leached. Everything of value in the mine has been hoisted and the pumps pulled.

MADISON COUNTY

Mapleton—This mine, near Adobetown, is being operated on a small scale by John Batten and is making occasional shipments. The ore is highly siliceous.

POWELL COUNTY

There are a number of properties in the Pikes Peak district, near Pioneer, upon which work will begin soon. A few have been operated in a small way all winter, the ore being put into stockpiles as fast as mined, preparatory to shipping by wagon about June 1.

Fourth-of-July—At this mine, in the Pikes Peak district, being worked by William Gilner, a 15-in. vein of gold-bearing ore has been encountered in No. 3 tunnel.

Eureka—Thomas Richards and Benjamin Witte have been working on this claim part of the winter, and have stocked 20 tons of ore, running from $75 to $200 per ton. The mine is 15 miles from Gold Creek, the nearest point to the railroad, but the ore is profitable. Plans are being made to erect a mill in the district within a year.

SILVER BOW COUNTY

Cardiff—Thomas Edwards and Joseph Stevens, owners of this gold claim, in the Highland district, south of Butte, will commence operations there soon. When they stopped work last winter, they were working on a faulted vein, which ran as high as $30 per ton in gold in places.

Nevada

COMSTOCK LODE

Ophir—In the southwest drift on the 2500-ft. level, quartz in place extends across the full width of the drift, the assays averaging about $10 per ton. It is the first pay ore found in this prospecting work. The ore stoped above the 2100-ft. level is showing higher average assays. Returns received last week from the smeltery gave a net yield of $19,258 on the first shipment of concentrate of Run 38 at the Kinkead mill. A cleanup is now being made. The company is preparing plans for a cyanide plant to work the tailings that have accumulated during the last two years.

Confidence—In cutting out a station on the east side of the joint shaft at the 200-ft. level, ore averaging $23 per ton has been broken down. The station has been advanced about 10 ft. to the east and is in ore on all sides.

Mexican—The mill last week treated ore worth $11,000, with a theoretical extraction of 91%. Second-class ore is being stoped from the 2300, 2400 and 2500 levels.

Consolidated Virginia—New work has just been started on the 2300-ft. level south of the main shaft. A south drift is being driven from the west crosscut, and will pass along the foot-wall of the main Comstock vein.

ESMERALDA COUNTY

Golden State Mining Co.—This company, owning claims in the Klondyke district, expects to erect a preliminary test mill on the property. Later it is planned to erect a 100-ton plant. James Golden, Goldfield, is the principal owner.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended May 9, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,350	62,219
Tonopah Belmont	1,550	39,676
Montana-Tonopah	1,136	19,245
Tonopah Extension	1,015	18,037
West End	675	13,409
Midway	......	180
MacNamara	485	6,335
North Star	......	80
Totals	8,211	159,181
Estimated value	$204,600	....

Tonopah Extension—The production for April amounted to 4322 tons, which yielded bullion worth $57,700. The oreshoot on the 500-ft. level, in the western workings is 29 ft. wide, averaging from $18 to $25 per ton.

MacNamara—The mill is treating 65 tons per day, of from $18 to $21 ore. Several new orebodies have been opened on the upper levels and the development of a 30-ft. vein is in progress on both the 700 and 800 levels.

Tonopah—During April, the company milled 13,842 tons of $19.48 ore and shipped 264,570 oz. of bullion worth $215,200, and 97 tons of concentrates worth $37,500. Net profits amounted to $156,204.

Tonopah-Belmont—During April 8390 tons of ore were milled for a total of 260,008 oz. silver and 2581 oz. gold. The net profits were $143,005. The work of retimbering the main shaft to the 1000-ft. level is nearing completion and a concrete collar, sunk to a depth of 14 ft., is being set on all sides of the shaft. The new mill is expected to be in operation about July 1. A new vein of low-grade ore was cut on the 1100-ft. level recently at a point about 600 ft. north of the shaft.

West End—The sinking of the main shaft from the 500- to the 600-ft. level has been commenced, consequent upon the strength of the orebodies in the lowest levels. In the extreme western workings, a winze is being sunk from the 500-ft. level on a shoot of rich ore in a vein 28 ft. wide, averaging $30 per ton.

Philadelphia—This 50-ton mill at Manhattan, having 10 stamps and a tube mill, has resumed the treatment of custom ores.

Associated—This 50-ton mill has milled 1000 tons of ore from the Steffner lease on the Manhattan Consolidated, which averaged $19 per ton. It is now milling 1000 tons from the White Caps that are averaging $45 per ton and has contracted for 1000 tons more from each of these leases. The Big Four company has decided to build a 10-stamp mill and construction work will commence soon.

WASHOE COUNTY

Nevada-United—The company's property is situated five miles northeast of Reno and 1½ miles from Sparks. The holdings include 57½ acres in a body, 40 acres of which are patented. The company's workings are said to contain some $26 milling ore. Nine subleases are stated to have been let, and are operating. Royalties to the company run from 10 to 25%. The erection of a 100-ton mill is planned. Present equipment includes a 15-hp. Fairbanks-Morse engine, boarding house, stables, orebins, etc. Edwin Arkell is president and the offices of the company are Suite 208, Peters Building, Reno.

Cortez—J. B. Menardi, of Reno, owner, states that sufficient lead-silver-gold ore has been developed to warrant the construction of a simple 50-ton concentrator, to be supplemented later with cyanide treatment. The mill is expected to be in operation in the autumn.

WHITE PINE COUNTY

As a result of a recent examination by J. E. Spurr and M. B. Huston, development work has been resumed on the tungsten mine on the west slope of Mt. Wheeler, 30 miles southeast of Ely. The mine is equipped with air drills and has an efficient mill of small capacity. One car of 60% concentrates was shipped a year ago. The ore is hübnerite in granite country rock.

Giroux—Work is practically confined to surface improvements around the Morris and Bunker Hill shafts, and the production of about 100 tons of ore per day, incidental to underground development. Crosscuts and raises are being run in the orebody. Excavation and foundations have been started for large orebins at the Morris shaft, the cars at present being loaded with a temporary chute near the collar of the shaft. The collar of the Morris incline, east of the Bunker Hill shaft, is being raised and the shaft otherwise repaired for lowering timber, tools and men. At the Giroux shaft the water is being held below the 1400-ft. level by pumping about 900,000 gal. per day.

Nevada Consolidated—Six per cent. sulphide ore was struck recently near the west side of the Veteran orebody. The ore appears to be a comparatively unaltered monzonite and may lead to deeper mining than has been contemplated on this property.

New Jersey

Pahaquarry—At this copper mine on the Delaware River in Warren County, work has been resumed after a suspension of about six months. Workmen are now busy cleaning out the drifts and adits and putting the machinery in order.

New Mexico

GRANT COUNTY

Apache Box—The first payment of $12,500 on the purchase price of these claims was made recently in Bisbee, by W .H. Small, of El Paso, Texas, one of the men interested in the option taken from the original owners. The purchasers are the Smith Brothers, of Springfield, Mass. Mr. Small, who has returned from the East, says that they will begin soon the erection of a 250-ton mill and cyanide plant. Miners are at work developing the claims.

Chino—During the quarter ended Mar. 31, 160,400 tons of ore were treated, yielding 8048 tons of concentrates, containing 20.33% copper, and 2,271,980 pounds.

SANTE FE COUNTY

Sante Fé—Material has arrived and teams are at work, hauling it to the mines at San Pedro, 15 miles. New houses for employees will be erected, and operations will be resumed on a large scale. It is expected that traction engines will be used to transport ore and supplies from the railroad.

SOCORRO COUNTY

Ozark Smelting & Mining Co.—Ground has been broken for a large mill which will use a new process that has been developed for working the complex zinc-lead-iron sulphide ore of this district. Philip Argall & Sons, of Denver, are consulting engineers.

Pennsylvania

LANCASTER COUNTY

Safe Harbor Iron & Steel Co.—This company, of 42 New St., New York, has purchased the Mastic iron mine, seven miles from Lancaster, and will operate it. The proposed ultimate capacity is 1000 tons of product per day. The ore is magnetite in schist and from four to five tons of rock will be required to yield one ton of product. Magnetic concentration and sintering will be used. The indicated rock tonnage is estimated at 7,000,000 tons. Experiments with electric smelting are being made. C. L. Constant is the consulting engineer.

South Dakota

BLACK HILLS DISTRICT

Wasp No. 2—High-grade ore is being sacked. The recent discovery was made under the quartzite, in what appears to be a fissure vein. The shoot is about 2 ft. wide with its length not yet determined. Assays show from $21 to $417 per ton, with the average samples showing better than $250 per ton. This material is being sacked for shipment to a smeltery. The mill is running regularly at full capacity, 480 tons per day.

Tennessee

Virginia Iron, Coal & Coke Co.—This Roanoke, Va., company is said to be conducting experiments near Butler, with a view of purchasing a large tract of magnetic ore land.

Utah

EMERY COUNTY

Active drilling for oil has begun in the San Rafael field south of Green River. Charles P. Taske, of Philadelphia, W. V. Young, of New York, and California and Texas men are interested in the explorations.

GRAND COUNTY

Utah Rare Metals—This company has made a shipment of 30 tons of carnotite from Cisco. The property is developed with a 25-ft. shaft and drifts.

JUAB COUNTY

Tintic shipments for the week ended May 10 amounted to 173 cars.

Iron Blossom—A cave occurred in the No. 1 shaft between the 300- and 600-ft. levels, causing serious damage and cutting off shipments from that shaft. The caved ground is to be encircled by a drift, which will afford an outlet for the ore. This work will be completed in about 30 days. In the meantime shipments will be reduced.

Opohongo—Drifting is being done east and west on the 1000-ft. level, where conditions are good. The winze from the 700 has been sunk 40 ft. below that level. Sinking was abandoned at that point, as the ore can be handled more easily from the level below. Shipments are coming from the 500, the 700, and above and below the latter. The output for the week ended May 10 was four cars.

Emerald—Development continues through the Opex. The raise from the 2000-ft. level is up 175 ft., and drifting to the north is being done from the raise. The work is in limestone.

Swansea—Shipping ore has been opened in the north drift from the 940-ft. level. This drift will soon reach the winze sunk below the 800 level.

Lower Mammoth—Development is being done on the 1000-, 1500- and 2000-ft. levels. On the 1000 a strike is reported.

SALT LAKE COUNTY

Alta Consolidated—The upper contact has been reached about 125 ft. above the tunnel level, and good ore opened.

Kennebeck—This property is being worked by leasers and ore is being sacked.

Tar Baby—Work on the tunnel will be resumed soon.

Summit County

Park City shipments for the week ended May 11 amounted to 3,595,840 pounds.

Daly West—The mill is being prepared for the resumption of operations, suspended owing to the freezing of the water supply in the winter. The date of resumption will be about June 1. Shipments for the week ended May 11 were 950,000 pounds.

Utah County

Union Chief—A car of silver-lead ore is being marketed.

Washington

Stevens County

United Copper—About 60 men are working and considerable development is planned.

Imperial—Five men are installing a compressor.

Blue Star—The property is under lease and is making a good showing. Six cars of ore were shipped during the winter.

Wisconsin

Douglas County

David Dobie, of Superior, and others are engaged in explorations for iron near Gordon. This area is supposed to be entirely within the Keweenawan formation and generally is believed not likely to disclose commercial iron. Drills are operated but no specific results are announced.

Weyerhauser—This copper property in the southeastern part of the county, is still being extensively drilled. The operations are on the southern edge of the Keweenawan synclinal and are considered more likely to find copper than the attempts made some years ago on the Douglas range to the north.

Canada

British Columbia

Motherlode Sheep Creek Mining Co.—This company, a Maine incorporation owning mining property and a newly erected stamp mill at Sheep Creek, in the Nelson mining division, commenced milling gold ore early in May. During two years development was carried on until the continuance of the ore to 500 ft. was shown; then a mill having ten 1250-lb. stamps, tube mill, amalgamating plates, Dorr continuous thickener, Pachuca and cyanide tanks, Merrill clarifying and precipitation presses, etc., was installed. Water is delivered at an average effective pressure of 600-ft. head. Power is derived from six Pelton waterwheels, which drive all machinery and a compressor with a capacity of 1440 cu.ft. of air per min. An aërial tramway, 3600 ft. long, from mine to mill, has also been constructed.

British Columbia Portland Cement—A plant of 700-bbl. daily capacity is being built.

British Columbia Copper—The company is developing properties on Copper Mountain, under bond.

Ontario

St. Anthony—At the 100-ft. level of this mine in the Sturgeon Lake district there is a stope 160 ft. long and 30 ft. wide of ore stated to average $12 per ton. The vein has been cut again at the 170-ft. level.

Ontario-Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended May 17, and for the year to date, are:

La Rose	67.11	1,248 18
Coniagas.		697 75
O'Brien.		263 21
Right of Way		148 60
Chambers-Ferland		161 60
McKinley-Darragh	26.87	982 61
Nipissing		695 44
Hudson Bay	62 74	312 62
Buffalo	30.20	412 57
Crown Reserve		190 93
Cobalt Townsite	30.38	505 28
City of Cobalt		145 84
Trethewey		174 19
Colonial		41.60
Kerr Lake	26.87	319 66
Cobalt Lake		176 26
Drummond		300.32
Temiskaming		320 64
Beaver		132 34
Wettlaufer		111 21
Provincial		22 22
Casey Cobalt		24 50
Totals	244.17	7,255.60

Bullion Shipments in Ounces

Mine	Week	Year to Date
Nipissing	76,490.00	1,453,429 72
Kerr Lake	2,774.00	7,240 25
O'Brien	15,598.54	88,433 01
Buffalo	7,500.00	38,938 00
Crown Reserve	6,060 00	207,203 00
Colonial	1,698 00	1,698 00

Nipissing—The best development during April was at vein 122, where 60 ft. below the surface the drift is in 6 in. of ore stated to assay 5000 oz. At the Meyer shaft work on the third level shows places in the vein where there will be from 10 to 12 ft. of milling ore.

Ontario—Porcupine

Dome—On May 16 the company shipped another $25,000 brick, bringing the total to 279 lb. Three mules have been imported to do the underground tramming and are the first of these animals to be used in northern Ontario. The difficulty of securing a sufficient water supply still continues and for a month not more than 20 stamps have been running at once.

Hollinger—Good progress is being made on the mill, which should be ready in June. Further delays in the delivery of material for the mill have resulted in a change of plans. The mill will be started without waiting for the large crushers. A small crusher, now on hand, will be used on the dump rock, and the milling begun as soon as the tubes and cyanide plant are completed.

Armstrong-McGibbon—A steam plant is to be installed on the property in Deloro township.

Foley-O'Brien—Work is to be resumed on this property. There are still about $132,000 left in the treasury.

Ontario-Sudbury

Wahnapitae Gold—The building of the Montreal line of the Canadian Northern R.R. across the southern portion of the Wahnapitae district has been a great help toward awakening interest in these claims. The old Charlie Ford claim was restaked by local men and sold to J. D. Taylor, of Toronto, who has about 25 men stripping and test-pitting. Judging by the reports and samples brought to Sudbury the claim is showing up well.

Wahnapitae Power Co.—The wheel and dynamo furnishing power to Sudbury were not seriously injured and were able to start after the dynamo had been dried out. This unit had sufficient excess power to furnish lights for all the company's customers and power to operate the Garson mine. The other unit is now repaired and power for the Moon Mountain and Whistle mines will be turned on soon.

Mexico

Baja California

Progresso—This company in the San Antonio district has started the erection of a new and larger mill.

La Junta—A property of this name has been purchased by Los Angeles men. It is near the San Antonio district.

Chihuahua

Rio Tinto—This copper mine, at Terrazas, is reported as still in operation, under James Corrigan and Price McKinney, as is also the Concheno silver-gold mine. Four hundred men are employed at the former and 800 at the latter. The Concheno 150-ton cyanide plant is being operated night and day, and an electric plant is being installed.

Batopilas—This company is operating steadily with 350 men. On May 11, a shipment of bullion reached El Paso, via. Creel, on the Kansas City, Mexico & Orient R.R. and the Mexico Northwestern Ry. Freight is being sent to the mine via Nogales and San Blas, to Fuerte and thence over the mountains.

Africa

Transvaal

Gold production in April was from the Witwatersrand, 706,763 oz.; outside districts, 30,897 oz.; total, 737,660 oz. This was 93,063 oz. less than in March; but the March report included 70,143 oz. transferred from reserves. For the four months, ended Apr. 30 the total was 2,605,654 oz. in 1911, and 3,009,309 oz.—or $62,202,417—in 1912; an increase of 403,655 oz. this year. The native labor report shows a total of 220,036 negroes employed, an increase of 3069 over March.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, May 22—The feature in the coal market this week is the acceptance by the mine workers in the anthracite region of the compromise agreement concluded by the committee. As already noted, this provides for 10% advance in wages, but does not include the check-off provision. The agreement for four years was signed in Philadelphia today. All preparations are being made to resume work at once.

This resumption comes just in time, for anthracite stocks were pretty well exhausted, and the market is quite ready to take the coal as soon as it can be shipped.

The seaboard bituminous trade is dull and the market is overstocked. It has not recovered from the heavy shipments to tidewater made in anticipation of trouble. There are still some lots of demurrage coal, which bring low prices.

In the West there is nothing new except that shipments to the Lake trade are increasing. Demand is fair and the markets are rather quiet.

The Southwestern Interstate Coal Operators' Association reports shipments as follows in January, short tons:

	1911	1912	Changes
Missouri	248,159	281,453	I. 33,294
Kansas	462,624	537,928	I. 75,304
Arkansas	143,445	155,666	I. 12,221
Oklahoma	251,411	348,982	I. 97,571
Total	1,105,639	1,324,029	I. 218,390

These shipments cover over 90% of the coal mined in the states named.

German Coal Production—Coal production of German Empire three months ended Mar. 31, metric tons:

	1911	1912	Changes
Coal	40,206,274	42,021,733	I. 1,815,459
Brown coal	18,571,886	20,413 947	I. 1,842,061
Total mined	58,778,160	62,435,680	I. 3,657,520
Coke made	6,364,091	6,742,553	I. 378,462
Briquettes m'de	5,311,385	5,841,900	I. 530,515

Of the briquettes reported this year 4,619,710 tons were made from brown coal or lignite.

German Coal Trade—Exports and imports of fuel in Germany, three months ended Mar. 31, metric tons:

	Exports	Imports	Excess
Coal	7,595,300	1,899,044	Exp. 5,696,256
Brown coal	13,930	1,871,904	Imp. 1,857,974
Coke	1,305,014	132,262	Exp. 1,172,752
Briquettes	663,791	50,367	Exp. 613,424
Total	9,578,035	3,953,577	Exp. 5,624,458
Total, 1911	8,093,576	4,033,034	Exp. 4,060,542

Exports this year included 5325 tons of coke to the United States.

British Coal Trade—Exports of fuel from Great Britain, with coal sent abroad for use of steamers in foreign trade, four months ended Apr. 30, long tons:

	1911	1912	Changes
Coal	20,049,233	13,967,643	D. 6,081,590
Coke	310,909	288,204	D. 22,705
Briquettes	548,697	395,188	D. 153,509
Total exports	20,908,839	14,651,035	D. 6,257,804
Steamer coal	6,169,010	4,893,370	D. 1,275,640
Total	27,077,849	19,544,405	D. 7,533,444

Imports were 5259 tons in 1911, and 107,812 in 1912. For the month of April the exports were 1,494,571 tons, against 4,847,881 in 1911; showing the results of the coal strike.

IRON TRADE REVIEW

New York, May 22—The iron and steel markets are still active, with evidences of continued large demand. This has been increased by orders from railroads for rails and equipment. The rail orders are rapidly approaching a large total. The large proportion of openhearth rails ordered is disarranging the market a little, and it begins to look as if openhearth steel would soon be in short supply. Already some large producers are out of the market on billets and sheet bars, and consumers are having some trouble to get what they need.

On plates, shapes, sheets, bars and wire, specifications on contracts are large and new orders considerable in volume. Structural steel is a little quieter, but there is still a good deal of business in sight. Advanced prices are generally held, the only exception being with bars at mills in the East.

Pig iron is the lagging part of the market. New orders are being placed, but not to the same extent as with finished material. Prices are slow in advancing, and furnaces find it hard to secure the 25 or 50c. more which they ask. Southern iron has done better than Northern, both as to orders and prices. Scrap is active and there is a good demand for heavy steel melting scrap.

Birmingham

May 20—Southern pig iron is again selling steadily, and while no big lots were placed during the last week, there was quite an aggregate sold. Delivery in the main is still for the third quarter of the year, while only a little of the business so far, comparatively speaking, is for the last quarter. The quotations are firm with $11 per ton, No. 2 foundry, as the basis. One or two companies are practically out of the market on anything under No. 2 foundry for delivery during the third quarter of the year. Inquiries are coming in again for a large quantity of iron for the cast-iron pipe makers. There is some delay in starting up additional furnaces, and it may be 30 days yet before the two which are almost in shape for operation can be ready. So far there has been no delay in deliveries save as to the lower grades of iron. The accumulated stocks of pig iron are going down rapidly. Before the summer is over, however, it is figured a material increase in the production can be provided. There is no trouble whatever in securing raw-material supplies. Cheaper coke is announced, as more of the byproduct coke ovens are placed in operation.

Machine shops and foundries in Southern territory are doing a little better every week, and it is believed that the best summer since 1907 will be experienced this year. There is a better feeling again noted in steel circles.

Baltimore

May 20—Exports for the week included 217,530 lb. pig iron for Scotland, and 133,887 lb. clips, hoops and car iron to Hamburg and London. Imports included 17,020 tons of Cuban iron ore. The stevedores strike still disturbs port conditions here.

Chicago

May 20—The iron market is steady, with the demand good in nearly every line, and pig-iron prices tending to strengthen. There are no sales of pig in large tonnage, but the market demands continuously a large aggregate tonnage, with melters inclined to buy farther ahead than sellers are willing to contract for, at current prices. Under these circumstances, actual sales are dependent on an adjustment of claims and expectations. For the producer of pig iron, it seems a strong market, since general consumption is rising and the tone of the market is bullish.

Northern No. 2 foundry sells for $15 on most business, with a rather wide range above and below—50c. each way—because of varying conditions of melters and their requirements. Southern No. 2 is holding to $11, Birmingham, or $15.35, Chicago, as a minimum, with almost an equally wide range—certainly 25c. above and below this quotation. Lake Superior charcoal iron sells at $16@16.50, and is in good demand with no over-supply.

In the iron- and steel-products market, the structural-iron demand continues good at 1.43c., with new contracts appearing constantly in the wide territory about Chicago, for building and bridge needs. Railroad business is improving as to orders for standard rails, while light rails and track fastenings are in increasing demand. Bars continue strong, with soft-steel bars at 1.38@1.43c., and bar iron 1.20@1.25c. Plates are fair sellers and wire goods are active. The general tone of business is strong and improving.

Cleveland

May 20—Weather conditions have been bad, and the ore receipts are still light.

Pig Iron—There have been many small sales and a number of inquiries. Prices are unchanged, except that 25c. more is asked for No. 2 foundry.

Finished Material—Specifications continue to be heavy, but new orders are rather slower, except for bars and wire. Prices are well held, except on bars, where there is some cutting.

Philadelphia

May 21—There is a good deal of half-dead-and-alive inquiry in the market for pig iron today with little actual business, as some of the inquiries presented are from people who are only willing to buy if they can dictate the prices. The strange impression prevails among some would-be buyers that with a little delay, probably after some furnaces blow in, they will be able to buy iron on their own terms. Interior concerns are figuring on a large amount of ferromanganese. While the tone of the market is strong, as it has been for two or three weeks, the purchases made have been mainly a little below asking prices. Steel irons are strongest, and foundry iron comes next. The stocks of No. 2 iron are in pretty good shape, which accounts for the halting quality. Low-grade iron for pipes has moved a trifle up and large sales have been made at the advance. Some concerns, in sight of big contracts, are endeavoring to cover at quotations ruling before the recent advance. Forge iron is standing still and large sales are unknown, though offers have been made by a number of Eastern bar mills, which will probably result in business, because of the heavy prospective demand for forge for car purposes. In a general way there is a stronger disposition to buy iron for forward requirements and anything like a conciliating disposition will bring out a good deal of business. At the same time, the chances for advanced pig-iron prices are stronger than they have been for many months. It is to be noted that the quotations for Southern foundry, as well as forge, have moved up with Northern. Sales of No. 2 Southern have been made at $15@15.25, and good gray forge has been bought at $14.25, which is about the same price inferior Northern forge has brought.

Steel Billets—A sharp advance has stimulated the inquiries for considerable supplies, covering in some cases only immediate delivery and in other cases deliveries delayed from two to four months. Supplies in the hands of consumers are light. Work calling for billets has increased and buyers must have them. The present indications are for a further advance.

Bar Iron—Bars have further advanced fractionally in small sales. In a large way quotations remain the same. Inquiries are increasing and the volume of business is gaining ground.

Sheet Iron—Sheets have been advanced fractionally on small orders for nearby delivery, and orders, particularly for galvanized, are brisk. The mills have a volume of business that will enable them to run to full time, though the hesitancy shown by the larger consumer indicates a lack of confidence in the permanency of present asking prices.

Pipes and Tubes—Tubes have advanced, especially in seamless, and a higher level may be regarded as permanent. The mills are booking a good volume of business and indications point to a continuous demand throughout the summer.

Plates—Business in plates is steadily increasing because of the inrush of orders from every branch of trade using that product. Car, bridge and ship work and general construction are all expanding, and the policy of consumers is to cover requirements as soon as contracts are closed. There are some exceptions to this rule, notably in car construction. The largest volume of business in plate seen within a year is now presented and an exceptionally large amount of business will be placed for distribution throughout the week. Bids are now under consideration for structural work throughout the week, especially in New York City; the disposition will probably be known before Saturday. The placing of this large amount of work will probably be followed by a further fractional advance in prices.

Structural Material—An exceptionally large volume of business in structural material is likely to be placed any day, as negotiations have been brought down to the signing point. A large percentage of this work is for use in New England and the Middle States east of the mountains.

Steel Rails—Orders foot up well for the week, amounting to about 50,000 tons for Eastern delivery, with much business now in the way of being closed.

Scrap—Scrap is active and a great deal of business has been transacted in old iron rails, steel and iron axles, heavy melting and railroad scrap.

Pittsburgh

May 21—Specifications for finished-steel contracts continue to exceed the current shipments, and the mills are daily getting into stronger position. The market, however, is not strictly in a stronger position, for the reason that July 1 is approaching, when many existing contracts will expire, and it is only natural that specifications should be heavy at this time, when so much of the contract business is at about $2 a ton below the going market. Strictly new buying is lighter than it was a fortnight ago, while it is improbable that fresh contracting for third and fourth quarters will mean as much tonnage as the contracts which are expiring.

Thus the prospect is that buying will be lighter during the next few months, but with the large accumulation of business on books, the mills will be able to maintain the present full operations for several months to come. There may be some additional pressure for material, which will force prices still higher, but this is not in sight thus far. Railroad buying probably holds the key to the situation. This has not been as heavy in the past 10 days as was predicted, and there is reason to suspect that some of the railroads have modified their ideas as to car orders when they found they would have to pay considerable advances over the prices ruling last November, when the foundation for the present movement was laid.

Steel-mill operations continue at record rate, making an average of close to 90% of capacity.

On Friday, May 17, the American Sheet & Tin Plate Co. advanced prices on all its coated tin-mill products about $2 per ton, advancing its minimum price on 100-lb. coke tin plates from $3.40 to $3.50. Most of the independents, however, will still sell at $3.40 on desirable business, with deliveries running through the year.

This morning the National Tube Co. announced an advance of about $2 per ton on welded-steel boiler tubes, reducing the card discount on sizes 3½ to 4½ in. from 75% to 74% off list. On desirable business two extra fives are given. The outside producers are expected to make a similar advance, as the market has been growing stronger steadily and producers are well filled. No change in merchant-pipe prices is expected, at least between now and July 1.

Pig Iron—The market is firm, but not active. Buyers are not taking hold freely, and furnaces are indifferent. They are well sold up, but do not care to advance prices and encourage the blowing in of additional furnaces. We quote: Bessemer, $14.25; basic, $13@13.25; malleable, $13; No. 2 foundry, $13.25; forge, $13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The latest advance in ferromanganese puts the market to $48.50, Baltimore, for contracts extending over the second half, and it is not easy to buy even at this figure. There have now been three $2.50 advances in about a month. When the market first started advancing, it was due to the understanding between the English producers, but the late advances have been directly attributable to the scarcity of ore, as it is difficult to get any vessel room. Small prompt lots have been selling at $50 to $55, Baltimore, freight to Pittsburgh being $1.95.

Steel—The market continues quiet. Consumers would like to have better deliveries on contracts, but can hardly afford to make fresh purchases at prices so much above the level of contracts now running. There are some sheet-bar contracts in force at about $19, maker's mill. We quote, f.o.b. maker's mill, Pittsburgh: Billets, $20.50@21; sheet bars, $21@21.50. Prices, f.o.b. maker's mill, Youngstown, are about 50c. less. Wire rods are $25@26, Pittsburgh, but quiet.

Sheets—The market shows no particular change. Mills are running a trifle better than they were, and are in receipt of better specifications, but new buying is rather light. We quote: Blue annealed, 10-gage, 1.40c.; black sheets, 28-gage, 1.90@1.95c.; galvanized, 28-gage, 2.95@3.00c.

St. Louis

May 20—The demand for pig iron is steady, though not so active as for several weeks. A number of good-sized contracts have been closed and the inquiry is fair. Demand for finished products of all kinds is good. Nearly all of the steel foundries are running nearly full time. The price of No. 2 foundry remains at $11@11.50 per ton, Birmingham, or $14.75@15.25 per ton, St. Louis. Northern No. 2 foundry iron is being quoted at around $15. Coke is in good demand. Seventy-two hour foundry is bringing from $5 to $5.10 per ton, St. Louis.

Foreign Iron Trade

British Blast Furnaces—The quarterly statement of the condition of blast furnaces in Great Britain shows that the average number in blast for the quarter ended Mar. 31, was 214. On Mar. 31, however, only 55 were active, showing the effect of the coal strike.

British Iron and Steel—Pig-iron production in Great Britain in 1911 was 9,718,638 long tons, against 10,216,745 in 1910; a decrease of 498,107 tons, or 4.9% last year.

Steel production in 1911 was 6,461,612 tons, against 6,010,084 in 1910; an increase of 450,528 tons, or 7.5%. The details of the make have not yet been received.

German Iron Production—The German Iron & Steel Union reports the make of pig iron in Germany in March at 1,424,076 metric tons which is 104,249 tons more than in February. For the three months ended Mar. 31 the total was, in metric tons:

	1911	1912	Changes	
Foundry iron	775,637	751,321	D.	24,316
Forge iron........	148,414	136,954	D.	11,460
Steel pig..........	428,202	518,245	I.	90,043
Bessemer pig.....	77,781	86,428	D.	1,353
Thomas(basic)pig	2,381,957	2,623,704	I.	241,747
Total......	3,821,991	4,116,652	I.	294,661

The total increase this year was 7.7%. Steel pig includes spiegeleisen, ferromanganese and all similar alloys.

German Foreign Trade—Exports and imports of iron and steel, and of machinery, in Germany, three months ended Mar. 31, in metric tons:

	Exports	Imports	Excess	
Iron and steel...	1,428,482	163,760	Exp.	1,264,722
Machinery.......	117,410	18,548	Exp.	98,862
Total...........	1,545,892	182,308	Exp.	1,363,584
Total, 1911......	1,384,185	148,554	Exp.	1,235,631

Increase in exports, 161,707; in imports, 33,754 tons.

METAL MARKETS

New York, May 22—The metal markets have been generally active with prices inclined to advance during the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Apr. 1912..	$ 1,816,816	$ 3,892,599	Imp.	$2,075,783
" 1911..	1,505,634	4,524,835	Imp.	3,019,201
Year 1912..	21,774,902	16,306,794	Exp.	5,468,108
" 1911..	3,364,658	23,990,572	Imp.	20,625,914
Silver				
Apr. 1912..	4,941,259	4,189,512	Exp.	751,747
" 1911..	7,610,154	4,251,532	Exp.	3,358,622
Year 1912..	21,897,247	16,039,732	Exp.	5,857,515
" 1911..	23,611,196	11,898,313	Exp.	8,712,883

Exports from the port of New York, week ended May 18: Gold, $1000; silver, $856,845, chiefly to Paris and London. Imports: Gold, $387,587; silver, $404,916, principaly from Mexico and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d per oz. for American coin. There was about the usual demand for India. In New York $500,000 was taken for export to Argentina, and more is expected to follow.

Platinum—There was more demand for platinum during the last week than for some months, but prices remain unchanged at $45.50 per oz. for refined platinum, and $48 per oz. for hard metal, up to 10% iridium. Abroad, the platinum market was easier.

Our Russian correspondent writes, under date of May 9, that the market is dull and inactive. The demand from abroad has considerably decreased and this has a depressing influence on the market. The stock of platinum with the speculators is rather large, but being in firm hands a sharp fall of prices is not expected. Therefore the prices have not decreased, correspondingly to the position of the market.

The quotations are: St. Petersburg, $36.75 per Troy oz.; at Ekaterinburg, $36.85 per ounce.

Iridium—Prices remain unchanged at $64 per oz. for pure metal, New York.

Silver—The price has been well maintained. The currency returns in India continue to attract a good deal of attention, and it is to the holdings of rupees being now reduced to 11½ crores, that the good undertone of the market must be attributed.

SILVER AND STERLING EXCHANGE

May	16	17	18	20	21	22
New York....	61⅜	61⅜	61¼	61⅜	61⅜	61⅛
London....	28¼	28¼	28 3/16	28¼	28¼	28⅛
Sterling Ex..	4.8685	4.8680	4.8705	4.8705	4.8705	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper—The strength in this market, which became emphasized last week, has continued, a large business having been done since May 15. Certain sellers having retired from the market because of exhaustion of their supplies, and the demand continuing strong, a sharp advance was the natural result. The labor difficulties at the Baltimore refinery (now settled) seem also to have been a factor. In the aggregate a large volume of business has been transacted, both for foreign and domestic account. At the end of the week, the leading sellers of Lake copper were asking 16¾c. Electrolytic was held at 16⅝c., delivered, usual terms, by some agencies, but others were still supplying the demand at 16½c., delivered, usual terms. The market closes firm with Lake copper at 16⅝@16¾c., and electrolytic in cakes, ingots and wirebars at 16.30@16.40c. Casting copper is quoted nominally at 16@16⅛c. as the average for the week.

Speculators, observing the improvement in the statistical position of the metal and the increased demand for refined copper, bought standard copper freely. The market was strong and advancing, and closes at £73¾ for spot, and £74⅛ for three months.

Copper, Tin, Lead and Zinc

NEW YORK

May	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
16	16 @16¼	15.95 @16.05	46½	4.20	4.05 @4.10	6.65 @6.75	6.50 @6.60
17	16⅛ @16⅜	16.05 @16.16	46½	4.20	4.05 @4.10	6.65 @6.75	6.50 @6.60
18	16¼ @16½	16.15 @16.25	46½	4.20	4.05 @4.10	6.65 @6.75	6.50 @6.60
20	16⅜ @16¾	16.25 @16.35	45⅞	4.20	4.07½ @4.10	6.70 @6.80	6.55 @6.65
21	16⅜ @16¾	16.30 @16.35	45¾	4.20	4.07½ @4.10	6.70 @6.80	6.55 @6.65
22	16⅝ @16¾	16.30 @16.40	45	4.20	4.07½ @4.10	6.70 @6.80	6.55 @6.65

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

May	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
16	73	73$\frac{7}{16}$	78	212½	207½	16$\frac{7}{16}$	25¾
17	74	74$\frac{7}{16}$	79	212½	207½	16½	25¾
18	......	......	......	......	......	......	......
20	73$\frac{13}{16}$	74$\frac{5}{16}$	79¾	209	204	16½	25⅞
21	74	74⅜	79	208	202½	16½	25⅞
22	73¾	74⅛	79	205	200¾	16½	25⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, ± £1 = ± 21¾c.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantites. Copper wire has advanced to 17½c. base, carload lots at mill.

Copper exports from New York for the week were 5823 long tons. Our special correspondent gives the exports from Baltimore at 2007 tons.

Tin—The London market evinced a rather weak tone during the last three days. Heavy shipments from the East, from where no increase in supplies was expected, is given as the cause for the decline in price. In this market there is an ample supply of spot material, and a good business was done in June tin. It is to be observed that prices quoted here now come closer to the import basis than for some time past. The market closes weak at £205 for spot, and £200¾ for three months, and about 45c. for May-June tin.

Lead—The market continues firm at 4.20c., New York, while St. Louis is a little stronger at 4.07½@4.10, owing, it is said, to threatened labor difficulties. Otherwise the lead market exhibits no special feature.

The London market is firm at £16½ for Spanish lead, and £16⅝ for English.

Spelter—The market is quiet, buyers having largely supplied their near-by requirements by their large purchases during the previous fortnight. However, some fair tonnages are reported sold during the last week and at slightly better prices. At the close, St. Louis is quoted at 6.55@6.65c. and New York at 6.70@6.80c.

The market in London is firm, good ordinaries being quoted at £26⅞, and specials at £27⅛.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7⅛c. per lb., New York, in carload lots.

Other Metals

Aluminum—The quotation for aluminum ingots in London, May 18, was £68 per long ton—equal to 14.75c., per lb., which is equivalent to about 22c., duty paid, New York. Trade in New York was exceedingly dull, both as to inquiries and sales. We quote 21½@22c. per lb. for No. 1 ingots, New York.

Antimony—The general feeling among dealers is that prices will advance, no one knows exactly why, and the tone of the market is firmer. Cookson's is still quoted at 8c. per lb., Hallett's at 7¾c., and Chinese, Hungarian and other outside brands at 7@7¼c. per pound.

Quicksilver—The market remains fair and prices are unchanged. New York quotations are $41@42 per flask of 75 lb., with 60c. per lb. charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for exports. The London price is £8 5s. per flask.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Zinc and Lead Ore Markets

Joplin, Mo., May 18—The highest price for zinc ore in the history of the district was paid this week, or rather settlement was made this week for one lot of ore purchased last week, on a $58 base of 60% zinc, which netted $61.65 per ton. The base this week is $52 to $57. Zinc silicate sold from $27 to $30 per ton of 40% zinc. The average price, all grades of zinc, was $53.16 per ton. The high price of lead ore was $54, and the average price $50.06 per ton.

The zinc-ore market took a slump this week of $2 per ton on the high-grade ores, and some producers did not sell, thinking before the week-end that the price would stiffen and they would get last week's prices, but such was not the case. The week has been a good one for producing, and the output is fast recovering from the reduction made by the floods of two weeks ago.

SHIPMENTS, WEEK ENDED MAY 18

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,353,210	......	860,640	$144,694
Joplin........	1,640,410	......	254,600	52,423
Duenweg.....	703,880	......	36,020	20,290
Alba-Neck....	616,240	......	......	17,870
Oronogo......	786,750	......	......	17,121
Galena.......	534,720	......	55,700	16,363
Granby	224,280	516,540	10,530	13,815
Jackson......	485,230	......	14,060	13,451
Spurgeon	273,570	210,600	13,780	10,342
Cave Springs.	299,040	......	54,480	10,086
Miami.......	258,240	.....	152,600	10,012
Carl Junction	209,690	......	......	6,290
Springfield ..	172,000	......	......	4,795
Aurora.......	92,260	......	......	2,583
Lawton	69,330	......	33,000	2,485
Wentworth...	34,300	......	....	857
Totals.....	10,743,160	727,140	1,485,310	$343,477
20 weeks...	200,803,160	12,458,410	33,509,780	$5,993,303

Blende val., the week, $293,629; 20 weeks, $4,895,758
Calamine, the week, 11,289; 20 weeks, 182,149
Lead value, the week, 38,669; 20 weeks, 915,496

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January....	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February....	40.21	45.75	39.16	43.31	54.46	52.39
March......	39.85	51.56	38.45	49.25	54.57	54.64
April... ...	38.88	52.00	37.47	50.36	66.37	54.18
May....	38.25	.....	36.79	......	65.21	......
June	40.60	......	38.18	......	56.49	......
July.......	40.75	......	38.36	......	68.81	......
August	42.50	......	41.28	......	60.74	......
September ..	42.63	......	41.29	......	59.33	......
October......	42.38	......	40.89	......	54.72	......
November. ..	45.40	......	43.25	......	57.19	......
December...	44.13	......	40.76	......	62.03	......
Year...	$41.45	......	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold

Platteville, Wis., May 18—The highest price paid this week for zinc ore was $56 per ton; the base price, 60% zinc, was a little weaker at $54@55 per ton.

The base price paid for 80% lead ore was $53 per ton.

SHIPMENTS, WEEK ENDED MAY 18

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	804,380	....	....
Benton	702,700	124,700	355,000
Platteville	607,100	....	169,000
Galena	555,200	....	....
Hazel Green	460,000	....	....
Cuba City	287,960	....	76,100
Shullsburg	194,000	....	....
Rewey	148,000	....	....
Total	3,759,340	124,700	600,100
Year to date	78,200,410	2,925,990	9,601,800

Shipped during week to separating plants, 2,217,230 lb. zinc ore.

The zinc smelters of Kansas and Oklahoma are operating at full capacity and enjoying much prosperity. At Cherryvale, 600 retorts are out of commission, for repairs, at Laharpe 620 out, at Gas City 320 out, and at Bartlesville 576 out. The idle retorts constitute merely the ordinary and necessary proportion. The number of retorts in operation is as follows: Deering, 3840; Caney, 3648; Cherryvale, 3600; Altoona, 3840; Laharpe, 620; Gas City. 1920; Iola, 2480; Chanute, 1280; Bartlesville, 4032; Bartlesville (Lanyon-Starr), 3456; Bartlesville (National), 4256; Collinsville, 3200; Collinsville (Tulsa). 3320; Neodesha and Nevada, not reported.

Chemicals

New York, May 22—The general market is distinctly dull.

Copper Sulphate—Quotations stand unchanged at $5.25 per cwt. for carload lots and $5.50 per cwt. in small lots, in spite of activity in the copper market.

Arsenic—The feature of the market is the still continuing scarcity of spot goods, which rule at $3.75 per cwt. Futures have eased off, and stand at $3.50 per cwt. for white arsenic. Both domestic and foreign other than Mexico are being offered more freely, and it is rumored that shipments can again be commenced from Mexico, in about two weeks.

Nitrate of Soda—Business is decidededly quiet, and prices eased off. Spot and June delivery are quoted at 2.40c. per lb., and 2.37½ for all later deliveries.

MINING STOCKS

New York, May 22—On May 16 the Exchange showed rather irregular advances on fair trading. On the Curb the mining list was slow.

May 17 the Exchange was again strong, with trading limited to specialties mainly. On the Curb mining stocks were in good demand, with trading well distributed and prices tending upward.

May 18 the Exchange was a little slow, but firm, on business largely professional. The Curb showed little activity in the mining list, but prices were well held.

May 20 the Exchange was fairly active, with prices a little inclined to weakness; but losses were only fractional. On the Curb mining stocks were in only moderate demand, with prices about stationary.

On May 21, the market was dull and price changes irregular. The explanation that the bull market of the last few weeks has about run its course was offered to account for this, but is too safe and sane an explanation to suit the great majority of traders who ascribe the dullness to the decisive primary vote to be held in Ohio. At any rate, business was the smallest of any day since Apr. 19, when total transactions totaled 333,174 shares, against 335,679- for May 21. National Lead and Tennessee Copper were features on the Consolidated Exchange.

Inspiration Copper Consolidated stock, heretofore dealt in on the Curb, has been listed on the New York Stock Exchange. The listing includes $14,452,160 capital stock; with authority to add $4,800,000 on notice of issuance in exchange for outstanding convertible bonds and $747,840 on notice of issuance and payment in full or on notice of issuance in exchange for outstanding stock of the Inspiration Copper Co., making the total authorized to be listed $20,000,000. Stock to be dealt in dollars per share.

At auction in New York, May 16, the following prices were realized: Comstock Tunnel $1000 first income bond, 13% of par value; 4 shares International Agricultural Cor., 65; Clinch Valley Coal & Iron Co., 100 shares preferred, $2.37½ and 200 shares common, $1.50 per share.

Boston, May 21—Copper shares continue disappointing. They have failed to respond to the further advance in the metal. However, there is a feeling that better things can be looked for a little later on and that copper stocks will receive more attention. Prices in the main are firm, but the market lacks snap.

The increasing of the Calumet & Hecla company's quarterly dividend from $8 to $10 is sufficient evidence that producing mines are becoming more prosperous. The increase in the Quincy rate to $5 per year further attests to this fact. Calumet stock reflected this increased rate by a $20 advance to $490 ex-dividend. Ahmeek rose $10 to $310, this being its record price. Mayflower and Old Colony were the market leaders in point of activity until recently, and both have suffered further declines, owing to disappointment regarding diamond-drill operations. Mayflower broke to $10 and Old Colony to $8.50, although substantial recoveries have followed. Osceola has maintained a $3 ad-

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Feb.	March	April
Alaska shipments	2,662,243	4,987,916	1,243,911
Anaconda	27,450,000	25,900,000	25,480,000
Arizona, Ltd	3,020,000	3,150 000	3,400,000
Copper Queen	6,046,860	7,197,121	....
Calumet & Ariz.	4,452,004	4,652,000	4,104,000
Detroit	2,068,370	2,246,238	....
East Butte	1,440,000	1,480,000	....
Mammoth	1,722,954	1,939,310	1,718,450
Mason Valley	1,100,000	1,140,000	....
Nevada Con	4,888,790	6,380,000	6,115,095
Old Dominion	2,039,000	2,432,000	2,167,000
Ray	2,140,000	2,300,000	2,612,500
Shannon	1,300,000	1,388,000	1,544,000
South Utah	283,838	299,000	284,215
United Verde*	2,250,000	2,250,000	....
Utah Copper Co	8,612,739	8,160,000	8,616,776
Lake Superior*	19,000,000	19,750,000	18,250,000
Non-rep. mines*	8,000,000	8,400,000	8,250,000
Total production	98,476,798	104,051,585	....
Imports, bars, etc.	18,976,513	23,519,215	....
Total blister	117,453,311	127,570,800	....
Imp. in ore & matte	10,432,438	8,736,874	....
Total	127,885,749	136,307,674	....
Miami	2,475,996	2,755,000	2,554,352
Brit. Col. Cos.:			
British Col. Copper	860,003	....	....
Granby	1,773,496	1,882,073	....
Mexican Cos.:			
Boleo	2,204,720	2,424,800	2,149,280
Cananea	2,948,000	2,834,000	4,654,000
Moctezuma	2,687,712	2,446,731	....
Other Foreign:			
Cape Cop., S. Africa	786,440	725,760	954,240
Kyshtim, Russia	1,055,000	....	1,545,000
Spassky, Russia	649,600	638,400	649,600
Famatina, Argen	....	....	....
Tilt Cove, Newf'd	109,059	104,992	119,869
Exports from:			
Chile	6,720,000	3,584,000	6,496,000
Australia	7,164,000	8,064,000	9,408,000
Arrivals in Europe†	10,868,680	12,559,680	12,064,640

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
IV, 1911	118,085,223	52,407,650	62,129,699
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	68,779,566
IV	125,464,644	69,513,846	53,252,326

VISIBLE STOCKS

	United States	Europe	Total
V, 1911	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,601	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757
V	65,066,029	134,176,000	199,242,029

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

vance to $120, while Mohawk went off $2.50 to $62, on lack of support. Some activity is noted of late in Santa Fé, which is up $1 to $3.50, on reports that mining operations would be resumed. Curb trading has been light and price changes unimportant.

Assessments

Company	Delinq	Sale	Amt
Alpha Con., Nev	May 29	June 19	$0.05
Andes, Nev	May 28	June 18	0.05
Best & Belcher, Nev	June 3	June 27	0.10
Black Horse, Ida			0.02
Black Jack, Utah	Feb. 6		0.01
Calodonia, Nev	May 21	June 11	0.10
Cedar-Talisman, Utah	Apr. 20		0.005
Challange, Nev	June 8	June 11	0.10
East Tintic, Utah	May 30	June 25	0.005
Ely Con., Nev			0.05
Exchequer, Nev	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Glen Dale, Utah	May 25	June 25	0.00
Hancock, Mich	Mar. 28		1.00
Houghton Copper, Mich	May 17		1.00
Julia, Nev	May 15	June 5	0.05
Lehi Tintic, Utah	Feb. 29		0.01
Lower Mammoth, Utah	Mar. 16		0.01
Michigan Cop. & Gold, Utah	May 15	May 30	0.002½
New York Bonanza, Utah	May 8		0.02
Ojibway, Mich	Jan. 10		1.00
Raven, Mont	Feb. 1		0.10½
Savage, Nev	June 4	June 26	0 105
Segregated Belcher, Nev	June 1	June 28	0.05
South Lake, Mich	Jnne 3		2 00
Southwestern Miami, Ariz	Jan. 15		1.00
Union Con., Nev	May 9	May 31	0.15
Utah Antimony, Utah	June 1		0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53 308	......	24.797	24.583	......
June	53.462	53.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24.428	24.082	......
September	53.295	52 440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53.486	53.304	......	24 670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62 893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15 741	12.275	15.930	54.034	70.294
May	11.989	......	12.214	......	54.313	......
June	12.385	......	12 611	......	56.365	......
July	12.463	......	12.720	......	56.673	......
August	12.405	......	12.634	......	56.266	......
September	12.201	......	12.508	......	55.253	......
October	12.189	......	12.370	......	55.170	......
November	12.616	......	12.769	......	57.253	......
December	13.552	......	13.768	......	62.068	......
Year	12.376	......	12.634	......	55.973	......

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	......
February	41 614	42 962	August	43 319	......
March	40 157	42.577	September	39 755	......
April	42 185	43 923	October	41 185	......
May	43.115	......	November	43 125	......
June	41 606	......	December	44.655	......
			Av. Year	42.281	......

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4 435	4 334	4 327	13 009	15.619
February	4 440	4.026	4 266	3 946	13 043	15 738
March	4.394	4.073	4 238	4.046	13 122	15.997
April	4 412	4 200	4 262	4 418	12.889	16 331
May	4 373	......	4 223	......	12 984	......
June	4 435	......	4 292	......	13.260	......
July	4.499	......	4 397	......	13 530	......
August	4 500	......	4 406	......	14.260	......
September	4 485	......	4 356	......	14 744	......
October	4 265	......	4 139	......	15.332	......
November	4 298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	15.648	......
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	6.499	5 368	6.349	23 276	26 661
March	5.563	6.626	5.413	6.476	23 016	26.048
April	5 399	6.633	5.249	6 483	23 743	25 644
May	5.348	......	5.198	......	24.375	......
June	5 520	......	5 370	......	24 612	......
July	5 695	......	5 545	......	25.006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	......	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14.75	$14.00
February	15 90	15.03	14 50	13.28	14 81	14.01
March	15.90	14.95	14 65	13.66	14.96	14.10
April	15 90	15.13	14 65	13.90	15 00	14 15
May	15 90	......	14 30	......	14 72	......
June	15 90	......	14 06	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13.94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS May 21

Name of Comp.	Bid.
Acacia	.05¾
Cripple Cr'k Con.	.01¾
C. K. & N.	.15½
Doctor Jack Pot.	.06⅛
Elkton Con.	.64
El Paso	.78¾
Findlay	04
Gold Dollar.	.16½
Gold Sovereign	.01¾
Isabella	.11⅜
Jack Pot	.05
Jennie Sample	.05⅛
Lexington	01
Moon Anchor	01
Old Gold	03½
Mary McKinney.	.72⅛
Pharmacist.	.01¾
Portland	.89
Vindicator	.75
Work	.95

SALT LAKE May 21

Name of Comp.	Bid.
Beck Tunnel	.14
Black Jack	18½
Cedar Talisman	.02
Colorado Mining.	.19
Columbus Con.	14
Crown Point	03
Daly-Judge	6.35
Grand Central	.73
Iron Blossom	1 20
Little Bell	.40
Lower Mammoth.	02½
Mason Valley	11.00
May Day	.10
Nevada Hills	2.20
New York	04¼
Prince Con	1 40
Silver King Coal'n	2.10
Sioux Con	.05
Uncle Sam	.21
Yankee	‡.10

TORONTO May 21

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡6 90	Hollinger	11 15
Hudson Bay	‡70 00	Imperial	.03
Temiskaming	.37	Pearl Lake	16
Wettlaufer-Lor	63	Poren. Gold	41
Apex	04	Poren. Tisdale	.02
Central.	‡5 56	Preston E. D.	05
Crown Chartered.	17	Rea	.35
Doble	25	Standard	04
Dome Exten	.37	Swastika	18
Foley O'Brien	21	West Dome	.15

SAN FRANCISCO May 21

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.12	Belmont	10.00
Belcher	.50	Jim Butler	.57
Best & Belcher	.07	MacNamara	.29
Caledonia	.97	Midway	.61
Challenge Con	.10	Mont.-Tonopah	2.95
Chollar	.05	North Star	.22
Confidence	.80	West End Con	2.00
Con. Virginia	.57	Atlanta	.26
Crown Point	.64	Booth	.10
Gould & Curry	04	C.O.D. Con	.11
Hale & Norcross	.16	Comb. Frac	.18
Mexican	2 75	Jumbo Extension	.41
Occidental	55	Pitts.-Silver Peak	1.30
Ophir	1.35	Silver Pick	.15
Overman	.90	St. Ives	.33
Potosi	.04	Tramp Con	‡.01
Savage	06	Argonaut	‡2.25
Sierra Nevada	.20	Bunker Hill	‡1 50
Union Con	.88	Cent. Eureka	.77
Yellow Jacket	.87	So. Eureka	‡4.00

N. Y. EXCH. May 21

Name of Comp.	Clg.
Amalgamated	83¾
Am. Agri. Chem	61¼
Am.Sm.&Ref.,com	86⅛
Am. Sm. & Ref., pf.	107
Am. Sm. Sec., pf. B	88
Anaconda	42¾
Batopilas Min	2
BethlehemSteelpf	71½
Chino	31¼
Comstock Tunnel	.10
Federal M. & S., pf.	46
Goldfield Con	4⅛
GreatNor.,ore.,ctf.	43⅝
Homestake	93
Inspiration Con	19⅛
Miami Copper	26
Nat'nalLead,com.	59
National Lead, pf.	109¼
Nev. Consol	21⅞
Pittsburg Coal, pf.	88¾
Ray Con	19¼
Republic I&S,com.	23½
Republic I & S, pf.	78¾
SlossSheffi'd,com.	51
Sloss Sheffield, pf.	‡100
Tennessee Copper	46⅛
Utah Copper	63
U. S. Steel, com	70⅛
U. S. Steel, pf.	111⅛
Va. Car. Chem	51⅞

N. Y. CURB May 21

Name of Comp.	Clg.
Barnes King	‡¼
Beaver Con	.46
Braden Copper	5¾
B. C. Copper	5
Buffalo Mines	‡1¼
Butte & Vipond	‡.53
Caledonia	¾
Con. Ariz. Sm	13/16
Davis-Daly	2
Diam'field-Daisy.	11
Ely Con	¼
Florence	.72
Giroux	5⅝
Gold Hill Con	5/16
Greene Cananea	9⅞
Greenwater	07
Guggen. Exp.	223
Internat. S. & R.	124
LaGrange Placer.	‡2⅞
Kerr Lake	2⅝
La Rose	3½
McKinley-Dar-Sa.	1⅞
Min. Co. of A. new	3⅛
Nev. Utah M. & S.	05
Nipissing Mines	8⅛
Ohio Copper	1 5/16
Pacific Sm. & M	7/32
Precious Metals	‡1⅜
Ray Central	2 5/16
Red Warrior	‡1½
South Utah M. & S.	1/16
Standard Oil (Old)	880
Stand'd Oil of N.J.	380
Stand'd Oil Subs.	490
Stewart	1¼
Tonopah	6 15/16
Tonopah Ex	2 7/32
Tri-Bullion	⅝
Tularosa	13/16
United Cop., pfd.	10
Yukon Gold	3 7/16

LONDON May 22

Name of Com.	Clg.
Camp Bird	£1 9s 6d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 11 3
Mexico Mines	7 0 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 5 0

BOSTON EXCH. May 21

Name of Comp.	Clg.
Adventure	8¾
Ahmeek	315
Algomah	7¼
Allouez	45¼
Am. Zinc	29¾
Ariz. Com., ctfs.	5½
Bonanza	.42
Boston & Corbin	7¼
Butte & Balak	3½
Calumet & Ariz	72½
Calumet & Hecla.	480
Centennial	25½
Con. Mercur	.05
Copper Range	59½
Daly West	5¾
East Butte	13⅞
Franklin	12½
Granby	54⅜
Hancock	34
Hedley Gold	16½
Helvetia	1¾
Indiana	20½
Island Cr'k, com.	53¼
Island Cr'k, pfd.	90¼
Isle Royale	28
Keweenaw	1¾
Lake	39⅞
La Salle	6½
Mass	7
Michigan	3
Mohawk	62½
New Arcadian	4⅜
New Idria Quick.	6⅞
North Butte	28¾
North Lake	6¾
Ojibway	5
Old Dominion	56½
Osceola	119½
Quincy	89
Shannon	14¾
Shattuck-Ariz	22¼
Superior	34½
Superior & Bost.	2½
Tamarack	44
Trinity	6¾
Tuolumne	3⅝
Union Mines	2⅝
U. S. Smelting	•38½
U. S. Smelt'g, pf.	48⅞
Utah Apex	2
Utah Con	13
Victoria	4
Winona	6¾
Wolverine	110
Wyandot	2¼

BOSTON CURB May 21

Name of Comp.	Last
Bingham Mines	2⅛
Boston Ely	1 13/16
Boswyocolo	.08
Butte Central	7
Cactus	.12
Calaveras	1¾
Chief Cons	1 7/16
Corbin	2 5/16
Cortez	1⅛
Crown Reserve	3 3/16
First Nat. Cop.	2 13/16
Majestic	63
Mazatan	‡ 60
Moneta Porc	11
Nevada-Douglas.	3 15/16
New Baltic	3¼
Oneco	2⅞
Raven Copper	.31
Rhode IslandCoal	31
San Antonio	‡3
S. W. Miami	7¾
South Lake	7¼
Trethewey	.50
United Verde Ext.	.35
Vulture	‡5.00

‡Last quotation

The Engineering and Mining Journal

Vol. 93. JUNE 1, 1912. No. 22

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. ROB'T MCKEAN, Secy.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N. W. 7.

WALTER RENTON INGALLS, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 10,000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page
Editorials:
Copper Refinery Stocks.......... 1065
American Iron and Steel Association 1066
On Technical Education.......... 1066
By the Way.......... 1067
Calumet & Hecla.......... 1068
*The Hyde Flotation Process.......... 1068
Correspondence and Discussion:
Mining Codes....The Tipuani, Bolivia, Rush....As to Prospecting 1069
Copper Determination at Granby. Frank E. Lathe 1071
Rapid Sinking in the Transvaal.... 1073
Gowganda District, Ontario.......... 1073
Inspiration Consolidated 1074
Details of Practical Mining:
*Pumps for Fire Protection....Drinking Fountains in Mines....*Joplin Hoisting-Bucket Hooks....*Signal Device for Mine Car....*Surveying New Cross Sections for Embankments....Blasting in Wet Shafts....*Cord Lagging for a Pulley.......... 1075
Details of Metallurgical Practice:
*Amalgamation Tables for Huntington Mills....*Joplin Hand Jig....Horsepower of a Pelton Wheel *Cast Iron Screen Frames for Jigs 1078
Notes from Current Literature:
The Magnetic Bronzes....Influence of Oxygen on Arsenical Copper....Properties of Rare Refractory Materials....Zinc Dust Precipitation....The Use of Molten Ferromanganese....Aging Cement with Steam....Saklatwalla Vanadium Extraction Process....Testing for Radioactive Minerals....Outlook for the German Potash Industry....Heat Insulating Materials....An Aluminum Disease....Titanium in the Blast Furnace....Amino White Lead Process....French Requirements for Tungsten Ore....Wet Screening Device....Detinning in Italy....Tin Ore in Poland....Pyrophoric Alloy.......... 1081
*Hydraulicking in Beauce County, Que. ....Fritz Cirkel 1083
Mass Action and Reaction Velocity. Harry C. Jones 1087
*The Eastern Michipicoten Iron Range..........Alois Goetz 1090
The Mocorito District in Sinaloa. G. L. Sheldon 1092
Vanadium—Its Ores and Uses. Thomas F. V. Curran 1093
*Bosqui Zinc-dust Feeder.......... 1095
Experiments in Speiss Treatment.. 1096
Mining Index 1097
Personal, Obituary and Societies... 1100
Editorial Correspondence.......... 1101
Mining News 1103
Markets 1109
*Illustrated.

Copper Refinery Stocks

In connection with the copper-refinery statistics, the amount of copper tied up in the electrolytic-refining process is a matter of interest. Regarding the copper so held in a multiple-system refinery of say, 10,000,000 lb. per month capacity, we believe the following figures are not far wrong:

In the tank room, exclusive of electrolyte, 9,750,000 lb. This includes starting-sheet stocks, half-eaten anodes, partly deposited cathodes, and all the miscellaneous copper which accumulates around the deposition tanks. The electrolyte would add about 250,000 lb. more. Around the anode furnaces, including stock of pig, the furnace bottoms, material for future blast-furnace treatment, etc., 1,300,000 lb. At the wirebar furnaces, including molds and bottoms, but excluding refined stock, about 1,230,000 lb. Various miscellaneous items, such as stocks in silver refinery, bluestone or nickel-salt departments, about 150,000 lb. The total copper thus figured would be about 12,680,000 pounds.

It is, of course, plain that the pig on hand for the anode furnaces and material on hand for blast-furnace treatment can be varied within any ranges whatever. In making the above estimates, we are simply attempting to figure on a safe working stock. So, in turn, it is possible to carry any stock of cathodes whatever, and as between pig and cathodes, the latter is the cheaper place to carry material that it is desired not to put into finished shapes. Here, again, we try to estimate only normal stocks.

As to the refined-copper stock of a 10,000,000-lb. plant, a stock of 1,000,000 lb. is practically no stock at all. It will be distributed among cakes, ingots, ingot bars and wirebars, and there are 57 varieties of the latter, so that practically it is the rare order that can be filled directly out of stock; consequently before the refined-copper stock begins to be comfortable, we may assume that an average 10,000,000-lb. refinery would carry a total copper stock of 13,680,000 pounds.

The present rated refinery capacity of the United States is about 1,494,000,000 lb. per annum. The actual electrolytic-copper production of the United States for 1911 was 1,156,000,000 lb., or 96,300,000 lb. per month. On the supposition that the refineries are at present working at the same rate, and making a small allowance for the fact that a series refinery should have a slightly smaller normal stock, in proportion to its capacity, we are of the impression that the refineries would, entirely exclusive of their refined stocks, have about 120,000,000 lb. of copper on hand.

As to how far this refinery stock can operate as a balance wheel is another interesting question. The ordinary refinery is kept fairly clean usually, but nothing compared to its condition just before a visit from the board of directors. The foremen of a refinery usually keep the large byproduct items cleaned up, but house-to-house canvass by the superintendent will commonly disclose a vast number of odd items, which will aggregate a large tonnage. Apart from this point, while receiving a regular 10,000,000-lb. input, a refinery can temporarily increase its output, and later hold the 10,000,000-lb. mark, by increased current density, thinner anodes and more frequent cathode pullings.

While this is at the expense of financial economy, we think it is not far from correct to state that the ordinary 10,000,000-lb. refinery could jump its output for two successive given months by at least 1,000,000 lb. per month, and after that hold its 10,000,000-lb. production at the disadvantage of higher cost, until the necessity for such a sprint were over, and normal running could be begun again.

At the same time, with cheap copper, it may pay to cast heavier anodes, put every tank into service and decrease the current density, paying interest on copper and saving in working costs, and it is with a view to this, and to the statements we have made concerning accelerated production, and of normal metal stocks, that refinery statistics should be judged.

The American Iron and Steel Association

In his presidential address, at the meeting of the American Iron & Steel Institute last week, Judge Gary announced that arrangements were in progress by which the Institute would, at the close of the present year, take over the work of collecting and publishing the statistics of the iron and steel trades, which is now performed by the American Iron & Steel Association. This practically involves the dissolution of that association, or rather its merger in the Iron & Steel Institute, after an existence of 60 years.

Originally formed in 1855 for the purpose of working for tariff protection, it was not until 17 years later, when there was revival of interest, that the members saw and appreciated the advantages of collecting adequate statistics of the trade. This work was undertaken and extended so that in time the association became almost purely a statistical bureau. The organization was extended until it included almost every maker of iron and steel in the United States, and in recent years in Canada also. The gathering of statistics and their presentation were systematized in such a way that no other iron-making country possesses such complete records of its trade and production. In addition the association has issued from time to time carefully compiled directories of the trade, which constitute valuable books of reference.

The work has been thoroughly and admirably done and the credit for it is largely due to James M. Swank, who has been connected with the association for its 40 years, since the revival in 1872, at first as secretary and later with the title of general manager. In a large sense he has been the association and has commanded general respect by his wide knowledge of the trades and the thoroughness and excellence of his statistical work.

For some time past Mr. Swank has wished to retire on account of his advancing age and the condition of his health; and it was largely this fact that led to the proposed merger. He will carry into his retirement the universal wish that he may long enjoy his leisure. It is to be hoped that the Iron and Steel Institute will carry on the work on the lines laid down by Mr. Swank in his many years of successful labor.

On Technical Education

It is undeniable, we think, that a common defect in the courses of instruction in the engineering and technical schools of this country is the failure to give more attention to the subjects of general cultivation. We understand, of course, that such emphasis is put upon the scientific, technical and professional subjects that but little time remains for anything else. This is, we think, a mistake. It is not sufficient to urge in excuse that the general education that is needed ought to be accomplished in the high schools and academies. Granting that it ought to be, the fact is that it is not. Nor is it very useful to urge that students ought to take a regular collegiate course and finish with two, three or four years at the technical schools. There are relatively few young men who are able to enter upon and complete such a course of training. The conclusion is, we think, that the technical schools themselves ought to give more attention to the subjects of broad education; that they have not done so is doubtless their failure to recognize generally the practical importance of so doing.

In our own experience with many graduates, young and old, we find a general weakness in composition and in the use of the English language, and even more general inability to read the most important foreign languages, let us say French and German; a lack of acquaintance with the simplest features of business law and a dense ignorance of the principles of economics. Yet these are all matters of great importance to the engineer.

On the ability to write good English, W. L. Saunders, president of the Ingersoll-Rand Drill Co., himself a distinguished engineer as well as the head of a great manufacturing and business enterprise, in an address at the 38th annual commencement of the Colorado School of Mines at Golden, Colo., May 24, made the following emphatic remarks:

> But of greater importance than good speech and reading, of higher value to the engineer than manners, is ability to write good English. Engineers are not given to public speaking; they pride themselves in being workers; they compare themselves with General Grant, who did things. It is very true that the engineering profession is one of practical work; but no one can hope to achieve prominence in this profession who cannot write good, understandable English. An engineer may not talk, but he must make reports; he must write letters; he should draw specifications and plans. To do these things properly he must command and know how to use the tools of language. Lord Bacon tells us that "reading makes a full man, conversation a ready man, and writing an exact man." Engineering is an exact science; accuracy is the one column on which the whole structure is reared. To write clearly and accurately can hardly be called an accomplishment; it is really a necessity. No college course is complete, whether it be a classical, scientific, medical or law course, without a thorough training in English. No graduate is worthy to be called an educated man who does not speak and write good English. It lifts a man above the common; it makes him bigger than his business or profession; it trims the ship of knowledge, and puts oil on rough places; it makes the man.

In this connection it is interesting to refer to a new departure that we have previously reported, namely, that the Michigan College of Mines, which is always efficient and enterprising, has lately established a department of technical writing in which the first course of instruction will be given next year. Other technical schools have included in their curricula some training in the writing of abstracts, professional reports, etc., but we believe we are correct in our idea that no special emphasis has been put upon this work and that its performance on the part of the students has been rather perfunctory, without realization of its importance, simply because that has not been adequately brought to their attention.

The effort to encourage mining in South Australia by state loans has not been an unqualified success from a banking point of view. Of £55,237 loaned only £6111 has been returned.

By the Way

J. Parke Channing received a fee of $25,000 for his examination of the Calumet & Hecla and allied properties in connection with the consolidation plan in 1911.

Much manganiferous iron ore has been disclosed in some of the recent explorations in the Cuyuna iron district of Lake Superior. Already the enterprising promoter has capitalized these discoveries on the basis of the druggists' retail price for permanganate.

It is expected that the copper statistics for May will be another exhibition of how production may increase and yet not increase. This remark is not intended to be a reflection upon the refiners' reports, which we believe to be faithful and trustworthy, but merely a comment upon a mysterious condition which causes many to marvel.

A Joplin engineer, in a report on an Arkansas zinc property, developed by tunnels driven on the ore beds outcropping on the steep hillsides, advised that the tunnels be abandoned as "it is always cheaper and more satisfactory to operate from shafts." Evidently the "engineer" in this case was influenced in his generalization by the local practice of the shaft-perforated region about Joplin.

A special dispatch to the Boston *News Bureau* reads as follows: President Sun Yat Sen, of China, to his premier: "Go thou to our learned men and find the reason for this trembling of the earth beneath our feet. If it is an earthquake, I wish to know, so that I may save my august life." Premier, returning hotfoot: "Your Excellency, 'tis the Old Colony drill looking for the Mayflower lode."

A recent meeting of two operators in the Lake Superior iron region brought out an interesting refinement of terms. "What kind of developed ore do you refer to?" said the one. "In my state they speak of three different kinds, 'developed ore for the assessor,' 'developed ore for the operator' and 'developed ore for a prospective investor.'" We did not ask which kind usually showed the largest digits.

The plans for the new construction at the Old Dominion concentrator at Globe, Ariz., are being drawn by H. Kenyon Burch, and not by Mr. Caetani as mentioned in an item under "New Construction" in the JOURNAL of May 18. Mr. Burch has been connected with much important construction work in the Southwest, having designed among others the Miami mill and the new concentrator of the Moctezuma Copper Co., at Nacozari.

Engineering News relates an early example of efficiency engineering in the building of a large banking house in Philadelphia 40 years ago. The rate of hod-carrying up ladders for three stories was raised to a maximum in this way: A negro with a good sound heart, a first-class pair of lungs and a stout pair of legs was found. The darky was paid $5 a day at a time when the other hod-carriers got $2.50. But the condition on which he worked was that he should lead the line up the ladder and break the record. The rest of the line in that day were Irishmen. Therefore, they hated a darky and on general principles asserted the superiority of the white man. They had to be consistent to their assertions and principles.

We are forced to call for help over the following from one of our contemporaries: "Every chemist in general will agree that up to the present our methods of gravimetric and volumetric analysis are apt to have some phase where the accuracy is in doubt, where the reaction is not fully, or in some cases purely hypothetical, and therefore not absolutely correct; we therefore go through journals and chemical literature to find our way out of a labyrinth of reactions which take place by a simple precipitation of two bodies chemically acted upon according to the laws which govern these reactions, visible and obscure, to all our scientific endeavors, methods, instruments, ability and chemical reasoning." After which we are told that "the problem of the absolute precipitation of the sulphuric acid with barium salts is still problematic." Some problems are.

In 1910, the Government began suit against the Southern Pacific company for the recovery of 6000 acres of oil land in the Elk Hills section of Kern County, California. In a public statement on May 28, Attorney General Wickersham declares that the evidence now at hand presents "sensational and startling disclosures indicating a conspiracy among high officials of the Southern Pacific company to acquire under an agricultural grant oil lands valued at $15,000,000." The Government lawyers are confident that the disclosures of Charles W. Eberlein, a former land agent of the Southern Pacific, will result in the restoration to the public domain of this land, Eberlein having saved from the San Francisco fire secret correspondence and documents which are expected "to prove previous knowledge on the part of the railroad officials of the mineral character of the land selected, and an intention to keep the fact from the Government officials until after the patents should be secured."

When labor is abundant, operating officials can select new employees with an eye to upbuilding the efficiency of the force. Where wages and conditions of labor are attractive, as, for example, at Anaconda, "rustlers" are plentiful and the general efficiency of the labor is high. During the pleasant summer months, it is difficult at Anaconda to secure even a "rustling" card—which gives the bearer permission to enter the plant to seek work—while at smelting plants farther south, "rustlers" during this period are almost as scarce as good 10c. cigars. The situation is often acute after holidays, especially when payday and "long change" are celebrated simultaneously. At such periods, a mere slip of a boy or an old man, in fact almost anyone short of "the halt and the blind" can "get on," and may even tantalize the foreman by inquiring what sort of work it is before accepting. The Bristol *Times* records an instance. The foreman at a large metallurgical works was short of laborers one morning, and as a last resort went to an old tramp, who was lying asleep beside one of the furnaces, and aroused him with the question:: "I say, my man, are you wanting work?" "What kind of work?" asked the tramp. "Can you do anything with a shovel?" "Yes," replied the tramp, rubbing his eyes. "I could fry a piece of ham on it."

After having grown musty with age, the Old Dominion-Bigelow case was burnished up again for headline use on May 27, when the U. S. Supreme Court affirmed the Massachusetts judgment against A. S. Bigelow in favor of the Old Dominion Copper Mining & Smelting Co. for the return of about $2,100,000, representing secret promotion profits and expenses of A. S. Bigelow and Leonard Lewisohn. Brushing off the mold that must now obscure the records of the original suit, it will be found that the first bill, filed in October, 1902, alleged that Messrs. Bigelow and Lewisohn, with the aid of a syndicate formed by them, bought the Old Dominion Co. of Baltimore for $1,000,000, receiving gratis certain outlying claims. The Old Dominion Copper Mining & Smelting Co. was then formed with a capital of $3,750,000, of which $2,000,000 was divided among the syndicate members *pro rata*, $500,000 in stock being taken by Messrs. Bigelow and Lewisohn for promotion fees and expenses. It was claimed that the expenses were afterward paid out of the new company's treasury and further that $750,000 in stock was given to Messrs. Bigelow and Lewisohn for their outlying claims. Suit brought against the Lewisohn estate in New York on the same facts as in the Massachusetts case was decided against the company and the decision affirmed by the U. S. Supreme Court. However, in Massachusetts, approaching Justice from another angle with an imposing array of able and alert attorneys, the lady who holds the scales concluded that the force of gravity was pulling stronger on the company's pan. The newspapers say that Mr. Bigelow will now sue the Lewisohn estate.

Calumet & Hecla

During 1911 the Calumet & Hecla company stamped 2,909,972 tons of rock which yielded 25.47 lb. of copper per ton, or 74,130,977 lb. of copper. Costs, excluding some interest adjustments, were 8.52c. per lb. of copper; selling price of copper 12.82c. Costs per ton of rock were (excluding construction) $1.84. Of these tonnages 1,924,480 tons of rock came from the Conglomerate lode, producing 58,469,399 lb. of copper (30.38 lb. copper per ton of rock), at a cost of 8.25c. per lb. of copper, or $2.07 per ton of rock.

On the Conglomerate lode there were 546 ft. of sinking done, 8613 ft. of drifting, and 201 ft. of crosscutting. The Calumet No. 4 shaft is down 7995 ft. on the incline; the Hecla No. 7, 7666 ft.; and the South Hecla Nos. 7 and 10, 7627 ft.

On the Osceola lode, shaft No. 13 is the deepest, 3232 ft. on the incline. There were 985,492 tons of Osceola lode rock stamped, which yielded 15,661,578 lb. of copper at a cost of 9.95c. per lb., or $1.34 per ton of rock. No work was done on the Kearsarge lode.

The recrushing plant treated 477,794 tons of coarse tailings from the Calumet mill. The tailings carried 12.66 lb. of copper per ton, of which 4.50 lb. was recovered, or 2,152,110 lb. of copper, at a cost, exclusive of smelting and selling, of 5.01c. per lb. New furnaces, with mechanical pouring devices, are being installed at the Calumet & Hecla Smelting Works.

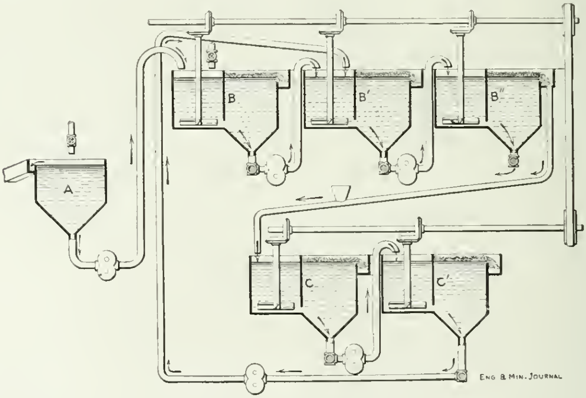
New South Wales Mining in 1911

The official reports for New South Wales for 1911 show the following mineral outputs, the items being arranged in descending order of value: Coal, 8,691,604 tons; silver-lead ore and concentrates, 338,469 tons; zinc, spelter and concentrates, 516,378 tons; gold, 181,121 fine oz.; copper ingots, matte, and ore, 12,100 tons; tin, ingots and ore, 1929 tons; pig lead, 17,276 tons; coke, 264,687 tons; silver, in ingots and mattes, 1,767,496 fine oz.; iron, 36,354 tons; precious opal, £57,300; oil shale, 75,104 tons; lime, 29,930 tons; wolfram ore, 283 tons; limestone flux, 46,237 tons; scheelite, 108 tons; all other items individually under £3800. The total value of the output was £9,758,000, an increase of £1,136,974 over 1910. Underground work in the Broken Hill Proprietary mine was resumed in February, 1911, after over a year's suspension. The same company commenced the production of spelter at its Port Pirie plant, but by far the greater part of its zinc, silver, and lead is shipped out of the state for treatment.

The Hyde Flotation Process

James M. Hyde, of Basin, Mont., has developed a flotation process for treating the ores of the Butte & Superior company. The experiments at Basin were so successful that the Butte & Superior company has erected a mill at Butte, on lines laid down by Mr. Hyde, details of which will be given below.

The description of the process is given in U. S. pat. No. 1,922,085, as follows: The ore, after crushing, is mixed with acid before thickening in a tank *A*. It has been found that adding the acid in advance cuts down the amount required, and promotes the settlement of colloidal material, which may be further aided, if necessary, by adding copperas, alum, or some other coagulant. From the thickener *A*, the pulp is pumped to the first treatment tank *B*, where oil is added and the entire mass agitated. A float concentrate is then taken off, and the gangue goes to the tank *B'*, where the process is repeated, and thence to *B''*, where the pulp is agitated and a third concentrate taken off. From *B''* the gangue is discharged as a final tailing.



Hyde Flotation Apparatus

There is considerable silica mixed with the first concentrates, so they are all recleaned in a second device *CC'*, the concentrates from which are the final product, while the tailing is all sent back to *B'*.

As an example of actual work with this machine, the following description is given. The material treated was the slimy portion of an ore, consisting principally of quartz, blende and various amounts of decomposed granite, in which the feldspars were largely kaolinized. About 92% of this material was fine enough to pass a 150-mesh screen. Without the use of a coagulant, part of the slime, containing a notable percentage of zinc, would remain in suspension for over 24 hours.

The pulp, as produced, contained from 29 to 100 or more parts of water by weight to one part of ore, to which was added, before thickening, from one-quarter to one-half pound of sulphuric acid per ton of ore. The thickened pulp was heated in the flotation machine by live steam to expand the gas bubbles, and facilitate coating the sulphide particles with the oil used, which, in this case, was "candle-maker's red oil." The oil consumption cannot be calculated beforehand, but must be gaged by experience. The ore fed carried 23.3% of zinc; the concentrate, 51.4%, and the tailing, 3.2%, indicating a 91% recovery. The concentrates from the primary section of the machine ran 38 to 42% of zinc.

The Butte & Superior ore contains enough rhodochrosite to generate the carbon dioxide needed for its flotation. The ore has been treated for some time at the Basin reduction plant, rented from the United Copper Co. by the Butte & Superior Co. The mill was too small and the rental heavy, so plans were drawn for a 1000-ton mill, one 500-ton unit of which should be in operation by the end of May, the other about a month later. The installation consists of a crushing plant, jigs, hydraulic classifiers, a slime plant for oil flotation, and Wilfley tables, which are used only to separate the lead from the zinc. The ore is first reduced by rolls to six mesh, and, after jigging, the tailings are reground to 40 mesh, and the tailings from the fine jigs ground to 100 mesh and treated by oil flotation. The pulp is thickened to three parts water and one part ore, and is mixed with a small quantity of oil and sulphuric acid and agitated.

Within the Columbia River drainage basin, according to the Geological Survey, are at least one-third of the available water powers in the United States, but development of this resource has scarcely begun.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Mining Codes

I would like to thank R. A. Burr for his admirable suggestion in the JOURNAL of Apr. 27, 1912, that all engineers using McNeill's code should state the edition on their letter heads and in their advertisements.

My original "Mining and General Code" first appeared in 1893—nearly 20 years ago. This period has shown marvellous progress in mining and metallurgy. To take one instance out of many: In 1893 the cyanide process was just becoming a practical success and the earlier code contains two sentences referring to it. The 1908 edition contains 65 sentences, under the headings: Cyanide; cyanide bullion; cyanide experiments; cyanide plant; cyanide process; cyanide treatment; cyanide vats; cyanided; cyaniding; cyaniding costs; as well as numerous other sentences, under the headings: Filter press; liquor; tanks; vats; zinc boxes; etc., etc.

The increase in the scale of the 1908 issue can be seen by the following comparison:

	1893 Code Contained	1908 Code Contains
Sentences and phrases	44,572	105,192
Mining surveys..	644	1,278
Letters and cables, etc.	944	13,200
Extra code..	644	1,740
Numbers, weights, moneys, etc	4,648	18,820
Total cipher words....	51,452	140,230

The result is a volume of about 1900 pages, well fitted for the office, but bulky for the traveling engineer. To meet this, the traveler's edition of the 1908 Code has recently been introduced as a small flexible volume, 6½x8¾ in., and only weighing 18 oz. It is an absolute photographic reproduction of the larger volume.

Your correspondent alludes to his difficulty in trying to decode a cable mesage by the wrong book. This cannot be done; the cipher words in the 1908 edition are different from those used in the original code. Each of the 140,230 cipher words was not only carefully selected for itself, but was also "eliminated" for telegraphic similarities, as against the cipher words of the earlier code, my aim being that either code could be used independently.

I cannot suppose that your correspondent complains at the issue of an uptodate code, but I would like to observe that the old code was getting behind the times and that I was approached from numerous quarters to issue a new one, in which should be incorporated all the economies the 1908 edition affords, together with the advantages of an additional 20 years' experience of the technical wants of the mining industry.

BEDFORD MCNEIL.

London, Eng., May 7, 1912.

The Tipuani, Bolivia, Rush

I have just received a letter from F. J. Dunleavey, Sorata, Bolivia, in which he tells of a stampede of American prospectors to the Tipuani valley in Bolivia, and asks me to do anything I can to help stop it. This stampede was started by a letter to a man named Jim McCormick in Ophir Creek, Alaska, written by a man who called himself Ferguson and telling of a rich placer strike in the Tipuani valley.

I spent two years in that district and prospected over the Tipuani valley from its head-waters in the Andes to where it joins the Mapiri. Mr. Dunleavey has been in that neighborhood for the last five years and is probably better acquainted with the existing conditions there than any other American. While there are undoubtedly some fairly rich placers in this valley, still everything has been filed on years ago and should any prospector make a strike there, he would immediately be overwhelmed with a mass of contests and it would be impossible for him to perfect his title or to take anything out. The trails leading to this valley, moreover, are among the worst in the world and unless a prospector went in very well equipped, he would find it impossible to even live there, let alone doing much prospecting. There is no such man as Ferguson in that district and no material amount of gold has been taken out of the Tipuani valley for many years.

If you can do anything in any way to aid in keeping prospectors away from this district, you will save them a very long journey and in all probability many hardships. Mr. Dunleavy is not only a man of the highest personal integrity, but is also an enthusiastic prospector, and would be the last man to discourage such a stampede if there were any chances that it might result in a strike of any importance. He is now and has been for the last five years, general manager of the Boston & Bolivia Rubber Co., which is operating on the Beni River. His address in Sorata, Bolivia.

JOHN W. HARRISON.

Kansas City, Mo., May 17, 1912.

As to Prospecting

UNITED STATES MINING LAWS

Title XXXII, Chap. 6, Revised Statutes.

Sec. 2318. In all cases lands valuable for minerals shall be reserved from sale, except as otherwise expressly directed by law."

Sec. 2319. All valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are hereby declared to be free and open to exploration and purchase, and the lands in which they are found to occupation and purchase, by citizens. . . .

Sec. 2320. Mining claims upon veins or lodes of quartz or other rock in place bearing gold, silver, cinnabar, lead, tin, copper, or other valuable deposits, . . . but no location of a mining claim shall be made until the discovery of the vein or lode within the limits of the claim located.

The tenor of many articles recently published in technical papers would lead both the prospective prospector and the prospective investor in prospects to the conclusion that there is no opportunity in these days for either, in the public lands of the west and particularly in the Forest Reserves. This is a mistaken conclusion and the statements make in Mr. Sheldon's article and many others which have appeared from time to time are utterly misleading, warranted neither by facts nor conditions. The reader might suspect a conspiracy to suppress prospecting.

Referring to the article in question, we will grant that there are fewer prospectors, relatively, than in earlier days. But there are other factors to be taken into consideration which have been noted in other articles which have appeared. It must, too, be remembered that with the discovery and development of the more easily discovered outcrops, the exhaustion of game, the necessity of some resource as a grub stake, and above all tireless and intelligent field work, prospecting is not what it used to be.

I must deny emphatically that there is anything in law or rulings that can drive the *bona fide* prospector from the forest reserves. The law is plain as stated above on this point and no rulings of the Department of Agriculture or the Land Office can drive the prospector from these legitimate fields for his activities. But the repetition of false assertions will influence some to desist prospecting.

It is true that the Forest Service has in many instances. filed complaint against application for patent on some mineral claims within the reserves and these are acted on by the special-agent service of the General Land Office. There are, too, cases in which charges have been preferred, asking the General Land Office to oust certain prospectors from locations. These actions are made the basis of such broad assertions as appear from time to time, which are due either to ignorance of the facts or willful misrepresentation.

In this I know whereof I speak, having served in the Department of the Interior and examined in the field and by investigation, many of the cases against which charges had been preferred. It is admitted that there are cases in which charges have not been warranted. These are easily disposed of and generally without other inconvenience to the claimant, than mental anguish, till such time as matter is disposed of. Of the other cases, there are, regrettable as it is, many in which some ulterior object is sought to be attained rather than the development of the mineral, among which may be mentioned, the securing of ranch or farm land by means other than those provided under the regulations, headquarters for stock and sheep camps, timber, water power, etc.; the aggressor crying over the shoulder of the "poor prospector."

The investigation and prosecution of such cases, of which there are far too many in this day of commercial honesty, redound to the benefit of the legitimate prospector, while control of the forest protects him in his timber, not only on his claim, which has not always been respected by his more powerful even though distant neighbors, but protects him by reserving the timber in the vicinity of a mineralized district, for the benefit of that district.

It is quite true that such lands as those of the Nevada Consolidated, and in such a district as Bisbee, as Bingham and as numerous other camps and formations, which under the strict letter of the law, might not, and by some of the agents of the several departments, would not, today, be passed upon favorably. This cannot be charged against the departments nor the agents of the departments. There is the law; if unenforced, are not the agents open to charges of malfeasance in office?

Here we touch upon another subject that is current, the changes in the mining laws and the proposed new laws now before Congress. These have been well criticized in the journals of recent date, and justly. There is the most urgent need of changes to meet changed conditions. There are new types of ore formations not contemplated by the law makers of the early days of mining-law construction. These must be met by new laws.

There is but one way that such propositions can be treated. Our knowledge of geology leads us by analogy to assume that valuable ores may be found in a given locality. To meet the case, the government should grant to him who is disposed to back his judgment on such assumption, a concession for the purpose of prospecting the ground and give reasonable protection against interlopers and blackmailers. The law today does not, and in cases in my own experience, I have found that charges have been preferred by individuals, merely with the hope that the defendant will pay him to keep out. The agent cannot always place his hand on the right motive in such cases, the department can act only under the law; to meet the conditions the law must, of necessity, be changed.

Much ado about nothing is made over the extra-lateral-rights phase of the present law. In many cases we find that the companies, by agreement, especially in the newer camps, are adjusting their lines to vertical planes bounding their properties.

In all the eastern states all property is held under such bounds. The law can be amended to provide, upon discovery, for the protection of the discoverer, of his lode on its dip, granting him extra widths of claim over the dip, after allowing reasonable time for its determination, giving him an extra claim, two or three, if required, and without the discovery as specified in the above quoted statutes. These can be taken by legal subdivisions.

I agree with those who would have the claim proved up and patented within a reasonable, given time. This would prevent much of the perfunctory "assessment" work now done, which merely excludes the man who would develop.

Reverting to the causes leading to the abandonment of prospecting, one of the most cogent causes is, tritely, lack of market for the product.

Looking back over the last few years, our mining journals have been filled with "recipes" for making examinations, sampling, measuring "ore in sight," with references and discussions on the last mentioned and other like phrases. Our city-bred engineers, in close touch with the capitalist, and largely influencing him, have insisted on certain characteristics as essential to anything examined, before it is a good investment, before they will recommend it; in short they require the bullion on the dump "with the eagle stamped on it."

It is only within a few weeks past that any one has mentioned the prospect as an object of legitimate investigation and investment. That it has been and today is a legitimate field for investment is surely told in the development of every one of our great mines. Capital is scouring the west for "good gold," "good copper," "good lead," or "good zinc" properties with ore blocked out, etc. Inquiries for such are frequent and repeated and can only be traced to the general trend of sentiment along the lines dinned into the ears of readers for years past. It is evident that there is no surfeit of such properties and without the development of prospects, we must pause and ask, whence is this greed for mines to be supplied?

The country is large, the field has been exploited but little. It is not isolated spots here and there, that remain; the entire country, even at the very doors of camps, well known in mining history, has opportunities for the investigation and investment of the most conservative capital.

There are vast stretches of mountain and foothill country, which have been merely scratched, that were not payable in the day of this casual investigation, yet today would afford a return of profits, satisfying to the most exacting investor. Other fields, because of inherent difficulties, have been passed by without thought, while others, studied by the mine geologist, will inspire favorable consideration and the justifiable expenditure to prove up.

If the investor is to have mines to invest in, and the market the metal required to carry the industries of the world, the prospect must have more consideration and the engineer must qualify for something more than a scaler of ore "in sight" and sampler of "ore blocked out," with his present ability to figure that considering the cost of the property, interest for three, two, and one years, added to the cost of mining, milling, marketing and selling, his employer will get all this back and pay good dividends in addition. L. S. Ropes.

Helena, Mont., May 15, 1912.

Referring to G. L. Sheldon's excellent letter on "prospecting" in the Journal of May 11, in which he says "Canada, Mexico and South America have better mining laws than the United States," I would like to express the opinion that while ours could certainly be improved upon, as far as acquiring title is concerned they are fairly good and it is not so much that the laws passed by Congress are ineffective, as that it is permitted some clerk in the Land Office to interpret them, and this has been done time and again in Colorado, as more than one of our engineers can testify, and cite the cases. The Courts interpret the laws made by Congress and theoretically no one has the right to go over the Supreme Court's head, and put another construction on them, but it has been done and the Secretary of the Interior has either permitted it, or failed to notice it. It is that which has put new discoveries out of business, in addition to the reasons correctly given by Mr. Sheldon, and as long as the Land Office conservation-reservation-interpretation blight is upon us, the prospector with his frying pan, coffee pot and burro, will only be known as an interesting character in the history of the early and prosperous mining days of the state. W. Weston.

Denver, Colo., May 16, 1912.

Copper Determinations at Granby

By Frank E. Lathe*

Description of the uses and limitations of the electrolytic, iodide, cyanide, and colorimetric methods of copper determination, as practiced at the Granby smeltery in British Columbia.

For the accurate determination of copper in ores and furnace products, the electrolytic method is always used if there be no interfering impurity present—arsenic, antimony, bismuth or lead. If these are present in any considerable quantity, necessitating a separation of the copper before electrolysis, it is better to adopt the iodide method, which, if properly done, is practically as accurate as the electrolytic method at its best, though requiring more manipulation. For approximate results, as on rough hand samples, and where quick work is necessary, as in the case of mattes and slags, the cyanide method is used for large quantities of copper, and the colorimetric method for percentages under about 0.5. The cyanide method, however, is not applicable to ores carrying zinc. The permanganate method is largely used in some places, but appears to require too much time and manipulation for the accuracy secured, to be applied to Granby work.

ELECTROLYTIC APPARATUS

The terminals for holding the platinum electrodes are aluminum bars, securely held in the wooden back of the electrolytic stand, and measure 3x⅜x¼ in., with a slit 1/16 in. wide cut in the free end of each for the passage of electrode stems. This slit terminates ⅜ in. from the end in a hole 3/16 in. in diam., through which a pointed aluminum pin 1 inch long can be forced about half way. These terminals are connected in series, pairs being set 5 inches apart; and the members of each pair, ¼ inch apart, may be short-circuited by means of an aluminum wedge. (A snap switch would be somewhat more convenient to use.) The current is taken from a 110-volt, d.-c. lighting circuit, and is passed through suitable wire and lamp resistances to cut down the voltage for use. The current is ordinarily 0.2 ampere, the voltage between each pair of electrodes being about 3.0. The only change found necessary with a varying number of determinations is to substitute a 32- for a 16-candle-power lamp in the circuit when more than eight depositions are being made at one time. Running as above, one gram of copper will be deposited in about 12 hours.

The platinum cylinders are of the type in general use, having a total depositing surface of 80 sq.cm., and a weight of about 11 grams each. They are standardized once a week, as follows: After dissolving off the copper with HNO_3, each cylinder should be well rinsed in distilled water, then allowed to stand one minute in a boiling hot solution of potassium cyanide, to remove grease or oil, rinsed again through three successive beakers of hot distilled water, and finally through absolute alcohol. Adhering alcohol is then burned off, and the cylinder itself heated to bright redness in the flame of an alcohol lamp. As soon as cool the cylinder may be weighed, and this weight will be used until the next standardization except in the special cases noted below.

Solutions for electrolysis should contain a small quantity of free acid, both HNO_3 and H_2SO_4, but HCl and HF must not be present, as the platinum would be attacked by the chlorine or fluorine set free.

MANIPULATION

Electrolysis is begun at the close of the day's work, and cylinders are removed in the morning. Before removing the pins which hold the platinum electrodes in place the aluminum terminals are short-circuited by wedges, as noted above, and the cylinders removed at once and rinsed twice through distilled water and once through absolute alcohol. Adhering alcohol is burned off and the cylinder thoroughly dried in the flame of the alcohol lamp, being kept in constant motion during the last two operations to avoid overheating and alloying copper and platinum, as well as oxidizing the surface of the copper. When cool, the cylinder is ready for weighing. The copper is then dissolved in hot dilute HNO_3, and the cylinder, when washed, is ready for a second determination.

When great accuracy is required the dilute acid around the deposited copper is first siphoned off, 500 c.c. distilled water being poured in meanwhile. (If ordinary tap water be used some lime will usually be deposited on the cylinder.) Then the cylinder is removed as usual, weighed, and the copper dissolved. The cylinder is rinsed thoroughly and dried through alcohol, without overheating. A second weighing is now made, and the result used as the correct weight of the cylinder. The errors avoided by these two precautions are counterbalancing, and may, with some operators, be practically equal. Neither should be over 0.03%. Pure copper on the cylinders will be bright in color. Should the deposit be dark it usually indicates the presence of arsenic in the sample, although bismuth will also interfere if present, and sometimes antimony and lead. Lead and manganese are both partly deposited on the anode as oxides, the former being readily soluble in HNO_3 and the latter in HCl, but these are not usually present in appreciable quantities. Silver is ordinarily neglected, but if it is desired to correct for it, the percentage calculated from the fire assay may be subtracted, or it may be precipitated as chloride and filtered off.

BLISTER COPPER ASSAY

The sample of copper is taken by momentarily deflecting into water the stream of copper as it is poured from the converter. The following method may, however, be also applied to drillings. For the determination, weigh out accurately between 0.9975 and 1.0025 grams of copper, selecting a large number of small pieces. To this copper in the beaker in which electrolysis is to be carried out (battery beaker) add 25 c.c. water and 10 c.c. HNO_3. Heat till all is dissolved. Wash down cover and sides of beaker, and heat a few minutes longer. Then remove from the heat, fill to within half an inch of the top (150 c.c.) with cold water, add 1 c.c. H_2SO_4, and electrolyze. After weighing the deposited copper add or subtract the difference between the original weight and one gram. If the copper be of 98% or better, no other correction will be necessary, and considerable time is thus saved in weighing out the original sample. This method has been carefully compared with the usual one of electrolyzing part of a large volume of solution, and found much more dependable.

Weigh accurately 0.5 gram matte into a battery beaker, add 10 c.c. NHO_3 and warm at a temperature just too low to boil the liquid. (If the sulphur be overheated by boiling it will usually form into a globule which contains undecomposed matte.) When brown fumes cease coming off boil a few minutes gently till liquid is reduced to about 6 c.c., then add 25 c.c. water and heat a few minutes. Finally fill beaker with cold water, add 1 c.c. H_2SO_4, and electrolyze.

For chilled slag, weigh out 2.0 grams slag into a 3½-in. casserole, add 10 to 12 c.c. HNO_3, and take to dryness on hot plate. Cool somewhat, add 8 c.c. H_2SO_4, and heat until SO_3 fumes are coming off freely. Cool, dilute with 25 c.c. water, heat a short time (at low heat, to avoid bumping) transfer to battery beaker, dilute, add 2 c.c. HNO_3, and electrolyze. In the morning siphon off liquid, as described above, remove cylinder and place in a battery beaker filled with hot distilled water. Add 4 c.c. HNO_3, warm (if necessary) till dissolved. Cool, add 2 c.c. H_2SO_4, and again electrolyze. Again siphon off liquid, weigh cylinder, dissolve copper and reweigh. The reduction by redepositing, and reweighing the cylinder, will vary up to about 0.05 per cent.

---

*Chief chemist, Granby Smelting Works, Greenwood, B. C.

Another method for slags is to weigh 5.0 grams of slag into a 600-c.c. beaker, containing 150 c.c. boiling water. While stirring well, add 25 c.c. boiling HCl, and when the slag is decomposed, dilute with hot water to 500 c.c. Remove from heat and pass in H_2S gas for three-quarters of an hour. Filter into suction flask, and remove paper from funnel as soon as filtration is complete, to avoid oxidation. Wrap in second filter paper, and place in porcelain crucible. Burn off paper at low heat in muffle, cool, and transfer to battery beaker with 5 c.c. HNO_3. Heat until copper is dissolved, add 25 c.c. water and again heat for a few minutes. Dilute with cold water, and add 1 c.c. H_2SO_4 before electrolyzing. Siphon off weak acid and reweigh cylinder, but it is not necessary to redeposit copper. This checks with the former method, but requires more manipulation.

For unchilled slags weigh out 2.0 grams of slag into a battery beaker, add 10 c.c. HNO_3, and heat about 10 min. Then add 8 c.c. HF, and warm till violent action has ceased. Cool, add 8 c.c. H_2SO_4, warm a few minutes, then transfer to a platinum crucible or dish, and heat till SO_3 fumes come off freely. Cool, and finish as under chilled slags, after H_2SO_4 treatment. Should traces of HF remain, as is often the case, the reweighing of cylinders will correct for it.

For ores, weigh 1.0 gram into a battery beaker, add 10 c.c. HNO_3 and then treat as under mattes. For custom ores check this with a 2.0 gram sample, using 12 c.c. of acid to decompose. Then after depositing copper, siphon off liquid and redeposit both. Many ores will give good results on first deposition, but unless this be known of a familiar ore the extra precaution should be taken.

Iodide Method

Weigh out two portions, of 0.5 and 1.0 gram, or double these quantities on low-grade ores, and treat with 10 to 15 c.c. nitro-hydrochloric acid in casseroles. Take slowly to dryness on the hot plate, cool somewhat, add 8 c.c. H_2SO_4 and heat to copious SO_3 fumes. Cool, add 25 c.c. water, and warm for 10 min. Filter into a 250-c.c. beaker, and wash at least seven times. Dilute to 75 to 100 c.c., place a triangle of sheet aluminum in the liquid, and boil till all the copper is precipitated —about 15 min. Wash down the cover and sides of beaker with H_2S water, using 15 c.c., and if not more than 10% copper be present, decant liquid and wash loose copper into filter, using a jet of H_2S water, with which also wash filter four or five times, being careful not to let the filter stand empty. (If there be a brown tinge in filtrate it indicates a loss of copper.) Place under funnel a clean 250-c.c. beaker. Pour over the aluminum in the other beaker 6 c.c. of 1:1 HNO_3, cover, and heat two minutes. Then pour this acid over filter to dissolve copper. Follow this with 5 c.c. saturated bromine water, and wash beaker and filter with hot water. Open filter and wash any dark residue into the beaker with the solution. (In the case of high-grade copper ores the precipitated metal should be washed by decantation with H_2S water four times, after which the copper is dissolved as before, but before giving the bromine treatment most of the red fumes should be boiled out of the filtrate.) Boil the liquid to expel bromine fumes completely. Cool somewhat and add a slight excess of ammonia. Boil a short time, then make acid with acetic acid and boil again. (These precautions appear to be necessary to make the neutralization complete, but when they are taken the excess of ammonia need not be boiled off.) Cool to room temperature, add 6 c.c. of a 50% KI solution. Titrate with a solution of $Na_2S_2O_3$ of value 2.0 milligram copper per c.c. till the liquid is only faintly colored with free iodine. Then add 5 c.c. fresh starch solution and continue the titration till the blue color just disappears.

Cyanide Method

For mattes, weigh out 0.5 gram matte into a 400-c.c. beaker, add 10 to 15 c.c. HNO_3 and heat at moderate temperature till decomposition is complete. Add 175 c.c. cold water, and ammonia to 10 c.c. excess. Cool to room temperature. Add from a burette, KCN solution of strength 1.0 c.c. equals 10 mg. copper till a change in the color of liquid indicates that the reaction is nearly complete. Allow to settle a few minutes, and continue the additions of KCN, with alternate settlings, till the blue color has just disappeared. A sample of matte in which the copper has already been determined electrolytically is run with the unknown sample as a standard. The method as thus carried out for mattes is not accurate within 0.5%, but for ordinary purposes this is sufficient. The accuracy may be increased by precipitation of the copper, and other precautions, but then becomes as slow as the more reliable iodide method. For ores, use from 1.0 to 5.0 grams, depending on the percentage of copper present, and if much accuracy is desired run as a standard a similar ore of known copper content. The manipulation is as for mattes.

Colorimetric Method

Colorimetric methods are particularly for use with slags, and the endeavor is to give them similar treatment. Weigh out 30 mg. clean copper foil into a beaker, dissolve in weak HNO_3, transfer to measuring bottle, and make up to exactly 180 c.c., so that 6 c.c. contain 1.0 mg. copper. Weigh into each of five 3½-in. casseroles about 150 mg. iron wire, and 50 mg. aluminum foil. Dissolve in 10 c.c. HCl and 5 c.c. HNO_3, dilute to 75 c.c., and to the five solutions in casseroles add 12, 18, 24, 30 and 36 c.c. respectively of the standard copper nitrate solution. Precipitate all with ammonia, using an excess of about 10 c.c. and warm for 10 minutes without actually boiling. Filter into colorimetric bottles, and make each up to the mark—150 c.c. These will be equal to 0.2, 0.3, 0.4, 0.5 and 0.6% copper, if 1.0 gm. be taken for sample. These standards keep well, but samples run by them must be checked occasionally by electrolytic determinations. Standards are usually slightly darker in color than solutions of slags containing an equal amount of copper, but in practice an allowance may be easily made for this, so that the error on single samples will not usually be over 0.02 per cent.

Ordinary tap water is used in the determination of copper in slag, and might be used in the preparation of standards except for the deposition of lime on bottles after long standing. Weigh 1.0 gram slag into a 3½-in. casserole, add 10 c.c. HCl and put on hot plate. After 10 min. add 5 c.c. HNO_3 and heat till action has ceased. Dilute to 75 c.c. with cold water and add ammonia in moderate excess. Warm, without boiling, for 10 minutes. Filter through 15 cm. No. 595 S. & S. filter paper into colorimetric bottle, washing twice. Make up to mark with cold water and compare with standards.

Ores are run similarly to slags, but use 0.5 to 5.0 grams of sample, according to the amount of copper apparently present. (If the ore be high in iron do not use over 2.0 grams.) If the quantity of ore taken proves too large, and the color of the solution be darker than that of the 0.6% standard, dilute just half of the solution to standard volume and compare. When the error on a copper ore is required to be less than 0.1% run as standards along with the unknown sample about three similar ores. Thus if ore appears to carry about 1.25% copper run 0.5 gm. each of the sample and of ores with 1.0, 1.2, and 1.4% as determined electrolytically. In this way the copper content may be judged within an average of 0.05%, which is rather better than the results by the cyanide method on similar ores.

Nevada Hills Mining Co.

The report of the Nevada Hills Mining Co. for the year ended Mar. 31, 1912, states that the construction program is completed, the total expenditure for this purpose being $502,918. The Webber shaft was sunk 501 ft. during the year, making the total depth 701 ft. The total cost of this shaft was $52,637. Exclusive of the Webber shaft, 3863 ft. of development work was done, mostly in connecting up this shaft with old workings and with the Nevada Hills shaft, in order that the ore may be economically handled in the future.

The new mill began operations Sept. 12, 1911, and continued until Jan. 13, 1912, when a temporary shutdown was necessitated because the power company could not furnish power owing to water shortage. Operations were not resumed until Apr. 15. During the four months' operations 10,948 tons were milled averaging $26.83 per ton, a recovery of 88.8% being obtained.

Rapid Sinking on the Rand

The southeast shaft of the Government Gold Mining Areas (Modderfontein) Consolidated was sunk 233 ft. during March, 1912, which is a record for shaft sinking on the Rand. Credit for this achievement is due to Martin H. Coombe, the manager, and to Lowson, Readhead & Robar, the sinkers. The previous record, states the *South African Mining Review*, was 213 ft. at the Modder Deep, beating the July, 1907, record at the south shaft of the Brakpan Mines. During the quarter, 583 ft. was sunk at the State Mines, which is also a record; the previous record being 532 ft. at the Brakpan mines.

The shaft in which the record was made is divided into seven compartments, the excavation being 45x10 ft. The tonnage of excavated material hoisted for the month for the 233 ft. sunk was 8155 tons, equal to 35 tons per foot. The sinking was done between the 1738- and 1971-ft. levels, through 155 ft. of quartzite, and 78 ft. of shale, or less than one-third in Kimberley shale, in sinking through which all previous records have been made. Natives did all the hand drilling and shoveling; 82 natives and a white assistant comprised the sinking crew for one shift; eight-hour shifts were worked seven days per week. The majority of the men drilled double-hand, using 7-lb. hammers; single-hand men worked only on the end benches.

The Routine of Sinking

In sinking this shaft the excavated material is hoisted in skips. An endeavor is made to keep the bottom flat, an ideal bottom being one with a bench only at each end. Blasting takes place every eight hours. From 40 to 45 holes square the shaft and complete a round for a shift. These holes are drilled from 3 ft. 6 in. to 5 ft. deep, advantage being taken of the bedding planes, and the majority of the holes are inclined to the north against the strata; four are drilled abreast for the length of the shaft. The side holes are given the desired lift from a plumb line hung from the bottom set. Blasting gelatin is the explosive used. No pump is installed in the shaft below the 600-ft. level. The water is handled with the sinking skips from rings at various points, 30 skiploads per shift being hoisted.

Four timbermen are employed in each of the four shafts which are being sunk on the State Mines; two men and six native laborers, being bottom-set men, one man and four laborers working at the hitches, bearers and permanent guides, and one laborer at the brattice. All timbermen work morning shift only, from 7 a.m. to 3 p.m. After the sinking shift is in the bottom and hoisting is commenced, the two bottom-set men block the next to the bottom set, using the bottom set to carry the stage planks. The men are not allowed to interfere with the skips, once they have reached their place of work, until the sinker has finished cleaning up and has started drilling. Then the engines are used by the timbermen to hang the next set. From the time the banksman shackles on the first pair of wall plates until the set is in place and the timbermen are at the surface again with their stage planks and crew is from one to 1½ hr. Timbermen are not allowed to attend to tight ground; the sinker is responsible and is compelled to take it down. If a set of permanent guides is required or a set of bearers is to be taken down, as soon as the timbermen have hung the wall plates and the filling-in timber has been sent down they hand the engine over to the sinker. As much as 57 skips or 114 tons of rock have been hoisted from the bottom, one set of timber blocked, another hung and filled, four 3-ft. guides hung and bolted in the shaft, and the shaft bottom drilled in the usual manner and blasted a quarter of an hour before the end of the shift. All hitches are cut, bearers installed and timber dropped or lowered, while the shift is at work in the bottom.

All Timber Framed by Hand

There are 132 cu.ft. of pitch pine in each set. The guides are 8x4-in. pitch pine carried on channel brackets, bolted to the dividers. Lagging, when any is used, is 12x12-in. pitch pine. Bearer sets are put in approximately every 120 ft. Hitches are cut to a minimum depth of 4 in. Wire plumb lines are dropped once per month to check the timbermen's lines. All the framing for timbers, guides, ladders, rings, etc., for the four shafts is done by hand by three men. Recently 64 sets at 7-ft. centers were placed in 61 consecutive days. Six 1⅛-in. iron hanging bolts per side are required, three for each half plate. The wall plates made in two pieces are butt-jointed on a divider, no plating or bolts being used.

Shaft and Surface Equipment

The south or pump compartment measures 8½x6½ ft. in the clear. Each of the six other compartments measures 6½x5 ft. in the clear. The pump compartment is further divided into compartments for ladderway, repair cage, and pipe bearers and columns. The power cables are carried down in the space between the wall plates and the repair-cage guides. Acetylene lamps are used exclusively.

No fan installation or pipes are used. A wooden chimney of sectional area equal to that of the pump compartment is taken up above the headgear. A ⅞-in. brattice between the pump compartment dividers is carried down with the timbering. This induces a draft of from 20,000 to 25,000 cu.ft. of free air per min.; 10 minutes after blasting the bottom is clear of smoke and fumes.

The shaft is equipped with a modern steel headframe 110 ft. high from collar to platform, covering all the compartments. Two double-drum engines are used, one a first-, the other a second-motion hoist. The drums are 8 ft. in diameter. The boilers are Babcock & Wilcox dutch-oven type. A 50-drill compressor has been also installed but is not used. The winding ropes are 1⅛ in. diameter. Sinking skips of 45-cu.ft. capacity are used. White and native change houses, shops, etc., are of the most modern design and construction. Massive concrete collars have been put in, built up from the solid rock to from five to six feet above the surface.

Gowganda District, Ontario

Gowganda Correspondence

The mining situation around Gowganda is quiet and there is little activity in the development of new prospects. Inaccessibility and lack of transportation continue to handicap the district. An improvement in this respect should be effected soon by the completion of the branch of the Temiskaming & Northern Ontario Ry. to Elk Lake, and also, it is hoped, by the improvement of the present wretched wagon road from Elk Lake to Gowganda. At the present time, three mines are operating steadily and producing ore. The Mann mine has recently purchased the property and plant formerly owned by the Boyd-Gordon Mining Co., and adjoining that property. Both high-grade and concentrating ore are being developed on the 90-ft. level at the Mann and a new shaft will be sunk soon for the development of the eastern orebody, from which excellent ore was taken near the surface during the last winter.

The Miller Lake-O'Brien mine has made additions to the mining and sorting plant, and now has a capacity of 14 drills. The development work is largely confined to the 250-ft. level, where an aggregate length of over 200 ft. of high-grade ore has been opened. The vein in places has a width of 6 to 8 in., assaying 3000 to 4000 oz. per ton in silver. Stoping is progressing steadily and the production consists approximately of 20 tons of high-grade ore each month.

The Milleret mine is operating steadily its 10-stamp concentrating mill, and is treating 1000 tons of ore per month, producing from 25 to 30 tons of concentrates. Developments are being carried on along the 200- and 150-ft. levels, and a fair amount of concentrating ore is blocked out, also some high-grade, which is sorted out underground.

Aside from these producing mines, five prospects are at present the object of vigorous development: The Willing, Hudson Bay, Homestake, South Bay and Powerful. Good reports come from all of these properties and some high-grade ore is being taken out in the course of development.

There are a great many properties which may be classed as promising prospects, on which more or less development work was done in the past, and which are at present closed down, mainly through lack of funds on the part of their owners to carry on further operations. Some of these are likely to resume operations in the near future, and it is probable that all will receive more or less attention after the transportation conditions are improved.

Inspiration Consolidated

Miami Correspondence

The development and construction program of the Inspiration Consolidated Copper Co., entailing the employment of over 1000 men and the expenditure of nearly $7,000,000 near Miami, Ariz., during the next two years, has been started. The site finally selected for the concentrator is about one mile east of the Inspiration mine and a mile north of the town of Miami. Managing Director W. H. Aldridge has just finished a visit to the property and has settled the main points of the program. He says:

> The site for the 7500-ton concentrator has been decided upon and all the necessary land secured. It will consist of six sections of 1250 tons each. The flowsheet, or method of concentration, recommended by J. M. Callow, who has been conducting tests on the ore for the last five months, will be adopted. It is the logical extended application of the principles of the roughing system developed by the Utah Copper Co. The general arrangement of the working shafts, crushing plant, and concentrator have been agreed upon and the details of mill design, shaft equipment and the specifications for machinery will be left to the company's engineers, Repath & McGregor. About 100 men are working underground and the number will be rapidly increased as soon as additional compressor facilities can be provided. A large amount of work must be done underground before the mine will be ready to supply the mill, and there will soon be as many men employed in and around the mine as there will be when the mine is producing at the rate of 7500 tons per day. Grading has already been started and the contract will be let in a few days for two large concrete working shafts and for railroad construction consisting of about eight miles of track. The steam-power plant will have a capacity for generating a minimum of 7500 hp., and the power will be distributed to the mill, mine, shops, etc., by high-tension, electric current.
>
> There will be nearly $7,000,000 expended in the development and equipment of the mine and the construction and equipment of the concentrator, power house, etc., and over 1000 men will be employed within the next few months. I look for a period of great prosperity for the district.

Mr. Aldridge stated that as soon as a general manager is appointed, which will be within two weeks, he will make his headquarters in New York instead of in Los Angeles as at present.

Ancient Mine Workings in The Transvaal

Johannesburg Correspondence

Ancient mine workings occur over a wide area in Rhodesia and are found as far South as the Transvaal. T. G. Trevor has collected many facts about these which he communicated in a recent paper before the Chemical, Metallurgical and Mining Society of South Africa. The natives now inhabiting the Transvaal have worked iron and copper ores on a very small scale; however, large workings for tin, iron, copper and gold exist and are probably the work of the same race responsible for the Rhodesian workings.

Workings are usually indicated by a line of depressions and these workings have in many cases been intentionally filled in, and in some cases deliberately concealed. There are no roads, ruins or inscriptions and no large tailing or slag heaps. At the Rooiberg tin mine, there is an accumulation of slag and some smelted tin, and bronze ingots were found. Stone hammers for use without handles have been found in the workings, and at Rooiberg some mine gads. The dumps left have been picked practically free from metal; at the Messina copper mine scarcely a trace of ore was obtainable, and at the Rooiberg tin mine the extensive ancient workings were for a long time believed to be iron workings only.

The "rubble" from the dumps of gold workings is not as in Rhodesia often payable, but contains practically no trace of gold, showing that these workers treated the very lowest grades of ore. No pillars of ore are left in the workings which are mostly underhand surface stopes or opencuts.

No profitable gold mine has been established on ancient workings in the Transvaal, unless we exempt some of the bedded deposits in the Lydenberg district, which are said to have shown some old work. The successful Messina copper mine in the northern Transvaal was established by exploring three parallel lines of workings running for about a mile. Some of the ancient excavations were 80 ft. deep by 30x10 ft. and bottomed on solid copper glance. It is estimated that the old workers must have removed at least 10,000 tons of copper from this vicinity. Even larger copper workings exist in the low veldt at Palabora. From the tin mines the old workers must have removed 2000 to 3000 tons of tin, as the workings at Rooiberg, Weynek, and Leeuwpoort in the Waterberg district are extensive.

Large workings exist all over the northern Transvaal, presumably for iron ore, as no other mineral has been yet found in them; but there is some mystery about these, as tin ore appears in many cases to be found, and it is possible that some other mineral has been completely removed.

Who these indefatigable workers were and whence they came still remains an unsolved problem. The Phœnicians certainly knew the coast and may have penetrated inland, and they may have found a race (since vanished) inhabiting Rhodesia and the Transvaal, who were natural miners and ready to exploit their mineral deposits for trade and barter. The Portuguese are responsible for many so called ancient workings in Rhodesia, but are scarcely likely to have been employed as far south as the Transvaal. Probably the news of an invading tribe from the North caused these workers to conceal their mines and flee, or they perished in a sudden raid such as the Zulus delighted to make upon their less warlike neighbors.

Mineral Production of Russia

Special Correspondence

The statistics of production of the chief metals and minerals in Russia in 1911, as collected by the Association of Russian Manufacturers and Traders, are as follows, the Russian measures being converted into kilograms and metric tons:

	1910	1911	Changes
Gold, kg. fine.	53,513	52,138	D. 1,373
Gold, value...	$35,566,045	$34,550,609	D. $915,436
Platinum, crude, kg...	5,481	5,432	D. 49
Copper, tons.	22,619	25,097	I. 2,478
Zinc, tons....	8,631	9,652	I. 1,021
Pig iron, tons.	3,042,046	3,588,449	I. 546,403
Steel, tons....	3,542,552	3,948,487	I. 405,945
Coal, tons....	23,105,628	16,678,280	D. 6,427,348

These figures are considered more reliable than those of the government, for the reason that the official statistics are used as the basis of taxation or royalties charged to the producers, who are, therefore, interested in keeping them as low as possible. Crude platinum contains 83% pure metal.

[The pig-iron figures, apparently, include only the iron sold or delivered in the form of pig, castings, etc., and not that converted into steel.—Editor.]

Details of Practical Mining

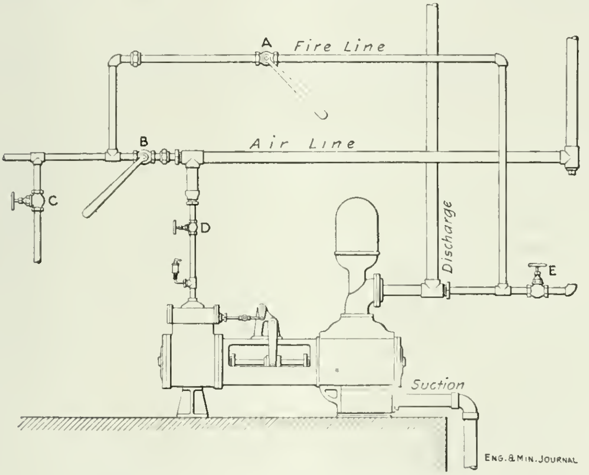
Accounts of Useful Ways of Doing Many Things in the Day's Work

Pumps for Fire Protection

By A. W. Newberry*

At the Belen mine of the Sierra Mining Co., Ocampo, Chihuahua, Mexico, recently closed on account of revolutionary disturbances, a simple and effective means of fire protection was made necessary by the presence of a large quantity of dry pine timber in one of the main haulage ways.

A Smith-Vaile, 8x5x10-in. duplex pump, situated on the 950-ft. level, handled all the mine water from a main sump. The water level was kept within 4 ft. of the station, so as to provide sufficient water in case of fire. The pump, which was supplied with air at 90 lb. pressure, could raise 50 gal. per min. against a head of 185 ft. To turn this water into the mine, a 2-in. pipe was provided, so as to connect the discharge end of the pump with the main air line to the drills, as shown in the accompanying sketch.



Pump Connected to Airlines for Fire Service

The valve shown in this line at *A* was kept closed, and the valve in the main air line at *B* was left open to allow the passage of air. In case of fire, the valve *B* could be closed; the release at *C* opened to bring the air in the line down to atmospheric pressure, and the pump started, if not running, by opening the valve *D*. If necessary, the pump could be quickly primed at *E*. As soon as the valve *B* was closed, the pumpman signalled the men at the working face by striking the pipe. These men then proceeded to disconnect the pipe at a point as near as possible to the fire, unions being provided every 120 ft. for this purpose. Over each union was hung a hose connection, and one 50-ft. armored hose was kept in the station for use in case the hose in the face could not be reached. As soon as the hose was connected, the pipeman signalled by striking the pipe twice, and the pumpman opened the valve *A*, allowing water under 185 ft. head to flow through the air line. This arrangement obviated the necessity of a valve in the discharge column, and allowed all excess water to escape through the latter.

Drinking Fountains in Mines

Sanitary drinking fountains were recently installed in the No. 7 hard-ore mine at Ishpeming, Mich., of the Oliver Iron Mining Co. The innovation proved to be such a success that similar fountains will be installed in all the mines as well as in the shops and offices of the company.

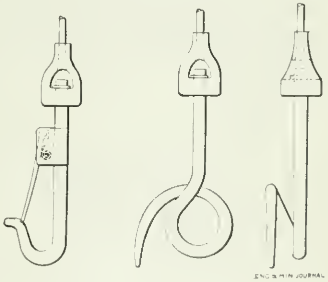
The drinking fountains were described in the Journal of Mar. 23, 1912, as used in the Republic mine of the Cambria Steel Co., at Republic, Michigan.

Joplin Hoisting-Bucket Hooks

By Claude T. Rice

The greater part of the ore produced by the Joplin mines is raised to the surface in buckets of 800 to 850 lb. capacity. These buckets are loaded in the stopes, trammed on platform cars to the shaft, where they are hooked to the hoisting rope and raised at such a speed that a round trip from a depth of 250 ft. is made in 35 sec. In many of the sheet-ore mines, 500 buckets are raised in a shift of 7½ hours, while in others, 700 and even 900 buckets are raised each shift, week in and week out.

To maintain hoisting at this speed, a hook must be used on the hoisting rope that will permit the hooking and unhooking of buckets with the utmost facility.



Snap and Pig-Tail Bucket Hooks used in Joplin Mines

Two types of hooks are in use; the snap hook, illustrated in Fig. 1, and the "pig-tail" hook, shown in Fig. 2. The snap hook is generally preferred, and is considered the safer.

The snap hook is made of 1¼-in. steel and the snap is held in a groove in the point of the hook by a coiled spring that is housed in the sheath welded to the shank of the hook. The pig-tail hook is made of 1¼-in. iron, bent in a spiral 4 in. in diameter and of 2-in. pitch, which permits easy entrance of the 1¼-in. bail of the bucket. Both the snap hook and the pig-tail hook are attached to the hoisting rope by a swivel.

The hooks in time become worn by the bail of the bucket, and it is common practice to repair the worn snap hooks by welding a piece of iron to the inside face after the hook has been hammered out straight. When the weld has been completed, the hook is heated and bent to its original shape.

---

*Assistant general superintendent, Mammoth Mountain Mining Co., Isabella, Calif.

Signal Device for Mine Cage

The object of the device illustrated in the accompanying sketch, is to provide a simple and inexpensive signal which can be applied to a mine cage so that a passenger can at all times instantly signal the hoisting engineer.

A pair of vertical strips, *A*, in Fig. 3, are secured to the wall of the shaft *B*, each of the strips being formed on its inner side face with a U-shaped recess or opening *C*. Strips of insulating material *D* are firmly secured in the openings *C*, and are formed with comparatively narrow slots *E*, within which there is secured a conducting strip *F*, which is preferably made of aluminum. The insulating strips *D*, have each a chamfered edge in order to allow the roller contact member carried by the cage to have easy access to the metal conducting strip.

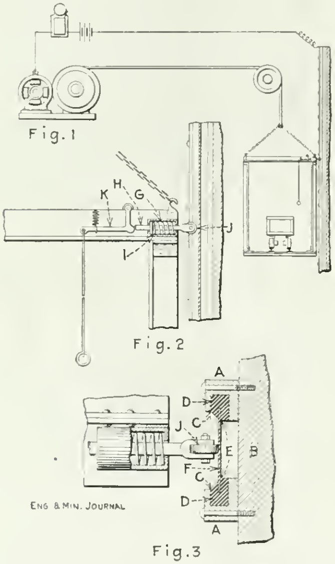


Fig. 3

Device for Signalling from a Cage

The cage carries on its top a housing *G*, within which is slidingly mounted a plunger which is engaged by a coil spring in the interior of the housing that surrounds the plunger and is engaged between one end of the housing and a collar *I*, carried by the plunger. The other end of the plunger carries a roller *J*. It will be seen by Fig. 2, that under normal action of the spring the plunger occupies the position wherein its roller is out of contact with the metal conducting strip. A bell-crank or L-shaped lever *K*, is pivotally suspended from its shorter arm and its longer arm is connected to a coil spring, the latter being of the retractile type and being supported at its upper end from the cage top. The normal action of the spring is to hold the longer arm of the bell-crank lever in a suspended position so that the nose of the bell-crank lever exerts but little pressure on the plunger. A cord or rope is attached to the free end of the horizontal arm of the bell-crank lever and extends downwardly on the cage so as to be conveniently accessible to any of the occupants.

As shown in Fig. 1, the hoisting engine is connected by the usual wire or cable with the cage. A bell is placed in the engine room, or at such points that its ringing will be audible to the engineer or operator. A wire connects the framework of the hoisting engine with the bell and a wire leads from the battery to the metal strip on the wall of the shaft.

In operation if a passenger in the cage desires to signal the engineer he pulls the cord downward thus pushing the nose of the bell-crank lever into engagement with the plunger, causing the roller to come in contact with the conducting strip. Thus a circuit is closed causing the bell to ring. Any other signals such as the semaphore may be used in lieu of the bell. This device has been patented (U. S. pat. 562,188) by Lee Bayer, of Willisville, Illinois.

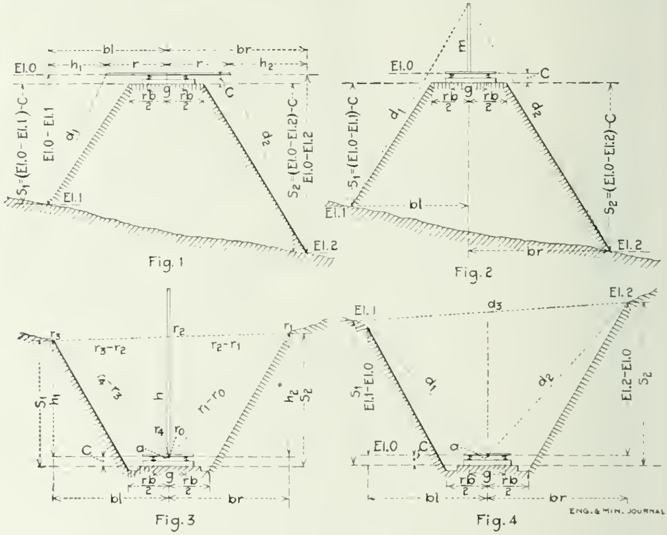
An aluminum alloy, composed of aluminum, 92%; copper, 5%; bismuth, 2%, and silicon, 1%, has been patented by Gaston Jacquier, of Belgravia, Transvaal. It is claimed, according to the *Brass World*, that this alloy will withstand the corrosive action of sulphuric acid better than other alloys of aluminum, and hence is especially suitable for making castings to be used in mines.

Surveying New Cross Sections for Embankments

By Lee Fraser*

In surveying for new cross-sections for about 50 km. of the Rio Mulato-Potosi branch of the Antofogasta to Bolivia railroad, it was found, in many instances, impossible to obtain a complete section with one set-up of the instrument, or to measure horizontal distances without many times breaking chain. To overcome the latter difficulty especially, the methods herein described were evolved.

For sections of embankment two methods were used, as shown in Figs. 1 and 2. For the method shown in Fig. 1, a track-gage was made with ends projecting out the distance *r* from the center, and graduated to 10 cm. for convenience in measuring the width of the road bed.



Methods of Measuring for Cut and Fill Data

In taking a section the distances d_1 and d_2 were measured, and the elevations were taken on rail and toes of the slope. Then:

$$bl = r + h_1$$
$$br = r + h_2$$
$$h_1 = \sqrt{d_1^2 - (El.\,0 - El.\,1)^2}$$
$$h_2 = \sqrt{d_2^2 - (El.\,0 - El.\,2)^2}$$

Except for inconveniences in measuring the road bed, the method shown in Fig. 2 was found preferable to the one just described. A rod-level was used to plumb the rod. The procedure was then the same as in the first method.

---

*Mining engineer, Apartado 168, Oruro, Bolivia, S. A.

$$bl = \sqrt{d_1^2 - (El.\ 0 - El.\ 1 + m)^2}$$

$$br = \sqrt{d_2^2 - (El\ 0 - El.\ 2 + m)^2}$$

For sections for excavation, the methods shown in Figs. 3 and 4 were used. In Fig. 3 a level-rod is shown pivoted to a track-gage, so that the base of the rod will have the elevation of the top of the rail, and is so constructed as to be free to swing from side to side for plumbing. The zero end of the tape is attached to the center of the track-gage, then it is stretched to r_1, thence to r_3 and back to the center of the gage. The tape is then read from r_0 to r_1; from r_1 to r_2; from r_2 to r_3; and from r_3 to r_4. Since h is the elevation above the top of the rail when the tape stretched from r_1 to r_3 meets the rod, h should be corrected by the amount of sag.

When, as shown in Fig. 4, the rod could not be used, the distances d_1, d_2 and d_3 were measured and the elevations were taken on the rail at the center and the sides of the cut. The distance d_3 was not necessary for the computation, for *bl* and *br* served as a check when the diagrams were plotted.

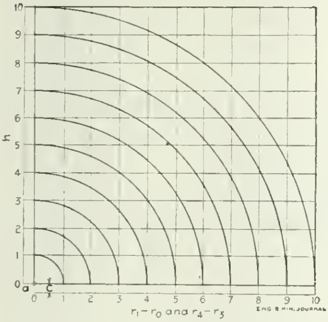


FIG. 5. DIAGRAM FOR CALCULATING

To obtain the depths of the cut, the distances S_1 and S_2, as shown in Figs. 3 and 4, a large-scale diagram was made as shown in Fig. 5. The point *a* in the diagram represents the point *a* in both Figs. 3 and 4. With the point *a* as an origin, ordinates and abscissas are drawn, beginning at a distance below *a* equal to *c* in Figs. 3 and 4. It will then be seen that radial lines from the point *a* represent the distances $r_1 - r_0$ and $r_4 - r_3$ of Fig. 3, and d_1 and d_2 of Fig. 4. In Fig. 3, the depths and widths of the cut, S_1 and S_2, and *bl* and *br*, may be taken directly from the diagram by describing arcs with radii equal to the distances $r_2 - r_1$, or $r_3 - r_2$, and with centers at points above *a* equal to the distance h_1, so as to intersect the arcs previously described with radii $r_1 - r_0$, or $r_4 - r_3$, and center at *a*. In Fig. 4, the distances *bl* and *br* are obtained directly from the diagram from the intersections of the arcs described with centers at *a* and radii equal to d_1 and d_2, with the projections of S_1 and S_2.

Blasting in Wet Shafts

BY E. M. WESTON*

It frequently happens, especially when shaft sinking with machines is in progress in wet shafts, that the pumps have to be withdrawn before blasting. This may mean that the water has risen to a height of several feet above the bottom of the shaft before the holes can be fired.

If fuses are used they should be well greased just where the detonator has been placed on one end and inserted in the primer. It is true economy to use two fuses and two detonators in the leading or cut holes of the round thereby lessening any risk of the whole round being hung up by missfires. All fuses should be of the same length, from 6 to 12 ft. depending upon the number of holes to be fired. In large shafts on the Rand 12-ft. fuses are used. As soon as the holes are charged the ends of the fuses are tied to a small plank or a wedge that has been used to rig the base for the machines, six inches or more of the end of the fuses projecting above the plank and as the water rises all fuse ends float.

The miners work in pairs lighting the fuses from the back of the shaft toward the bucket or skip in the center. "Cheesa sticks," as they are called locally are made by splitting blasting gelatine and wrapping it around pine sticks about 18 in. long. In a wet shaft the fumes given off though poisonous are rapidly absorbed by the water and the use of such sticks in shaft sinking is justified. One miner carries the lighted stick and the other cuts each of the back row of fuses about one inch from its end and rapidly bends it back, while the other miner applies the stick before the composition becomes damp. When the fuse is seen to spit the next one of the row is lighted. If the fuse does not take fire after the first cut has been made, another cut is made, and no fuse is left until it is seen to spit. The next rows are dealt with in the same way except that the fuses are cut several inches further down so that each row nearer the center of shaft will explode before those first lighted.

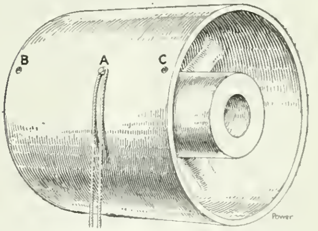
If considered more convenient the reverse order of lighting may be adopted, but the advantage of lighting the back rows first is that the men are near the bucket when all the fuses have been lighted; they are not obliged to walk over lighted fuses to reach the bucket. In this way fuses can be lighted with certainty even in the wettest shafts and it is worth while at mines where lower-grade explosives are used to have some blasting gelatine on hand with which to make these lighting sticks, as gelignite and dynamite are too granular and brittle for the purpose. Substitutes for "cheesa sticks" made of chemical combinations and designed to give off no carbon monoxide or nitrous oxide are being introduced with more or less success for general mine work on the Rand. I have not, however, heard that they have been used successfully in wet-shaft sinking.

---

*Union Club of South Africa, Johannesburg, Transvaal.

Cord Lagging for a Pulley

To cover a pulley cheaply and quickly, states D. H. Hull in *Power*, drill a small hole about 1/16 in. diameter in the face, as shown at *A* in the accompanying sketch, and drive in a small pin and cut off about 1/8 in. above the pulley face; then obtain a continuous hard, twisted cotton cord 1/8 in. diameter and free from knots, and loop the middle point of the cord over the pin. With the free ends held tight, turn the pulley in the direction of rotation, applying a good coat of belt glue as the cord is wound on the pulley. When the face of the pulley is completely covered, draw the free ends through the holes marked *B* and *C* on the sides and fasten with a soft wooden pin well covered with glue. As soon as the glue hardens, the pulley will be ready for use.



PULLEY TO BE LAGGED WITH CORD

The pulley surface should be thoroughly cleaned before applying the glue. As the cord forms a right- and left-hand thread, so to speak, the belt will tend to work from the side to the center, which will insure the belt running on the center of the pulley. The length of cord for one turn may be found approximately by multiplying the diameter of the pulley by 3 1/7, and this multiplied by the number of turns necessary to cover the face will give the total length. This pulley cover is easily cleaned and will last a long time.

The purpose for which such lagging is used is usually to prevent slipping, but heavy cord may also be used in the same way when it is desired to slightly reduce the speed of the pulley.

The practice of loading holes to the collars is attended by an increase in the quantity of powder consumed, but the extra cost for explosives may be offset by the greater facility in shoveling due to more thorough shattering of the rock.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

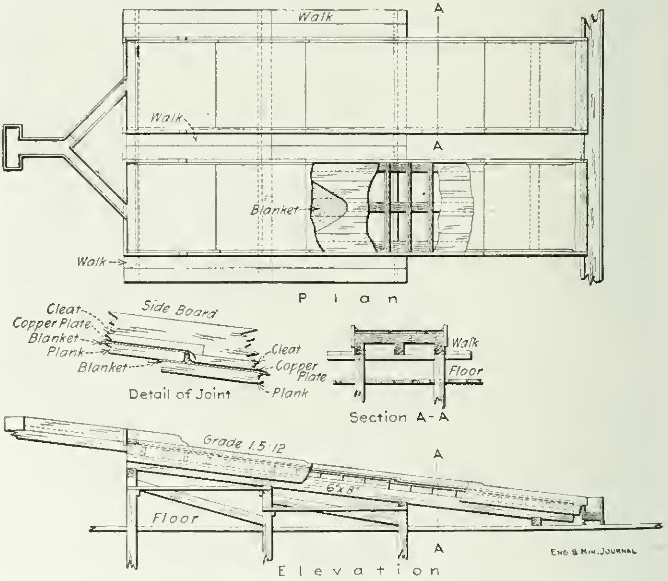
Amalgamation Tables for Huntington Mills

The amalgamation tables used in connection with Huntington mills differ from those usually used with stamps in that they are covered with several small copper plates set in sequence and so that there is a small drop from one plate to another, whereas the common type of table used in front of stamp batteries is covered with one large sheet of copper. The fall between plates seems to be a more desirable feature in Huntington-mill than in stamp-battery tables, although the reason for this is not perfectly clear. However, it is a fact that most of the gold is caught on each plate at a distance of about four inches beyond the drop.

It is a more difficult task to make a table with drops than a plane table, because of the tendency of the former to leak at the joints. A leaky table is an abomination to the millman and a source of loss to the owners. A well designed and well made table will not leak even after having been subjected to the vibrations of the mills for years. Tongued and grooved flooring may be used on the tables, but there is the possibility of a flooring constructed in this way swelling laterally enough to push the side cleats over the edge of the copper plates.

The table shown in the accompanying illustration has been in use in a South American mill for several years and, although it leaked a little when first used, the joints soon swelled and there was no recurrence of the trouble. The plates on this table are 5 ft. wide by 5 ft. 2 in. long. The lower edge of all the five plates is curved downward to a radius of 1½ in., and the upper end of all but the first plate is curved upward at the same radius, but the edge projects only ¾ in. above the surface of the rest of the plate while the projection below the plate at the lower end is 1¼ in. high. The plates are placed in sequence on the table with the curved ends overlapping as shown in the illustration. There is a great difference in the size of the tables used with Huntington mills, a width of four feet is common but five feet is better when the distance between mills is sufficient to allow two such tables being used for each mill. The lengths range from 10 to 30 ft. or more.

The 1¼-in. flooring is laid upon 2x4-in. cross-pieces spaced a little more than a foot apart. The flooring for one plate extends a distance of six inches beyond and under the edge of the flooring for the next plate above. The joint can be made water-tight by inserting a thin piece of blanket or flannel and covering the surfaces of the boards with marine glue. Blanket or flannel is laid over the flooring and brought up over the side boards before placing the plates on the table. The plates are held in place by side cleats 1 in. wide. After the cleats are nailed in place the blanket projecting above is cut off flush with the upper edge. It is also the practice in some mills to use a narrow strip of blanket between the cleat and the plate.



Amalgamation Tables for Huntington Mills

Leakage is most apt to occur at the joints between two plates where the curved ends overlap. This joint may be made water-tight by laying a strand of ball wicking, soaked in marine glue if desired, between the two projections before bringing them tightly together. The remaining details of construction are shown in the drawing.

It is a great advantage to use two tables in front of each mill, the pulp being conveyed to the distributing troughs at the head of each table by a split launder, as shown in the drawings. Then at clean-up time it is not necessary to stop the mill and the pulp can be shut off from one table by inserting a board in cleats nailed to the side of the launder just below the split as indicated by the dotted lines in the drawing.

If the floor of the mill is flat, as it often is when Huntington mills are used so that the driving gear will be above the floor, short running boards along the sides of the tables are necessary in order that the platemen can reach over the tables when dressing the plates. The plates are dressed working from the bottom upward as often as required.

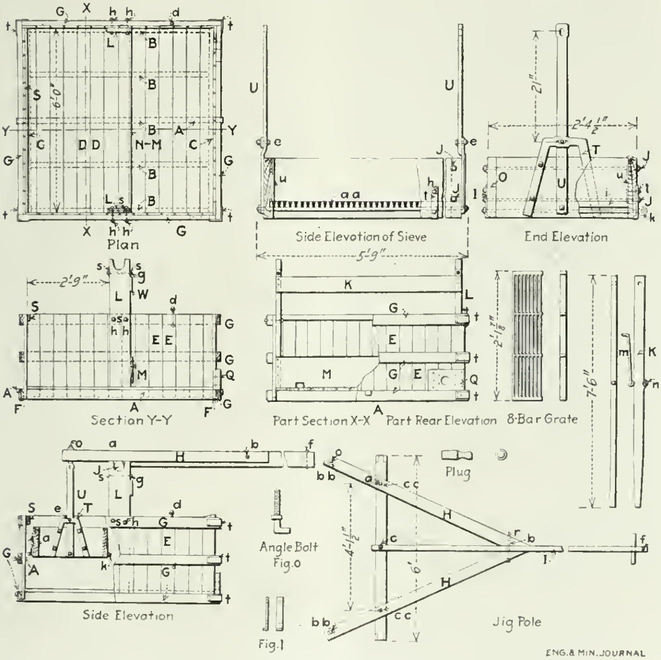
The marine glue mentioned may be obtained from any ship chandler or can be made by dissolving 1 part india rubber in crude benzine and mixing with 2 parts shellac by the aid of heat. This glue should be applied while warm; it sets quickly upon cooling, is slightly flexible and waterproof.

A basic lining for copper converting that has given good results at one smeltery is formed by putting in ordinary magnesite brick and cementing with a paste made by mixing finely ground magnesite with 20% sodium-silicate solution.

Joplin Hand Jig

The accompanying drawing shows the details of the design of the hand jigs used in the Joplin district of Missouri, where hand jigs are still used, although not so much as formerly. The drawing is self-explanatory. In the accompanying table is given a bill of the materials required for building one of these hand jigs. In the first column of the table, letters are given referring to the corresponding parts on the drawing.

The sieves are approximately 5½ ft. long, 2 ft. wide and 10 in. deep. They are suspended from the jig pole by strap-iron swings, connected through a slot to the jig-pole frame by angle bolts, and when new have ¼-in. play up and down, but as this link wears the play increases to ½ or ¾ in. This is desirable as it makes a quick suction stroke and a slight pause between the pulsion and the suction strokes. The jig pole, which is a 2x6-in. plank 20 ft. long, is provided with a bolt at the end to keep it from splitting. In jigging, the man, who stands on a spring board, grasps the cross bolt that goes through the jig pole as a handle. This spring board is arranged so that the bolt comes about waist-high while he is jigging. Before beginning to jig, the bed is settled and evened by a few vigorous up and down strokes with the sieve well submerged. Then the jigging proper begins with its peculiar short stroke, which is made much easier on the operator by the spring board.



Details of a Typical Joplin Hand Jig

The box of the jig is about 2 ft. 4 in. deep, 5½ ft. wide and 6 ft. long, perpendicular to the screen. The screen cradle is carried by two uprights that come up about in the middle of the side walls of the tank. The jig box is divided into two parts by a baffle-board across the center about 12 in. high, so as to confine the hutch concentrate under the sieve while providing a quieter compartment for the settling of the finer sizes of concentrate that come through the grates. Notches are cut in the bottom of the partition or baffle-board, so as to permit the water to drain out from the hutch part proper when the tank is emptied of the jigging water that has become too dirty for further use.

The sieve is generally lined with No. 16 sheet iron, although sometimes this lining is as heavy as No. 12. A lever with a hook is provided for fastening to the sieve and pulling it out of the way while the hutch product is being cleaned out of the jig. The parts are proportioned so that a rougher-jig sieve filled with a bed about 8 in. thick is about balanced when the bed is submerged. A stroke of about 1 in. is used on the rougher-jigs and one of about ½ in. on the cleaner-jigs, but the stroke is varied according to the ore and the operator.

Grates are used on the sieves with heavy bars, as shown in the drawings. Slots from ⅝ to ¾ in. wide are generally used on the rougher-jigs and from ¼ to ⅜ in. on the cleaner-jigs. A man operating a cleaner-jig has an easy time taking care of the middlings coming from the sieve and the box of two rougher-jigs. Usually three men will treat 15 to 20 tons of ore on two roughers and one cleaner in a 10-hour shift, provided the ore is favorable to hand jigging. Ore suitable for hand jigging must be comparatively free from clay and the metallic minerals not too intimately associated with the gangue. The middlings are saved and re-treated in mills, while often the tailings are run over again in a mill at some later period in the history of the mine.

At Granby, because mining has been going on for years and the workings are comparatively shallow and have been well drained, the silicate ore is not as wet and muddy as is characteristic of the ordinary silicate and lead gouges, as these workings are rightly called in the district. Ordinarily the ore, before being sent to the hand jigs, has to be washed free from this mud and clay, so as to facilitate the hand sorting of the coarser sizes as well as to aid in the hand jigging. This washing is done in a sluice box, in which the man wades around and claws the ore around with a shovel and his feet. After being washed, the ore is taken by the cullman, who either screens it through openings from 1 to 1¼ in. wide, or else uses a cull fork having openings about 1⅛ in. wide between tines. With such a cull fork he removes the coarser pieces from the product that goes to the hand jigs. When the ore is coming from a "jack" mine that is later to be equipped with a mill, seldom is there enough mud and clay in the ore to make it pay to sluice the ore before hand jigging.

No bed is used on the rougher-jigs, and each time that the load in the sieve has been properly bedded, the tailings are scraped down to the middlings or "chats"; the chats are then scraped off and saved, then the bed of "jack" or lead is removed, and the sieve loaded again. Consequently, the hutch work has to be re-run to clean it, although on the sieve some clean jack or lead may be made. In case that a lead-jack ore is being jigged, the ore on the sieve is stratified into the following products: Tailings that are first scraped off, jack chats, jack, jack-lead middlings and lead. The jack and jack chats are cleaned on the cleaner-jig apart from the lead products, the two being piled separately and saved until enough have accumulated for final treatment on the cleaner. The clean lead is put into the lead concentrate and the lead-jack middlings piled separately until the time when there is a good thick bed of lead on the cleaner. The jack is then separated from the lead by stratifying it on top and scraping it off as a high-grade product to be re-run with the other jack products. The bed maintained on the cleaner-jig varies from 2 to 6 in. in thickness, as the operator lets the bed accumulate, loading on more material from the rougher and scraping off the tailings as soon as he has stratified the load properly, until finally the load on the sieve becomes so heavy that he cannot jig it properly. Then he cleans his screen, leaving a bed about 2 in. thick, and begins over again. The shake that he gives the sieve varies with the thickness of the bed on the jig. Owing to the thinness of the bed, the hutch product is not properly cleaned the first time through. Toward the end of the shift the operator of the cleaner has a thick bed on his jig and re-runs the hutch product. Of course, the hutch has to be cleaned every time that the jigman changes from the cleaning of lead to the cleaning of zinc products. Generally, though, there is only a one-mineral separation to be made on the hand jigs. The two-mineral separation is not so common.

BILL OF MATERIAL FOR HAND JIG

Fig.	Number of Pieces	Material
A	1	2x4 in. x 6 ft. 6 in.
B	4	2x4 in. x 5 ft. $8\frac{1}{2}$ in.
C	2	2x4 in. x 6 ft.
D	14	$\frac{7}{8}$x$5\frac{1}{4}$ in. x 6 ft. 6 in. flooring
E	56	$\frac{7}{8}$x$5\frac{1}{4}$ in. x 2 ft. 8 in. flooring
F	4	$\frac{7}{8}$x1 in. x 6 ft. $2\frac{1}{4}$ in.
G	12	2x4 in. x 6 ft. $3\frac{3}{4}$ in.
H	2	4x4 in. x 7 ft. $1\frac{1}{2}$ in.
I	1	2x6 in. x 20 ft.
J	1	4x6 in. x 6 ft.
K	1	2x4 in. x 7 ft. 6 in.
L	2	2x8 in. x 4 ft. 2 in.
M	1	1x12 in. x 6 ft.
N	1	1x6 in. x 6 ft.
O	2	2x12 in. x 5 ft. 6 in.
P	2	2x12 in. x 2 ft. 1 in.
Q	1	2x8 in. x 14 in.
R	1	4x4x10-in. plug
S	1	1x2x6 in.
T	2	Angle irons
U	2	Hanger irons
a	2	$\frac{5}{8}$x11-in. bolts
b	1	$\frac{5}{8}$x9-in. bolt
c	1	$\frac{1}{2}$x11-in. bolt
d	1	$\frac{1}{2}$x$6\frac{1}{2}$-in. bolt
e	2	$\frac{1}{2}$x$1\frac{3}{4}$-in. bolts
f	1	$\frac{3}{8}$x6-in. bolt
g	2	$\frac{3}{8}$x8-in. bolts
h	4	$\frac{3}{8}$x$4\frac{1}{2}$-in. bolts
h_1	10	$\frac{3}{8}$x2-in. bolts
i	1	$\frac{5}{8}$x5 ft. 9 in.-rod
j	4	$\frac{5}{8}$x$3\frac{1}{2}$-in. rods
k	1	$\frac{5}{8}$x$31\frac{1}{2}$-in. eye-rod
l	2	$1\frac{1}{4}$x$\frac{3}{8}$x6-in. irons
m	1	$\frac{1}{2}$x19-in. eye-hook
n	1	$\frac{1}{2}$x5-in. eye-bolt
o	2	$\frac{1}{4}$x2-in. angle bolts
p	5	$\frac{5}{8}$-in. cut washers
r	8	$\frac{1}{2}$-in. cut washers
s	14	$\frac{3}{8}$-in. cut washers
t	12	Corner irons
u	2	$9\frac{1}{2}$-in. x 2 ft. 1-in. No. 16 sieve liners
v	1	$10\frac{1}{2}$-in. x 5 ft. 4-in. No. 16 sieve liner
w	1	$9\frac{1}{2}$-in. x 5 ft. $4\frac{1}{2}$-in. No. 16 sieve liner
4a	8	$\frac{1}{2}$-in. cast washers
aa	10	Grates
bb	2	$\frac{3}{4}$-in. cast washers
cc	4	$\frac{3}{8}$-in. cast washers

Surprisingly clean concentrates are obtained from the hand jigs when the ore is free, as it is called when there is not much true middling going to the jigs, but inasmuch as the ore is not crushed before hand jigging, much fine mineral is locked up in the tailings, and, of course, an efficient saving is not made on the finest of the mineral particles. On account of the inclusion of some of the true middlings in the jack concentrates, these concentrates are generally somewhat lower in grade than they would be from a mill treating the same ore, but owing to the freeness with which the lead particles break from the jack and the gangue, the lead concentrates from the hand jigs are as clean as those from the mill jigs.

Only at the lead gouges and the silicate workings are hand jigs extensively used at present. Spring City and Granby, where silicate ore is mined, are the places where hand jigging is chiefly done at present, although there are several plants near Lehigh and Belleville where the zinc-sulphide ore from the upper runs is quite free-milling. Otherwise the hand jig is generally used as a preliminary operation to treat the ore coming from the development workings in the early life of a mine, so as to make the mine help pay the cost of its development, and the tailings are saved and re-run in the mill which is erected later.

With some ores three men with three jigs, two running as roughers and the third as a cleaner, can clean up 20 tons per shift on most of the hand-jigging ore in the southwestern Missouri zinc and lead district. With some ore, as high as 30 tons can be cleaned by such a crew, while with other ore 15 tons is a good day's work. Tonnage statements are difficult to make on hand jigging, as so much depends on the ore treated.

The hand jigs are sold ready for use, and cost completed about $30. When the ore is given a preliminary sluicing, one cullman at $2.25, one sluiceman at $2.50, and three jigmen at $2.50 each are required, making a total of $12.25, which may be taken as the cost of treating 18 tons of ore, so that the cost is less than 70c. per ton of ore treated.

Horsepower of a Pelton Wheel

The horsepower of a Pelton wheel may be calculated from the following formula, states *Power*:

$$Hp. = 0.00496\ Ecnd^2 \sqrt{h^3}$$

Where

E = Efficiency of the wheel;

c = Coefficient of discharge from nozzle;

n = Number of nozzles of equal diameter;

d = Diameter of jet in inches;

h = Effective head in feet.

Assuming the efficiency E to be 80% and the coefficient $c = 0.9$, the formula will be reduced to

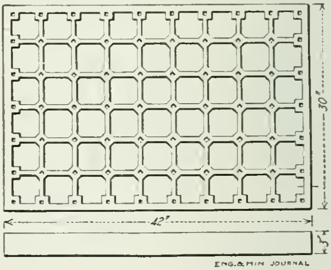
$$Hp = 0.00357\ nd^2 \sqrt{h^3}$$

Cast-Iron Screen Frames for Jigs

By Claude T. Rice

Grates are generally used to support the bed of ore in the jigs in Joplin mills. They are preferred because the cherty constituents of the ore tend to break into long splinters which choke wire-cloth screens; the grates do not become choked as easily as do screens and when choked can be more easily cleared. However, in certain mills screens are used in some of the jigs, and in order that the jigs may do their work most effectively it is essential that the screen be supported rigidly in a horizontal plane. In many jigs a wooden grating is used for this purpose, the screens being stretched tightly over and tacked to the grate.

Another device for supporting wire-cloth screens has been developed by J. A. Rogers, a Joplin foundryman. It consists of a cast-iron grid, as shown in the accompanying illustration. This grid is a rectangular cast-iron frame, 1 in. wide by 3 in. deep, divided by ribs into a number of lozenge-shaped openings. The ribs are ⅝ in. wide and 3 in. deep. The junctions of the ribs with one another and with the sides of the rectangular frame are enlarged and in casting the grid these enlarged junctions are cored so as to leave holes ½ in. square in the finished casting. At the junctions of the ribs with the frame the sides of these squares are parallel to the sides of the frame while at the junctions of the ribs with one another the diagonals of the square holes are parallel to the sides of the frame. Wooden plugs are driven into these small holes and after the projecting ends have been cut off flush with the top of the ribs the screen is tacked to these plugs.



Jig Grates Used in Joplin Mills

These grids are used in a few mills at Joplin, but because of the splintery nature of the crushed ore screens are used only in a few jigs. In other districts where the ore is not splintery and screens are more extensively used in the jigs these grids might be used to advantage.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

The Magnetic Bronzes

It was not known before 1903 that alloys of nonmagnetic metals could acquire permanent magnetism, when Heusler discovered this fact (*Metaux et Alliages*, Feb., 1912). The alloys of manganese with aluminum, arsenic, boron, bismuth, antimony and tin become magnetic under the influence of powerful fields, and if copper is present, the magnetism becomes permanent. The alloys are hence usually made by adding the third metal to cupromanganese.

There are many peculiarities of these alloys brought out by heat treatment. For instance, if MnP is warmed in the hand it no longer reacts with a magnet, but does so immediately upon being placed in cold water (Hilpert and Dieckmann, *Proc.* Faraday Soc., Apr. 23, 1912). The critical points seem to be functions of the atomic weight of the third metal, while the magnetic properties themselves seem to be connected in some way with valence. Again, the metals apparently must be in molecular proportions so that the alloy is a mixture of chemical compounds; thus, one series of manganese-copper-aluminum alloys consists of mixtures of Cu_3Al and Mn_3Al.

Influence of Oxygen on Arsenical Copper

The influence of oxygen on copper containing arsenic and antimony was discussed by R. H. Greaves before the Institute of Metals, on Jan. 17, 1912. For rolling, as the percentage of arsenic increases to 0.5%, the percentage of oxygen can be raised to as much as 0.28%, before the material becomes cold-short. If the metal is cold-short from oxygen, arsenic will, up to a certain point, help it. However, the effect of both arsenic and oxygen in wire drawing was detrimental. Increase in oxygen seemed to have no detrimental effect on tensile strength, but produced a marked decrease in elongation.

The addition of arsenic or antimony to pure copper hardens it; the effect of either on copper containing oxygen is first to diminish and then increase its hardness. The addition of oxygen to arsenical copper is without any marked influence on the hardness until it reaches a limit, depending on the percentage of arsenic, when the hardness rapidly increases. Thus copper with 0.4% arsenic and 0.3% oxygen is quite as soft as, if not a little softer than, a similar metal free from oxygen. The limit of the percentage of oxygen which does not noticeably affect the hardness rises to about 0.35% as the arsenic increases to 0.5%. In a similar way antimony first diminishes and afterward increases the hardness of copper containing oxygen, while quite a low percentage of oxygen begins to harden copper containing antimony.

In every case the conductivity of a wire containing oxygen and arsenic was less than one containing no oxygen and equal arsenic, but this effect was reversed with antimony.

Properties of Rare Refractory Materials

An examination was recently made of some infrequently used refractory materials by Fitzgerald and Bennie, and the Norton Co. (*Met. and Chem. Eng.*, Mar. 1912). Alundum (purified and fused bauxite) was found to have a melting point between 2050 and 2100° C. for the white variety, and about 50° lower for the brown; linear coefficients of expansion of 78×10^{-7} and 85×10^{-7} for the two varieties; sp.gr., 3.9 to 4.0; and a high heat conductivity. This latter property makes it useful as a protector for pyrometer couples. The bricks are highly refractory, but in steel furnaces are subject to corrosion from basic fumes arising from the slag.

Crystolon or carborundum (silicon carbide) has a small coefficient of expansion, a higher heat conductivity than alundum, and is extremely infusible. In strongly oxidizing atmospheres it decomposed giving CO_2 and SiO_2, the latter forming a protecting coating on the surface of the brick.

Magnesia has long been regarded with suspicion as a refractory because of its great shrinking on heating. Electrically calcined material is almost free from this fault, and is also apparently unaffected by moist carbon dioxide. Fused lime was also tried, and exhibits some remarkable characteristics. It can be heated to redness and then plunged into water without cracking, and resists moist air and water remarkably well.

Zinc Dust Precipitation

An improvement in zinc-dust precipitation is patented by Charles W. Merrill (U. S. pat. 1,006,865 and 1,006,866), which consists in adding the zinc dust to the unprecipitated liquid in motion, subjecting the emulsion to a grinding action, and filter pressing the resulting mixture. Inferior grades of fume and dust can thus be utilized. The process is applicable to other similar precipitants. The idea of grinding is to remove the coating of oxide on the metallic dust.

The Use of Molten Ferromanganese

In a digest of two articles appearing in *Stahl und Eisen*, the use of solid ferromanganese as a deoxidizer is deprecated by *Echo des Mines*, Apr. 25, 1912. When used either cold or warm in the solid state, it is uneconomical, as small pieces of it do not get through the slag, hence an excess is necessary for complete deoxidation; there is a loss of time if the addition is made after washing the metal; the washing is incomplete if added during this process; and in any event the bath is chilled. Consequently, the procedure used at the Burbach works at Saarbruck, of melting the ferromanganese in an electric furnace in a neutral or reducing atmosphere, is strongly recommended.

Aging Cement with Steam

The Bureau of Standards has been investigating the quick aging of cement blocks, pipe, etc., by exposure to steam, and the following are their conclusions (No. 5, *Technologic Papers*. Bureau of Standards):

Steam up to 80 lb. per sq.in. gage pressure has an accelerating action on the hardening of portland cement mortar and concrete. The compressive strength increases as the steam pressure is increased. The compressive strength increases with the increase in the time of exposure to steam. A compressive strength considerably (in some cases over 100%) in excess of that obtained normally after aging for six months may be obtained in two days by using steam under pressure for curing the mortar. Steam under pressure, if of sufficient duration, permanently accelerates the hardening of the mortar, giving subsequent constant increase in compressive strength with age. The steam-cured mortar or concrete is of much more uniform appearance and much lighter in color than normally aged mortar or concrete made from the same materials. The mortar or concrete should obtain an initial set before it is exposed to the steam treatment. For steam curing a "quaking" or medium consistency is preferable to a dry or a wet consistency. The initial modulus of elasticity and the yield point of the mortar increase directly with the duration of steam treatment. The initial modulus of elasticity and the yield point of the mortar increase directly with the steam pressure. The initial modulus of elasticity does not increase in direct proportion to the increase in the ultimate compressive strength of the steam-cured mortar. Results indicate that the compressive strength obtained by steam curing is directly proportional to the cement content of the mortar.

Saklatwalla Vanadium Extraction Process

A process for the extraction of vanadium from its ores is that of Bryamji D. Saklatwalla (U. S. pat. Nos. 1,020,224; 1,020,312, assigned to the American Vanadium Co.), who treats the ore with acid, preferably dilute sulphuric, and oxidizes the resulting solution with ammonium persulphate, sodium chlorate, or some similar salt, thereby throwing down the hydrated, red oxide of vanadium. Gaseous oxidizers can be used also; for instance, chlorine is said to be advantageous, as the solution from which the vanadium has been precipitated, if used for treatment of further ore, is especially potent in dissolving sulphides. The hydrated, red oxide is then dried, leaving V_2O_5 as a marketable product.

Testing for Radioactive Minerals

That all pitch-black, or clear-yellow ores, which verge upon the green, should be tested for radioactivity, is advised by *Echo des Mines*, Apr. 29, 1912. The test is simple. A photographic plate is placed sensitive side up in a box which can be made light tight, and the mineral to be tested placed upon it. At the end of ten days or so, develop the plate. Black spots and diverging rays of fog show radioactivity. Of course, all precautions taken in ordinary photography to insure an unfogged plate must be taken in this work.

Outlook for the German Potash Industry

That the German potash laws enacted two years ago are not unmixed benefits is claimed in the recently published report of the Aschersleben Potash Mines (*Bull.* Amer. Assoc. of Commerce and Trade, Berlin, May 1, 1912). The struggle to gain a larger quota of the potash sales has resulted in the opening of new shafts at great expense. From 1909 to 1910 the number of mines contributing to the output increased from 55 to 68, and in 1911 was 73. In 1912 the prospects are that there will be 97 mines, and there are now 113 mines sinking shafts, as against 73 in 1911.

It is represented that 10 double mines, such as Aschersleben and Sollstedt, with 30 shafts, would be able to supply the world's consumption of potash. Now, there are more than three times this number, and still others threatened, none of which will probably ever be operated to its capacity. The effect on the potash industry of this sinking of capital, mainly secured by bond issues, in these useless shafts, and of the part-capacity working, is deplored.

Heat Insulating Materials

At the Boston meeting of the American Electrochemical Society, Apr. 18 to 20, 1912, F. A. J. FitzGerald gave a paper on the suitability of various heat insulating materials for checking furnace heat-radiation losses. The materials tested, in the form of bricks, were built into furnaces, heated from the inside by a nichrome resistance wire. The following is the order in which some of the materials tried stand; in order of descending conductivity: Silicon carbide; magnesia; alundum; silica; firebrick; red brick. The above results show why alundum crucibles or muffles should be desirable. The great insulating effect of small quantities of loosely packed coverings was also pointed out.

An Aluminum Disease

It appears that spun, hammered or rolled aluminum is, like tin[1], subject to disease (*Metal Industry*, May, 1912). The disease manifests itself in the same way, by the disintegration of the metal. This is said to be due to different degrees of electric tension in adjoining layers of metal having been set up by strain in the metal, when in the presence of electrolytes. Lime salts especially seem to favor corrosion.

Titanium in the Blast Furnace

The troubles formerly experienced with titanium in the blast furnace were due to excess of flux, says the *Pahasapa Quarterly*, January, 1912. This resulted in forming infusible calcium titanate. If a greatly reduced quantity of flux is used, the titanium is taken up as calcium titano-silicate, which is readily fusible. It is claimed that fusible slags carrying as much as 20% TiO_2 can be made in this way.

Amino White Lead Process

A patent has been taken out in Germany on a new method of making white lead, says the *Oil, Paint and Drug Reporter*. According to the patent, white lead is made by treating litharge or other lead compounds with a boiling solution of amino acids, such as result on hydrolysis of albuminoid substances, and precipitating the lead from the solution by passing through it a current of carbonic-acid gas. As the organic acids remain in solution when the white lead is precipitated, the liquor can be used continuously for dissolving more litharge.

French Requirements for Tungsten Ore

A great French steel works demands the following requirements in tungsten ore: It shall titrate a minimum of 60% of tungsten, and a maximum of 5% manganese; it must be practically free from substances which injure steel, such as tin, arsenic, bismuth, zinc, and sulphur; it must be in large pieces (small sizes will be penalized); and the material ought to be in boxes, instead of sacks. Commenting on this *Le Journal des Mines et de la Metallurgie* says that the works in question seems entirely ignorant of mining conditions; for instance, practically all the Colorado output must be in small sizes, as it is a concentrate.

Wet Screening Device

For wet-screening, Enos A. Wall, of Salt Lake City, has patented (U. S. pat. 1,005,907) a screen having a slight inclination, which is thrown forward by a spring against a bumping post, so that the ore will be dislodged and fall on the screen at a lower point, with any cakes so broken as to be subject to action of the wash water. The screen is then slowly retracted against the action of the spring.

Detinning in Italy

There are said to be three detinning plants in Italy: the Dossmann company, at Pegli; the Eugenio Gueco company, at Arenzano, and the Societa Electrochimica Vesuviana at San Giovanni-Tettucio. The first named has been running about five years, says the *Journal du Four Electrique*, Apr. 13, 1912, and treats about 2500 tons of tin scrap per year. The process is the caustic-soda electrolytic.

Tin Ore in Poland

A group of capitalists has been making explorations in the basins of the Sosnowice and Dombrowa, in Poland, to discover tin ore. Tin ore is at present known near Kogroufka, says *Echo des Mines*, Mar. 25, 1912, where the deposits attain a thickness of about 1¼ m. The commercial exploitation of these ores will be undertaken shortly.

Pyrophoric Alloy

A new pyrophoric alloy, said to be cheaper than the cerium-iron alloys, and not subject to disintegration, is: Mn, 80%: Sb, 10%; Cr, 10% (*Brass World*, May, 1912). The alloy is airproof, and is said to produce a long streak of flame, instead of a shower of sparks.

---

[1] Eng. and Min. Journ., Dec. 31, 1910, Feb. 1 1911.

Hydraulicking in Beauce County, Que.

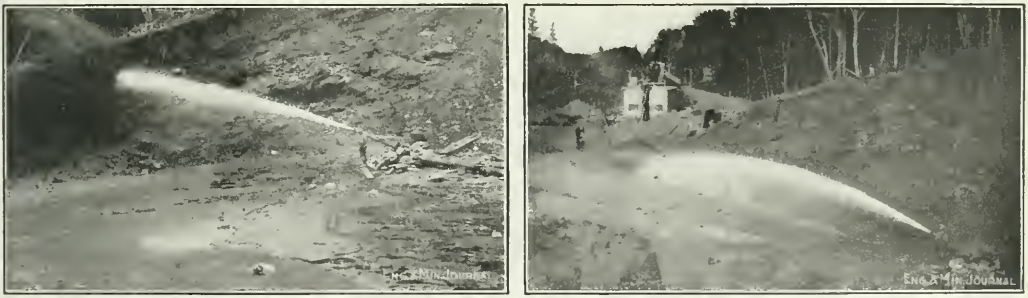
By Fritz Cirkel*

Hydraulicking was tried on Rivière de Loup in 1882, but failed; this method was consequently in disfavor until another company, after two years' investigation, installed a hydraulic plant on the Ruisseau des Meules. A 7½-mile flume was constructed for conveying water from Lake Fortin, which is 335 ft. above the gravel workings; in a trial run last summer the plant worked satisfactorily.

The hydraulic exploitation of alluvial gold gravels, in Beauce County, was first attempted in 1882, when the Gold Mining Association of Canada, under the management of A. F. Humphrey, installed a hydraulic plant on the banks of the Rivière de Loup. This plant consisted of a ditch 11½ miles long, to tap the waters of that river, the necessary steel pipes, giants and all accessories; 215 ft. of head was obtained; the quantity of water supplied to a 4½-in. nozzle amounted to about 350 miners' inches, and the capacity of the plant to about 1000 cu.yd. per day of 24 hours. The thickness of the pay dirt varied from 30 to 40 ft., yielding, so it is reported, on an average of 10c. per cubic yard.

HYDRAULICKING ABANDONED IN 1884

The company operated during the seasons 1882 and 1883, but abandoned the works in 1884, after having spent upward of $150,000. The suspension of operations of this concern was a serious setback to gold mining in that section of the country, and the failure to work the gravel banks by means of hydraulicking is responsible for the continuation of the old primitive mining method, that is, by pick and shovel.



CUTTING AND DRIVING GIANTS AT WORK ON THE RUISSEAU DES MEULES GRAVELS. MECHANICAL ELEVATOR IN BACKGROUND

From a closer examination of the gold deposits along the shore of the Rivière de Loup, it appears that at the points where they were worked, the richer portions are concentrated near bedrock, and as the latter was much below the actual river bed, it is obvious that the hydraulic method would fail unless the course of the river was changed altogether. After the experience of the Canada Gold Mining Association, the hydraulic method was considered unsuitable to the working of the Beauce River banks, and this is the principal reason why no further attempt at hydraulicking was made in later years.

The extensive investigations, however, carried on by the Champs d'Or Rigaud Vaudreuil for the last 2½ years, over the greater part of the Seigneurie Rigaud de Vaudreuil, conclusively prove that there are stretches of gold-bearing ground along certain river beds, which, by reason of their favorable situation, richness and water facilities, are well suited for the successful application of the hydraulic process.

Of course, it must be admitted that in some cases it is not easy to determine offhand whether the hydraulic method can be successfully applied; it takes a serious study primarily as to water conditions and further as to the conditions governing the distribution of the gold in the alluvials; a mistake made in either one of them means the loss of considerable capital, especially in cases where a long ditch has to be built for the conveyance of the water to the works.

NEW COMPANY PROSPECTED THOROUGHLY

First of all, the investigations regarding the situation, character and tenor of the alluvial gold deposits have to be carried on systematically either by shafts in connection with underground work to some extent, and also by drilling. This latter method has been advocated as the only proper means for the exploration of these gold fields by mining engineers for many years. Although I was the first to introduce the method in that district, I am rather skeptical regarding the all-around application of this method in preference to shaft sinking.

Two kinds of drills were employed, the Empire hand drill and the Keystone power drill. Several hundred holes were put down in different sections of the seigneury, and while it must be admitted that, on the average, good results were obtained as far as the cost per foot was concerned, the fact must not be lost sight of that testing by shafts enables one to study the character of the gold alluvials to far greater advantage than by drill holes. Again, where the ground is extremely bouldery, the progress of drilling is slow, and it often happens that explosives have to be resorted to in order to get rid of the impeding boulders. One important point, however, in favor of the drills is that there is a possibility of penetrating to bedrock in places where much water and quicksand are encountered. In these cases, either hand or power drills are indispensable, and there is today no other efficient method to replace them.

BOTH SHAFTS AND DRILLS USED

To perform the exploration of a given strip of land efficiently, it is necessary to divide the surface into squares, if possible, all of the same dimensions, and test each square by a certain number of shafts and drill holes. On the northeast branch of the Gilbert River and along the lower part of the latter on Lots 9 and 10, St. Charles, a checkerboard system of drill holes and shafts was brought down, the total length of the ground to be tested in both cases being about 1000 ft. long, its width from 100 to 300 ft., all divided into squares of 50 ft. each.

As a concrete result of the varied exploration work carried on in different sections of the seigneury, it must be said that it is far more advantageous to sink shafts than to drill holes in ground which is known to contain boulders; in ground comparatively devoid of these or containing quicksand, the drilling method is preferable.

---

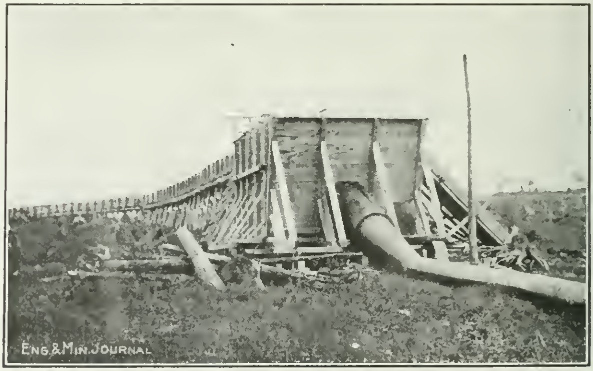
*Consulting mining engineer, 80 Stanley St., Montreal, Que.

In the selection of the ground tested previously by drilling or shaft sinking for the hydraulic method as outlined above, it must be stated that certain fundamental principles underlie the successful exploitation of the alluvials, viz.: (1) the water facilities, (2) the head to be obtained, (3) the grade of the river bed. After a thorough investigation of all these factors, the Champs d'Or Rigaud Vaudreuil, Ltd., decided to place hydraulic equipment on the lower banks of the Ruisseau des Meules, a small stream draining considerable territory on the left bank of the Chaudière River, south of Beauceville.

Water Supply a Problem

The difficulty of obtaining the necessary quantities of water was, at the beginning, not easily overcome; having an abundant supply of water all the year round in the Chaudière River, the idea suggested itself at first to build a ditch from some suitable point between the towns of St. Georges and Beauceville and to pump the water from the river into this ditch, but after careful consideration this project was abandoned. It must be stated here also that C. W. Purington, of the U. S. Geological Survey, reports that out of nine plants visited by him in Alaska and in Canadian territory, at which pumping to secure head for hydraulic mining was in progress, not one of them was making expenses.

Accordingly a search for other sources was made, and it was soon established that there were a number of lakes about seven miles to the southwest, which, by reason of their elevation and quantity of water stored in them, would likely solve the difficulty. The largest of these lakes, Fortin Lake, at St. Victor, Tring Township, covers an area of 381 acres. Its elevation above sea level is 1020 ft., above the point on Ruisseau des Meules, where the plant was to be established, 335 ft., and its distance 7½ miles. This lake, which was selected as the main reservoir for the hydraulic plant, is fed by Lake Castor, at an elevation of 60 ft. above Lake Fortin. In order to store the water in Lake Castor for the summer, to be used as needed, a dam was built 320 ft. long, 6 ft. above normal level, and the intake of the ditch placed at 3 ft. below the lake level; this makes a water column of 9 ft., and based upon the area of the lake at normal water level, that is, 36.5 acres, and taking the gently sloping condition of the land immediately surrounding the lake into consideration, it is safe to assume that about 30,000,000 cu ft. of water can be stored for immediate use.



Penstock at End of Flume from Lake Fortin in Beauce County, Que.

Lake Fortin Main Reservoir

In Lake Fortin, a dam, 6 ft. above normal lake level and 650 ft. long, keeps all the water back resulting from the early spring freshets. The bottom of the intake of the long ditch is 5 ft. 2 in. below the normal level, thus forming with the 6-ft. dam, a water column of 11 ft. 2 in. It is calculated that together with the unavoidable overflow and the water stored in Lake Castor, about 250,000,000 cu.ft. of water can be obtained, which, at a daily consumption of 1100 miners' inches, will keep the plant going from 4½ to 5½ months, depending, of course, greatly upon meteorological conditions.

The main point in favor of Lake Fortin as the main water reservoir was its satisfactory elevation to cover the greatest range of mining ground at the smallest expense with a great hydraulic pressure. For the first 3200 ft. near the lake, the ditch has a grade of 1 ft. to every 800 ft., and for the balance, that is, for a length of 6¼ miles, 1 ft. to every 600 ft., leaving thus a net head pressure for the giants of 275 feet.

Construction of Ditch

The most difficult section in the construction of the ditch was that part lying nearest to Lake Fortin, covering a distance of about 3200 ft. Most of this section had to be cut through solid rock, the deepest cut being about 30 ft. at a distance of 900 ft. from the lake. The timbering of this cut consists of two posts 8 ft. square and caps and sills to match, the inside measurements being: 30 in. under cap, 40 in. above sill between posts, and 64 in. between cap and sill; these sets are placed every 4 ft. For the protection of the timber against ice, snow and heat, it is covered with several feet of earth. Manholes for the inspection of the ditch are installed every 1000 feet.

The remainder of the ditch measures 3 ft. at the bottom, 6 ft. at the top, is from 2½ to 3 ft. deep, and is timbered where necessary; it is calculated that with a velocity of 4.1 ft. per second, the ditch will carry 2000 miners' inches. The flumes, 16 in number, and measuring 5600 ft. in length, are 4 ft. wide and 3 ft. 6 in. high, having approximately the same areal sections as the ditch; the longest stretch of flume is 1050 ft. The ditch empties into the pressure box or penstock, a large wooden box, from whence the water is conveyed by a pipeline down to the works. Connected with the penstock is the sand or refuse box, which is placed below the ditch line to catch all sands, and also a grating of bars to retain all floating substances.

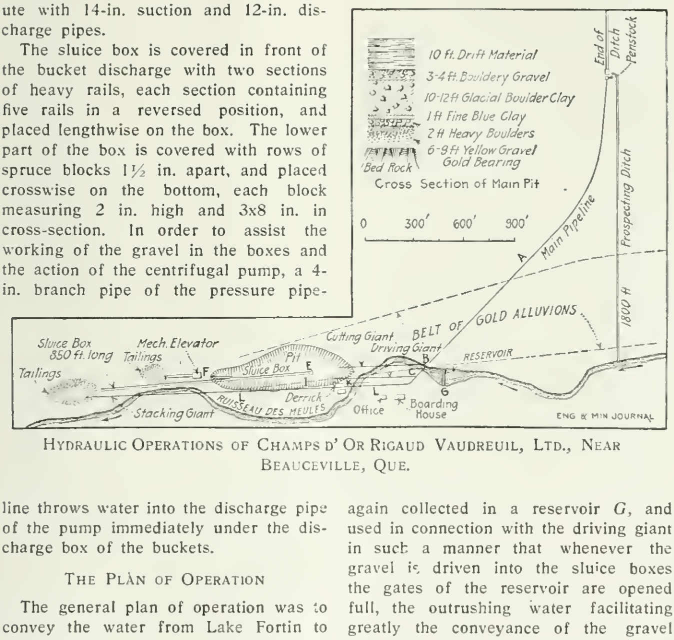
The pipeline, made of wrought iron in sections of 8 ft., from the pressure box to the works, has a length of 2600 ft., and to the end of the sluice box, 3450 ft. The diameter of the first 1600 ft. is 18 in., with No. 18 gage plate; for the next 800 ft., 15 in., with No. 16 gage plate; the pipe line for the cutting and driving giants is 15 in., with No. 14 gage; and for the stacker, 10 in., with No. 12 gage plate. Gates are installed all along the line, the main gate being in the upper part of the pipeline, and the others on all the branches. Air valves are installed every 100 ft. with apertures of 2x4 in. For the supply of the mechanical elevator and the Pelton wheel of the derrick, 4-in. branches are used. Three giants are installed: two for cutting and driving, and the third one for stacking at the end of the sluice box.

The main sluice box is 850 ft. long, and is composed of sections of 12 ft., each having a grade of 3½ in. It is 3 ft. wide, 3 ft. 6 in. high, the sides being made of 1½-in. planks, with 4x6-in. posts. The bottom, made of 2-in. planks, is covered with sections of five rails, each 4 in. high, and 20 ft. long, placed lengthwise in the box and in a reversed position. The rails facilitate the transport of the gravel a great deal, and retain between them the gold in a highly satisfactory manner.

Mechanical Elevator Used

The mechanical elevator, a compact steel structure, lifts 23 buckets of 3 cu.ft. each per minute, which is equivalent to a capacity of 3672 cu.yd. per 24 hours, and is mounted on two trucks of a 20-ft. gage track resting on bedrock. There are 48 buckets mounted on a ladder which can be lowered or raised by an electric hoist with steel cables and shackle blocks; they are operated round an upper and lower tumbler and an idler placed half way up the ladder. The material lifted by the buckets is dumped into the upper sluice box and is here washed by means of a flow of water thrown from a powerful centrifugal pump of a capacity of 4500 gal. per minute with 14-in. suction and 12-in. discharge pipes.

The sluice box is covered in front of the bucket discharge with two sections of heavy rails, each section containing five rails in a reversed position, and placed lengthwise on the box. The lower part of the box is covered with rows of spruce blocks 1½ in. apart, and placed crosswise on the bottom, each block measuring 2 in. high and 3x8 in. in cross-section. In order to assist the working of the gravel in the boxes and the action of the centrifugal pump, a 4-in. branch pipe of the pressure pipeline throws water into the discharge pipe of the pump immediately under the discharge box of the buckets.



Hydraulic Operations of Champs d' Or Rigaud Vaudreuil, Ltd., Near Beauceville, Que.

The Plan of Operation

The general plan of operation was to convey the water from Lake Fortin to the top of a hill close to the works, and pipe it from there to the alluvions 275 ft. below. The grade of the river bed, 2.35%, not being sufficient to dispose conveniently of the tailings without an extra giant, it was decided to install a mechanical elevator, by means of which the tailings were to be raised and stacked in the manner indicated in one of the halftones.

A sketch plan of the operation, as carried out during the summer of 1911, is presented in the accompanying engraving. One main pipeline *A* is laid to a point 1000 ft. from the works; it then branches out in two smaller lines for the cutting and driving giants *B* and *C*. The gravel bank is attacked by the cutting giant *B* and the loosened gravel driven by giant *C* into a sluice box *E*, where all the coarse and some of the fine gold are retained. The tailings are then elevated by a string of buckets in the mechanical elevator *F*; the remainder of the fine gold is retained in the upper sluice boxes of the latter, and the tailings disposed of as indicated.

The overflow of the pressure box or penstock in case some of the giants are stopped is utilized for prospecting purposes; all the water is led in ditch *H* over a hill which forms the continuation of the gravel bank, now under exploitation. After two months' flow over a stretch of 1800 ft., the water had cut into the bank in some places as deep as 18 ft., and had laid bare in this way a stretch of gold-bearing alluvions of over 200 ft. wide. All this overflow water is again collected in a reservoir *G*, and used in connection with the driving giant in such a manner that whenever the gravel is driven into the sluice boxes the gates of the reservoir are opened full, the outrushing water facilitating greatly the conveyance of the gravel through the boxes to the elevator. It was found that by these means the efficiency of the plant was increased fully 40 per cent.

Derrick for Removing Boulders

For the extraction of boulders from the gravel a hydraulic derrick *I* is used; this is placed at a convenient point near the gravel pit and is driven by a Pelton water wheel operated through high-pressure water from a 4-in. branch pipe *K* of the main pipeline. Since the water supply has been greatly increased through enlargement of the ditch and other improvements, experiments have shown that all the tailings instead of being elevated through a costly mechanical operation, can be disposed of conveniently by hydraulic stacking.

A sluice box was built 850 ft. long, one end being brought right up to the gravel banks, while the other landed in the river valley below the elevator. The tailings accumulating at the end of the sluice box were stacked to the side of the valley by a giant with a 4-in. nozzle, fed by an 8-in. pipe *L* from the main line as indicated in the diagram. The long sluice box is also connected, as shown in the diagram, with the mechanical elevator; this serves as an emergency in case the water pressure is low or the stacking of the tailings by hydraulicking is interrupted for any reason.

The hydraulic plant was worked principally for experimental purposes during part of the summer of 1911. The main trouble in starting it right was in the adjustment of the operating units of the elevator, deepening of the sump, changes at the discharge end of the buckets, trouble with the electric transmissions and motors; but once these difficulties were overcome, the whole plant worked satisfactorily under prevailing conditions.

In the beginning of the season, when the mechanical elevator was operated, only one giant using 520 miners' inches was used. Three 8-hour shifts were run in 24 hours, Sunday and holidays alike, about two-thirds of the time being used for hydraulicking, and the other third for the removal of boulders by derricking. The fact, however, that owing to the insufficient water supply, only one giant could be operated, which was used for both cutting and driving purposes, mitigated against the efficient handling of the whole plant, and it was soon recognized that unless the quantity of water was increased to such an extent that two giants could be used simultaneously for cutting and driving, the plant could not be economically operated.

Consequently, as soon as Fortin Lake had dispensed its surplus water, the problem of increasing this water supply was seriously attacked, and within 2½ months after the suspension of hydraulicking, the whole ditch and flume line, seven miles long, as well as the intake on Fortin Lake, was thoroughly overhauled, enlarged, many places deepened, leakages stopped, and the grades adjusted; and on Nov. 5, 1911, for the first time, two giants could be used simultaneously in connection with the 850-ft. sluice box in the handling of the gravel banks.

Capacity 2500 Cu.Yd. Daily

Owing to the advance of the winter season, however, the plant had to be shut down after only two weeks of operation, but at the outset it was recognized that during this short time the pay dirt could be handled for just half the cost as when operated under the old system. The capacity of the plant as it stands today is about 2500 cu.yd. per day of 24 hours, and this might possibly be increased through additional alterations and improvements now contemplated, and to be made after the season's work is finished.

A general description of the physical features and the geology of the country was given in my paper[1], "Alluvial Gold Deposits in Quebec." Those interested are referred to that article. A cross-section is shown of the main bank, which now forms the subject of extensive exploitation by means of this new hydraulicking plant. These alluvions in more or less variation constitute, so far as present knowledge through exploration work goes, the valley and banks along the Ruisseau des Meules, commencing from the confluence with the Chaudiere River and extending to a point about three miles further up the creek. The present hydraulicking machinery is situated about half way, the plan having been adopted to ascend gradually the valley and fill the remaining spaces with the débris and tailings of the washed pay dirt.

Extensive Deposits Available

It is estimated that there are available for immediate exploitation in the vicinity of 3,000,000 cu.yd. of pay dirt, not counting the extensive stretches along the upper part of the creek, where many indications point to the continuation of the alluvial deposits. A part of this ground, especially where the plant is now situated, constitutes the tailings from earlier washings on a small scale, and an idea may be gained from the tenor of the ground when it is stated that at the first trial cleanup, on July 5 and 6, 1911, 37c. per cu.yd. was obtained from a lot of 2600 yards of tailings. A second cleanup, on Aug. 15 and 16, from 16,600 cu.yd. composed partly of tailings and partly of virgin ground, gave 42c. per yard.

The width of pay alluvions immediately in front of the elevator is 90 ft.; at 300 ft. distance it is 165 ft., and at 1800 ft. from the elevator, as far as the exploration in the overflow ditch shows, about 400 ft. Most of the gold is found close to bedrock, which is composed of slate and schist, or in crevices of the latter. The strike of this formation is the same as the general trend of the river valley, namely, 63° northeast. All the big nuggets found so far on this property were taken from the bedrock or from gravel immediately overlying it, the latter having a thickness of from 3 to 9 ft. The largest nugget found at the last cleanup had a value of $292.50; other nuggets found at the same time represented the following values: $171.60, $98.47, $76.93, $43.39, $35.22, $30.17 and $18.16.

Electric Power for Elevator

The power house for the operation of the mechanical elevator plant is situated on the track of the Quebec Central Ry., about 1000 ft. from Beauceville Station, and contains one 200-hp. engine with 15-ft. flywheel of the Jerome Wheelock system (diameter, 17 in., stroke, 28 in., speed, 94 r.p.m.), with condenser, two 100-hp. Goldie & McCullogh tubular boilers with forced-draft system, one Allis-Chalmers-Bullock three-phase, 60-cycle, 150-kw. generator (900 r.p.m.), and all other accessories incidental to the proper operation of a plant of this class.

The current at 2300 volts is carried by a transmission line 1½ miles long to the mechanical elevator. It is transformed to 440 volts for the electric-lighting plant, which consists of three arc lights and numerous incandescent lights all over the premises. A 50-hp. motor for the operation of the 48 buckets, and a 150-hp. motor for the operation of the big 4500-gal. pump, are installed within the steel structure of the mechanical elevator.

There being no feed water for the boilers of the power plant in its immediate vicinity, a creek one mile distant had to be utilized by damming same and conveying the water down a mountain slope to the plant. The pipe line consists of two sections: The upper one, 2700 ft. long, consisting of 2-in.; and the lower one, 2600 ft. long, of 1½-in. galvanized-iron pipe. The intake is 270 ft. above the power plant, so that the water is delivered to the latter under a pressure of 122.7 lb. A regular telephone system is installed all along the transmission line and the ditch up to the lake, or over a total of 8½ miles, facilitating the operation of the plant a great deal.

A boarding house for the accommodation of 40 men; an office and manager's lodgings; a machine shop and storehouses at the diggings on the Ruisseau des Meules, make up the remainder of this interesting plant. The hydraulic part of the plant was projected and installed with the assistance of California miners, who had more than 20 years' experience in hydraulicking in Siskiyou County, Calif. Much of the success of the enterprise so far recorded is due to the foresight of these men and to the practical manner in which this difficult operation was handled from the start.

---

[1] Eng. and Min. Journ., Nov. 25, 1911.

Associated Oil Co., California

The Associated Oil Co., of California, according to the 10th annual report, made a profit in 1911 of $1,766,246. The gross earnings, after deducting operating expenses, maintenance and transportation, were $4,172,215. Interest on bonds, $687,754; depreciation reserve, reinvestment, including sinking fund for retirement of outstanding bonds, $1,718,215. The statement includes the activities of the Associated and its proprietary companies, as well as dividends from affiliated companies. The proprietary companies include the Associated Transportation Co., Associated Supply Co., and Bakersfield Iron Works. The following named are the affiliated companies: Pioneer-Midway Consolidated, Sterling Oil & Development, West Coast, California Coast, Amalgamated, Salt Lake and Arcturus. Of these the last three are on a dividend basis, having paid a total of $576,000 during the period.

British Iron and Steel Production

The British Iron Trade Association reports the production of pig iron for the calendar years 1910 and 1911 as follows, in long tons:

	1910	1911	Changes
First half......	4,993,745	5,110,823	I 117,078
Second half....	5,223,000	4,607,815	D. 615,185
Year	10,216,745	9,718,638	D. 498,107

As compared with 1909, the make in 1911 showed an increase of 54,351 tons. It will be seen that there was a considerable drop in production during the second half of last year, while in 1910 the opposite condition prevailed.

The total production of wrought or puddled iron in 1911 was 1,191,499 tons, which compares with 1,118,893 in 1910, showing an increase of 72,606 tons. The increase over 1909 was 62,087 tons. This production in 1911 was the largest reported since 1899, when the total was 1,210,609 tons, or 10,110 tons more than last year.

The production of steel ingots, unlike that of pig iron, showed an increase over 1910. The total make was, in long tons:

	1910		1911	
	Tons	%	Tons	%
Bessemer..	1,779,115	28.0	1,461,140	22.6
Open hearth..	4,595,366	72.0	5,000,472	77.4
Total........	6,374,481	100.0	6,461,612	100.0

This statement shows a decrease last year, as compared with 1910, of 317,975 tons in converter steel, but an increase of 405,106 tons in openhearth; the total increase being 87,131 tons. The make of openhearth ingots last year was the largest ever reported in Great Britain, the highest figure previously recorded being in 1907, when the total was 4,663,489 tons. Converter steel make has been exceeded in a number of previous years.

The division into acid and basic steel in 1911 was:

	Acid		Basic	
	Tons	%	Tons	%
Convertor..........	887,767	13.7	573,373	8.9
Openhearth........	3,131,218	48.5	1,869,254	28.9
Total	4,018,985	62.2	2,442,627	37.8
Total, 1910........	4,154,933	65.2	2,219,548	34.8

The larger part of the increase in the make in 1911 was in basic openhearth steel.

Representative Kahn, of California, has introduced a bill by which lands chiefly valuable for asbestos may be patented under the provisions of the laws relating to placer mineral claims.

Mass Action and Reaction Velocity

By Harry C. Jones*

A further discussion of the influence of mass on reaction velocity and chemical equilibrium. This is of great consequence to the metallurgist in the reduction of metallic oxides, and to the technical chemist as determining the possibilities of many of his reactions.

We can now deal with chemical reactions in a far more scientific manner than in the past, due to the recent developments in physical and general chemistry; and these developments have centered around the generalizations already discussed in these papers.

The measurements of the heat changes that always manifest themselves whenever a chemical reaction takes place, and which condition the chemical reaction, led Berthelot to the conclusion that that chemical reaction will take place which evolves the largest amount of heat. There are exceptions known to this generalization, but it contains a large element of truth, and most chemical reactions conform to it.

Most chemical reactions evolve heat or are, as we say, exothermic. The effect of rise in temperature is to oppose that reaction which takes place with evolution of heat, and the products of exothermic reactions are less and less stable the higher the temperature to which they are subjected. The principle is, that the addition of heat opposes the formation of those substances, whose formation involves the evolution of heat; and rise in temperature renders such substances less stable.

The converse is also true. A reaction which absorbs heat is known as endothermic. The addition of heat favors the formation of a reaction which absorbs heat, and in general renders the products of such a reaction more stable.

Heat Changes Determine Even Reaction Direction

The importance of the heat changes, and the effect of mass or quantity as conditioning not simply the velocities of chemical reactions, but even their direction, is now realized not only by the man of science, but by the engineer in the industries. Whether any given reaction will or will not take place is often conditioned solely by one or the other of these factors.

This is well illustrated by the example cited by Bodländer in *Zeitschrift für Elektrochemie*, VIII, 838 (1902). It is there pointed out that the reducing action of carbon can take place in terms of any one of the three equations, and with the following evolutions of heat:

I $C + 2O = CO_2 + 97{,}650$ calories

II $CO + O = CO_2 + 68{,}000$ "

III $C + O = CO + 29{,}650$ "

This explains why carbon monoxide (CO) is often a better reducing agent than carbon (C), since, for a given amount of oxygen taken from say an oxide, more heat is evolved—48,825 cal. is less than 68,000 cal.

We can also, in the light of these facts, see the meaning of the following facts. It should be stated first, that the amount of heat liberated in the formation of any given chemical compound is a fair, general criterion of the stability of the compound. A moment's thought will show that this is true. The heat liberated in the reaction comes from the intrinsic energy of the substances that react. The more heat liberated the more intrinsic energy of the initial substances is lost as intrinsic energy.

This is the same thing as to say that the resulting products contain less intrinsic energy the greater the heat evolution of the reaction. Chemical stability varies inversely as the amount of intrinsic energy present. The more intrinsic energy present in a substance, the more reactive it is chemically, that is to say the more unstable it is. Water is so stable because it contains relatively little intrinsic energy; shown qualitatively by the enormous amount of heat liberated in its formation—this being the most exothermic of all chemical reactions known to man.

The Reduction of Oxides

The heat of formation of zinc oxide, and, therefore, its energy of formation at absolute zero is 85,800 cal. If this energy of formation persisted at higher temperatures, it could not be reduced either by carbon or by carbon monoxide since they have less energy of formation.

While zinc oxide is not reduced by carbon at 1100° C., it is appreciably reduced at 1125 by carbon, showing that its energy of formation at this temperature is equal to that of carbon monoxide when formed from carbon and oxygen= 29,650 calories.

When zinc oxide is reduced by carbon monoxide, this will take place only until the carbon dioxide present reaches a certain concentration. Thus, at 1000° carbon monoxide would reduce zinc oxide only until the concentration or mass of the carbon dioxide reached 0.1%. At a temperature of 1125° the concentration of the carbon dioxide can be 0.2% before the reduction of the zinc oxide by carbon monoxide ceases, and at 1500° the carbon dioxide can have a concentration of 0.76% before equilibrium is reached.

If the concentration or mass of the carbon dioxide is greater than that mentioned above at the temperature in question, then the reverse reaction takes place; zinc being converted into the oxide. We are obviously dealing here with a typical reversible reaction, and this leads us to consider more fully the nature and meaning of such reactions.

Velocity and Equilibrium of Chemical Reactions

The meaning of reaction velocity, chemical equilibrium and reversible reactions was referred to in the introductory chapter which dealt with the discovery of the law of mass action. These must be discussed here a little more fully, or at least more exactly.

Given a reaction in which two substances disappear, and in which everything is in solution before the reaction and everything remains in solution after the reaction is over. How would we calculate the velocity of such a reaction? If we represent the mass of one of the substances present by x and the mass of the other substance by y, the velocity of the reaction is the amount of transformation in a given time. If s is transformed in time t, we have

$$\frac{ds}{dt} = K(x - s)(y - s)$$

in which K is a constant whose value depends upon the nature of the substances reacting.

If we use equivalent quantities $x = y$, the above expression becomes,

$$\frac{ds}{dt} = K(x - s)^2$$

which, on integration, gives—

$$\frac{1}{x - s} = Ct + const.$$

and this is the expression for the velocity of such a reaction, which, since two substances are involved, is a second order reaction; and since everything is in the same state of aggregation, is a homogeneous reaction.

How do we calculate the condition of equilibrium in a second order, homogeneous reaction? Equilibrium, it will be recalled, is that condition of a reversible reaction where the two opposite reactions have the same velocity.

The velocity of a second order homogeneous reaction, is, as we have just seen, expressed thus—

$$\frac{ds}{dt} = K(x - s)(y - s)$$

---

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

in which x and y are the two initial substances that react. The second reaction takes place between the products of the initial reaction x_1 and y_1, and since $s_1 = -s$, and $ds_1 = -ds$, has the velocity—

$$\frac{ds_1}{dt} = K_1 (x_1 + s)(y_1 + s)$$

At equilibrium the two opposite velocities are equal—

$$K (x - s)(y - s) = K_1 (x_1 + s)(y_1 + s)$$

or

$$\frac{K}{K_1} = \frac{(x_1 + s)(y_1 + s)}{(x - s)(y - s)}$$

and this is the condition of equilibrium in a second order, homogeneous reaction.

By methods analagous to the above the velocities and equilibria of reactions of almost all known orders can be calculated. Here again space will not permit of any further detail. Any one who is interested can find these matters discussed at some length in my "Elements of Physical Chemistry," pp. 526 to 600.

Catalysis

There are few subjects more to the front both in science and the industries than catalysis. Just what do we mean by a catalyzer? We mean a substance that affects the velocity of a reaction without itself entering into the reaction. The effect may be an acceleration or a retardation of the velocity of the reaction in question, but is usually an acceleration. The great technical problem is often to find a substance that will increase the velocity of a given chemical reaction, without itself being "used up" as it is said: i.e., without itself entering into the reaction in question.

This was the definition that was given a catalyzer by the discoverer of catalysis, the great Swedish chemist Berzelius, and the definition holds as well to-day as when it was proposed nearly a century ago. The finely divided metals, many of the metal oxides, the metals at high temperatures, hydrogen and hydroxyl ions are among the more common catalyzers.

The hydrogen ions are very good catalyzers indeed. The inversion of cane sugar by acids is due to the catalyzing action of the hydrogen ions. The hydrogen ions do not enter into the reaction—no acid is used up—and yet the velocity of the inversion is proportional to the number of hydrogen ions present. The cane-sugar molecule in the presence of hydrogen ions takes up a molecule of water and breaks down into glucose and fructose. Similarly, hydrogen ions cause an ester to take up water and break down into the corresponding organic acid and alcohol, without themselves entering into the reaction.

Dioxides as Catalyzers

The action of manganese dioxide on hydrogen peroxide in neutral solution breaking it down into water and oxygen is an example of the catalytic action of the dioxides. In neutral solution the manganese dioxide remains unchanged. In the presence of an acid it is, of course, true that both the hydrogen peroxide and the manganese dioxide break down losing one-half of their oxygen.

The metals act catalytically especially when in a finely divided condition. Indeed, the catalytic action of any metal is greater the more finely divided its condition. Take metallic platinum; a sheet of it may act catalytically, but platinum sponge or platinum black will have much greater power to accelerate the velocity of the reaction in question, and this brings us to some recent work on the catalytic action of very finely divided metals.

When we were discussing the methods of preparing colloidal suspensions, it was pointed out that colloidal suspensions of the metals can be readily obtained by bringing two pieces of the metal in question near together under water and passing an electric current between the metals. Under these conditions the metal is torn off in a very finely divided state, and remains suspended in the water as a colloidal suspension.

Finely Divided Metals Act Like Ferments

These finely divided metals have a powerful catalytic action. They resemble in their catalytic action the organic ferments, which are important catalyzers in the living body. The catalytic action of these finely divided metals can be inhibited by very small quantities of the same substances that "poison" the organic ferments; but we cannot go further into this. The important point to remember here is that the catalytic action of a metal increases with the surface of the metal. Keeping the mass of the metal constant and simply increasing its surface increases enormously its action as a catalyzer. The best way to increase the surface of a given mass of metal is, of course, to divide it more finely. This fact is important as we shall see when we come to discuss the meaning of catalysis.

Catalysis in the industries is coming to play a more and more important part. The manufacture of sulphuric acid by the action of oxygen on sulphur dioxide depends upon the presence of a catalyzer. At one time highly heated platinum was employed, but it was found that highly heated metal oxides act satisfactorily. Just one other application of catalysis to a technical problem will be considered.

Catalytic Fixation of Nitrogen

One of the most important industrial problems at present is the so called "fixation" of nitrogen; the conversion of free nitrogen into ammonia and nitrates. Haber has recently worked out a catalytic process of making ammonia. When nittrogen and hydrogen are brought together under pressure, and heated in the presence of hot metallic uranium, the metal acts as a catalyzer and causes the nitrogen and hydrogen to combine directly and form ammonia gas.

In addition to the true catalyzers we have the substances which accelerate the velocities of chemical reactions by taking part in them. The substance may form an addition product by adding itself to one of the substances that take part in the reaction, and then this added substance split off again in the free condition.

Such substances are known as pseudocatalyzers to distinguish them from true catalyzers. The study of pseudocatalyzers is much less interesting than that of the true catalysers.

The important question still remains. How do catalyzers act if they do not take part or enter directly into the reactions whose velocities they accelerate? A number of answers have been given to this question from the time of its discovery by Berzelius down to the present. The most important point in connection with electrolysis, is the connection between the amount of surface exposed and the catalyzing action. This raises the question what has surface to do with catalysis? How does the surface of a metal differ from the interior?

The difference is to be sought in the large amount of energy that is piled up at the surface of things. In the case of liquids we have seen that it manifests itself in surface tension. While we cannot measure the energy at the surface of solids, we have every reason to believe that it is there in large quantity. The introduction of this large amount of energy renders the system more unstable and chemical reaction is, in consequence, accelerated. Just how this surface energy renders the system more unstable we at present do not know; and in so far our knowledge of the innermost nature of catalysis is at present unsatisfactory. What we really know is that there is some close connection between the surface energy of the catalyzer and its catalytic action.

How to Change Reaction Equilibrium

This is a matter of fundamental importance for the engineer. Given a chemical reaction which produces a certain amount of a certain product that is desired. When equilibrium in the reaction is reached it means that the maximum amount of the substance in question is formed which, under the conditions, can be formed. If the substance in question is the thing desired, it is obvinusly most important to find some method of changing the natural condition of equilibrium, and shove it further along as we say, that is, in the direction which will yield more of the desired substance. Indeed, the importance of being able to do this, from the standpoint of the industries, cannot easily be overestimated.

Much has already been accomplished in this direction. When we were discussing the development of the law of mass action, we saw how the amount of ester formed in the reaction between the alcohol and acid could readily be increased. It was only necessary to increase the mass of one of the substances present relative to the other. Indeed, it was the quantitative study of this reaction that furnished some of the best data that led to the exact formulation ot the effect of mass in chemistry, or, as we say, to the discovery of the law of mass action.

Different Solvents Change Equilibrium Point

There are other methods of changing the equilibrium point than to change the relative masses of the reacting substances. The medium or solvent in which the reaction in question takes place often has a marked effect on the equilibrium point. This would be expected to be the case. We have seen that the different solvents have different dissociating powers, and since chemical reactions are due primarily to ions, the actual numbers of the ions present would affect not only the velocities of the reactions, but their equilibria as well.

Further, different solvents have different viscosities—and this affects the speed with which the ions move through the liquid; and the frequency with which they come in contact with one another.

One other effect has already been referred to in another connection, but should be mentioned here for clearness and completeness. That is the effect of temperature.

Effect of Pressure and Temperature

The effect of rise in temperature is to shove the equilibrium in the direction which involves the absorption of heat. Rise in temperature therefore opposes exothermic reactions, and favors endothermic reactions.

A reaction may, however, be exothermic at one temperature and endothermic at another. Thus, hydriodic acid is formed as the result of an endothermic reaction at ordinary temperatures, and consequently, rise in temperature favors the formation of the acid from its elements. This is, however, true only up to about 320°. Above this temperature the acid is formed from its elements as the result of an exothermic reaction. Consequently, further rise in temperature diminishes the amount of the acid formed.

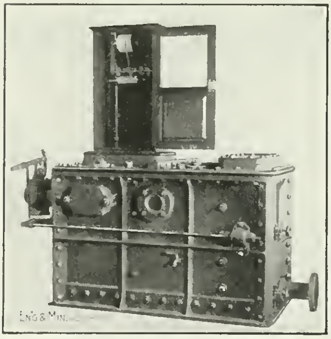
Similarly, ozone is stable below 200° and above 1000°, since the thermal character of the reaction involved in its formation changes with the temperature.

It has already been pointed out that the effect of pressure is to shove the equilibrium in the direction of smallest volume.

The generalizing of the effect of temperature and pressure on chemical equilibrium we owe to the distinguished French chemist, Le Chatelier.

Lea Water Flow Recorder

In these days of scientific management, when so much depends on getting at the root of the evil in order to correct abuses, the Lea water-flow recorder is an aid in keeping an accurate record of happenings in the boiler room. It shows all irregularities in the boiler feed, records the quality of water evaporated per pound of coal, and thus shows the number of heat units in the coal.



Lea Water-flow Recorder

The apparatus works on the V-notch weir principle and is described as follows: A float spindle passes through the bottom of the instrument case, gearing into a small pinion upon the axis of a drum revolving between centers. Upon the body of the drum is a screw thread, the contour of which is the curve of flow for the V-notch, in connection with which the recorder is used. The spiral drum serves a double purpose: Its screw thread rectifies the motion of the recording pen, so that it moves equal distances for equal increments in the rate of flow; it provides a magnified scale for making an accurate observation of the rate of flow at any moment.

The actual depth of water in the notch can always be observed, and the instantaneous rate of flow in pounds or gallons can be seen with a high degree of accuracy. The recording pen which moves in direct proportion to the rate of flow produces a diagram, the area of which is a measure of the total quantity, and this can easily be deduced by means of a standard planimeter.

Heretofore, the Lea recorder was made on the open or atmospheric principle, but recently the manufacturers added a new type. The notched tank is made of cast iron, similar to the standard open-heater construction. The tank is entirely closed and is suitable for withstanding any pressure or vacuum up to 10 lb. The operating head of the Lea recorder is only about 18 in. Hence it can be installed without extensive changes in piping. It is made in sizes from 200 to 10,000 boiler-horsepower.

Besides being used for the measurement of boiler-feed water, steam consumption, etc., the Lea recorder can also be used for measuring pump discharges, flow of streams, acids, etc. For measuring the flow of acids the apparatus is provided with wooden tanks lined with lead, and the V-notch plate is similarly made. Hard lead or glass, however, can be used.

The apparatus is guaranteed to produce records which shall be within 1½% of absolute accuracy by weight; also that the average error due to variations of temperature over a range of 50° F. (i.e., 25° F. on either side of the normal shall not exceed 0.5%. A feature claimed for the Lea recorder is that it is equally accurate at large or small rates of flow. Moreover, accuracy can be checked at any moment by observing the head flowing over the V-notch and computing the flow by Thompson's formula, and then seeing whether the record on the chart is being made accurately. The apparatus is made by Yarnall-Waring Co., 1109 Locust St., Philadelphia.

Copper-Nickel Additions to Iron

C. F. Burgess of the chemical-engineering department of the University of Wisconsin, at Madison, Wis., under a grant from the Carnegie Institution, of Washington, has been making experiments for the use of copper-nickel additions to iron with a result of indicating that the use of this combined alloy may develop into a valuable improvement in the field of alloy steel.

The experiments have indicated that the long standing and well developed prejudice against the existence of copper in iron or steel is not entirely well founded, The results of these experiments open up a new avenue for the utilization of the natural alloy of copper and nickel, Monel metal, which results at one stage of the treatment of the Sudbury (Ontario) ores.

The Eastern Michipicoten Iron Range

By Alois Goetz*

This range north of Sault Ste. Marie, in Ontario, includes the Helen, Mildred, Lucy, Ruth and Josephine properties. The outcroppings show a cherty, sideritic iron formation in a green schist area, carrying about 35% iron. Drilling has disclosed some red hematite carrying 59% iron and of bessemer quality.

The following notes are derived principally from memoranda taken while staking and prospecting the five different properties on the eastern Michipicoten iron range in Canada. The first discovery was made Aug. 25, 1897, and the claims then staked were sold in 1899 and are now owned and mined by the Lake Superior Corporation, of Sault Ste. Marie, Ontario, which named them the Helen mine.

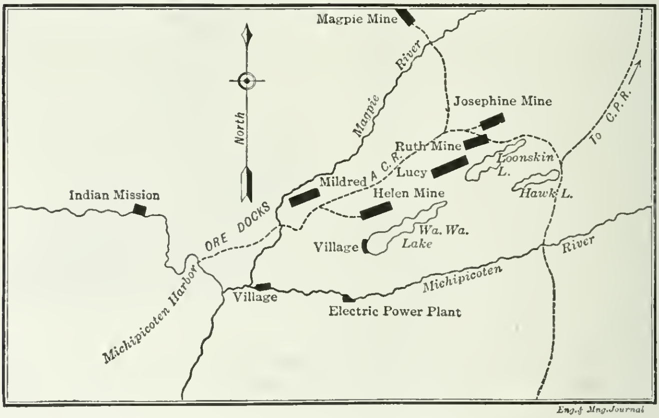
THE HELEN IRON MINE

The important part of the range commences near Sayers Lake, a small deep basin of water lying entirely in the iron formation, and is less than one-fourth mile long. On the south shore of Sayers Lake are large outcrops of pyritic, silicious rock which often becomes nearly pure pyrites. The iron rocks are bounded on the south by quartz porphyry and green schists, and on the north by green schists, all striking northeast, with a steep southerly dip. On the northwest shore of Sayers Lake, the iron rocks are brecciated and also show much pyrites in the granular rock. Along the north shore high, steep hills of banded chert, much broken, stretch to the easterly limit of Boyer Lake, which is also a small, deep body of water with a length of about one-fourth mile, lying less than 300 ft. east of Sayers Lake. The southern shore of Boyer Lake consists of quartz porphyry and green schists, but the usual iron rocks are in the bottom of the basin. The rock between the two lakes is mostly pyritic, and a small lens of siderite is found on the southwest end of Boyer Lake. The iron formation along the two lakes has a width of over 800 ft. On the northeast shore of Boyer Lake, a diabase dike, about 20 ft. wide, cuts through the iron formation in a southerly direction. Its course down hill to the shores of the lake can be seen plainly, as the dike rock, and the iron rocks at this point show no change by the contact. There can, however, be no doubt about this dike having greatly shattered the iron rocks in its course southward, fracturing them most severely along the south part of the range and thereby aiding their destruction by weathering and so forming a deep valley bounded on the south by the schists.

OREBODY CROPS ON SURFACE

In this carved-out valley, the iron orebody was found cropping on the surface. The ore formed the point jutting into Boyer Lake at its southeast end, and extended as a low ridge, eastward for over 600 ft., having a width of about 400 ft. covered with a mantle of moss and sometimes earth. Just north of the iron and close to the point, an almost vertical cliff, facing the lake, rises. This cliff consists of alternate bands of iron and quartz, quickly rising into a hill 450 ft. high, which, in its easterly course, circles around the valley wherein the ore lies, joining on the south the high schists having an easterly strike, and together they then run as a high, narrow ridge for about three-fourths mile farther northeast, sinking then into a broken country of schist rocks. The hillside, pitching steeply southward into the valley toward the orebody, shows a smooth, brecciated iron rock and the side, sloping more gently, but still steeply, westerly into the same valley, is covered by large masses of broken rock, some of which is siderite. Several trenches have been dug on the top of the western end of the hill, disclosing the drift-covered range. Taking a section across the ridge on the eastern trench, from north to south are found: Rusty granular chert and banded chert, 450 ft.; siderite, 28 ft.; undetermined rock, 55 ft.; siderite, 28 ft.; undetermined rock, 37 ft.; siderite, 20 ft.; schist, 5 ft.; siderite, 60 ft.; in all, 136 ft. of siderite. After this comes the green schist. From this point the iron rocks gradually narrow, and where they end, the rusty, granular silica and banded chert are about 200 ft. wide and the siderite less than 50 ft. From geological conditions it was thought quite possible that ore might occur under Boyer and Sayers Lake, under the hills north of the two lakes, and under the high hill east of Boyer Lake. Since acquiring the property, the Lake Superior Corporation has constructed ore and other docks at Michipicoten Harbor, built the Algoma Central Ry. to the Helen mine, a distance of about 12 miles, and is now engaged in completing the railway to other mines in the district, as well as to Sault Ste. Marie, Ontario. The orebody was found to be much longer than shown on the surface, and has great depth; large quantities have already been mined and shipped. Boyer Lake has been pumped dry, and exploration under it has resulted in finding a large high-grade hematite orebody.

In the small area so far explored, bodies of pure pyrites have also been found in both granular and massive form, with bright prospects of finding much more in the large untested area. Siderite is said to have been found at a depth of over 500 ft., south of the hematite ore in the valley, and when it is remembered that the hill top, whereon the siderite crops, is over 400 ft. above this valley, it appears that the siderite might have a depth of 1000 ft. There are large quantities of this class of ore which carries about 35% iron, and when the possibilities of finding red hematite under Sayers Lake, and the other two places mentioned, are taken into consideration, the future of the Helen mine is bright.



MINES ON MICHIPICOTEN RANGE AT EASTERN END OF LAKE SUPERIOR, IN ONTARIO

THE JOSEPHINE IRON PROPERTY

The Josephine property extends along the main part of this belt for 1⅛ miles in a northeasterly direction, and is owned by Sault Ste. Marie, Mich., men. It is situated 10 miles northeast of the Helen mine on a spur near the main line of the Algoma Central Ry.; the distance to the harbor at Michipicoten is 20 miles. The iron formation is similar to the Helen, consisting of banded, rusty granular, pyritic and oxidized sideritic chert, and lenses of siderite, the general width being over 600 ft. The enclosing rocks are green schist and slates on the north, quartz porphyry, green schists and in some places limestone on the south, all dipping steeply to the north. A portion of the western part, or about one-fourth of the property, is covered by the waters of Red Lake, which is within the iron formation. Several islands in the lake consist of iron rock. From this it was inferred that there was iron ore beneath the bottom of the lake, and diamond drilling has revealed red hematite, containing 59% iron and of bessemer quality. E. F. Bradt, who was in charge of the drilling, stated that the orebody has been shown by diamond-drilling to be over 3000 ft. long and at a depth of 500 or 600 ft. to have a width of 50 ft.[1] The depth of this orebody is unknown, but is believed to be great.

---

*Chandler Heights, Sault Ste. Marie, Michigan.

Besides the red hematite, some drill holes near the southeast end of Red Lake show several close-lying, parallel lenses of siderite, having a total width of over 75 ft., but of undetermined length or depth though one hole cut the siderite at an angle of 45° at a depth of about 300 ft. below the shallow waters of the lake. Outcrops of siderite are seen along the south of the iron formation on top of the high hill east of Red Lake, and at the eastern boundary an outcrop 50 ft. wide is seen; while no stripping has been done, this is apparently an extension of the outcrop seen on the same hill to the west. If so, the lens would have a length of over 2000 ft. Considering the height of the hill and the depth shown in the lake, it would indicate a depth of at least 600 ft. This, and the lenses cut by the diamond drill, are large enough to warrant the expectation of the existence of large quantities of this ore which contains about 35% iron. The iron rocks on the hill east of Red Lake are greatly shattered and broken; no drilling has been done here but the prospects from a geological standpoint are favorable for the existence of red hematite under this hill. Large bodies of pure pyrites have been found at the Helen, and as the conditions at the Josephine are similar, they may be expected to occur here also.

THE RUTH MINE

The Ruth property, also owned by Sault Ste. Marie men, is less than one mile southwest of the Josephine and the Algoma Central Ry. runs southward through the eastern end of the property. The latter has a length along the important part of this belt of about three-fourths mile in a southwesterly direction. The iron formation is similar in character to the Helen and Josephine but the maximum width is much greater, being over 1000 ft. The greatly shattered iron rocks, though often vertical, dip generally steeply northward and are in a trough of green schists, with some quartz porphyry inclusions on the south of the lenses of siderite. Near the western boundary a high, steep hill rises rapidly, forming the iron range and the high hill running between Long and Leg Lakes. Long Lake is a narrow body of water extending along the north side of the iron rocks for about 3000 ft. Several small islands in the lake show ferruginous rocks, and the eastern part of the lake lies entirely in the iron formation. Leg Lake is a small, shallow lake lying to the south, near the eastern end of the property. On top of the high hill is a wet, boggy marsh, which at one time was probably the basin of a lake, carved out of the broken iron formation. The wide iron rocks are broken and open to the influence of meteoric waters, a condition looked upon as favorable for the development of red hematite orebodies. The Long Lake basin, under the hill and especially under the marsh basin, are ideal places for ore concentration. South of the iron rocks and a few hundred feet east of the west boundary, on top of the south side of the hill, an intrusive greenstone cuts off a portion of a lens of siderite and has changed it, by heat, into magnetite; east of this intrusive rock the siderite, which has here a width of 140 ft., has also been changed into magnetite for 100 ft. along its trend.

DIPS ARE STEEP

The contact between the two rocks is sharp and is in a vertical plane. This lens of siderite has been stripped through the center for 1800 ft. east, and cross-trenched at short intervals, showing a solid continuous orebody, having a width in two places of 200 ft., though the general width is from 100 to 140 ft. About 1600 ft. from its western end it swings outward but still forms the top and also the side of a steep hill; about 150 ft. down the hill side, a short tunnel was driven northward into the side of the the siderite, showing the same steep or nearly vertical dip. Taking the length of the stripped area and the general width, and using the depth at which the tunnel was driven gives a large tonnage of ore carrying 35% iron, and when it is borne in mind that the dip of the ore in the tunnel is still steep, it is reasonable to expect the ore to go down deep with the almost vertical rock formation. From the eastern end of the stripping, the lens of siderite narrows rapidly to about 30 ft. and runs at that width 1400 ft. farther east where it ends in eruptive green schist, which here also has changed the ore into magnetite for about 80 ft. Between this siderite and the iron rocks there is a band of pyritic rock which often is almost solid pyrites. It has a length of about 1200 ft. and a width in one place of 100 ft., though the normal width is about 20 ft. Besides this band, there are other pyritic outcrops, so that the outlook for finding bodies of pure iron pyrites is favorable.

THE LUCY MINE

The Lucy mine is about one-half mile south from the southwest end of the Ruth, and is owned by Kelly & Mayer of Sault Ste. Marie, Michigan, and associates. The iron range stretches as a high ridge for two miles southwest. From the western end it is less than four miles in a straight southwest course to the Helen mine, and about two miles west, over a level sand plain to Mile 14 on the Algoma Central Ry., which here runs northeast but which bends sharply to the south at the Josephine. The iron formation is similar to that at the Helen, and has a nearly vertical dip. Many trenches have been made across the range at short intervals, which gave a good opportunity for examination. At the eastern end the iron range, having a width of 150 ft., rises from under the surrounding green schists, and runs at this width for 600 ft. when it abruptly widens to over 800 ft. running at this width for about 1400 ft. when once more it narrows to 600 ft., keeping this width for about 2400 ft., at which point it is crossed by a narrow diabase dike. On the west of this dike the iron rocks are 500 ft. wide, rapidly narrowing to 400 ft. and near the western end to 300 ft., where it is cut out by the green schists which surround the iron range. The iron rocks here are also greatly broken and have permitted the free circulation of the iron-bearing solutions, which for ages have leached the crushed iron rocks, probably carrying the dissolved iron down into the underlying basins of impervious green schists. It has been noticed on the Michigan ranges that large ore deposits are apt to be found where the iron rocks have been most violently shattered and there is reason for believing that this may be true here also. Along the range on the south side of the iron rocks, there are five lenses of siderite, having various lengths and widths; the average dimensions of these are: 1600 ft. long and 120 ft. wide; 1650 ft. long and 53 ft. wide; 1050 ft. long and 27 ft. wide or a total length of 4700 ft. with a nearly vertical dip. This ore, which runs about 35% in iron, is here, as well as on the other properties mentioned, slightly pyritic, though there are large masses at the Ruth, and here also, which show no pyrites, are low in phosphorous and carry some lime and magnesia useful for fluxing purposes, and on roasting would probably yield a product running about 52% in iron. The roasting would eliminate the carbonic acid and the sulphur, and the ore would then also be practically without moisture and of good quality. The calcined ore ground fine in oil would also make a good paint of a deep brown color, requiring no dryer.

---

[1] Twelfth Report, Bureau of Mines, Ontario, pp. 103 and 104.

THE MILDRED MINE

The Mildred property is about one mile northwest of Helen Mine Junction. The iron formation consists of many varieties of chert and porous black slate. This range lies on top of a high hill and is about two miles long, ending in green schists on the east, and disappearing under a sand plain at the west. From the western end it is 1½ miles along the Magpie River sand flats to Mile 6½ on the Algoma Central Ry., or about eight miles to the harbor at Michipicoten. On the western end the range rises out of the sand plains into a high steep hill. The iron rocks wind south across 40 acres in the shape of a horseshoe and have a width of about 400 ft. The northern arm of the loop narrows rapidly to about 20 ft. and dies out. The southern arm widens to 650 ft. and runs east for 1100 ft., when the iron rocks open again, on the north, in a smaller horseshoe form. The southern arm here has a width of about 500 ft. and continues farther east for 1200 ft., ending in green schist. The northern arm has an average width of about 100 ft., and runs northeasterly for 1250 ft., where it sinks into a wet marsh. The rock inside of both folds, as well as on the outside of the whole range, is green schist, including however in some places, quartz porphyries on the south; the dip as a rule is about 70° south. The iron rocks are a crumpled and brecciated mass, having strikes and dips in most every direction. The northern iron rocks rise out of the marsh, forming the main range. They have a width of about 225 ft. and run 1500 ft. east, where they seem to be cut by a narrow greenstone. The iron rocks along this part are also greatly shattered and crushed and lie in a low basin on top of the high hill. East of the greenstones the iron rocks rise into a low ridge and widen to 350 ft., extending east for 2600 ft., where they are faulted. A swampy valley, bounded by higher green schists, follows along the broken iron rocks on the north, as well as on the south side, and both meet in the fault line.

IRON FORMATION FOLLOWS LAKES

A narrow, shallow lake, 1100 ft. long, extends along the range in the south valley at the western end, through which a portion of the iron rocks runs the entire length. Across the range from the eastern end of the lake, another narrow, shallow lake runs along the range in the north valley for 800 ft. in an easterly direction. In the fault-line valley there is a muddy pond and marsh, several acres in extent, into which the iron rocks dip on the west; on the east side of this marsh little iron formation is seen, but a considerable area of bog iron ore is seen here, and the iron range is shifted several hundred feet both north and east. The range rises into a still higher ridge, and the shattered iron rocks have a width of about 300 ft.; they run easterly for 2200 ft., shrinking then gradually and at the eastern boundary, 400 ft. farther on, to less than 25 ft. Where the range narrows, it runs along a wet marsh on the south; here considerable bog ore can also be seen. This, and the other area, have not been stripped or tested as to depth, on account of water, all the higher parts of the range having been trenched while doing the work necessary to obtain title. Less than one-half mile north and far below the iron range, the Magpie River flows in a narrow valley westward for about 2¼ miles, where the river bends sharply southward, making an elbow wherein the Mildred property is situated. The geological features of this entire belt hold out much promise for the existence of large orebodies in the various basins indicated along the range, which can, however, only be verified by diamond-drilling.

The Mocorito District in Sinaloa

BY G. L. SHELDON*

The Mocorito mining district is in the northern part of the state of Sinaloa, Mexico, and extends from the Gulf of California eastward to the foothills of the coast range. It is a well-settled agricultural district. The principal town, Mocorito, is on the west bank of a small stream known as the Mocorito River, which runs dry for a part of the year. The town is about twelve miles east of the Southern Pacific of Mexico R. R., and about 65 miles northwest of Culiacan, the capital of the state. A wagon road, 14 miles long connects the town with Guamochil, the nearest railroad station.

PALMARITO THE LARGEST MINE

The principal mine is the Palmarito, six miles northwest of Mocorito. The vein is from 40 to 50 ft. wide, in andesite near limestone. The east side of the vein is exposed for a height of 100 ft. for a distance of several hundred feet along the strike. The ore, which assays about 15 oz. silver per ton, can therefore be cheaply quarried. It was formerly crushed in a five-stamp mill and treated profitably by lixiviation. Five years ago the property was purchased by Philadelphia men who built a 100-ton lixiviation plant. This treatment was not a success so the cyanide process was adopted and under the capable management of A. W. Morris, who installed modified Pachuca tanks, Dorr classifiers and tube mills, 80 tons of ore are now treated daily, 75% of the silver being recovered. It is said that the capacity of the mill is to be doubled in the near future. The ore contains lead and its treatment by cyanide is attended by some difficulties. The Palmarito and Eldorado were the only mines in the state that were operated during the recent revolution.

The Eldorado mine is on a 3-ft. vein of free-milling gold ore which assays $5 to $6 per ton on the surface. The vein has been opened to a depth of 300 ft. and on that level the ore is still free milling. It is said that about 50,000 tons of $10 ore has been blocked out and that the building of a mill is under consideration.

There are many veins of a similar character in this vicinity. At the Belin property, 10 miles northeast of Eldorado several veins of gold-silver ore have been developed on a small scale. At Bequillas, 15 miles east of Mocorito a two-foot vein of ore, made up of copper and iron pyrites containing gold and silver, has been worked and the owner has shipped several lots of ore that returned him $100 per ton.

NUMEROUS PROMISING PROSPECTS

Several miles to the east of Eldorado near Sierra de Pajaros, is the Magistral vein which was worked 10 or 12 years ago. The ore contains copper and is rich in gold. There are several veins of copper ore in porphyry at Los Tajos, 35 miles east of Mocorito, which were extensively developed by Philadelphia men four or five years ago. A 25-ton wood-burning furnace was built, but fluxes were scarce so a concentrator was erected and several small shipments were made. The property has since remained idle.

The largest production from any one mine in the district is credited to La Jolla mine, 30 miles northeast of Mocorito. It was worked by Mexicans to a depth of not more than 300 ft. It is said that the dumps consist of silver ore of fair grade.

While the mineralized area of the district is small as compared with other districts in the state, there is a sufficient member of gold, silver and copper veins known to merit investigation and as there is a railroad in the district and operating costs are low, it is probable that it will receive more attention in the near future.

The extensive experiments which have been recently made to extract the vanadium from the vanadiferous coal deposits of Argentine and Peru have not been successful commercially.

---

*Box 135, Ely, Nev.

Vanadium—Its Ores and Uses

By Thomas F. V. Curran[*]

An account of the occurrences and applications of this important alloy metal. Discovered in 1803, its applications and metallurgy have only been developed within the last decade. The addition of small quantities of vanadium greatly enhances the useful qualities of various metals. The increased resistance of steel and cast iron to vibration and shock is especially noteworthy, and has stimulated the search for tractable vanadium ores.

Vanadium is a member of the phosphorus group of elements and is of wide occurrence, though commercial deposits are comparatively rare; traces are frequent in titaniferous magnetites and in nearly all rocks, the smallest quantities being in persilicic rocks. In subsilicic rocks the amount is often as high as 0.05% of V_2O_5. It is also found in slates and other sedimentary rocks, also in French bauxite, in rutile, clays and oil-bearing shales, in coal and in the ashes of plants.

Del Rio, of Mexico, discovered the element in 1803, in the lead ores of Zimapan, but allowed himself to be persuaded by the fallacious assertions of French savants that it was impure chromium, hence the honor of the discovery was given to Sefstrom, of Sweden, who found it in 1830 in the Taberg ores.

Vanadium Ores

The principal ores containing vanadium are patronite, carnotite, roscoelite, vanadinite and the hydrocarbon asphaltite.

Patronite is a sulphide of vanadium, associated with pyrite, in a carbonaceous substance resembling slaty coal but abnormally rich in sulphur. It contains 35% vanadium sulphide, 5% iron sulphide, 35% free sulphur, 15% silica, and small quantities of molybdenum, nickel, alumina, lime, etc. It occurs at Minasragra, 30 miles west of Cerro de Pasco, Peru, in the Andes at altitude of nearly 16,000 ft. above sea level, in a lens-like vein having a dip of about 63°, thickness of from 3 to 6 ft. and length of 300 ft. The patronite ore is free-burning, is easily calcined and loses 45% of its weight in the process. The calcined ore contains about 52% vanadium oxide, (V_2O_5). The aluminous clays in the vicinity of the patronite vein are impregnated with solutions of oxidized vanadium. Possibly 5000 tons of these materials have been extracted.

Carnotite is a complex vanadium and uranium mineral of variable content, the usual commercial quality having about 4% vanadium oxide and 2% uranium oxide. It seems to be a canary-yellow ocherous pigment impregnating the siliceous sandstone and is to a large extent made up of calcium and barium compounds admixed with an amorphous silicate containing vanadium in the trivalent state, probably replacing aluminum. The stratas are flat, and vary in thickness from 1 to 4 ft. The color changes in proportion to the content of the vanadium or of the uranium. In ores containing 14% vanadium oxide and 3% uranium oxide (U_3O_8) with 3 to 4% sulphur and some carbonaceous matter, the color is a dark olive green, with yellowish specks, while in ores free from carbonaceous matter and high in calcium, the vanadium content is appreciably higher and the color is a brick-red, somewhat like soft iron oxide, but interspersed with minute particles of the yellow carnotite, or containing thin layers of the blended vanadium carnotite of duller yellow hue. The principal deposits operated are in the Paradox Valley, Montrose County, Colorado, and are over 50 miles in length and 12 miles in width. The occurrence is in the La Plata sandstone of the Jurassic age. Carnotite is found also in San Miguel, Mesa, Routt and Rio Blanco counties, Colorado; in Grand and Emery counties, Utah; in South Australia, Portugal and Turkestan. The shipments from Paradox Valley have totaled probably 2000 tons.

Roscoelite, which is a muscovite in which vanadium has partly replaced aluminum, or a closely related compound, occurs in blanket deposits in the Lower San Miguel mining district of San Miguel county, Colorado, as a replacement of the original calcareous cement. The deposits are persistent, thick and easily worked, and contain an average of about 3% vanadium oxide. The ore is milled close to the mines and the production so far has been probably 10,000 tons.

Vanadinite, $Pb_5V_3O_{12}Cl$, occurs in a great variety of isomorphous mixtures, indicative of hydro-chemical reactions. Endlichite is a mixture of the arsenic and vanadium compounds; mottramite, a vanadate of copper and lead, is found at Alderley Edge, Eng., as an impregnation of the Keuper sandstone. A further variety is descloizite, close kin to ramirite found in many parts of Mexico. The vanadates occur principally in metalliferous veins, and their formation is attributed to percolating vanadiferous waters acting on other compounds, usually the compounds of lead. Several deposits occur near Cutter, New Mexico, associated with descloizite, lead molybdate, fluorspar, galena, barite and copper minerals. The average ore contains about 1% vanadium oxide and 5 to 7% lead. Considerable difficulty is experienced in mechanically concentrating the ore. Deposits also occur at Bayard, Hillsboro and Cook's Peak, while a somewhat higher grade vanadinite occurs near Tucson, Arizona.

Mexican Occurrences

In Mexico, vanadinite is found near Villa Rasales, Chihuahua, also at Coyame, Iturbide, and at Zimapan, Hidalgo; at Cardonal, in San Luis Potosi, at Charcas in the Sierra de Coronados, and at Catorce, as well as in Ojocaliente, near Berriozabal, Zacatecas. The vanadinite from Chihuahua is fairly pure and easily concentrated to 18% vanadium oxide. The ore from Zacatecas contains over 4% vanadium oxide and 64% lead but is frequently associated with arsenic.

Cuprodescloizite, or ramirite, is probably akin to chileite, which contains 13.5% vanadium oxide, 55% lead oxide, 14.6% copper oxide, and 4.6% arsenic oxide, 2% sand and clay, the remainder being lime, iron, alumina, etc. It occurs in Guanajuato at San Luis de la Paz, in San Luis Potosi, Matehuala, and Charcas. A variety that occurs near Zacatecas contains the vanadium in association with wulfenite.

In the descloizite as obtained from the River Plate district, Argentina, manganese replaces the copper and the vanadium oxide content is 22%, with 11% combined manganese oxides. Many varieties of vanadates occur in the silver-lead mines of Cordoba, some of the mines being extremely rich but flooded by underground streams.

The lead ores of Northern Spain contain from 4 to 5% vanadium oxide and by crude hand-dressing are concentrated to 12% vanadium oxide, with 35% lead. 13% ferrous oxide, 35% siliceous matter and about 3½ oz. silver to the ton.

Asphaltite Deposits

Asphaltite is an extremely soft, friable, lustrous substance, of very low specific gravity, containing about 80% hydrocarbon; it breaks into minute squares or cubes and burns with a long, smoky flame, yielding much tar. The vanadium content is quite uncertain, ashes from coal from the same deposit giving from 5% to 50% vanadium oxide. It occurs near Page, Okla., and at Palisade, Nev.,—a sample from the latter place giving

---

[*] President, General Vanadium Co. of America, Continental Bldg., Baltimore, Md.

1.39% ash and 25% vanadium oxide in the ash.

There are many asphaltite deposits in Peru, those of the Yauli, being best known. The surface consists of three layers which at a slight distance unite and form a single layer from 7 to 9 m. thick, with average content of 1% vanadium oxide, which being burned to an ash yields from 25 to 40% vanadium oxide. Other mines are situated near Huanuco, a sample ton of ashes received recently giving 17% vanadium oxide. A lignite coal of this nature also occurs near San Rafael, Argentina.

In discussing the source of vanadium in certain ores, Doctor Hillebrand suggests:

> Coal is a possible source of the vanadium and perhaps uranium in carnotite and other evidently secondary minerals that contain one or the other of these elements. This suggestion is based on the repeated finding of vanadium in coal ashes and the observation of uranium in anthracite bitumen, in Sweden, and nodular forms of carbon from the oldest sedimentaries of that country, in grahamite from North America, and in carbonaceous materials from a pegmatite dike in Quebec. Further in the San Rafael swell, in the eastern part of Utah, vanadium has been found by me in relatively large amount in the carbonaceous material accompanying and impregnating sandstone, and at Cerro de Pasco, Peru, carbonaceous matter very rich in vanadium occurs. These facts are so indicative of a relation between vanadium and possibly uranium, and certain coals and carbonaceous materials that an examination of the coals and bitumens of western Colorado and eastern Utah for a possible content in these elements seems desirable. If found in them, the question of ultimate origin would still remain.

An ordinary steaming quality coal from Rockvale, Colo., gave 1.5% ash with 27% vanadium oxide in the ash. In operating the Jodandy carnotite mine in Paradox Valley, a small pocket was opened in the solid sandstone that was filled with pea-size pieces of red calcium vanadate, yellow siliceous carnotite, and vanadiferous coal. In the Minasragra deposit, the patronite is enveloped with veins of quisqueite and natural coke. The elevation of the Yauli deposits is about the same as those at Minasragra.

Kent Smith's Method for Vanadium

Comparatively few assayers in mining districts can accurately determine the vanadium content of ores. It therefore seems desirable to repeat J. Kent Smith's method which is as follows:

Weigh out 0.512 grams of the finely powdered material, and dissolve in HNO_3, if possible, or else digest in warm *aqua regia*. To the solution add an excess of strong H_2SO_4 and evaporate to copious fumes. The liquid is then diluted with water at about 30° C., permanganate added until the solution shows barely pink, and a measured excess of $N/10$ ferrous sulphate added. The excess of ferrous sulphate is titrated with $N/10$ bichromate, using ferricyanide on a spot plate, as indicator. The cubic centimeters of ferrous sulphate consumed in oxidizing the vanadium, as given by difference, represent the percentage of vanadium. Vanadium divided by 0.5614 equals V_2O_5 present.

In the case of ores and alloys difficultly soluble, a convenient way to bring the vanadium into solution is to fuse the ore or alloy in a nickel or iron crucible with about eight times its weight of sodium peroxide, dissolving the melt in water, boil, acidify with sulphuric acid, and proceed as usual. The clarity of the end reaction is much enhanced by having the solution well acid with sulphuric acid. Care should be taken that the ferricyanide indicator is freshly prepared, and that it is quite free from ferrocyanides; the crystals of ferricyanide should be rough washed before dissolving them.

To make a mere qualitative test to show the presence of vanadium, with ores difficulty soluble or containing much carbonaceous matter, reduce to an ash. (In non-carbonaceous ores, carnotites, vanadinites, etc., this is unnecessary.) Pour a teaspoonful of sulphuric acid into a test tube, then drop into the acid a small amount of ground ore or ash. Heat to fumes. Allow tube and contents to cool. Dilute with pure water; the coloration will probably be bluish green. Add a little peroxide of hydrogen, and if the color changes to dark red or mahogany, it indicates the presence of vanadium.

Growth of Vanadium Industry

The growth of vanadium industry will be appreciated when it is considered that the total value of the alloy produced in the year 1906 did not exceed $50,000, while the 1911 output was worth $1,500,000. The metal is silvery white and readily oxodized. It has a high fusing point but when alloyed properly with iron, the melting point is less than that of mild steel. Hence it is marketed in the form of ferrovanadium, an alloy containing two parts iron to one part vanadium. The present selling price of this alloy is $3.50 per lb. of metallic vanadium content.

Vanadium cleanses, toughens, and strengthens iron and steel to which it is added, rendering possible revolutionary changes in the lightening of parts, lengthening of service, increased safety, and the vitalizing of inventions otherwise impossible of practical operation.

In an address before the British Iron and Steel Institute 10 years ago, Prof. J. O. Arnold declared that vanadium was the master weapon of the steel metallurgist. The advanced steel makers accepted his dictum and encouraged their subordinates to renewed efforts in the commercial application of the element. However, stockholders were prone to consider profits rather than excellence of product. The public was not then ordering vanadium steel, although there was an ever increasing necessity for stronger and safer steel. The price of vanadium alloy was high, its quality irregular and its supply uncertain.

The industry needed a genius who should combine the attributes of the enthusiast with remarkable gifts as chemist, metallurgist and practical steel maker. J. Kent Smith, of Liverpool, England, has eminently filled this difficult rôle. In fact, the history of vanadium in the last decade is largely a story of his struggles, defeats and victories, in devising and making the various grades of vanadium alloy proved necessary in the production of the multitudinous types of vanadium steel and iron. He supervised personally the initial use of vanadium in most of the leading steel mills of the old and the new world.

Uses of Vanadium

Vanadium has accomplished wonders in crucible steel and in openhearth steel. It gives to cast iron greater strength and endurance, and copper and aluminum are remarkably improved for certain purposes by its addition. Engineers impressed by its valuable properties are gradually disregarding the first-cost fetish; wherever static or dynamic weakness, porosity, strain or vibration and shock, are to be overcome, vanadium is the infallible antidote. It is now being used in the steel for engine axles and frames, in transmission shafts and gears, in wire and springs, in piston rods, hydraulic cylinders, tires, tubes, boiler plates, bolts, gun shields, projectiles, armor plate, gun barrels, watch springs and in castings and forgings generally.

As vanadium unites with the nitrides and oxides and carries them into the slag, the quantity of vanadium that will remain in the steel is proportionate to the amount of scavenging to be done. In well deoxidized steel, the scavenging will consume about one-fifth of the vanadium. The method of adding ferrovanadium is very simple. In the crucible process, the alloy, broken small, is put into the molten charge with the second addition of the manganese. In acid-openhearth practice, the alloy, in large pieces, is dropped into the bath when the flame has been blanketed after the addition of the manganese and warmed silicon pig. In basic-openhearth practice, the alloy, broken small, is run through a spout that empties into the ladle in which the molten steel is being poured; a similar method is followed in bessemer and tropenas practice and also in the cupola process for cast iron, although in the latter, the alloy should be crushed exceedingly small so as to melt readily.

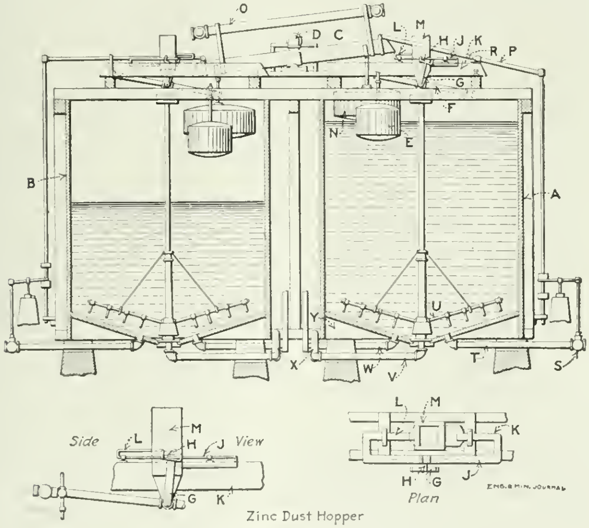
Vanadium intensifies the effects of carbon, manganese, silicon, etc., hence materials of necessarily mild nature, such as boiler plates, chains, anchors, eye-bolts and products to be case-hardened, should contain only 0.12% to 0.14% vanadium in addition to the ordinary proportions of the other elements. For shafts, axles, castings, tires, saws, punches and dies, etc., the vanadium should be from 0.16% to 0.20%, while for springs a slight increase of the vanadium will be beneficial. For gun shields, protective deck and armor plates, etc., the vanadium should be from 0.30% to 0.40%. High-speed steel may be considered as an alloy; the usual practice here is to reduce the tungsten addition and to add from 0.35% to 0.50% vanadium, while in some of the Sheffield mills 2% of vanadium is added and the amount of tungsten is reduced one half or more. A few makers have substituted molybdenum for tungsten, with excellent results. In cast iron, vanadium addition varies in the different foundries using it, and ranges from 0.08% to 0.15%. Its effect is to scavenge, evenly distribute the carbon, eliminate porosity, refine the grain, check spalling and flaking, and lessen greatly the inherent brittleness. It follows naturally that these castings give unusual service records and that shop rejects are reduced so as to more than pay the cost of the vanadium.

Vanadium increases largely the resistance of metals to vibratory disintegration, and I predict that not only will all locomotives ultimately be made of vanadium steel, but all high-service materials will contain it.

Bosqui Zinc-dust Feeder

A recent invention of Daniel Bosqui (U. S. pat. 1,018,604), assigned by him to the Merrill Metallurgical Co., provides for automatically adding a proportionate supply of zinc dust to the charge of cyanide solution to be treated. The inventor claims that by the use of this apparatus there is a positive feed of a predetermined quantity of zinc dust to a given quantity of cyanide solution; a positive time contact for the zinc dust with the solution is provided before withdrawal to the filtering medium, and at the same time the solution is maintained in a continuous agitated condition during the entire operation of precipitation.

A side elevation of the apparatus is shown in the accompanying engraving. One of the receiving tanks is shown filled with liquid with its outlet valve open for the discharge of liquid, while the companion tank is being filled with liquid and has its outlet valve closed. The cyanide solution to be treated is alternately delivered to each receiving tank by means of a tilting launder *C*, which receives the solution to be treated from the feed pipe *D*. When the tank is nearly full, the solution acts against the float *E* which raises the inner end of the tilting lever *F*. This lever consists of a tubular rod or pipe partly filled with quicksilver and is supported centrally.



Bosqui Zinc-dust Feeder

Attached to this lever and projecting upward is a forked arm *G*, the free ends of which, depending on the upward and downward movement of the float *E*, engage with a pin *H*, projecting laterally from a horizontally slidable arm *J*. This slide arm carries the cutter blades *K* and *L* which move within the zinc feed box *M* from opposite sides, working within milled grooves in this box. The cutter blades are spaced apart and the inner end of the blade *L* overlaps the inner end of the blade *K* for a slight distance, so that when the blade *L* makes a return stroke from within the zinc-dust box, the same moving in unison with the blade *K*, no zinc dust feeds out of the box. As the outer end of the lever *F* is depressed, the cutter *L* is moved into the feed box and the cutter *K* is withdrawn from it, allowing the zinc dust to drop from the feed box into the solution in the tank. The charge of zinc dust depends on the inside measurements of the feed box and the distance between the cutter blades.

After the charge of zinc dust has been discharged within the tank *A*, the cyanide solution continuing to rise, actuates the float *N* which raises one end of the launder *C* and as it is carried above the horizontal position, the quicksilver in pipe *O* moves to the lower end. The resulting movement, being transmitted by a system of levers, opens the discharge valve *S*, permitting the treated solution to flow to the usual filtering medium.

The gold- and silver-bearing solution will now flow from the launder *C* into the tank *B*, the outlet valve of which is closed.

Tanks *A* and *B* are alike as to apparatus and operation. It will thus be seen that while one tank is bein filled with cyanide solution to be treated, the treated cyanide solution contained in the companion tank is being withdrawn.

In each tank is an agitator *U*. In operation the liquid is drawn from the tank through the pipe *W* and is forced by the centrifugal pump *X* back into the agitator through the discharge pipe *V*. The pressure of the liquid thus forced into the agitators escapes through the nozzles *Y*, causing the agitator to be rotated at a suitable speed. The nipples are so arranged that the jets of solution striking the bottom of the tank tend to prevent any settlement of the precipitate. The only contact with air that possibly takes place is through the surface exposure of the solution which is a negligible quantity.

Zinc Trade of Germany

The exports and imports of zinc ores and products of Germany for the year 1911, are reported, in metric tons, as follows:

	Imports	Exports
Spelter	48,355	77,088
Sheets	467	36,093
Scrap	2,252	3,953
Zinc ore	262,398	48,998
Zinc dust	787	3,689
Zinc sulphide	2,719	13,740
Zinc white	4,977	20,677

Smelting in British Columbia

VICTORIA CORRESPONDENCE

In the course of an address, by Robert R. Hedley, of Vancouver, B. C., presented at the annual meeting of the Canadian Mining Institute held in Toronto on Mar. 6-8, he gave the following information concerning the Consolidated Mining & Smelting Co., of Canada, Ltd:

OPERATIONS AT TRAIL

This company has established at Trail, B. C., a great metallurgical industry. Beginning with a small copper-matting plant, it now has complete modern copper-matting, and lead-smelting and refining plants. It is doing a large custom ore-smelting business, as well as smelting its own ores and operating, as owner, the following mines in British Columbia: Center Star, Iron Mask, Le Roi, War Eagle, and others, at Rossland; Phœnix Amalgamated and No. 7 group, in Boundary district; Molly Gibson, near Nelson; Richmond-Eureka, in Slocan district; and St. Eugene and Sullivan, in East Kootenay. Also, it is exploiting, under option of purchase, the Hudson Bay group and Silver Dollar, near Salmo; and the Tiger and No. 1. in Ainsworth camp.

The Consolidated company has always had an efficient staff in mining and metallurgy. Thus, its mines are operated to the best advantage; its St. Eugene concentrator, at Moyie, is lacking in nothing that conduces to successful working; and its smeltery at Trail is kept uptodate if not a little ahead. This company took hold of a crude and imperfect, but effective process for refining lead by electrolysis and perfected it in every detail. Although a little slow in putting in the Huntington-Heberlein process for roasting and desulphurizing ores, it improved on its accessories when it did install it, and it has been quick to recognize the advantages of the Dwight-Lloyd roasting and sintering machine, which it is striving to adapt to all its most complex conditions.

It is known that the company has for some time been at work on the problem of zinc metallurgy, but I do not know how near success it has got. This is with it a most vital matter, for in addition to the byproduct zinc concentrate of so many of the mills, it has in the Sullivan mine large bodies of ore the zinc content of which well nigh puts it out of the lead-smelting class; also an immeasurably larger quantity of ore quite excluded from that class by reason of its high zinc content. The company is now investigating the French process for reduction of mixed zinc-lead sulphides.

Concerning copper mining and smelting in British Columbia, Mr. Hedley, who was for a number of years manager of the Hall Mines smeltery at Nelson, B. C.

COPPER SMELTERIES

The large and modern plants of the Granby Consolidated Mining, Smelting, & Power Co., and the British Columbia Copper Co., both in Boundary district, have accomplished great things, both in mining and metallurgy. Each is so admirable in its achievement that it is sufficient to generalize on the chief features. Without handicaps of fuel shortage such as occurred last year, the total cost of mining and smelting ore and converting matte into blister copper may be safely stated as having been not more than $2.50 per ton of ore. Marketing the copper costs 20c. more. The ore generally averages about 25 lb. of copper, $1 in gold, and 10 to 20c. in silver per ton. Slag losses under present conditions rarely exceed 4 lb. of copper per ton of ore.

The B. C. Copper Co. has two blast furnaces 360x48 in. and one 240x48 in., while the Granby company has eight furnaces 266x44 in. The latter company has recently deepened its furnaces to give a column of 11 ft. above the tuyeres, which has not only increased the capacity, but has reduced the slag loss, the flue dust produced, and the coke consumption. The most recent change at the Granby works is in disposal of the slag, which will be elevated by traveling belt from a central pit, into which the granulated slag will first flow.

It is gratifying to see both these companies extending their operations in the province. The Granby, having developed to its satisfaction the Hidden Creek mine, at Goose Bay, Observatory inlet, is now proceeding with the erection of a smelting plant, with capacity to treat 2000 tons of ore daily. The management thinks it conservative to figure as available 6,000,000 tons of 2% copper ore, or if it be demonstrated that 1.65% copper ore will be profitable, to double that tonnage. The precious-metal content will probably be somewhat lower than at its Boundary District mines, but I can see no reason for expecting a higher cost at Hidden Creek than in the Boundary. True, coke will at the former be, for the present, either of inferior quality, or greater cost, but the sulphur content of the ore should permit the company to use but one-quarter the quantity.

The British Columbia Copper Co. has recently installed a cyanide plant at its Napoleon mine, situated not far south of the International Boundary line. It is now exploiting under option of purchase a large field of siliceous, low-grade copper ore near Princeton, Similkameen; also a big deposit of low-grade gold ore near Silverton, Slocan Lake. If proven worthy, the former will require the installation of a copper-reduction plant, and the latter a cyanide mill, at the respective properties. The establishment of a smeltery at Princeton would do much to encourage the opening of promising mineral claims in that district.

Experiments in Speiss Treatment

Some laboratory experiments were recently made by Barth on the treatment of a partly roasted speiss of the following composition: CoO, 25.79%; NiO, 18.78; Ag_2O, 0.30; PbO, 24.53; As, 5.66; Sb, 2.08; Fe_2O_3, 17.66; CuO, 0.24; CaO, 1.95%. According to *Metallurgie,* 1912, p. 199 (abstracted in *Journ, Soc. Chem. Ind.,* May, 1912), preliminary experiments showed that a convenient process consists in heating the material at 500 to 600° C. in a current of air containing sulphur dioxide, which converts the oxides of nickel and cobalt into soluble sulphates. It is not possible to do this in such a way as to get any considerable separation of nickel from cobalt, but it is a satisfactory first process and converts about 67% of the nickel and cobalt into the soluble form, along with traces of silver, copper and tin. The silver is then precipitated by metallic copper, and the copper by metallic iron. After precipitating the hydroxides of nickel, cobalt, and iron with milk of lime, and filtering, the nickel and cobalt are washed out by means of hot ammonium chloride thus producing a nickel-cobalt solution free from other metals. The insoluble residue after the sulphate roasting, which still contains nickel and cobalt in combination with arsenic and antimony, as well as lead sulphate and ferric oxide, is smelted with a suitable amount of galena. This quantity is calculated from the amounts of lead sulphate and ferric oxide in the residue so as to reduce them according to the equations: $6Fe_2O_3 + 2PbS = 12FeO + 2PbO + 2SO_2$; $2PbO + PbS = 3Pb + SO_2$; $PbSO_4 + PbS = 2Pb + 2SO_2$. This operation yields three products: (1) lead (containing silver), which may be treated in the ordinary way; (2) slag containing the bulk of the iron as silicate with a little lead, nickel and cobalt. This slag should contain 10 to 14% of silica and either the galena must be chosen so as to provide for this or else silica must be added. If it is melted with any sulphur-containing material the slag gives up its more valuable material as an infusible nickel-cobalt-lead sulphide which may be added to the original roasted speiss before the sulphating process; (3) nickel-cobalt speiss containing quantities of arsenic and antimony which are now so great as to be partly removable by roasting, the product then being sulphated by the air-sulphur-dioxide method as before.

The Mining Index

A Classified Bibliography of the Current Literature of Mining and Metallurgy

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print), in the original language, for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COAL AND COKE

18,827—ACCIDENTS in Anthracite Coal Mines. Frederick L. Hoffman. (Coal Age, Apr. 27, 1912; 3½ pp.) 20c.

18,828—ALASKAN COAL PROBLEMS. W. L. Fisher, Secretary of the Interior. (Bureau of Mines, Bull. 36, 1912; 32 pp., illus.)

18,829—ANALYSIS—The Causes for Variations in Volatile Matter Determinations. S. W. Parr. (Journ. Ind. and Eng. Chem, May, 1912; 2½ pp.) 60c.

18,830—BREAKER—The New Buck Mountain Breaker of the Lehigh Valley Coal Co. E. L. Cole. (Coal Age, May 18, 1912; 4 pp, illus.) 20c.

18,831—BRITISH COLUMBIA—Bear River Coal Fields, B. C. C. F. J. Galloway. (Can. Min. Journ., May 15, 1912; ¾ p.) 20c.

18,832—CANADA—The Coal Fields of Western Canada. E. Jacobs. (Coal Age, May 4, 1912; 1⅔ pp.) 20c.

18,833—COKE—By-Product Coke Ovens in America. F. E. Lucas. (Mines and Minerals, Apr., 1912; 1¼ pp.) 20c.

18,834—COKE—The Jamison Coke Plants, Greensburg, Penn. R. Dawson Hall. (Coal Age, Apr. 27, 1912; 3 pp., illus.) 20c.

18,835—COKE DUST—Some Methods of Coke Dust Disposal. C. J. Bacon. (Progressive Age, May 1, 1912; 7 pp., illus.) 20c.

18,836—COLORADO—A Mammoth Seam in Colorado. Benedict Shubart. (Coal Age, May 4, 1912; 2 p., illus.) 20c.

18,837—DUST—Versuche mit Kohlenstaub im Versuchstollen des Rossitzer Steinkohlenrevieres. Czaplinski and Jicinsky. (Oest. Zeit. f. B. u. H., Mar. 30, 1912; 6½ pp., illus.) 40c.

18,838—ELECTRICITY—Safeguarding the Use of Electricity in Mines. Hartley M. Phelps. (Coal Age, May 11, 1912; 1 p.) 20c.

18,839—EXPLOSION at Merritt, B. C. Chas. Graham. (Coal Age, May 11, 1912; 1⅓ pp., illus.) 20c.

18,840—EXPLOSION—Bruceton, Penn., Explosion. George S. Rice. (Mines and Minerals, May, 1912; 2¼ pp., illus.) 20c.

18,841—EXPLOSION—Mine Explosion at McCurtain, Okla. A. A. Steel. (Mines and Minerals, May, 1912; 5¼ pp., illus.) 20c.

18,842—EXPLOSIONS—Review of Iowa Mine Explosions. R. T. Rhys. (Coal Age, May 11, 1912; 1½ pp.) 20c.

18,843—GAS—Der Kohlensaüreausbruch auf dem Steinkohlenbergwerk Cons. Ruhengrube bei Neurode am 17. Sept., 1911. Laske. (Preuss. Zeit. f. B., H. u. Salinenwesen, 1912, part 1; 5¾ pp., illus.)

18,844—GAS—Testing for Fire-Damp and Black-Damp by Means of a Safety-Lamp. Henry Briggs. (Trans. Min. Inst. of Scotland, Feb. 15, 1912;) 15½ pp., illus.)

18,845—MINE CAR—Colliery Mine Car Construction. A. T. Shurick. (Coal Age, May 11, 1912; 3 pp., illus.) 20c.

18,846—MINE REGISTRATION AND CHECKING at Coleman Mine of International Coal & Coke Co. W. A. Davidson. (Coal Age, Apr. 28, 1912; 2 pp., illus.)

18,847—MINE STABLE MANAGEMENT. Beverly S. Randolph. (Mines and Minerals, Apr., 1912; 1 p.) 20c.

18,848—MINING METHOD—Die Wirtschaftlichkeit und Zweckmässigkeit des Unterwerksbaues und Oberwerksbaues im rheinisch-westfälischen Steinkohlenbergbau. Westermann. (Glückauf, Apr. 6, 13 and 20, 1912; 35¾ pp., illus.) $1.20.

18,849—OHIO—Mining the No. 8 Seam in Ohio. William Hibbs. (Coal Age, May 18, 1912; 1¼ pp., illus.) 20c.

18,850—OVERCASTS with Light Walls. A. A. Steel. (Mines and Minerals, Apr., 1912; 1⅓ pp, illus.) Describes method of construction that will afford relief for explosion pressure and can be readily repaired. 20c.

18,851—PEAT—The Improved Anrep Machinery for the Manufacture of Machine Peat. Ernest V. Moore. (Journ. Can. Peat. Soc., Nov., 1911; 8½ pp., illus.) 40c.

18,852—PEAT INDUSTRY in Holland. (Journ. Can. Peat Soc., Feb., 1912; 4 pp., illus.) 40c.

18,853—PENNSYLVANIA—Mining Conditions under the City of Scranton, Penn. By Wm. Griffith and E. T. Conner, with a chapter by N. H. Darton. (Bureau of Mines, Bull. 25, 1912; 89 pp., illus., with numerous maps.)

18,854—PHILIPPINES—Coal Situation in the Philippines. Monroe Woolley. (Coal Age, May 18, 1912; 1 p.) 20c.

18,855—POWER—Does it Pay the Average Coal Mine to Purchase Central Station Power? Graham Bright. (Proc. A. I. E. E., May, 1912; 11 pp.)

18,856—PREPARATION—Neuere Fortschritte auf dem Gebiete der Kohlenaufbereitung. Eschenbruch. (Preuss. Zeit. f. B., H. u. Salinenwesen, 1912, part 1; 27 pp., illus.)

18,857—QUEENSLAND—Coal on the Oakey-Cooyar Railway. Lionel C. Ball. (Queensland Govt. Min. Journ., Apr., 1912; 1¼ pp., illus.) 60c.

18,858—RESCUE WORK—Emergency Car of Colorado Fuel & Iron Co. (Coal Age, May 4, 1912; 2⅔ pp., illus.) 20c.

18,859—SHAFT AND SLOPE CONSTRUCTION, 201 Mine, Virginia. R. G. Johnson. (Coal Age, May 4, 1912; 3 pp., illus.) 20c.

COPPER

18,868—ANALYSIS—Oxalate-Permanganate Process for the Determination of Copper Associated with Cadmium, Arsenic, Iron, or Lead. H. L. Ward. (Am. Journ. Sci., May, 1912; 8¾ pp.) 60c.

18,869—ARIZONA—Notes on the Miami Copper District, Arizona. Walter Harvey Weed. (Min. and Eng. Wld., May 18, 1912; 1½ pp.) 20c.

18,870—BRASS AND COPPER—The Manufacture of Brass and Copper at the Plants of Basse & Selve, Altena, Germany. (Brass World, May, 1912; 9½ pp., illus.) 20c.

18,871—CHILE—El Mineral de "El Teniente." Ignacio Diaz Ossa. (Bol. Soc. Nac. de Mineria, Chile, Jan., 1912; 4 pp.)

18,872—CONCENTRATION ANALYSIS from Cananea Practice. Alfred Tellam. (Min. Mag., Apr., 1912; 6 pp., illus.) 40c.

18,873—FURNACE CHARGES—Handling Furnace Charges at Cananea. M. J. Elsing. (Min. and Sci. Press, May 4, 1912; 3¼ pp., illus.) 20c.

18,874—JAPAN—The Sumitomo Properties. (Far Eastern Rev., Mar., 1912; 5 pp., illus.) Description of mining and smelting at the Sumitomo Besshi Copper Mine.

18,875—LEACHING Applied to Copper Ore. W. L. Austin. (Mines and Methods, Apr., 1912; 3⅔ p.) Seventeenth article of series, dealing with electrolytic deposition of copper from solutions. 20c.

18,876—MARKETING—How the Metals are Sold—Copper. W. R. Ingalls. (Eng. and Min. Journ., May 4 and 11, 1912; 6¼ pp.) 20c.

18,877—MICHIGAN—The Copper Mining Industry of Michigan. Reginald E. Hore. (Min. and Eng. Wld., Apr. 6, 1912; 4⅓ pp., illus.) Continuation of article previously indexed. 20c.

18,878—MICHIGAN—The Quincy Mine from Stope to Smelter—II Geo. E. Edwards. (Min. and Eng. Wld., Apr. 27, 1912; 4 pp., illus.) 20c.

18,879—MILL—Miami Concentrating Mill. C. E. Golding. (Mines and Minerals, Apr., 1912; 2½ pp., illus.) 20c.

18,880—MINING METHOD—Baltic Copper Mine in Michigan. Claude T. Rice. (Eng. and Min. Journ., Apr. 27, May 4 and May 11, 1912; 15½ pp., illus.) 40c.

GOLD DREDGING

18,884—CALIFORNIA—Dredges on Upper American River. Lewis H. Eddy. (Eng. and Min. Journ., May 18, 1912; 3⅓ pp., illus.) 20c.

18,885—GEORGIA—Modern Gold Dredge in Georgia L. M. Richard. (Eng. and Min. Journ., Apr. 27, 1912; 1 p., illus.) 20c.

GOLD AND SILVER—CYANIDATION

18,886—AIR-LIFTING OF SLIME PULP. A. W. Allen. (Min. Mag., Apr., 1912; 3 pp., illus.) 40c.

18,887—ASSAY OF GOLD-BEARING CYANIDE SOLUTIONS by Electrolysis. C. Crichton. (Journ. Chem., Met. and Min. Soc. of South Africa, Mar., 1912; 1¼ pp.) Author's reply to discussion. 60c.

18,888—CONCENTRATE—Cyaniding of Concentrate. E. M. Hamilton. (Eng. and Min. Journ., Apr. 27, 1912; 3⅔ pp.) 20c.

18,889—EXPERIMENTS—Miscellaneous Cyanide Experiments. Louis Cohen. (Met. and Chem. Eng., Apr., 1912; 2½ pp.) 40c.

18,890—GOLDFIELD CONSOLIDATED—Goldfield, Nev., Cyanide Mill. (Mines and Minerals, May, 1912; 1¾ pp., illus.) 40c.

18,891—PRECIPITANT—Sodium Sulphide as Cyaniding Precipitant. E. H. Webster. (Eng. and Min. Journ., May 18, 1912; 1⅓ pp.) 20c.

18,892—SLAG FURNACE—A Convenient Slag Furnace at Oriental Consolidated Mining Co.'s Plant. J. D. Hubbard. (Min. and Sci. Press, Apr 27, 1912; 1 p., illus.) 20c.

GOLD AND SILVER—GENERAL

18,893—AMALGAMATION PLATES—Notes on Absorption of Gold by Amalgamated Copper Plates, Cast-Iron Retorts and Amalgam Trays. G. H. Stanley and M. Thornton Murray. (Journ. Chem., Met. and Min. Soc. of South Africa, Mar., 1912; 1 p.) Discussion on paper previously indexed. 60c.

18,894—ARIZONA—The Congress Junction Mining District, Arizona. Chas. A. Dinsmore. (Min. and Eng. Wld., May 11, 1912; 1½ pp., illus.) 20c.

18,895—ASSAYING—Notes on the Assay of Sulphide Ores. Philip D. Wilson. (Mex. Min. Journ., May, 1912; 2¼ pp., illus.) 20c.

18,896—BRITISH GUIANA, Gold and Diamond Industries of. (Commissioner of Lands and Mines, British Guiana, 1911; 15 pp.)

18,897—CALIFORNIA—The High Grade Mining District in California. (Min. and Eng. Wld., May 11, 1912; 2⅙ pp., illus.) 20c.

18,898—COBALT—Operations at the McKinley-Darragh Mine, Cobalt. (Min. and Eng. Wld., Apr. 27, 1912; 1⅓ pp., illus.) 20c.

18,899—CRUSHING—The Crown Mines' Crusher Stations. (South African Min. Journ., Apr. 13, 1912; 1¾ pp., illus.) 20c.

18,900—HONDURAS—A Visit to the Department of Olancho, Honduras. (Bull. Pan American Union, May, 1912; 10 pp., illus.)

18,901—HYDRAULIC MINING—Timber Expansion in Flumes; Causes and Remedies. Godfrey Sperling. (Can. Engineer, Apr. 25, 1912; 1⅓ pp) 20c.

18,902—IDAHO—Mines and Mills of Shoshone County, Idaho. Robert N. Bell. (Min. and Eng. Wld., Apr. 6, 1912; 2⅔ pp., illus.) Abstract from annual report of the State Inspector of Mines. 20c.

18,903—MILLING—Costs of Milling in Leadville. Oliver C. Ralston. (Mines and Minerals, May. 1912; ¾ p.) 20c.

18,904—MONTANA—Notes on the Blue Bird Mine. H. V. Winchell and A. N. Winchell. (Econ. Geol., Apr.-May, 1912; 7¼ pp., illus.) 60c.

18,905—ONTARIO—Report on the Geology of the Area along the T. & N. O. Railway, Trial Line between Gowganda and Porcupine. J. G. McMillan. (L. K. Cameron, King's Printer, Toronto, 1912; 24 pp., illus.)

18,906—NEVADA—Mason Valley Mines and Smelting Works. A. H. Martin. (Mines and Methods, Apr., 1912; 2 pp., illus.) 20c.

18,907—ONTARIO—The Gold Fields of New Ontario. Walter Baelz. (Can. Min. Journ., May 1, 1912; 5¾ pp., illus.) Translation from Zeit. f prakt. Geol., Nov., 1911. 20c.

18,908—ONTARIO—The Mining Industry in that Part of Northern Ontario Served by the Temiskaming and Northern Ontario Railway. Arthur A. Cole (T. & N. O. Ry. Commission, Toronto, 1912; 57 pp., illus.)

18,910—PLACER DEPOSITS—The Law of the Pay Streak in Placer Deposits. J. B. Tyrrell. (I. M. M., Bull. 92, May 9, 1912; 13 pp., illus.)

18,911—PORCUPINE—Mines and Ores of Porcupine. R. E. Hore. (Eng. and Min. Journ., May 4, 1912; 1⅔ pp., illus.) 20c.

18,912—QUEENSLAND—Some "Outside" Charters Towers Mines. E. O. Marks. (Queensland Govt Min. Journ., Apr., 1912; 3¼ pp., illus.) 60c.

18,913—RAND—The Randfontein Central Gold Mining Co., Ltd. Rowland Gascoyne. (Min. and Eng Wld., Apr. 6, 1912; 2¼ pp., illus.) 20c.

18,914—RAND—Visit to the Modderfontein B.

Gold Mines, Limited. (Journ. South African Inst. of Eng., Apr., 1912; 2½ pp., illus.) Description of the property, illustrated by a number of plates. 60c.

18,915—RAND'S ORE RESERVES, The. (South African Min. Journ., Apr. 13, 1912; 1½ pp.) 40c.

18,916—REDUCTION PLANT—The Modern Reduction Plant of the Modderfontein "B." Rowland Gascoyne. (Min. and Eng. Wld., May 4, 1912; 1¾ pp., illus.) 20c.

18,917—RUSSIA—Gold and Platinum Alluvial Deposits in Russia. Leon Perret. (I. M. M., Bull. 92, May 9, 1912; 34 pp., illus.)

IRON ORE DEPOSITS, MINING, ETC.

18,921—ALGERIA—Etude sur les Gisements de Fer de l'Algérie. Dussert. (Ann. des Mines, Vol. I, No. 3, 1912; 121 pp., illus.) Conclusion of article previously indexed.

18,922—FRANCE—Frankreichs Eisenerze. Flegel. (Bergbau, Apr. 4, 1912; 9 pp., illus.)

18,923—IRON SULPHIDES—The Geology and Synthesis of Iron Sulphides. E. T. Allen, J. L. Crenshaw and J. Johnston. (Min. and Eng. Wld., Apr. 20, 1912; 3 pp.) Abstract from Am. Journ. of Sci., Mar., 1912. 20c.

18,924—MINING METHOD—Special Method of Mining on Dangerous Ground on the Mesaba Range, Minnesota. B. M. Concklin. (Wisconsin Engr., Apr., 1912; 2 pp., illus.)

18,925—ORE DRESSING—Anreicherung der Eisenerze in Schweden. (Stahl u. Eisen, Apr. 4, 1912; 6½ pp., illus.) Abstract from Ann. des Mines. 40c.

18,926—VIRGINIA—Brown Hematite Mining in Virginia. Charlton Dixon. (Mines and Minerals, Apr., 1912; 1½ pp., illus.) 20c.

IRON AND STEEL—METALLURGY

18,927—BLAST FURNACE—A New Blast Furnace for the Inland Steel Co. (Iron Tr. Rev., May 9, 1912; 5½ pp., illus.) 20c.

18,928—BLAST FURNACE—Reduktion und Kohlung im Hochofen, im Zusammenhange mit Hochofenstörungen und auf Grund von Schmelzversuchen erläutert. Bernhard Osann. (Stahl u. Eisen, Apr. 18, 1912; 10 pp., illus.) 40c.

18,929—BLAST FURNACE—Vorteile, Nachteile und Kosten der Zumischung von Sauerstoff zum Gebläsewinde der Hochöfen. Fritz W. Lürmann. (Stahl u. Eisen, Apr. 11, 1912; 2 pp.,) 40c.

18,930—BLOWHOLES—Note on the Welding up of Blowholes and Cavities in Steel Ingots. J. E. Stead. (Iron and Steel Inst., May, 1912, advance sheets; 10 pp., illus.)

18,931—BRIQUETTING of Iron Ores. N. V. Hansell. (Bull. A. I. M. E., May, 1912; 18½ pp., illus.)

18,932—CHILE—The Iron and Steel Industry of Chile. Carlos G. Avalos and Guillermo Young. (Min. Journ., Apr. 27, 1912; ¾ p.) Abstracted from Boletin de la Sociedad Nacional de Mineria. 40c.

18,933 — CONVERTER — Oil-Fired Converter Used at the Works of the Darlington Forge Co., England. Frank C. Perkins. (Mines and Minerals, Apr., 1912; 1 p., illus.) 20c.

18,934—CORROSION—The Influence of Carbon on the Corrodibility of Iron. C. Chappell. (Iron and Steel Inst., May, 1912, advance sheets; 25 pp., illus.)

18,935—CORROSION—The Mechanism of Corrosion. J. Newton Friend, J. Lloyd Bentley, and Walter West. (Iron and Steel Inst., May, 1912, advance sheets; 10 pp., illus.)

18,936—ELECTRIC FURNACE—The Nathusius Electric Steel Furnace. W. Lipin. (Met. and Chem. Eng., Apr., 1912; 5½ pp., illus.) 40c.

18,937—ELECTRIC FURNACE PROCESS as Applied to the Metallurgy of Steels. Harold G. Ade Stedman. (Can. Min. Journ., May 15, 1912; 6½ pp., illus.) Abstract of paper before the Cleveland (England) Instn. of Engrs. 20c.

18,938—ELECTRIC FURNACES — Improvements in Electric Furnaces and Their Application in the Manufacture of Steel. Hans Nathusius. (Iron and Steel Inst., May, 1912; advance sheets; 34 pp., illus.)

18,939—ELECTRIC POWER—The Selection of Control Apparatus for Steel Plants. M. A. Whiting. (Gen. Elec. Rev., May, 1912, 6 pp., illus.) 40c.

18,940—ELECTRIC POWER—Direct - Current and Alternating-Current Mill Motors for Auxiliary Drives. Brent Wiley. (Proc. A. I. E. E., May, 1912; 16 pp., illus.)

18,941—EQUIPMENT — Maschinenwirtschaft in Hüttenwerken. Hoffmann. (Zeit. d. Ver. D. Ing., Mar. 16, 23 and 30, 1912, 17 pp., illus.)

18,942—FOUNDRY ACCIDENTS—Suggestions for Preventing Foundry Accidents. (Foundry, May, 1912; 3½ pp., illus.)

18,943—FOUNDRY PRACTICE—Ueber Amerikanische Giessereiverhältnisse. C. Humperdinck. (Stahl u. Eisen, Apr. 25, 1912; 7 pp., illus.) 40c.

18,944—FRACTURES—Note on the Investigation of Fractures. F. Rogers. (Iron and Steel Inst., May, 1912, advance sheets; 11 pp., illus.)

18,945—GAS DETERMINATION—Bestimmung von Gasmengen in Eisenhüttenbetrieben. H. Naegell. (Stahl u. Eisen, Apr. 11, 1912; 1½ pp.) 40c.

18,946 — GERMANY — Die Roheisen-Selbstkosten in den Industriegebieten Südwestdeutschland, Neiderrheinland Westfalen und Oberschlesien. Werndl. (B. u. H. Rundschau, Apr. 20, 1912; 7½ pp.)

18,947—INDIA—The Works of the Tata Iron and Steel Co., Limited. (Iron and Coal Tr. Rev., May 3, 1912; 3½ pp., illus.) 40c.

18,948—METALLOGRAPHY—Le Systeme Fer-Carbone au Point de Vue de la Cristallisation. V. Adolphe Kroll, Jr. (Rev. Univ. des Mines, Mar., 1912; 59 pp., illus.)

18,949—MIXING PLANTS—Neuere Mischeranlagen. (Oest. Zeit. f. B. u. H., Apr. 20, 1912; 4½ pp., illus.) 40c.

18,950—MOLDING MACHINES—Neuerungen an Bonvillainschen Formmaschinen. U. Lohse. (Stahl u. Eisen, Apr. 25, 1912; 6 pp., illus.) 40c.

18,951—POURING LADLES—Ueber Rissbildungen an Gehängehaken von Stahlgiesspfannen. C. Canaris. (Stahl u. Eisen, Apr. 11, 1912; 3 pp. illus.) 40c.

18,952—ROLLING—Ueber interessante Erscheinungen im Stahlblöcken während des Auswalzens. Karl Neu. (Stahl u. Eisen, Mar. 7, 1912; 2 pp., illus.) Interesting phenomena in steel ingots during rolling. 40c.

18,953—ROLLING MILL—Operation of a Large Electrically Driven Reversing Rolling Mill. Wilfred Sykes. (Proc. A. I. E. E., May, 1912; 26 pp., illus.)

18,954—ROLLING MILLS—Steam-Engines for Driving Reversing Rolling Mills. John W. Hall. (Iron and Steel Inst., May, 1912; advance sheets; 15½ pp., illus.)

18,955—SHERARDIZING PROCESS. Oliver W. Storey. (Wisconsin Engr., Apr., 1912; 7¼ pp.)

18,956—SILICON—Ueber den Einfluss des Siliciums auf die Eigenschaften des Flusseisens. Paglianti. (Metallurgie, Apr. 8, 1912; 12¾ pp., illus.)

18,957—SLAG—Eine neuere Brechanlage für Hochofenschlacke. C. Abels. (Stahl u. Eisen, Apr. 11, 1912; 3 pp., illus.) 40c.

LEAD AND ZINC

18,964—BLAST ROASTING—The Important Factors in Blast-Roasting. H. B. Pulsifer. (Met. and Chem. Eng., Apr., 1912; 5¼ pp., illus.) Conclusion of article previously indexed. 40c.

18,965—JOPLIN MINES—Methods Employed in Following the Ore in the Sheet Ground, the Disseminated Ore, and the Soft Ground. L. L. Wittich. (Mines and Minerals, Apr., 1912; 3 pp., illus.) 20c.

18,966—MAGNETIC SEPARATION of Zinc-Iron Ores as Found in Southwestern Wisconsin. Otto E. Ruhoff. (Met. and Chem. Eng., May, 1912; 2¼ pp., illus.) 40c.

18,967—OKLAHOMA—The Miami, Okla., Mining Camp. C. H. Plumb. (Mines and Minerals, May, 1912; 1½ pp., illus.) 20c.

18,968—ZINC FURNACE—Johnson Continuous Electric Zinc Furnace. (Iron Age, May 2, 1912; 1½ pp., illus.) 20c.

18,969—ZINC SMELTING in Kansas and Oklahoma. (Eng. and Min. Journ., Apr. 27, 1912; 2¼ pp.) 20c.

18,970—ZINC SMELTING—The Electric Zinc Smelting Furnace. Charles F. Johnson. (Met. and Chem. Eng., May, 1912; 2 pp., illus.) 40c.

18,971—ZINC SMELTING—The Reduction of Blue Powder in Zinc Smelting. W. F. Bleecker. (Min. and Eng. Wld., May 4, 1912; 1½ pp.) Abstract of paper before Am. Electrochem. Society. 20c

OTHER METALS

18,972 — ALUMINUM — La Fabrication de l' Aluminium en Feuilles. (Metaux et Alliages, Apr., 1912; 3¼ pp., illus.)

18,973—ALUMINUM—The Production of Bauxite and Aluminum in 1911. W. C. Phalen. (Advance chapter from Mineral Resources of the U. S., 1911; 19 pp.)

18,974—ALUMINUM—Zur Geschichte der Französischen Aluminiumindustrie. H. Grossmann. (Zeit. f. Elektrochem., Mar. 1, 1912; 1½ pp.) 40c.

18,975—MONAZITE AND ZIRCON, The Production of in 1911. D. B. Sterrett. (Advance chapter from Mineral Resources of the U. S., 1911; 6 pp.)

18,976—NICKEL—Monel Metal, Its Manufacture, Properties, Uses, Etc. R. H. Gaines. (Journ. Ind. and Eng. Chem., May, 1912; 4 pp.) 60c.

18,977—PLATINUM—Gold and Platinum Alluvial Deposits in Russia. Leon Perret. (I. M. M., Bull. 92, 1912; 34 pp., illus.)

18,979—TIN—Equipment at Pushing Bharu Tin Mines, Malay Peninsula. (Min. Mag., Apr., 1912; 1½ pp., illus.) 40c.

18,980—TIN—Latest Developments in the Tin Industry. (So. African Min. Journ., Mar. 30, 1912; 1½ pp.) 40c.

18,981—TIN—Some Genetic Relations of Tin Deposits. Joseph T. Singewald, Jr. (Econ. Geol., Apr.-May, 15½ pp.) 60c.

18,982—TIN—The Electrolytic Recovery of Tin from Tin Sheet Scraps in Italy. (Met. and Chem. Eng., Apr., 1912; 1 p.) 40c.

18,983—TIN—The X River Tin Field, Tasmania. L. Keith Ward. (Geol. Survey of Tasmania, Bull. 12, 1911; 29 pp., illus.)

18,984—TIN AND WOLFRAM in Spain and Portugal. (Min. Journ., May 11, 1912; 1¼ pp.) 40c.

18,985—TIN DREDGING in the Seward Peninsula, Alaska. W. W. Johnson. (Mex. Min. Journ., May, 1912; ¾ p.) 20c.

18,986—VANADIUM as a Staple Colorado Product. P. H. Carl. (Min. Sci., May 9, 1912; 2 pp.) 20c.

NONMETALLIC MINERALS

18,988—DIAMONDS—New Diamond Field Near Bloemhof, Transvaal. (Min. and Eng. Wld., Apr. 6, 1912; 1⅓ pp.) 20c.

18,989—FELDSPAR—The Extraction of Potash and Alumina from Feldspar. H. W. Foote and S. R. Scholes. (Journ. Ind. and Eng. Chem., May, 1912; 1½ pp.) 60c.

18,990—GRAPHITE—The Production of Graphite in 1911. E. S. Bastin. (Advance chapter from Mineral Resources of the U. S.; 38 pp.)

18,991—MICA—The Production of Mica in 1911. Douglas B. Sterrett. (Advance chapter from Mineral Resources of the U. S., 7 pp.)

18,992—NITRATE OF SODA—El orijen del Salitre en Chile. Lorenzo Sundt. (Bol. Soc. Nac. de Mineria, Feb., 1912; 3 pp.)

18,993—POTASH SOLUTIONS in the Searles Lake Region. W. D. Hamman. (Min. Sci., Apr. 25 and May 2, 1912; 4 pp.) 40c.

18,994—SULPHUR—La Industria del Azufre en Sicilia. Juan Blanquier. (Bol. Soc. Nac. de Mineria, Feb., 1912; 34 pp., illus.)

18,995—TALC AND SOAPSTONE, Production of in 1911. J. S. Diller. (Advance chapter from Mineral Resources of the U. S.; 8 pp.)

PETROLEUM AND NATURAL GAS

18,996—ALABAMA—The Fayette Gas Field, Alabama. M. J. Munn. (U. S. Geol. Surv. Bull. 471-A-2, 1910; 51 pp., illus.)

18,997—NATURAL GAS—Problems in Natural Gas Engineering. Thos. R. Weymouth. (Journ. Am. Soc. Mech. Engrs., May, 1912; 43 pp., illus.)

18,998—OIL SUPPLIES Available for Power Purposes. (Min. Journ., May 11, 1912; ¾ p.) 40c.

18,999—TEXAS—Oil and Gas Fields of Wichita and Clay Counties, Texas. J. A. Udden. (Min. and Eng. Wld., Apr. 6, 1912; ⅗ p.) 20c.

19,000—URAL CASPIAN OIL FIELDS. E. De Hautpick. (Min. Journ., Apr. 20, 1912; ¾ p.) 40c.

19,001—UTAH—Geology of the San Juan Oil Field, Utah. E. G. Woodruff. U. S. Geol. Surv. Bull. 471-A-4, 1912; 31 pp., illus.)

19,002—WEST AFRICA—Prospecting for Petroleum in West Africa. (Petrol. Rev., May 4, 1912; 1 p., illus.) 40c.

19,003—WYOMING—The Powder River Oil Field, Wyoming. Carroll H. Wegemann. (U. S. Geol. Surv. Bull. 471-A-3, 1912; 20 pp., illus.)

ECONOMIC GEOLOGY—GENERAL

19,004—ARIZONA—The Geology and Ore Deposits of the Silverbell Mining District, Arizona. C. A. Stewart. (Bull. A. I. M. E., May, 1912; 51 pp., illus.)

19,005—COLORADO—Leadville, Colo., Fissure Veins. Oliver C. Ralston. (Mines and Minerals, Apr., 1912; ¾ p.) 20c.

19,006—CRYSTALLINE ROCK—The Value of Certain Criteria for the Determination of the Origin of Foliated Crystalline Rocks.—I. J. D. Trueman. (Journ. Geol., Apr.-May, 1912; 30 pp., illus.) 60c.

19,007— GROUND WATER — Grundwasserstudien. Keilhack. (Zeit. f. prakt. Geol., Mar., 1912; 5¾ pp., illus.)

19,008—MARYLAND—Geologic Folio of the United States, Choptank Folio. B. L. Miller. (U. S. Geol. Survey, 1912; 8 pp., illus.)

19,009—ORE DEPOSITION—Gels in Relation to Ore Deposition. E. Hatschek and A. L. Simon. (I. M. M., Bull. 92, May 9, 1912; 17 pp.) Discussion on paper previously indexed.

19,010—PHILIPPINES—Additional Notes on the Economic Geology of the Baguio Mineral District. Warren D. Smith and Frank T. Eddingfield. (Philippine Journ. Sci., Dec., 1911; 17 pp.)

19,011—PROSPECTS—Geology in the Examination of Prospects. C. A. Stewart. (Min. and Sci. Press, May 4, 1912; 1¾ pp.) 20c.

19,012—SONORA—Notes on the Geology of the Mina Mexico Vein. Dibrell P. Hynes. (Econ. Geol., Apr.- May, 1912; 7 pp., illus.) 60c.

MINING—GENERAL

19,014—ACCIDENTS in Transvaal Mines, with Special Reference to Falls of Ground. James Chilton. (Journ. Chem., Met. and Min. Soc. of South Africa, Mar., 1912; 1½ pp.) Discussion on paper previously indexed. 60c.

19,015—BLAST—Big Blast at Steins, N. M., Whereby 237,000 Yards of Material Was Moved by the Explosion of 77,600 Pounds of Explosive. (Mines and Minerals, Apr., 1912; 1½ pp., illus.) 20c.

19,016—BLASTING—Where Should the Primer Go? Discussion by Joseph Hocking, P. E. Barbour and C. B. Hanson. (Eng. and Min. Journ., Apr. 27 and May 4, 1912; 1½ pp.) 20c.

19,017—BRITISH COLUMBIA—Preliminary Review and Estimate of Mineral Production for Year 1911. Wm. Fleet Robertson. (Bureau of Mines, Victoria, B. C., 1912; 8¼ pp.)

19,018—COSTS—Mining Cost Chart. Carson W. Smith. (Mines and Minerals, Apr., 1912; 1½ pp., illus.) 40c.

19,019—DIAMOND DRILLING—Recent Practice in Diamond Drilling and Bore-Hole Surveying. John I. Hoffmann. (I. M. M. Bull. 92, May 9, 1912; 10¾ pp.) Discussion on paper previously indexed.

19,020—DUST—The Prevention of Dust in the Development Drives of Mines During Drilling Operations. C. J. N. Jourdan. (Journ. South African Inst. of Eng., Apr., 1912; 4½ pp., illus.) Author's reply to discussion. 60c.

19,021—EARTH PRESSURES—Notes and Experiments on Earth Pressures. James C. Meem. (Proc. Engrs.' Club of Phila., Apr., 1912; 17 pp.) 40c.

19,022—EMPLOYEES AID FUND of Homestake Mining Co. Jesse Simmons. (Mines and Minerals, Apr., 1912; 1 p.) 20c.

19,023—ENGLISH LAW—Das neue englische Grubengesetz. Walter. (Bergbau, Apr. 4, 1912; 3½ pp.)

19,024—EXCAVATION—The Cost of Rock Excavation in Open Cutting. (Engineer, Apr. 26 and May 3, 1912; 2 pp.) 80c.

19,025—EXPLOSIVES—The Use of Permissible Explosives. J. J. Rutledge and Clarence Hall. (Bureau of Mines, Bull. 10; 33 pp., illus.)

19,026—FINANCE OF A MINE, The. H. S. Denny. (Min. Mag., Apr., 1912; 3½ pp.) Discussion on a series of articles previously indexed. 40c.

19,027—FLOW OF WATER—The Directograph Pitometer for Measuring and Recording Flow of Liquids in Pipes (Eng. News, Apr. 25, 1912; 1⅓ pp., illus.) 20c.

19,028—GERMANY—Die Wasserwirtschaft von St. Andreasberg im Harz. Weroer. (Preuss. Zeit. f. B., H u. Salinenwesen, 1912, part 1; 18 p., illus.)

19,029—HAULAGE—Notes on the Margin of Safety Required by Government for Man Haulage at Great Depths. R. B. Greer. (Journ. South African Inst. of Eng., Apr., 1912; 1 p.)

19,030—HOIST CABLE BREAKAGE—Breaking of the Gold Cliff Hoist Cable. Lewis H. Eddy. (Eng. and Min. Journ., May 11, 1912; ⅔ p., illus.) 20c.

19,031—HOISTING—Mine Hoisting Systems Compared—I. Bruoo V. Nordberg. (Eng. and Min. Journ., May 18, 1912; 3⅛ pp.) 20c.

19,032—HOISTING—Ueber Schachtförderung aus grosser Teufe beim Steinkohlenbergbau im Oberbergamtsberzirk Dortmund. Schulze Höing. (Preuss. Zeit. f. B., H. u. Salinenwesen, 1912, part 1; 28 pp., illus.)

19,033—MANAGEMENT—The Science of Management in Practice—IV and V. Frederic A. Parkhurst. (Indus. Eng., Apr. and May, 1912; 19 pp., illus.) 80c.

19,034—MEXICAN LAW—The Conveyance of Mining Property in Mexico. D. A. Richardson. (Min. and Eng. Wld., May 4, 1912; 1⅓ pp.) 20c.

19,035—MINE REPORTS—Illogical Precision in Mine Reports. F. Percy Rolfe. (I. M. M., Bull. 92, May 9, 1912; 6 pp.)

19,036—MINING LAW—Birth of the American Mining Act—II and III. H. W. MacFarren. (Min. and Sci. Press, Apr. 20 and 27, 1912; 7¾ pp.) Conclusion of article previously indexed. 40c.

19,037—ORE TRANSPORTATION—All-Water Transport of German Iron Ore. Stuart Rice. (Min. and Eng. Wld., May 11, 1912; 1⅔ pp., illus.) 20c.

19,038—ORE WHARF in Chile. Alfred Gradenwitz. (Eng. and Min. Journ., May 18, 1912; ⅔ p., illus.) 20c.

19,039—PIPE—Wooden-Stave Water Pipe. Frank C. Perkins. (Mines and Minerals, May, 1912; 1 p., illus.) 20c.

19,040—PRUSSIA—Versuche und Verbesserungen beim Bergwerksbetriebe in Preussen während des Jahres 1911. (Preuss. Zeit. f. B., H. u. Salinenwesen, 1912, pt. 1; 66 pp., illus.)

19,041—PUMPING—Compressed Air Pumping Systems. Frank Richards. (Power, May 21, 1912; 2 pp., illus.) 20c.

19,042 — PUMPING — Raising Water by Compressed Air. Frank Richards. (Power, May 14; 1912; 1½ pp.) 20c.

19,043—PUMPING—The V-Notch Weir. E. H. Webster (Eng. and Min. Journ., Apr. 27, 1912, 1½ pp., illus.) 20c.

19,044—SHAFT SINKING—Das Schachtabbohrverfahren von Stockfisch und seine Anwendung auf Schacht II der Gewerkschaft Diergardt. Krecke. (Glückauf, Apr. 6, 1912; 7¼ pp., illus.)

19,045—SHAFT SINKING—Schwierigkeiten beim Schachtabteufen. Diancourt. (Bergbau, Apr. 25, 1912; 3 pp.) 20c.

ORE DRESSING—GENERAL

19,053—BLENDE-BARITE SEPARATION—Process for Separating Blende and Barite. F. C. Bryant. (Eng. and Min. Journ., May 11, 1912; 1 p., illus.)

19,054—CRUSHING—A Grizzly Crusher Feeder. S. A. Worcester. (Eng. and Min. Journ., May 4, 1912; 1 p., illus.) 20c.

19,055—EXPERIMENTAL ORE DRESSING AND METALLURGICAL PLANT of the Colorado School of Mines. Victor C. Alderson. (Met. and Chem. Eng., May, 1912; 3 pp., illus.) 40c.

19,056—FLOTATION of Minerals. Part II. Kenneth A. Mickle. (Proc. Royal Soc. of Victoria, Vol. XXIV, Part 2, Mar., 1912; 29 pp., illus.)

19,057—JIGGING—Joplin Jigging Practice. Claude T. Rice. (Eng. and Min. Journ., May 18, 1912; 1½ pp.) 20c.

19,058—SLIME CONCENTRATION—Concentration of Ore Slime by Centrifugal Separation. (Met. and Chem. Eng., Apr., 1912; 2½ pp., illus.) Describes apparatus patented by P. F. Peck. 40c.

METALLURGY—GENERAL

19,059—ALLOYS—Die Erhöhung der chemischen Widerstandsfähigkeit mechanisch noch gut bearbeitbarer, für Konstruktionszwecke Verwendbarer Legierungen. Otto Barth. (Metallurgie, Apr. 22, 1912; 15 pp., illus.) 40c.

19,060—BRONZES—Les Bronzes magnetiques. E. Masseloo. (Metaux et Alliages, Feb., 1912; 1 p.)

19,061—CARBON—Das Schmelzen von Kohlenstoff. Borchers. (Metallurgie, Apr. 8, 1912; 1¼ pp., illus.)

19,062—CHIMNEY—The Design of a Brick Chimney. J. Norman Jensen. (Eng. News, May 9, 1912; 3½ pp., illus.) Gives general principles to be applied in the design of an ordinary brick chimney and presents in detail the computations necessary for the design of a typical 125-ft. chimney.

19,063—FURNACE CHARGES—Calculation of Furnace Charges—IV. Regis Chauvenet. (Met. and Chem. Eng., Apr., 1912; 3½ pp.) 40c.

19,064—MONEL METAL. Richard H. Gaines. (Journ. Ind. and Eng. Chem., May, 1912; 4 pp.) Manufacture, composition, properties, uses, etc. 60c.

19,065—PYROMETRY—Radiation Pyrometry. G. A Shook. (Met. and Chem. Eng., Apr., 1912; 3 pp., illus.) 40c.

19,066—SMELTER BUILDING in Chile. Frank Langford. (Min. and Sci. Press, Apr. 27, 1912; ¾ p., illus.) 20c.

19,067—SMELTER FUMES—Thiogen Process Demonstration at the Penn Smeltery, Campo Seco, Calif. L. H. Eddy. (Eng. and Min. Journ., May 4, 1912; 1⅔ pp., illus.) 20c.

19,068—SMELTERY—The Pioneer Smeltery, Arizona. A. L. Waters. (Eng. and Min. Journ., May 4, 1912; 1 p., illus.) 20c.

MINING AND METALLURGICAL MACHINERY

19,069—AERIAL TRAMWAY—The Tesorero Mine Aerial Tramway, Spain. Frank C. Perkins. (Mines and Minerals, Apr., 1912; 1¼ pp., illus.) 20c.

19,070—AIR COMPRESSOR—Abnahmeversuche an einem elektrisch angetriebenen Kolbenkompressor. (Glückauf, Apr. 20, 1912; 5½ pp., illus.) 40c.

19,071—AIR COMPRESSORS—Increasing the Efficiency of Air Compressors. S. R. Stone. (Min. and Eng. Wld., May 18, 1912; 3¼ pp., illus.) 20c.

19,072—COMPRESSED AIR—Electric Heater for Air-Line Drains Used in Cobalt District. G. C. Bateman. (Eng. and Min. Journ., Apr. 27, 1912; ¾ p., illus.) 20c.

19,073—CRANES—Neuere Gieszbettkrane. F. Heym. (Stahl u. Eisen, May 2, 1912; 6½ pp., illus.) 40c.

19,074—DRILL BITS—Notes on the Design of Drill Bits. Ward Blackburn. (Eng. and Min. Journ., May 11, 1912; 1⅔ pp., illus.) 20c.

19,075—DRILL STEEL—Tempering Drill Steel. Clarence C. Semple. (Eng. and Min. Journ., May 11 and 18, 1912: 1⅓ pp.) 20c.

19,076—DRYING FURNACES — Mechanical Drying Furnaces. John S. Nicholl. (Mines and Minerals, Apr., 1912; 1¾ pp., illus.) 20c.

19,077—ELECTRIC MOTOR—A New Type of Induction Motor. (The "Cascade" Single and Multi-speed Motor.) M. I Williams-Ellis. (Journ. South African Inst. of Eng., Apr., 1912; 14 pp., illus.) 60c.

19,078—GAS-ENGINE POWER at French Mines and Smelters. Stuart Rice. (Min. and Eng. Wld., May 4, 1912; 2¼ pp., illus.)

19,079—GAS ENGINES for Collieries. E. L. Chorltnn. (Coal Age, May 4, 1912; 2¼ pp., illus.) 20c.

19,080—GAS PRODUCER—The Peat Producer Gas Power Plant at the Government Fuel Testing Station, Ottawa, Ont. B. F. Haanel. (Journ. Can. Peat Soc., Nov., 1911; 6 pp., illus.) 40c.

19,081—HOISTING—An Interesting Overwind Preventer. (Coal Age, May 18, 1912; 1¾ p., illus.) 20c.

19,082—HOISTS—Electrical Mine Hoists and Their Control—II. C. A. Tupper. (Min. and Eng. Wld., Apr. 6, 1912; 5½ pp., illus.) 20c.

19,083—HOISTS—The Control of Electric Mine Hoists. S. Haar (Gen. Elec. Rev., May, 1912; 7 pp., illus.) 40c

19,084—HYDROELECTRIC PLANT — Santa Rita Pressure Box. R. D. O. Jnhnson. (Eng. and Min. Journ., May 4, 1912; ⅔ p., illus.) 20c.

19,085—LOCOMOTIVES—Vergleichende Untersuchungen an Grubenlokomotiven. Bütow and Dobbelstein. (Glückauf, Apr. 27, 1912; 5½ p.) Continuation of article previously indexed. 40c.

19,086—MINE CARS AND SKIPS—Die Eichung der Fördergefässe im Bergwerksbetriebe. Kobrich. (Glückauf, Apr. 27, 1912; 10 pp.) 40c.

19,087—POWER PLANT for Upper Michigan Mines. (Iron Age, May 2, 1912; 3¼ pp., illus.) Describes high-head hydroelectric development on the Marquette Range for the Cleveland-Cliffs Iron Co. 20c.

19,088—SAFETY CONSIDERATIONS in Industrial Engineering. David S. Beyer. (Proc. Engrs. Soc. of W. Penn., Apr., 1912; 88½ pp. illus.) 60c.

SAMPLING AND ASSAYING

19,089—ALUMINUM AND IRON—Some Methods of Separating Aluminum from Iron. Gordon Surr. (Min. and Eng. Wld., Apr. 27, 1912; 1½ pp.) 20c.

19,090—ASSAY RESULTS—Presenting Assay Results by Graphic Methods. J. B. Stewart. (Min. and Sci. Press, May 11, 1912; 3½ pp.) 20c.

19,091—BITUMINOUS MATERIALS—An Examination of Some Bituminous Minerals. F. C. Garrett. (Journ. Soc. Chem. Ind., Apr. 15, 1912; 3 pp.)

19,092—CEMENT ANALYSIS—Ueber die Trennung des Calciums vom Magnesium. Kallauner und Preller. (Chem. Ztg., Apr. 23 and 25, 1912; 4½ pp.)

19,093—EVAPORATION—Ueber das Kaysersche Verdampfverfahren. Kayser. (Chem. Ztg., May 2, 1912; 1¾ pp.)

19,094—GAS ANALYSIS—New Forms of Apparatus for Gas Analysis. F. M. Williams. (Journ. Ind. and Eng. Chem., May, 1912; 1¾ pp., illus.) 60c.

19,095—QUALITATIVE ANALYSIS—A System of Qualitative Analysis for the Common Elements—Part V. Detection of the Acidic Constituents. Arthur A. Noyes. (Journ. Am. Chem. Soc., May, 1912; 32½ pp.) 60c.

INDUSTRIAL CHEMISTRY

19,096—ALUMINUM SULPHATE—L'etat actuel de l'Industrie des Aluns et du Sulfate d'Alumine. E. Cazes. (Journal du Four Electrique, Feb. 1, 1912; 2½ pp.)

19,097—SULPHURIC ACID—The Theory of Sulphuric Acid Manufacture. W. C. Reynolds and W. H. Taylor. (Journ. Soc. of Chem. Ind., Apr. 30, 1912; 2 pp.)

19,098—WATER PURIFICATION—Beiträge zur Frage der Wasserreinigung. Schwarzer. (Chem. Zeit., Mar. 26, 1912; ½ p.) Contributions to the problem of water purification. 40c.

MATERIALS OF CONSTRUCTION

19,099—CEMENT AND CONCRETE—A Study of Sand for Use in Cement Mortar and Concrete. E. S. Larned. (Journ. Assn. Eng. Soc., Apr., 1912; 18½ pp., illus.) 40c.

19,100—CEMENT PLANT—Electric Driving in a Cement Factory. (AEG Journ., Jan., 1912; 5 pp., illus.) 20c.

19,101—CEMENT PLANT—Universal Portland Cement Company. Plant No. 6. (Cement Age, Dec., 1911; 3 pp., illus.) 20c.

19,102—CEMENT PLANTS—Dust in Portland Cement Plants. Otto Schott. (Eng. News, Jan. 13, 1912; 1 pp.) Paper before Am. Soc. of Mechan. Engrs., Dec., 1911. 20c.

19,103—CEMENT WORKS—Economic Construction of Storage Bins and Trestles at Cement Plants. W. S. Marston. (Journ. Western Soc. of Engrs., Oct., 1911; 15 pp., illus.) 40c.

19,104—DINA BRICKS—Ueber die Konstitution der Dinassteine. K. Endell. (Stahl u. Eisen, Mar. 7, 1912; 5 pp., illus.) On the constitution of dina bricks. 40c.

19,105—FIREBRICKS—Feuerfeste Kunststeine für Heizungen. (Bergbau, Jan. 18, 1912; 1 p.) Fire bricks for various purposes. 20c.

19,106—FIRECLAY INDUSTRY—Notes on the History and Development of the Fireclay and Refractories Industry. Francis T Havard. (Wisconsin Engr., Jan., 1912; 8 pp., illus.)

19,107—PORTLAND CEMENT—The Adulteration of Portland Cement. R. C Carpenter. (Eng. News, Jan. 18, 1912; 1¼ pp.) 20c.

19,108—PORTLAND CEMENT and Cement Resources of the Southern States. T. Poole Maynard. (Proc. Am. Min. Congress, Oct. 24-28, 1911; 6 pp.)

19,109—PORTLAND CEMENT—Problems involved in the Selection of Machinery for the Manufacture of Portland Cement. Paul C. Van Zandt. (Eng. News, Dec 14, 1911; 4¼ pp., illus.) 20c.

19,110—PORTLAND CEMENT MORTAR—Some of the Properties of Oil-Mixed Portland Cement Mortar and Concrete. (Proc. A. S. C. E., Nov., 1911; 11 pp., illus.)

19,111—REFRACTORIES. Francis A. J. Fitzgerald. (Met. and Chem. Eng., Mar., 1912; 3¾ pp.) Results of research work on the manufacture and uses of alundum, crystolon, electrically calcined magnesia and fused lime. 40c.

19,113—TIMBER PRESERVATION—The Antiseptic Effect of Creosote Oil and Other Oils Used for Preserving Timber. Joho Morris Weiss. (Journ. Soc. Chem. Ind., Dec. 15, 1911; 5 pp.)

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Charles A. Chase has removed his office at Denver, Colo., to No. 734 First National Bank Building.

H. O. Swoboda, consulting mechanical and electrical engineer, has opened an office at Pittsburgh.

George W. Bissett, of Sudbury, Ont., has been visiting Tonopah, Goldfield and adjacent camps in Nevada.

A. S. Ross, manager of the Pittsburgh-Idaho Mining Co., at Gilmore, Idaho, has been in Pittsburgh, Penn., on business.

Calvin Haines, recently of Colorado, has been appointed manager of the Blue Mountain mines, near Sumpter, Oregon.

J. F. Musselman, of Los Angeles, Calif., is at Las Vegas, Nev., making some mine examinations in that district.

C. Stanley Martin, an English steel expert, has been appointed superintendent of the Dominion Steel Co. in place of C. H. McMillan, resigned.

George T. Robinson, superintendent of mines for the Cambria Steel Co., Johnstown, Penn., has resigned. He has been with the company 21 years.

The firm of Worthington & Pickard having been dissolved, Byron O. Pickard has established an office as consulting mining engineer, at Phœnix, Arizona.

J. H. Plummer, president of the Dominion Steel Corporation, has returned from an extended visit to England in connection with the finances of the company.

J. P. Tyrrell, Confederation Life Building, Toronto, Ont., has arranged with S. N. Graham to attend to his professional business during his absence this summer.

Guy J. Stock, Darlington, England, inventor of the Stock steel converter, is in this country, and is visiting a number of steel casting plants in the United States and Canada.

Prof. S. C. Ells, of Ottawa, will be employed by the Temiskaming & Northern Ontario Railway Commission to make a report on the harbor facilities of the mouth of the Moose River, on James Bay.

Simon Itura Patina, of Oruro, Bolivia, is visiting New York and intends to spend some time in the United States before extending his trip to Europe. He is the largest individual owner of tin-mining properties in Bolivia.

J. G. Kirchen, general manager of the Tonopah Extension Mining Co., was rescued from drowning in Martin's Creek, near Bethlehem, Penn., May 23, by Charles M Schwab. They were on a fishing expedition together.

John Fritz, who is ill at his home in South Bethlehem, Penn., was remembered feelingly at the annual banquet of the American Iron & Steel Institute in New York, May 17. At Judge Gary's invitation the guests drank to Mr. Fritz's continued health and happiness, and a telegram was sent to him bearing good wishes and hopes for his recovery.

Arthur Cooper has been chosen president of the British Iron & Steel Association for the ensuing year. He is general manager of the Northeastern Steel Co. at Sheffield and is widely known in the steel trade. He has been a member of the association since 1874, and was awarded the Bessemer medal for his work in the development of the basic openhearth process.

OBITUARY

Henry W. Hoyt, recently of New York, but formerly of Baltimore, was drowned in the Orinoco River, in Venezuela, May 24, according to a despatch received from La Guayra. He was a graduate of Harvard University, 1897, a mining engineer, and had spent much time in South America. He went to Venezuela from New York recently, to examine some iron-ore properties on the Orinoco, in connection with John S. Williamson, of London.

Harry M. Hirst died at Tooele, Utah, May 16, aged 24 years. Born at Folcroft, Penn., Sept. 29, 1887, he was a graduate of Lafayette College, Easton, in 1908, and for the last 3½ years has been engineer for the Utah Metal Mining Co.; previous to that he put in some time in the coal mines near Pottsville. He died as a result of a cave in the tunnel of the Utah Company. His body was brought to his home and he was buried in Woodland Cemetry, Philadelphia. He was exceptionally fitted for his work as a mining engineer. and promise of a bright future was assured. Through his death the mining profession has lost one of its able young men.

Societies and Technical Schools

Massachusetts Institute of Technology—The Committee on Graduate Scholarships has recommended scholarships for R. D. Huxley, A. L. Matte, L. C. Tomlinson, E. L. Bray and H. E. Dexter, who are candidates for advanced degrees in electrical engineering, at the Massachusetts Institute of Technology. The popularity of the post-graduate study of electrical engineering at the institute continues to increase.

American Institute of Mining Engineers—The Spokane section held its quarterly meeting at Wallace, Ida., May 11. Papers were read by O. B. Hofstrand, of the Federal Mining & Smelting Co., on "The Macquisten Process of Ore Separation"; R. S. Handy, mill superintendent for the Bunker Hill & Sullivan Mining & Concentrating Co., on "The New Bunker Hill Mill." Visits were made to various mines and mills in and about Wallace.

Southeastern Missouri Lead Managers—Tuesday evening, May 22, Messrs. H. A. Buehler, state geologist of Missouri, E. S. Gatch, manager of the Granby company, S. B. Kirby, P. N. Moore, A. Thacher and H. A. Wheeler, gave a dinner at the St. Louis Club to the engineers of the Southeastern Missouri lead district. This, it is understood, is to be the first of a series of dinners, the purpose of which is to promote closer friendship and foster greater discussion of the problems of the district than has been characteristic of this important district in the past. The dinner was well attended. From the Federal Co. came H. A. Guess, the general manager, L. Johnson, the mine superintendent and Mr. Ring, the head engineer; from the Doe Run Co. O. N. Bilharz, the manager and Mr. Adami, the mine superintendent; from the St. Joseph Co., Roscoe Parsons, the manager, and Mr. Monio, the mine manager; and from the Desloge Consolidated, Furman Desloge, the manager; while owing to the detention of Mr. Comins, the manager, Mr. Carpenter, of the National Lead Co., represented its subsidiary, the St. Louis Smelting & Refining Co. The only smelterman at the first dinner was Mr. Porter, manager of the Alton works of the A. S. & R. Co. Prof. Overstrom, who has been installing his system of classification at the mill of the St. Louis Smelting & Refining Co., outlined the points in his system and made some remarks on the milling of these lead ores. He was followed by Mr. Guess, who gave a short description of the Federal plant, and then Mr. Bilharz outlined the history of milling in the district. Mr. Parsons reviewed the early history of the district from the beginning of the present period of mining activity, and the subject of the evening was changed to a more individual one when Mr. Gatch asked Mr. Moore, the new director of the Doe Run Co., and an old St. Louis resident, why, after Mr. Gatch had for years been heralding to St. Louis in particular the greatness of the neighboring lead district and the wonderful opportunity that there was there, he had waited until this year before he began to notice the district and began to acquire some portion in it. This Mr. Moore retorted to by inquiring what the astute manager of the Granby Co., with its thousands of surplus, had been doing that he, knowing the district so well, had not gobbled some of it long ago for his own company. After this pleasantry, the dinner ended in general conversation and discussion, with all feeling glad that the step toward bringing the engineers of the district together had been taken.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

May 22—The installation of auto trucks at the Bunker Hill mine in Amador County and by the National Borax Co., will be watched by mining operators in California. The Bunker Hill has initiated the system in Amador County in the employment of one truck for the transportation of concentrates to the railroad at Martell, and the hauling of timbers and supplies to the mine. The distance is six miles, the road is a good wagon road and the grade is irregular but not difficult. When the road is dry there will be no difficulty, and it is possible that even in wet weather the road may not be too heavy for the motor. Should this undertaking prove economical there is a probability that other mines in Amador and adjoining counties in the Mother Lode region will adopt this method of transportation. The National Borax Co. has ordered five Saurer trucks for the transportation of borax across the desert to Bakersfield, from which point the product is shipped by rail to Galveston, thence by ocean vessels to Germany. The haul from the borax mines to Bakersfield is 40 miles over a desert road. It is planned to operate these trucks in 24-hr. shifts, and thus make practical demonstration of the ability of gasoline motors to stand this character of hauling. In many mining districts the crude oil used for fuel at the mines is hauled exclusively by motors, and in the oil districts much of the crude oil and most of the supplies are moved by this method. The employment of automobiles in passenger traffic is quite common in the mining districts, and there appears no good reason why the auto truck should not come into general use in most of the mining camps of the state.

The Palmer Union Oil Co. has completed its amalgamation with a newly incorporated British concern, the Palmer Union Oil Co. Ltd., and has secured $1,500,000 new capital with which to carry out development and improvement. New wells will be drilled and transportation facilities increased. The properties now operating are chiefly in Santa Maria and Ventura Counties, connected by the Associated pipelines and by rail with Port Harford. For the present these methods of transportation will be employed, as it is considered better economy to apply the funds to development of the oil measures than to the building of a pipeline, although there would be a saving of about 3c. per barrel.

Butte

May 22—The electrifying of the Butte, Anaconda & Pacific R.R., between Butte and Anaconda, has been under way for about a month. The first section to be electrified is the 3-mile branch from East Anaconda to the orebins at the Washoe smeltery. The main line, 26 miles long, between Butte and Anaconda, will be the next to be electrified, after which the lines to the various mines in Butte will receive attention, and finally the new branch from Anaconda to the Georgetown district, now under construction. The trolley system will be used, as the third-rail system would be dangerous, owing to the large amount of surface traffic over the line, which it is impossible to prevent. The electric motors will be similar to but more modern than those of the New York Central Lines. General Manager Harry Gallwey states that the company expects to have the entire system, including both freight and passenger service, in operation under electric power within a year.

Work on the construction of the branch of the Chicago, Milwaukee & Puget Sound R.R., from Three Forks into the Radersburg mining district, is well under way, and it is predicted that the mines will be shipping ore over the branch by Sept. 1. Track-laying will be commenced in about a week, three construction camps are established and five miles of grading have been done. The mining companies will effect a saving of $2 per ton by the new line, the amount now required to ship by wagon to the Northern Pacific R.R., at Toston; as a result, a number of properties are preparing to open, which have been closed for years.

Denver

May 23—The main orebody of the Vindicator mine has been opened at the 1500 level and the ore is said to be better than in the level above, which is further evidence of the permanence of good ore with depth in the deepest mines in the Cripple Creek district. Sublessees on the Hill City mine of the same estate are also producing high-grade ore. There are four other veins to be opened on the 1500 level, and it is asserted that the Vindicator will be a steady dividend payer for the next two years, even if no other oreshoot is opened. The Hill City shaft and workings are under lease to John Sharpe, of Cripple Creek, and there are 15 sets of sublessees who are shipping ore, the bulk of which is mill grade, but some of it runs from 3 to 5 oz. gold per ton. The Vindicator pays 3% quarterly dividends on its $1,500,000 capital stock and with the July dividend of $45,000, the shareholders will have received $2,587,500 on a gross production of $11,073,441, which is 23% of the value of the output, with a good cash balance in the treasury.

The dredges are at work again in the Breckenridge placers, in Summit County, and it is predicted that the Colorado, Reliance and French Gulch companies will take out gold worth $1,000,000 this season. The production of blende and silver-lead ores in the county this year will show an increase of from 20 to 35% over last year. The leading producer of these ores is the Wellington, near Breckenridge, and the next is the Wilson mine, near Robinson, owned by the King Solomon company. The mines of Montezuma and the Snake River district will help to increase the output.

Salt Lake City

May 23—The strike situation, at the Murray plant of the American Smelting & Refining Co., appears to be clearing. Three lead furnaces are in operation and about 275 men are at work. This is somewhat less than 50% of the regular working force. The demand on the part of unskilled laborers, chiefly Greeks and Austrians, for higher wages was refused, and early in the month the works were closed down. Strikebreakers were brought in, and on May 14 the first furnace was blown in; two more have since followed. Some of the strikers are returning to work. An attempt was made to dynamite some tanks at the plant, on May 16, but since then there has been little disorder, as active measures were taken by the county authorities to prevent disturbances. Armed deputy sheriffs are constantly on the ground. During the closedown, ore consigned to the Murray smeltery has been diverted to other plants. Some of this has gone to the United States smeltery, at Midvale, while other ore has been sent to the American Smelting & Refining Co.'s plant, at Pueblo.

According to a decision by the U. S. General Land Office, what are known as the Freed Coal Land Entries are held for cancellation, an earlier decision of the local land commissioners favorable to the defendants being reversed. The case involves 4160 acres of coal land, in Huntington Cañon, Emery County, within the boundaries of the Manti national forest. The land is said to be worth about $1,000,000. Originally 26 entries were made, each on 160 acres of land, the entrymen paying the government from $10 to $20 per acre. Adjoining land has since been appraised by the government at $300 per acre. The average value of land in the neighborhood is about $100 per acre. During 1905 and 1906, some time after the entries were made, they were sold to C. M. Freed. The General Land Office holds that while there was considerable conflict in the testimony, the facts showing conspiracy were established, and that it was apparent the entrymen did not seek title for their own benefit. About a month remains in which to file protest to the Secretary of the Interior, who will make the final decision.

The remodeling of the Utah Copper Co.'s Arthur mill is nearing completion. The 10th section is in operation, and the 11th is ready. By July 1, all 13 sections are expected to be finished. When these are in operation, the capacity of the mill will have been increased from an original 3000 tons to 8000 tons or more per day. The capacity of the Magna mill was increased along the same lines from 8000 to 12,000 tons. It is expected that both plants will be operated at full capacity by July, and will handle approximately 20,000 tons.

Duluth

May 25—The Cuyuna district will have five and perhaps eight shipping mines this season. The Kennedy and Armour No. 1 and No. 2 are now shipping. The Meacham and the Thompson are about ready to ship. These are all on the north range. The Cuyuna-Mille Lacs and the Barrows, and perhaps the Adams, the latter two on the south range, probably will ship before the season closes. It is likely that the total season's shipments from the Cuyuna district may exceed 1,000,000 tons.

Calculations of total tonnage of ore of non-bessemer grade running better than 50% iron are variously placed at from 50,000,000 to 125,000,000 tons, depending on the strictness of construction of the term "developed ore," but it is certain that the district will be a large producer, perhaps as large as the Mesabi when its full extent is opened. The range practically extends for nearly 70 miles through Aitkin, Crow Wing and Morrison Counties. There are at least two distinct ranges for part of this distance and perhaps more, and each of these ranges presents several parallel but interrupted ore deposits. The ore on the south range is probably about 250 ft. below the surface and on the north range much deeper, probably averaging more than 400 ft. and in some places at least 800 ft. deep. The deposits are from 50 to 200 ft. wide.

Toronto

May 24—A gold rush has set in to the Whiskey Lake country, 40 miles north of Massey, on the Sault Ste. Marie branch of the Canadian Pacific Ry. The leading man in the movement is Jack Wilson, the discoverer of the Dome at Porcupine, and among other well known mining men who have gone are Clement Foster, A. W. ("Lucky") Scott, Benjamin Hollinger and Alexander Gillies. Wilson is said to have made the first discoveries, consisting of gold and copper, some time ago.

Cobalt

May 24—Work has been started in the old Cobalt Central mine, which is now known as the Penn-Canadian. The property has passed into the hands of a syndicate of Pennsylvania men who will develop it systematically. It has generally been believed that the mine had considerable merit but it was badly managed and finally forced to suspend operations. The old company was involved in litigation for years, but it is hoped that the property will now have a chance to demonstrate its merit.

Porcupine

May 24—At the annual meeting of the Jupiter Mining Co., held in Toronto recently, R. W. Brigstock, the consulting engineer, stated in his report that the results of development to date were satisfactory. The No. 1 series of veins has been opened on the 50-, 100- and 200-ft. levels, and at each level profitable ore has been found. The No. 2 series has been opened on the 100-, 200- and 300-ft. levels. On the 100-ft. level, 20 ft. of profitable ore was cut, but owing to the proximity of the lake, little work was done. There are indications of the extension of this orebody on the lower levels. No. 1 series indicates a width of 3 ft., assaying from $2 to $25. No. 2 series gives an average of $10 over greater widths. Over 3000 ft. of underground work have been accomplished for an expenditure of $100,000, which sum includes surface expenditures for buildings and equipment. The financial report showed cash on hand of $16,137 and liabilities of $8076. There remain in the treasury 320,529 shares of stock, which are under option at 40c. per share. This stock will be taken up as development expenses require.

The growing scarcity of timber suitable for fuel is forcing the mining companies, many of which have completely stripped their land of wood, to use coal. The McIntyre has ordered 2000 tons of coal, the first consignments of which are arriving, and several others will be obliged to do the same in order to continue operations.

Johannesburg

Apr. 22—The recommendations of the commission on miners' phthisis largely agree with those of the West Australian Government Commission on the same disease. A bill has been introduced into the South African Parliament which is causing perturbation among the mine owners and the miners whom it is designed to benefit. It provides that all persons taking up mining work must first be medically examined to ascertain their physical fitness and freedom from tuberculosis. No blasting certificate will in the future be issued without the production of such a health certificate. Compulsory examination of mine workers from time to time is provided for. The commission estimates that about 1000 cases of miners' phthisis will come up for compensation every year and the bill provides for the establishment of a fund for this purpose drawn from mine owners and men. Six pounds per month are to be contributed for every rockdriller at work; of this the mine owner contributes £4 10s. and £1 10s. will be deducted from the wages earned by the men, £3 being contributed for every other underground employee, the contribution being divided as before. The benefits in case of partial disablement will be £8 per month for one year and for total disablement £8 per month for life, but anyone accepting benefits is never to be allowed to resume underground work. Provision is also made for widows and children. It is expected that from £400,000 to £500,000 will be taken from the industry per annum if the bill becomes law. The bill in its present form has many defects and its consequences will be serious in several directions. Already the mines are quietly dismissing old employees suspected or known to be affected by the disease, and the miners now see that any such measure is an anti-white labor bill that must discourage the employment of whites underground. The bill means that 5d. per ton on present tonnage will be added to the costs, of which the mines must pay 75 per cent.

There is no doubt that men with tubeculosis should not be employed underground, as they infect a whole mine; but it is a pathological condition which may remain in the same state for a long period if the source be removed. Much is now being done to allay dust in the mines and to produce better ventilation; should the 32% of the workers who are affected be debarred from work, the conditions would be serious. No doubt the bill will be somewhat modified in its passage. Twenty-five thousand pounds has already under a former temporary measure been granted as compensation and in some cases where lump sums were awarded the miner simply spent it on holidays or dissipation and returned to work underground.

The Mining News

The Current History of Mining

Alaska

B. A. Earldey, general manager at Dolomi, has brought in lumber and other equipment for the mill to be erected there. The mill will contain 10 stamps and should be in operation soon.

Alaska-Treadwell—During April, the mills crushed 75,292 tons of ore, yielding $176,655 gross and net $69,887. Operating expenses were $79,818; construction, $26,949; development, 785 ft. The ore averaged $2.37 per ton.

Arizona

GILA COUNTY

Copper Reef—At this mine, 5 miles south of San Carlos, the erection of the new equipment is completed and the development of the mine has been resumed. The equipment consists of an Ingersoll-Rand, 5-drill compressor driven by a Stover low-grade-distillate engine and a pump for furnishing the mine and camp with water. The driving of the California tunnel, now in about 1000 ft., and the California drift, leading off from this tunnel, has been resumed, air drills being used. The tunnel is being driven to cut four veins having prominent outcrops and surface showings of copper and is expected to cut them at depths of from 1000 to 1200 feet.

Old Dominion—The concreting of the fourth section of the Kingdon shaft of the United Globe mine is progressing rapidly and will be finished in a few days, giving 710 ft. of finished concrete lining. It is believed that the remaining 300 ft. can be finished in one section.

Keely Cure—A strike of rich silver ore was reported recently from this mine, five miles north of Globe.

South Live Oak—The first hole passed through about 450 ft. of leached capping and on May 21 entered disseminated chalcocite ore at 455 ft. which became of commercial grade at 495 ft. This apparently continued to 520 ft. where the drill is said to have entered a probable fault in which it was still working on May 24 at 595 feet.

MOHAVE COUNTY

Gold Road—It is rumored that the company will increase its equipment by the addition of two tube mills, 20 stamps and other improvements. It is expected to increase capacity to 350 tons per day.

California

AMADOR COUNTY

Central Eureka—The cleanup in April is reported at about $12,000. The recent strike of good ore in the 2800-ft. level does not count in the April extraction and treatment. In February some barren ground was encountered, and development was directed to the 2800-ft. level.

Bunker Hill—More than 50% of the total production of bullion in April was recovered from the sulphurets, and the total yield of the mine was up to the average. An auto truck has been installed for hauling sulphurets to the railroad at Martell.

Plymouth Consolidated—The water has been lowered to the 1000-ft. level in the Pacific shaft. The lowest depth is 1650 feet.

BUTTE COUNTY

Nimshew Ridge—This mining and development company, operating three miles south of Nimshew, will resume work in June. Sluice boxes will be installed in the main tunnel, which is 897 ft. long, and the gravel washed as it is extracted.

Great Western Power Co.—This company will build a club house, gymnasium and cottages for employees, at Las Plumas station.

CALAVERAS COUNTY

Big Fraction—The 20-ton Huntington mill is in commission, working the dump. The mill is run by water power taken from the Mokelumne ditch. When the dump is cleaned, the mill will handle mine ore.

Melones—The machinery for the new electric hoist, to be installed on the 1350-ft. station, has been received.

ELDORADO COUNTY

Golden Rule—This mining company has leased the Lukens property, at Cool. A drift will be run from the bottom of the 100-ft. shaft.

HUMBOLDT COUNTY

Berch—This old placer claim is being operated this season by R. L. Young, of Orleans Bar. An exceptionally good water right enables operations to continue late into the summer.

California Mining & Dredging Syndicate—This company suspended hydraulic operations about a year ago, the flume having worn out. It is rumored that a dredge may be installed this summer. Fred T. Hale, of Orleans Bar, is interested.

MARIPOSA COUNTY

Mt. Gaines—It is reported that the mine is to be reopened as soon as A. R. Mains, of Los Angeles, who purchased it at a sheriff's sale, secures title in June. This mine is a former large producer, and is believed still to contain ore worth development.

MODOC COUNTY

Reports from New Pine Creek in the middle of May say the weather was mild, and that every train was carrying men into the camp. This good weather followed what was said to have been the worst storm known in the Highgrade district for several years. Besides the new townsite, one-half mile south of New Pine Creek, another is reported as being staked at Willow Ranch, six miles south.

MONO COUNTY

Standard—An electric pumping plant is contemplated for installation in the Lent shaft, to unwater the lower levels with a view of prospecting for new orebodies. Dividends amounting to $17,839 were paid in 1911, although at the beginning of that year the company feared it was facing a loss. J. R. Buchanan is superintendent.

NEVADA COUNTY

Pennsylvania Consolidated—A second payment of $40,000 is said to have been made by A. H. Winn, of San Francisco, who holds a purchase bond. The purchase price is reported to be $500,000. The present operator has added 10 new stamps to the mill, an electric pump and has deepened the shaft.

Black Bear—A rich strike is reported. Free gold was found in an upraise in the tunnel about 150 ft. in from the portal.

PLACER COUNTY

Three Queens—This mine, near Forest Hill, is to be reopened by Frank Savage. The mine produced $20,000 under bond to George Wingfield.

Herman—The fuel supply at this mine is being replenished and preparations for next year's fuel are being made. Ten new stamps are being added to the present 20-stamp mill. The gallows-frame at the station on the 600 level is being raised. The ore pockets at this station are being enlarged to facilitate the hand-g of ore due to increased mill capacity. w stopes are being opened and mill es provided. The unwatering of the er levels will be completed soon. e mine and mill will be in full opera- n early in June. This property is ned by the Pennsylvania Gold Min- Company.

Plumas County

Altona—A 12-hp. gasoline hoist is be- installed for prospecting. The mine s a former producer of average-grade . The veins are from 18 in. to 7 ft. le and have a dip of about 45 degrees.

Sierra County

Butcher Ranch—This quartz property s been bonded to David Atkins and sociates, of San Francisco.

Sierra City—The Keystone mine has umed work, and the Cleveland and llion are about to resume after a sus- nsion of several months.

Croesus—At this Alleghany mine work s commenced on the laying of 6200 ft. 3-ft. redwood pipe to carry water from Middle Yuba River to the power use.

Rainbow—The mill is being run three ilts on good ore, and the tunnel is be- extended to develop the orebody re- ntly cut. L. P. Woodbury is in charge.

Hayes Consolidated—This property s been transferred to a San Francisco mpany, and is in charge of Thomas Heide, a mining engineer of that city.

Flynn—In running for gravel on this operty, good quartz has been encoun- red by Michael Flynn, the owner.

Trinity County

Trinity Gold Mining & Reduction Co.— ne 40-stamp mill and cyanide plant eated 6200 tons during April, of an erage grade of $4.45. Net working ofit was $7914. Five hundred inches of ater under 400-ft. pressure are being ed to remove overburden from the ore- dy.

Alta Bert Dredging Co.—The 7½-cu.ft. edge installed by this company on the operty between Carrville and Trinity enter on the Trinity River, has been orking successfully since its comple- on three months ago. It is handling 00 yd. per day with a daily output of 00. The company is contemplating the uilding of a much larger dredge. The nd adjoins that owned by the Trinity xploration Co.

Yuba County

Pennsylvania—A Beer roller mill and ther necessary machinery have been re- ceived and are ready for installation. Con- rete foundations are being built. J. C. ampbell, Browns Valley, is owner.

Tarr Mining Co.—The trial of the suit y the E. Clemons Horst Co., to enjoin ne mining company from taking water rom Bear River, has been postponed till eptember.

Colorado

Boulder County

The Wolftongue mill at Nederland, and the Primos mill at Lakewood, have both resumed operations, after an idleness of several months. With the starting of these two mills the leasers throughout the tungsten district have a place to dispose of their ore.

Colorado Tungsten—This property, at Carrie Nation Park, has received its electric motors for the mill and they are being installed. The mill is expected to be ready early in the summer.

Clear Creek County

The excitement last year in the Bard Creek district was stopped by the heavy snows, but the work carried on during the winter was encouraging, and many prospectors and mine operators are now going in again to this gold and silver section.

Capital—It is stated that this mine is the heaviest producer of gold in the county, and that during the last two months the production has been as high as $3000 per day from the plates, besides heavy shipments of concentrates and smelting ore.

Lake County—Leadville

Mt. Champion Mining Co.—The new machinery at the mill is being installed by Manager Smith, who expects to have the plant running by July 1. The ore is said to be 6 ft. thick, a horizontal vein carrying free-milling gold.

Roy—This group on Prospect Mountain was owned by the late Thomas F. Walsh, and it is rumored that his son-in-law, McLean, will develop the property this summer.

Leadville District Mill—This mill, in lower California Gulch, is being remodeled under S. H. Dunlop. When completed it will handle zinc-lead ores.

Resurrection No. 1—The lessees are shipping two cars per week of ore that nets $14 per ton.

Elk—The lessees have a body of iron ore 14 ft. wide, from which 20 tons per day are going to the smeltery. They are also shipping from a 4-ft. vein of lead ore.

Crescent—Men are cleaning out this tunnel of the Winthrop Mining Co., in Big English Gulch. It will be driven ahead into the mountain.

Gold Basin—The lessees have shipped to the local smeltery seven cars of ore that runs 1 oz. gold per ton.

Ouray County

Barstow—On this gold producer, near Ironton, in the Red Mountain district, 40 men are at work under C. R. Wilfley, manager. Shipments will commence as soon as the Red Mountain R.R. is in operation.

Atlas—Development is keeping 10 stamps busy, and the other 10 stamps will be put in operation. J. P. Sidwell, president, arrived at the mine from Boston this week, accompanied by Dr. Julius Garst, of Worcester, Mass., a large stockholder.

San Juan County

It is stated that after being in operation for three months, the first plant erected in Colorado for the electrostatic separation of lead-zinc ores, at the Sunnyside, near Silverton, has been a success, as a 40% zinc product is made and the lead and copper recovered.

Congress—It is reported that a large body of copper ore, carrying gold and silver, has been struck by the lessees, Clay & Morris. There is a great deal of enargite in this mine.

Gold King—The mill at Gladstone has resumed operations and is dropping 40 to 60 stamps daily and turning out concentrates. The sublessees are encouraged by the pockets of gold ore being found, and they are doing extensive development. Sixty men are employed.

Vermillion—The mine was closed down last year, owing to shortage of funds. It is stated that the owners and officers are due to arrive soon in Silverton from Cleveland, Ohio, to straighten the affairs of the company and to resume operations.

San Miguel County

San Miguel Consolidated Mining Co.—The 110-ton stamp mill, in Bear Gulch, under lease to the Junta Gold Mining & Milling Co., was destroyed by fire on May 23. The company expected to have the mill in operation by June 15, as well as a tramway, which is under construction from the mine to the mill.

Teller County—Cripple Creek

It is reported that Judge Colburn, president of the Ajax company, will build a Clancy mill at the Mary McKinney mine, work to commence within a month.

Golden Cycle—It is reported that about 280 tons of ore per day are being shipped to the company's mill, at Colorado City. A station is being cut at the 1700 level, and an electrically driven 1000-gal. station pump will be installed, which will lift the water to the second pumping station at the 1400.

Dante—The mill, which is being built by Edwin Gaylord, is progressing rapidly and the machinery will be installed soon.

Signal King Gold Mining & Milling Co.—William Christen, president, Cripple Creek, expects to install some machinery at this property. Some grading for a mill has been done, part of the water main is installed and lumber is on the ground.

Work—Extensive development, with occasional shipments, is being carried on by seven sets of lessees at the Morning Glory, Little Clara and Morning Glory No. 4, owned by this company.

Idaho

Stewart—Edward C. Carter, of Spokane, a stockholder and director, has brought suit against F. A. Heinze and others, for the appointment of a receiver for the company. It is claimed that the company has earned more than $950,000 in the last two years and that no dividends have been paid nor a proper accounting made.

Bear Top-Orofino—The company has gone into the hands of a receiver and the 20 claims will be sold. It is stated that the company is a producer of high-grade lead-silver bullion, that the equipment is complete and that 32 cars of ore have been shipped since October, 1911. Charles N. Mundell, 173 S. Adams St., Spokane, Wash., was former secretary.

Michigan

COPPER

Indiana—Shaft-sinking is going forward satisfactorily, to develop the felsite formation revealed in drill cores. The shaft is sinking in trap, passing through the amygdaloid formation encountered at a depth of about 800 ft., which was highly mineralized for 20 ft. Developments on the lode exposed by the crosscut from the 600-ft. level continue encouraging.

South Lake—This company has selected the site for its shaft and will begin sinking soon.

North Lake—The Copper Range R.R. is running a spur to the shaft site, about a half-mile distant.

Copper Range—This company is installing a series of Hardinge conical tube mills in the Baltic stamp mill for fine grinding. A contract has been closed with the Allis-Chalmers Co. for a 1500-kw., low-pressure steam turbine to be installed in the Baltic mill also. This is the forerunner of a number of similar installations that will be made in the company's other mills and the latter will eventually be tied together with a common substation and the power used for the electrification of the mines.

Osceola Consolidated—The old Osceola branch is to be reopened soon. Repairs have been made to the shafts and alterations to the rockhouses, so that the property is in shape to handle economically an increased tonnage.

Isle Royale—The testimony in the injunction case of G. M. Hyams, restraining this company from purchasing a portion of the Lake Milling, Smelting & Refining Company and the Tamarack company from selling its two-head mill on Torch Lake to the L. M. S. & R. Co. was given at the general offices of the Calumet & Hecla company at Calumet during the last week, before Federal Judge Sessions. Vice-president Agassiz was called to the stand as was Mr. Hyams. The testimony was completed Friday morning and court was adjourned until June 3, when the final argument will be presented at Marquette.

IRON

Cleveland-Cliffs Iron Co.—This company is reported to have sold 2,000,000 tons of ore which will clean up the large stockpiles that have been accumulating for two years. The new North Lake mine is shipping ore; this property four miles west of Ishpeming has been developing for several years and now has a full equipment; two shafts, the Morris and Lloyd, are hoisting ore. The Negaunee mine, at Negaunee, the Lake and Cliff shafts at Ishpeming, and the Stephenson mine at Gwinn, are active.

Davidson—At this mine of the New York State Steel Co., at Iron River, the new engine house at the Gleason shaft is nearly completed. Wires have been strung from the steam plant of the Peninsula Power Co. and the new compressor will soon be running by electricity. This season the New York State Steel Co. will ship about 100,000 tons of ore from the mine, which last season made its initial shipment of 45,000 tons. The same company expects to ship 345,000 tons from its Mesaba range mines, distributed as follows: Kellog, at Biwabik, 160,000 tons; Roberts, at Biwabik, 20,000 tons; Knox, at Mesaba, 115,000; and 50,000 from the Larkin at Virginia.

Minnesota

Adams—Cuyler Adams is sinking a concrete shaft at this mine on the Cuyuna range, two miles southwest of Deerwood. The shaft is 12x15 ft. in the clear and will reach the formation at 125 ft. from the surface. It is now down 90 ft. and difficulty is being encountered in getting the concrete column to follow down as the sand is removed. Recently 500 tons of pig iron were used to weight it. The shaft and equipment for it will cost about $100,000.

Cuyuna-Mille Lacs—This company and the Iron Mountain company are each sinking shafts on the north range, about a mile north of Ironton.

Montana

BUTTE DISTRICT

Butte-Alex Scott—During April, net earnings amounted to $25,000. Five thousand tons of ore were shipped to the East Butte smeltery, bringing gross returns of $39,700 and operating and mining costs were $14,700. Several small improvements are to be made at the mine, after which there will be a material increase in the output.

Tuolumne—The average daily shipments of first-class ore to the Washoe smeltery have been increased from 150 to 300 tons, and on May 15, a record shipment of 400 tons of ore was made, as a test of the new hoisting plant. The first-class ore averages about 7.5% copper, and about 5 oz. of silver. No second-class ore has been mined yet, but negotiations are under way with the Anaconda company for the treatment of this ore at the Washoe smeltery.

Butte & Superior—The first unit of the new mill has been completed and several test runs of ore made with satisfactory results. By June 1, the plant will be treating 400 tons of ore per day. Development in the mine during the last few months has increased the reserves. The vein on the 900-ft. level is 35 ft. wide of an average grade of 20% zinc; a raise on this level on the same vein is up 60 ft., the ore averaging 35% zinc and 30 oz. of silver per ton. On the 1200-ft. level, ore 25 ft. wide has been opened on the Four Johns claim. In drifting on the 1300- and 1400-ft. levels west of the shaft, the ore has maintained its width and grade.

Raven—Shaft sinking is in progress and the 1600-ft. level has been reached. A vein was encountered in sinking, which caused difficulty from a heavy flow of water. It is being taken care of by an additional sinking pump and work will progress faster. On the 1300-ft. level, a raise has been put up, and preparations made to begin stoping. An orebody on the 700-ft. level is being mined and occasional shipments made.

BROADWATER COUNTY

Keating—The shaft is being sunk from the 700-ft. to the 800-ft. level, and when the railroad is completed, it is planned to increase shipments to about 200 tons of ore per day.

JEFFERSON COUNTY

State—Dr. O. B. Whitford, of Butte, owner of this group of claims, in the Bigfoot district, 15 miles from Boulder, has finally found a vein of high-grade gold and silver ore. He has operated the property intermittently for the last 25 years at an expense of $70,000. The vein has a width of 28 inches.

Bell—This mine in the Warm Springs district, 10 miles southeast of Helena, has been transferred to interests connected with the Corbin Copper Co. Work is to be commenced soon and a shaft will be sunk on the vein. The mine produced about $250,000, years ago. The ore is a heavy sulphide, carrying gold, silver, lead and copper.

Assets Gold Mining Co.—This company's property in Golconda Gulch, has been transferred to Colin McIntosh. Electric power has been carried into the property, which will be vigorously developed.

LEWIS & CLARK COUNTY

Some activity is being shown in the Marysville district; the St. Louis company is working the St. Louis and Nine Hour claims, and part of the Drumlummon, and several independent producers are operating. Other properties being worked in this vicinity are that of the Hendricks brothers, between Bald Butte and Marysville, and that of the Boyer brothers, on Deer Creek. The latter is installing new machinery.

Piegan—At this mine, situated between Marysville and Gloster, James Deering, owner, has men at work and is preparing to build a 10-stamp mill.

Bald Butte—George W. Padbury, manager, is preparing to start the mill at this mine; he has sufficient ore blocked out to last some time.

POWELL COUNTY

Twin Cities—William O'Connel, president, recently visited the mine near Elliston. The shaft will be sunk to the 200-ft. level, and the vein developed. The equipment is on the ground and sinking will start as soon as the new headframe is completed.

Nevada

COMSTOCK LODE

Mexican—The new clarifiers are being installed. This equipment is expected to increase the capacity to 100 tons per day, as well as to give a higher percentage of extraction. Last week, 583 tons of $22.64 ore were treated at the mill.

Ophir—The southwest prospecting drift on the 2500-ft. level continues to follow the east vein with the face in quartz across the width of the drift. The final shipment of concentrates from the run at the Kinkead mill has been made and included 31 tons of an estimated value of $25,200 and a bar of bullion worth $5100. The net proceeds from the run are estimated at $50,000, including a previous concentrate shipment.

Union Consolidated—A northeast drift has been started on the 2200-ft. level, from the south boundary line, and is being advanced in quartz. Work has been handicapped on the 2500-ft. level by air conditions, but a large blower has been ordered.

Consolidated Imperial—One station set of timbers was put in place last week at the new station on the 200-ft. level, and from the opening made for the timbers, 61 mining cars of ore were saved of an average grade of $33.32 per ton. This vein was cut in the sinking of the shaft, and after the station is completed will be thoroughly explored.

ESMERALDA COUNTY

Blue Bull—Operations are reported to have been resumed. The Cosser & Terrel shaft, now 400 ft. deep, will be sunk to 700 ft., where drifting and crosscutting will probably be started. Developments at this mine will be watched with considerable interest.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended May 16, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,300	65,519
Tonopah Belmont	1,750	41,426
Montana-Tonopah	1,017	20,262
Tonopah Extension	1,030	19,067
West End	775	14,184
Midway	.....	180
MacNamara	485	6,820
North Star	......	80
Totals	8,357	167,538
Estimated value	$208,925	....

The placer mines in Manhattan Gulch are employing about 100 men in channel mining and several new washing plants are being erected. Operations last winter were successful.

Nevada Reduction Co.—Charles J. Webb & Co., Philadelphia, have secured this plant. The cyanide department will be overhauled and the mill started.

Big Four Leasing Syndicate—The syndicate has sold its holdings to the Big Four Co., and the shaft is sinking to the 500-ft. level. The mine contains a quantity of low-grade ore above the 300-ft. level.

War Eagle—This 50-ton mill has resumed operation. Both this and the Philadelphia have contracted for enough ore to run continuously for three months.

Montana-Tonopah—The downward extension of the new vein recently cut on the 565-ft. level has been opened on the 665-ft. level and is 2½ ft. wide, assaying from $80 to $110 per ton. The company milled 4646 tons of ore in April.

WHITE PINE COUNTY

Ely Verdi Copper Co.—This company, in which George Wingfield has been interested for some time, was recently reorganized. It is doubtful if active work is contemplated.

Boston Ely—Diamond drill work was started on May 9. The first hole will be put down from the bottom of the Emma shaft, starting at a depth of 1200 feet.

Taylor—It is understood that J. E. Spurr's examination resulted in the surrender of the option held by the Tonopah Mining Company.

Ely Central—This company is putting down a churn-drill hole on the Chispy claim, at a point less than 400 ft. south of the edge of the Copper Flat pit of the Nevada Consolidated. The hole was started east of the fault plane and went through it encountering low-grade copper sulphide ore at a depth of 300 feet.

Railroad Valley Saline Co.—The company is drilling its first hole in the old lake beds of Railroad Valley, and has reached a depth of nearly 600 ft. The formation so far consists of successive beds of sand and clay. The company holds 6000 acres of land. The existence of potash salts of commercial worth has not been shown yet. The point at which work is being carried on is 115 miles from Tonopah and 72 miles from Ely, on a direct line between the two places.

New Mexico

GRANT COUNTY

Recent developments in the Juniper district, 16 miles north of Silver City, seem to indicate that the region may possess workable deposits of low-grade ore. Conditions are said to be favorable for mining and milling, with a good supply of water and timber.

Eighty-five—It is reported that this company has purchased the Superior mine for $100,000.

Chemung—This company, together with the Savanna company, has been investigating the cost of a motor-truck road from the Burro Mountains to Whitewater on the Santa Fé road.

SOCORRO COUNTY

Ernestine—Engineers are examining this property with a view of purchasing a controlling interest. If the deal is consummated, it will mean much to the district in the way of operations on a larger scale.

Deadwood—Unwatering of the lower levels is about completed. The good ore recently encountered in the third level continues and other development breasts are also producing a good tonnage. Considerable custom ore is being handled in addition to the mine output. The daily ore treatment is about 60 tons.

Oaks—Thirty-four tons of ore were shipped to the Deadwood mill from 20 ft. of development on the Pacific mine. Twenty-one tons were milled from the Johnson mine, extracted in sinking the shaft 18 feet.

Deep Down—A fair tonnage is being sent to the Deadwood mill from the development conducted by leasers.

Treasure Mining & Reduction Co.—There is sufficient ore now broken in the stopes to supply the mill for six months. Development in the lower levels is satisfactory.

Mogollon Gold & Copper Co.—The winze in the Little Charlie tunnel has been sunk 30 ft. in excellent milling ore.

Oregon

LINN COUNTY

The district in the vicinity of Foster is about 30 miles from the town, on the north fork of the South Santiam River. Adequate transportation is lacking, and pack horses are used. Both free-milling and base ores are found.

Lawler—This mine and 20-stamp mill was shut down several years ago and is still idle. It is in the Quartzville camp and is in charge of Mr. Edison, of Gates.

Albany—Some opencut prospecting was done during the winter. The 10-stamp mill is idle. John McChesney, of Albany, formerly interested in the property, states that it is being sold.

Savage—This mine on Nye Creek, four miles south of Quartzville, has been leased to E. Mannd, of Salem, who expects to install a small mill.

Paymaster—Some development will probably be done this summer, at this mine, 1½ miles from the Savage. Good galena ore has been exposed in several places. Lance Stewart, of Gates, is interested.

Paywell—A contract has been let for some development at this mine, 21 miles from Foster. G. B. Whitcomb, of Foster, is manager.

South Dakota

BLACK HILLS DISTRICT

Evans—A porphyritic high-grade ore has been discovered on this property, near Deadwood, and Manager Forester is pushing development to determine its extent. The property is unusual in the variety of its ores. Some of the ore carries a high percentage of iron pyrite, some zinc and lead; other is typical silicious ore, amenable to cyanidation; some of the shoots are largely free milling, and some of the porphyry can be cyanided to advantage, although in places it, too, carries pyrites. A number of laboratory tests have been made recently, which show that amalgamation, concentration and cyanidation will probably be necessary.

Utah

JUAB COUNTY

Tintic shipments for the week ended May 16 amounted to 154 cars, as compared to 173 cars for the week preceding. The decrease in shipments is due largely to caving ground at the Iron Blossom, which held back the output.

Eagle & Blue Bell—The new orebody, carrying gold and silver, opened on the 700 level, has been followed for 35 ft. on the strike, and is reported to average $17 per ton.

Iron Blossom—Drifting has been started around the cave, which occurred recently between the 300- and 600-ft. levels of the No. 1 shaft. It will be about a month before the output can be brought to normal. New equipment for the No. 1 workings has been arriving.

Dragon Consolidated—Good progress is being made in the work which is being done through the Black Jack. Small bunches of ore have been encountered in the raise, which is being driven from the 300-ft. level.

Eureka Leasing—Articles of incorporation were filed, May 20. The capitalization is 10,000 shares, par value 10c. W. L. Mangum is president. The company has obtained a six months' lease on the Tetro claim, belonging to the Plutus. Work will probably be started through the 400-ft. level of the Godiva, adjoining, to reach shipping ore, which has been found through other workings.

Chief—Shipments of good ore are being made at the rate of one car per day.

May Day—Ore has been opened on the 1000-ft. level, where work is being done to connect with the orebody developed below the 1000. There is zinc ore on the 400, which it is thought can be marketed at a profit. Shipments average three cars per week.

SALT LAKE COUNTY

Utah Metal—This company's tunnel, between the Tooele side of the range and Carr Fork, has been driven about 8600 ft., which leaves about 2400 ft. still to be driven. It is thought that the work will be finished during the coming autumn. The Tooele side is in 7400 ft., while the Bingham side has been driven 1200 feet.

Montana-Bingham—The tunnel has between 300 and 500 ft. still to go to reach the Bingham Amalgamated line. Pyrite carrying some copper has been encountered at frequent intervals during the work. The present length is over 800 ft., and progress of 4 ft. per day is being made.

Michigan-Utah—At a recent meeting of the directors, Norman C. Haire was elected president, to succeed Duncan MacVichie, who has resigned from that office and from the executive committee. Mr. MacVichie is still one of the directors. Shipments are being made from the ore that accumulated during the winter. The wagon road up Big Cottonwood was opened May 19, and shipments will be increased. Shipments from the Little Cottonwood side will probably begin soon. Leasers at the City Rocks are stated to have 200 to 300 tons of ore of fair grade ready for shipment.

South Hecla—Work was started, May 8, in extending one of the main tunnels. Ten men are employed. The compressor is reported to be in good condition, and one or two machine drills are in use. These will later be increased to five, so that operations can be undertaken on a more extensive scale.

SUMMIT COUNTY

Silver King Coalition—The annual stockholders' meeting was held, May 20, in Salt Lake City. David Keith was reelected president, and Thomas Kearns vice-president. Shipments of about 600 tons per week are being made.

Ontario—The Mines Operating Co. has started the installation of a cyanide plant to handle the low-grade ore, which has been left as stope filling. The mill will have a capacity of 150 tons per day, and is expected to cost about $125,000. Provisions are being made to increase the capacity, if this is desired later. The company has a 10-year lease on the old Ontario mine, and it is estimated that there are over 500,000 tons of stope filling and low-grade ores available.

Silver King Consolidated—A new underground hoist has been ordered, and is on the way to the mine. Operations are being curtailed at present, on account of bad roads.

Barry-Coxe—Ore is again reported in the face of the tunnel, which is in 175 ft. This point is about 240 ft. from the surface.

UTAH COUNTY

Mineral Hill—Work will be resumed during the summer. There are 25 claims, on which about 1500 ft. of development have been done. This is largely tunneling. About $20,000 are being raised by assessment.

Mineral Flat—This property adjoins the Mineral Hill, and is also controlled by the Knight interests. The property also adjoins the Pacific, which has a vein of galena ore, and it is thought possible that this vein may extend into Mineral Flat ground.

Wyoming

New Rambler—This mine, on Elk Mountain, which contains platinum in its ore, has been leased for 15 years to J. Thielman, of Merrill, Wis., who has incorporated the Platinum Mining & Milling Co. Twenty men are at work and the concentrating plant will be started soon.

Canada

BRITISH COLUMBIA

Bluebird—Lyman Carter, manager, recently let a contract to sink the shaft 200 ft. to the 300-ft. level. At 180 ft. surface water necessitated temporary suspension of work. Good ore has been encountered and sinking will be resumed soon. Equipment includes a 30-hp. boiler and a 6x8-in. hoisting engine.

Center Star—This group, operated by the Consolidated Mining & Smelting Co., of Canada, Ltd., consists of the Center Star, War Eagle, Iron Mask, Idaho, Spokane, Monita, Pilgrim and Red Mountain. The holdings of the Le Roi Mining Co., in Rossland, were added last July. The company recently purchased at auction the Virginia claim, adjoining the Iron Mask, and developed by a 500-ft. shaft and laterals on the 300-ft. level. Drifting has shown good ore on the 13th level of the War Eagle.

Standard—The company is milling 100 tons per day and shipping concentrate and sorted crude ore to the smeltery. Payment of dividends was commenced in April, when $25,000 was distributed among shareholders. Hereafter $50,000 is to be divided monthly, which, on the

$2,000,000 capitalization, will total 30 per cent. per annum. The mine and mill are near Silverton, Slocan Lake.

Ontario

Buffalo Union Furnace Co.—This company, a half-mile from the Cordova, has opened the 100-ft. level and has crosscut a body of magnetite, averaging 60% iron and sufficiently low in phosphorus to grade bessemer. The rock-house, 85 ft. high is nearly completed and is set on rollers ready to be placed over the shaft. The company intends to erect a magnetic concentrating mill at Belleville to treat low-grade ore.

Ontario-Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended May 24, and for the year to date, are:

La Rose	31.13	1,279.31
Coniagas	74.05	771.80
O'Brien	..	263.21
Right of Way	....	148.60
Chambers-Ferland	32.00	193.60
McKinley-Darragh	38.02	1,020.63
Nipissing	97.17	792.61
Hudson Bay	....	312.62
Buffalo	....	412.57
Crown Reserve	28.50	219.43
Cobalt Townsite	.....	505.28
City of Cobalt	...	145.84
Trethewey	.....	174.19
Colonial	.....	41.60
Kerr Lake	.....	319.66
Cobalt Lake	......	176.26
Drummond	......	300.32
Temiskaming	......	320.64
Beaver	......	132.34
Wettlaufer	.....	111.21
Provincial	......	22.22
Casey Cobalt	......	24.50
Totals	300.87	7,556.47

Nipissing—The new cyanide plant under construction, together with the necessary tramways to various parts of the property will involve an expenditure of approximately $300,000.

Beaver—The first shipment of concentrates from the new mill, amounting to 33 tons, realized about $20,000. The mill is treating about 60 tons of ore per day and there is about half a car of concentrates ready for shipment. Ore is being raised for the mill from four levels, the lowest being 500 ft. At 530 ft. a smaltite vein is being drifted upon.

Crown Reserve—This company has entered into a contract with the government of Saxony to supply six cars of ore, containing an aggregate of 720,000 oz. of silver. The ore will be used in the government smelteries, to grade up the Saxony ores.

Ontario—Porcupine

Hughes—The directors have decided to install a plant suitable for carrying on the projected development work.

Canadian Tonopah—This company, at Larder Lake, has ordered a 5-drill compressor.

Three Nations—The directors are visiting the property and will decide whether to build a mill.

Iroquois—This property has been acquired by New York men.

Dome—All work except that which is urgently necessary will be suspended on Sundays.

West Dome—All work has been suspended until the power companies can supply electricity. This will probably be in November. The shortage of fuel is given as the reason for closing.

Gosselin — Trenching on this West Shining Tree property has opened a new vein said to be better than anything yet found in the district.

Dome Lake—The plans for the stamp mill, for which excavations are now being made, provide for 10 stamps, to be operated with tube grinders, giving a total capacity of 100 tons of ore per 24 hr. At 100-ft. depth the main vein shows over 4 ft. in width of good ore. A body of ore sufficient to supply the mill for one year has been blocked out.

Rea—Work will be resumed soon at this mine. If the shareholders are unable to raise funds by a loan or an additional issue of stock, the property will probably be leased.

Crown Chartered—At the Davidson property, the orebody at the 100-ft. level has been drifted on for 30 ft., showing good ore in both faces, with a crosscut 20 ft. in pay ore.

Ontario—Sudbury

Miller—This syndicate has one diamond-drill at work on the Cryderman claim, in Falconbridge township, and two on the Murry property. It is rumored that results so far have been good and that the second payment on the Murry mine has been made.

Moose Mountain Co.—Lack of power has somewhat delayed construction on the new Gröndal magnetic separation plant, but the first unit is now about completed while work on the pumping station, at Vermilion River, is being actively pushed.

Mond—The Froude shaft is down about 180 ft., nearly as far as that of the Canadian Copper Company. The foundations of the new smeltery buildings are completed.

Dominion Nickel-Copper Co. — This company has one diamond drill at work at the Gertrude mine, which it recently bought from the Lake Superior Corporation.

Mexico

Chihuahua

Promontorio—This mine, of the Cusi Mining Co., is reported to have developed considerable low- and medium-grade ore. The erection of a mill is planned and plans and estimates have been completed. C. R. Watson is manager.

Mexico

Esperanza—During April, the mill crushed 16,081 tons of ore. Total receipts were $105,575; working expenses, $74,710; estimated profit, $23,624. Development totaled 645 ft. Drifting, raising and sinking on the San Carlos vein opened ore running from $8 to $37 per ton.

Sonora

Sonora Mining & Smelting Co.—According to press reports, the property is being worked. The 100-ton smeltery is completed and will be blown in soon. A 3500-ft. aërial tram takes the ore from the mine to the smeltery. The water-jacketed furnace was built by the El Paso Foundry & Machine Co. Arrangements are under way to run a spur from the Southern Pacific Ry. station, three miles to the plant. Mine development is below water level, at 920 ft. depth. Another shaft is to be sunk. A. M. Conara, Noria, is in charge.

Manhattan Exploration Co.—This company has ceased operations at its property on the Yaqui River, near Alamos.

Yaqui River Consolidated Copper Co.—This company is reported to be meeting with some success at its mine east of Imures, in the Magdalena district.

Ritchfield—The new smeltery is said to have been completed, but it is unlikely that operation will start under the present unsettled conditions. The property is 45 miles east of Querobabi.

Greene-Cananea—It is planned to increase the converter capacity.

West Coast Smelting Co.—This company, operating west of Carbo, about 40 miles from the Gulf coast, is planning the erection of a 500-ton smelting plant. It is financed by Holland capital and extensive developments have been under way for about two years. A railroad to the Gulf of California is projected.

South America

Chile

Braden—A large orebody is said to have been indicated in the Teniente mine. The 3000-ton concentrator is two-thirds completed and operating and is expected to be completed by autumn. This will mean an increased production.

Asia

Chosen

Oriental Consolidated—During March, 24,295 tons of ore were crushed, yielding $145,680 gross and net $72,678. Operating costs were $65,207 and $7794 were put back into improvements, development, etc. The Kuk San Dong 40-stamp mill was hung up the full month because of labor shortage.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, May 29—Most of the anthracite collieries are at work by this time and coal is going forward. In the tidewater markets the domestic requirements, which, of course, are light at this season, are generally being filled but there is a scarcity of the steam sizes and it will take some time to meet the demand fully. The Lake trade is beginning to make some demands and considerable shipments are being made westward to Buffalo. There is a little confusion yet about tidewater prices. It is assumed that there is to be an advance which has been stated at 25c. a ton on prepared sizes including pea coal, but the schedules do not seem to be fixed as yet.

The anthracite operators have chosen as their representatives on the Conciliation Board under the new agreement, S. D. Warriner, of the Lehigh Valley, W. L. Richards, of the Reading, and W. L. Connell, an independent operator.

The Seaboard bituminous trade is dull; prices are unsettled and inclined to be low. There is still a surplus of coal at tide and apparently it is going to take some time to work it off.

The coal trade in the West is rather heavy, though the demand for steam coal is reported good. Lake trade is moving rather slowly. There are plenty of boats ready, but coal does not arrive at the ports as freely as might be expected. The West Virginia movement is rather slow.

The United States Supreme Court has decided that the Ohio Railroad Commission had no right to fix rates on Ohio coal intended for shipment up the Lakes, since such shipments come clearly under the head of Interstate business and the rates are under the jurisdiction of the Interstate Commerce Commission.

Coal and coke carried on Pennsylvania R.R. lines east of Pittsburgh and Erie, four months ended April 30, short tons:

	1911	1912	Changes
Anthracite........	4,166,812	3,579,602	D. 587,210
Bituminous. .	13,303,935	15,461,920	I. 2,157,985
Coke............ ...	3,639,874	4,190,832	I. 550,958
Total............	21,110,621	23,232,354	I. 2,121,733

Total increase this year, 10.1%. The decrease in anthracite was entirely in April, when the quantity carried was only 290,865 tons, against 1,178,787 last year.

IRON TRADE REVIEW

New York, May 29—The conditions of active demand and full work at mills still prevail, and there is even some talk of premiums being paid for early deliveries. The mills report heavy specifications on contracts while a fair quantity of new business continues to come in. The majority of the Steel Corporation mills are being operated at 90% of capacity or over, while the leading independents report, most of them, 95%, or practically full capacity. The price advances made in April are well held and some further increases have been made. There is still, however, some shading on structural steel and two or three large contracts are known to have been taken at low rates by the fabricators. The latest advance noted is of 10c. a box or $2 a ton on tinplates. A further advance is expected owing to the high price of tin. Sheets are in heavy demand and some of the mills find difficulty in getting sheet bars as fast as they need them. Structural steel is again in active demand and a number of contracts, both large and small, have been let.

In pig iron the demand is good although most large users have covered their wants up to the end of July and a number of them also through the third quarter. In eastern territory foundry requirements are large, both in large and small lots, and there is a special demand for Nos. 3 and 4 foundry and forge for the cast-iron pipe makers. In the Central West some large lots of both bessemer and basic pig have been taken by some of the large steel companies whose own furnaces are unable to supply the demand.

The taking of testimony in the Steel Corporation suits is still going on. Most of the evidence has again this week related to the condition of affairs at and prior to the time of the organiation of the corporation. The evidence has brought out little or nothing that has not been already known.

During the four months of the present year, from Jan. 1 to May 1, the *Railway Age Gazette* has reported orders for 62,464 freight cars, 1067 passenger cars and 1476 locomotives. For the entire calendar year 1911 the orders as reported amounted to 133,117 freight cars, 2623 passenger cars and 2850 locomotives. In the case of freight cars and locomotives, therefore, the orders placed in the first one-third of 1912 amount to about one-half of those for the entire year 1911; and in the case of passenger cars the number is larger in proportion than for last year.

Baltimore

May 27—Exports for the week included 742,000 lb. steel rails, 575 bundles rail joints and 928,000 lb. steel billets to Glasgow. Imports included 5500 tons manganese ore from Brazil; 9477 tons pyrites from Huelva, Spain; 28,300 tons iron ore from Cuba.

Birmingham

Birmingham, May 27—Pig-iron quotations in Southern territory are firm at $11@11.50, No. 2 foundry, and some selling, though in small lots, is still reported. The greater bulk of the business for delivery during the third quarter of the year has been placed and considerable tonnage has already been engaged for the last three months of the year. The manufacturers are inclined to hold $11.25 per ton, No. 2, as the minimum, for iron to be delivered during the last quarter, and, in some instances, small lots of iron have been sold at $11.50. The manufacturers in the South, because of the strong demand for the lower grades of iron, have been making effort to make the differential prices 25 instead of 50c. In some instances, it has been necessary to consider offers of business for the lower grades carefully, the orders on books already requiring a large proportion of the probable make. The cast-iron pipe makers have been in the iron market most liberally, the expectations being there will be need for a steady operation of the various pipe works not only through the balance of the present year, but into next year. Delivery on orders for pipe placed some time back is being requested, and the production is to be increased just as soon as possible. The melt on the part of the pipe makers in the South is proving of great value in the iron market. There is still some activity with the machine shops and foundries, and the reports from that branch of the industry are encouraging. It has been necessary of late to run the steel-rail mill of the Tennessee company's plant a little overtime, a few small orders requiring immediate delivery. There are hopes of an improving demand for rails, so that the mill at Ensley, Ala., can be assured of steady operation all through the summer. Fabricated steel is in strong demand.

Chicago

May 28—The iron market is quiet as regards the demand for pig iron and busy as regards the demand for manufactured products. Mills in this district are crowded with orders, the requirements showing a rapid expansion of manufacturing and construction needs. Under these circumstances pig iron remains firm, though sales are not in more than carload to 300-ton lots. Furnace agents are well sold up for the production of the next three months. On last-half deliveries, pig iron is held at more than most melters care to pay now for it, so the business resolves itself into small though numerous sales for third-quarter or earlier deliveries.

Northern No. 2 brings in general $14.50@15 at furnace, and Southern No. 2 brings $11@11.50, Birmingham, or $15.35@15.85, Chicago, with the higher prices obtaining on deliveries in the last quarter or last half. Lake Superior charcoal iron is a trifle weaker and brings $15.75@16.25 per ton.

Railroad supplies are being bought more heavily, with rail orders increasing and in prospect and track fastenings active. Structural material has a good and increasing sale for bridge and building purposes throughout Western as well as local territory, at 1.43c. for material up to 15 in. Bars are active, with the local mills getting the business at firm prices, iron bars selling for 1.25c. and soft-steel bars for 1.38c. base. Plates also are in large demand at 1.43c. for ¼-in. tank plates. Sheets and wire products are in better demand than for several weeks. General business conditions are good.

Cleveland

May 27—The iron-ore movement has become active and many cargoes are coming down.

Pig Iron—Orders are coming in freely. Prices have not advanced, but are very firm, and some furnaces are asking more for iron. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.25 for No. 2 foundry, $12.75 for forge and $15.50 for Lake Superior charcoal.

Finished Material—Specifications are coming in freely, and new orders are increasing. Bars are in demand, and plates are active. Steel billets are scarce, and some good orders have been placed with local plants.

Philadelphia

May 29—Comparatively little pig iron was sold during the past week. New York and New Jersey buyers have purchased a few lots, with small inquiries from New England sources. Furnace production has been increasing so much faster than deliveries call for as to make possible a little accumulation of stock. A large sale of steel iron has been made within a day or two for Western delivery. Other transactions are pending from the same quarter, but for smaller quantities. There is further activity in forge iron, most of it for early delivery. No. 2 foundry is again dragging, but makers are holding firmly to recent advances. Basic and bessemer are strong and with an excellent outlook. Low-grade irons are selling well, but Southern furnaces seem to control that branch of the trade. Prices will no doubt remain where they are until some new development occurs in the market. The opinion of furnace men and brokers is that the crude-iron situation will steadily improve.

Steel Billets—Billets are advancing in price and large lots have recently changed hands in this territory. Premium prices are likely to prevail to urgent buyers whose judgment has been on the wrong side of the market for several weeks.

Bars—Prices have fractionally advanced for early deliveries, which are the chief features of present inquiry. Both large and small buyers are looking for summer and fall stocks.

Sheets—The sheet mills of this district are running to nearly full capacity and prices are in the upward way. It looks as though an advance would be announced in a few days, but definite information is not to be obtained.

Pipes & Tubes—The demand for pipe is exceptionally large and tubes have advanced, especially in seamless. Merchant pipe will soon advance and in anticipation some orders are being placed.

Plates—A large business has been done in iron and steel plate, especially on car-building account. Inquiries are crowding in and buyers requiring earlier than 60 days' delivery are not finding it easy to be accommodated. Mills are crowding their capacity to get ready for new work which is likely to be offered.

Structural Material—Orders for structural material have been crowding in within a few days and our territory capacity is now pretty well sold up.

Scrap—The heavy supplies of scrap which have recently been gathered by the larger dealers have already been disposed of to early buyers who paid good prices.

Pittsburgh

May 28—In general, there has been noticed a slight falling off in new business in the past fortnight, and this is particularly marked in the past week. Specifications upon contracts, however, keep up very well indeed, and are probably as heavy as at any time. In bars, plates and shapes they are so heavy that the mills are now confident they can maintain full operation until November. Most of the mills are definitely behind in deliveries on these products, being unable to ship as promptly on new specifications as buyers would desire. In other lines specifications are not on books in as large volume, but in all of them the volume of business is good and the whole market situation is regarded as satisfactory.

The mills are deriving less benefit from week to week by reason of the advanced prices than is generally estimated. While the very lowest priced business has been worked off to an extent, there is still much low priced business under contract, while the sales at the present advanced prices have been relatively light. Some products, it must be remembered, have not advanced at all, and it is improbable that the steel mills as a whole will realize an advance of more than $1 a ton on their second-quarter shipments as compared with the first quarter.

The strongest item on the list, the one in which mills are farthest behind, is universal mill plates, merchant bars coming next, plates third, and shapes, sheets, tinplates, etc., about the middle, while tubular goods are relatively slack and wire products are almost absolutely stagnant. The wire-product market is if anything weaker than 30 days ago, and rods can be bought at a cut from $25, a price formerly well maintained.

Pig Iron—The market has been almost stagnant. There is occasional figuring on bessemer and basic iron, the Steel Corporation in particular having had some negotiations, but there are few purchases. Foundry pig iron is dead, and the situation is a curious one in that furnaces are well sold up and it would require only a slight increase in demand to send the market up several notches, since idle furnaces will not, on account of the high price of coke, get into blast except upon quite a good advance. A peculiar feature of the situation is that a great deal of foundry iron has been sold for second-half delivery at $13.50, Valley, yet with the second half only five weeks away prompt foundry iron is bringing only $13.25, Valley. We quote: Bessemer, $14.25; basic, malleable and forge, $13; No. 2 foundry, $13.25@13.50, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market is quiet. Occasional small lots, less than carloads, frequently bring well above $50, Baltimore, but carload and larger lots can be had at about that figure. For second half the regular price remains $48.50, Baltimore.

Steel—In some quarters it appears that sheet bars are a trifle easier, but this is probably only by comparison, some fictitious prices having been named in the past few weeks as representing the market. Small billets are scarce, and command, as formerly, a full dollar above 4x4 billets, while occasionally a larger premium is obtained. In one or two exceptional cases sales of small billets have been made at $23, f.o.b. mill, Pittsburgh. We continue to quote, f.o.b. maker's mill, Pittsburgh: Billets, $20.50@21; sheet bars. $21@21.50, with prices f.o.b. maker's mill, Youngstown, about 50c. less. Rods are regularly quoted at $25, Pittsburgh, but this price could be shaded about 50c. on an order at all attractive.

Sheets—The market shows no material change, and the prices of the leading interest continue to be cut, although it is booking considerable business at its minimum. We continue to quote: Black, 28 gage, 1.90@1.95c.; galvanized, 2.95@3c.; blue annealed, 10 gage, 1.40c., the higher price being that of the leading interest.

St. Louis

May 27—Business continues good in the pig-iron market; no large orders are reported this week but a number of small sales make up a large total. Southern No. 2 foundry is quoted at $11.25@11.50, Birmingham, or $15@15.25, St. Louis, the higher prices being for July or later delivery. Northern iron is in less demand and is quoted about $15 for No. 2 foundry.

The demand for finished products of all kinds continues good and local mills are busy. Coke is quoted at $5@5.10, St. Louis, for Connellsville foundry, with supplies rather short.

Iron Ore Trade

The Lake Shore, the Erie, the Pennsylvania company and the Cincinnati, Hamilton & Dayton, have filed tariffs with the Interstate Commerce Commission, fixing the unloading rates at their Lake Erie docks at 10c. per ton on iron ore. The Pennsylvania R.R., the Baltimore & Ohio and the Pittsburgh & Lake Erie have not yet filed their schedules, and they may be somewhat lower. The rate on iron ore from the ports to the Pittsburg district is fixed at 96c.; to Youngstown, 56c. per ton.

Some small sales of Spanish ore are reported on the basis of 7c. per unit, delivered to furnaces in eastern Pennsylvania.

British Iron and Steel Trade

Exports and imports of iron and steel, and of machinery, in Great Britain, four months ended Apr. 30, are valued by the Board of Trade returns as below:

	Exports	Imports	Excess
Iron and steel	£15,007,223	£3,683,797	Ex. £11,323,426
Machinery...	10,370,236	2,214,538	Ex 8,155,698
Cutlery and hardware..	4,039,416	2,654,004	Ex. 1,385,412
New ships....	1,716,933	....	Ex. 1,716,933
Total......	£31,133,808	£8,552,339	Ex. £22,581,469
Total, 1911..	29,881,007	7,898,862	Ex. 21,982,146

Increase in exports this year, £1,252,801; increase in imports, £653,477. The quantities of iron and steel were, in long tons:

	1911	1912	Changes
Exports............	1,475,674	1,574,918	I. 99,244
Imports............	445,951	459,239	I. 13,288

Tinplate exports to the United States decreased from 8369 tons in 1911 to 703 tons this year.

Metal Markets

New York, May 29—The metal markets have been generally active, with some advances in price.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Apr. 1912..	$ 1,816,816	$ 3,892,599	Imp. $2,076,783
" 1911..	1,505,634	4,524,835	Imp. 3,019,201
Year 1912..	21,774,902	16,306,794	Exp. 5,468,108
" 1911..	3,364,658	23,990,572	Imp. 20,625,914
Silver			
Apr. 1912..	4,941,259	4,189,512	Exp. 751,747
" 1911..	7,610,154	4,251,532	Exp. 3,358,622
Year 1912..	21,897,247	16,039,732	Exp. 5,857,515
" 1911..	23,611,196	14,898,313	Exp. 8,712,883

Exports from the port of New York, week ended May 25: Gold, $339,050, chiefly to Argentina; silver, $1,464,997, chiefly to London, except $366,000 direct to Bombay. Imports: Gold, $392,747; silver, $81,056, largely from Mexico.

Gold—The price of gold on the open market in London continues at the usual rate, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. With the exception of £500,000 for India, and £50,000 for Egypt, supplies arriving were taken by the Bank of England.

Iridium—This metal continues unchanged, the current price being $64 per oz. New York.

Platinum—The market is rather quiet and very little is being taken just now by the jewelers. There is apparently little or no surplus, however, and dealers continue to ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal. The market abroad is reported a little easier.

Silver—The undertone in the market continues good. Tendency will be governed a good deal by the monsoon prospects of the coming summer. The offtake at Bombay, which had risen to 140 bars per day, has now materially been reduced.

SILVER AND STERLING EXCHANGE

May	23	24	25	27	28	29
New York....	61	60¾	61⅛	61	61	61
London	28 1/16	28	28⅛	....	28⅛	28 1/16
Sterling Ex..	4.8715	4.8716	4.8720	4.8720	4.8720	4.8720

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to May 16, as reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India...	£3,457,600	£2,588,800	D. £868,800
China	822,800	630,000	D. 192,800
Total	£4,280,400	£3,218,800	D. £1,061,600

Exports of gold from Great Britain to India in April, £739,865 in 1911, and £762,160 in 1912; exports, four months ended Apr. 30, were £4,607,150 in 1911, and £7,088,315 this year.

Copper, Tin, Lead and Zinc

NEW YORK

May	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
23	16½ @16¾	16.30 @16.40	45⅝	4.20	4.07½ @4.10	6.70 @6.75	6.55 @6.60
24	16½ @16¾	16.30 @16.40	46¼	4.20	4.10 @4.12½	6.70 @6.75	6.55 @6.60
25	16½ @16¾	16.30 @16.40	46¼	4.20	4.10 @4.12½	6.70 @6.75	6.55 @6.60
27	16½ @16¾	16.35 @16.45	46⅝	4.20	4.10 @4.12½	6.70 @6.75	6.55 @6.60
28	16½ @16¾	16.45 @16.50	47⅛	4.20	4.10 @4.12½	6.70 @6.75	6.55 @6.60
29	16½ @16¾	16.50 @16.55	45½	4.20	4.10 @4.12½	6.70 @6.75	6.55 @6.60

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

May	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
23	73 13/16	74 3/16	79	204¾	200¾	16½	25⅞
24	74	74 7/16	79	208¼	201½	16 7/16	25⅞
25	......	.....	.....	......	......	......	......
27	....	....	....	....	......	....	....
28	74⅝	75⅛	79¾	214	202	16 7/16	25⅞
29	75⅝	76⅛	80¾	206½	199½	16 9/16	25⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, ± £1 = ± 21¾c.

Copper—During the week of May 23-29, the business in copper has been rather light, the holidays in Europe having suspended the demand from there, but a fair tonnage of electrolytic copper has been placed with domestic consumers. During the first three days, this was done at 16½c., delivered, usual terms, and 16.35c., cash, New York, which is the same thing. During Monday the agencies generally raised their price to 16⅝c., delivered, usual terms, and by the end of the day this was realized. On Tuesday the market was fully on that basis, and at the end of that day one of the agencies advanced its price asked to 16¾c., delivered, usual terms. Some of the sellers of Lake copper have complained of the relative slackness in the demand for that kind of metal. Some moderate sales are reported at 16⅝c., and small quantities at a little above and below that figure. Some of the sellers of electrolytic claim to have booked all their July metal. The market of this week has been chiefly in July-August, with a little running into September. Consumption continues excellent. Production has been somewhat interfered with by strikes at certain of the refineries, which probably has been a factor in the market. These now seem to have been settled. At the close, Lake copper is quoted at 16½@16¾c., and electrolytic copper in cakes, wirebars and ingots at 16.50@16.55c., while casting copper is quoted nominally at 16.20@16.30c., as an average for the week.

The London standard market has been strong and advancing. The bears have come to recognize that the intrinsic position of the metal is too strong to continue their position, and there has been considerable bear covering, in addition to which there has been renewed bull speculation. In consequence, prices have advanced, and at the close spot is quoted at £75 12s. 6d. and three months at £76 2s. 6d. per ton.

Copper sheets have been advanced to 21½@22½c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 17½c. base, carload lots at mill.

Copper exports from New York for the week were 11,205 long tons. Our special correspondent gives the exports from Baltimore at 1324 tons.

It is reported that the Katanga copper recently sold in Antwerp analyzed: Cu, 89 to 90%; Co, 4.5 to 5; Fe, 0.30 to 2; S, 0.50 per cent.

Tin—Up to Tuesday of this week, the London market ruled firm on good-sized orders which were placed from this side for June delivery. On Tuesday, spot tin in London advanced almost £6 over its close on Friday, while future tin only improved to the extent of 10s. per ton. This movement was ascribed to depleted stocks in London warehouses, and the inability, due to London dock strikes, to unload promptly arrivals from the East.

Buying in this market centered on June deliveries, while, after the rapid advance in London, a disposition among dealers was shown to sell July-August deliveries at a discount. At this writing, the London market has again declined as abruptly as it advanced, and the close is weak at £206 10s. for spot, and £199 10s. for three months.

Lead—The market is firm. New York lead is quoted at 4.20c., while lead at St. Louis is somewhat higher at 4.10@4.12½ cents.

The London market is unchanged at £16 11s. 3d. for Spanish lead, and 2s. 6d. higher for English.

Spelter—A fair tonnage of July-August metal has been turned over at an average of 6.55@6.60c., St. Louis. There has been but little demand for June delivery, but on occasional carloads of spot metal fancy premiums have been realized. Speaking generally, the market is quiet, and without special feature. St. Louis is quoted at 6.55@6.60c., and New York at 6.70@6.75 cents.

The London market for good ordinaries is quoted at £25 17s. 6d., and specials £26 2s. 6d. per ton.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7⅛c. per lb., New York, in carload lots.

Other Metals

Aluminum—Trade in New York is still rather dull at the recent advances. There are still some lots imported at low prices in second hands, but these are gradually disappearing. We quote 21½@22c. per lb. for No. 1 ingots, New York.

It is said that the aluminum convention in Europe has agreed upon £70 per long ton—equal to 15.21c. per lb.—for No. 1 ingots for 1912 delivery. This is equivalent to about 22½c. per lb., duty paid, at New York. A price of £80 for 1913 is proposed.

Antimony—Trade has been on a moderate scale but the outside brands are a little firmer. Cookson's is still held at 8c. per lb. and Halletts at 7¾c.; while Chinese, Hungarian and other outside brands are quoted at 7⅛@7¼c. per pound.

Quicksilver—The market is steady with a fair business doing and prices are unchanged. New York quotations are $41@42 per flask of 75 lb., with 60c. per lb. charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. The London price is £8 5s. per flask, with £8 quoted from second hands.

Cadmium—The latest quotations received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, four months ended Apr. 30, figures in long tons, except quicksilver, which is in pounds:

Metals	Imports	Exports	Excess	
Copper, long tons	43,455	18,506	Imp.	24,949
Copper, 1911....	50,906	26,493	Imp.	24,413
Tin, long tons....	16,485	19,165	Exp.	2,680
Tin, 1911........	14,367	16,455	Exp.	2,088
Lead, long tons.	69,006	15,880	Imp.	53,126
Lead, 1911 ...	67,404	20,972	Imp.	46,432
Spelter, l'g tons.	42,641	2,731	Imp.	39,910
Spelter, 1911....	40,956	3,352	Imp.	37,604
Quicksilver, lb...	2,342,284	806,923	Imp.	1,535,361
Quicksilver, '11	1,732,639	1,120,898	Imp.	611,741
Minor met's, tons	2,369	8,273	Exp.	5,901
Minor, 1911.....	1,809	6,684	Exp.	4,884
Ores				
Tin ore and con.	10,071	....	Imp.	10,071
Tin ore, 1911..	9,766	....	Imp.	9,766
Pyrites	311,388	....	Imp	311,388
Pyrites, 1911..	328,180	....	Imp.	328,180

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Miscellaneous metals include nickel, aluminum and the minor metals and alloys.

Zinc and Lead Ore Markets

Platteville, Wis., May 25—The highest price paid this week for zinc ore was $55; the base price, 60% zinc, was $54 per ton. The base price paid for 80% lead ore was $53 per ton.

SHIPMENTS, WEEK ENDED MAY 25

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point... ...	800,270	......	....
Galena.....	568,700	......	....
Benton........ ..	485,100	106,180	593,850
Platteville.... .	406,000	50,000	200,000
Cuba City..........	324,650	....	109,600
Hazel Green.... ..	280,000	.....	....
Harker.............	206,330	......	.....
Shullsburg......	197,000	....	....
Rewey.........	80,000	....	....
Linden....	72,040	....	....
Total....	3,420,090	156,180	903,450
Year to date..........	81,620,500	3,082,170	10,505,250

Shipped during the week to separating plants, 1,517,360 lb. zinc ore.

Joplin, Mo., May 25—The high price of zinc sulphide ore this week is $61, the base per ton of 60% zinc is $52@58. Zinc silicate sold at $27@30 per ton of 40% zinc. The average price, all grades of zinc was $54.62. The high price of

SHIPMENTS, WEEK ENDED MAY 25

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,424,830	.....	1,082,260	$153,116
Joplin........	2,495,500	......	265,280	76,771
Duenweg.....	841,900	......	......	23,573
Galena.	706,720	.....	72,230	21,628
Miami	442,080	......	178,350	15,156
Alba-Neck ..	449,430	.....	57,560	14,529
Oronogo.....	374,750	......	......	10,368
Granby	351,450	43,060	11,860	9,600
Cave Springs.	198,010	......	16,550	6,156
Aurora.......	159,970	126,210	......	5,892
Carthage.....	212,520	......	......	5,737
Carl Junction	135,240	.....	......	4,057
Spurgeon	......	198,000	12,790	3,290
Jackson......	114,250	......	......	3,084
Springfield ..	84,000	......	......	2,500
Lawton	62,410	......	......	1,747
Badger	62,980	......	......	1,574
Quapaw......	51,210	......	......	1,280
Totals.....	11,167,250	367,270	1,696,880	$360,058
5 mos......	211,970,410	12,825,680	35,206,660	$6,353,361

Blende val., the week, $309,460; 5 mos., $4,205,218
Calamine, the week, 5,538; 5 mos., 187,687
Lead value, the week, 45,060; 5 mos., 960,556

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January....	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February..	40.21	45.75	39.16	43.31	54.46	52.39
March......	39.85	51.56	38.45	49.25	54.57	54.64
April.......	38.88	52.00	37.47	50.36	56.37	54.18
May....	38.25	...	36.79	...	55.21	
June........	40.50	....	38.18	..	56.49	..
July........	40.75		38.36	....	58.81	
August	42.50		41.28	...	60.74	
September	42.63	....	41.29	.	59.33	...
October.....	42.38	.. ..	40.89	.....	54.72	
November.	45.40	.. .	43.27	.. .	57.19	
December	44.13	....	40.76	..	62.03	..
Year....	$41.45		$39.90	.....	$56.76	....

Note—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

lead ore is $56 and the average price all grades, $53.10 per ton.

The zinc-ore market shows a gain of $1 per ton over that of last week. It seemed on Thursday that the same prices were going to rule as last week, but owing to there being no surplus ore in the district prices stiffened and in order to fill orders buyers were compelled to pay a little extra for a few choice lots. The lead market also stiffened, as there was more competition this week than for several weeks past.

Chemicals

New York, May 29—The general market continues to be in a more active condition and a good deal of business is reported.

Copper Sulphate—The volume of business done has been fair. Quotations continue unchanged at $5.25 per 100 lb. for carload lots, and $5.50 per 100 lb. for smaller orders.

Nitrate of Soda—Business is rather quiet but prices continue firm, and have even advanced a little. Spot and June delivery are quoted at 2.42½c. per lb. while 2.40c. are asked for all positions after July.

Arsenic—A good demand continues, as the manufacturers of insect poisons are again in the market to some extent, while spot supplies are not any too large The current price is $3.75 per 100 lb. for white arsenic. Futures are quoted at $3.50 per 100 lb. but there is not much interest in them.

Potash Salts—Late dispatches from Vienna state that arrangements have been completed to exploit the deposits of potash salts at Kalusz in Galicia, the discovery of which was reported two years ago. A company has been formed with a capital of $2,400,000, which is backed by the Länder Bank of Vienna and the Industrial Bank of Lemberg in Galicia.

Petroleum

The total production of petroleum in Galicia in March was 94,830 metric tons.

The Philippine Bureau of Lands has made a topographical survey of the Tayabas peninsula in the Philippines, and the Division of Mines is to make a geological survey of the district to determine the probability of the existence of petroleum there. About 100 claims have been taken up in the district under the mining law.

MINING STOCKS

New York, May 29—On May 23 the Exchange was quieter and more steady, with no marked movement of prices in either direction. The Curb was more active, but mining stocks were in light demand, with few price changes.

May 24 the Exchange was quiet, with few changes and closing firm. The Curb ran chiefly to industrials, but there were fair sales of copper stocks at slight advances. Elizabeth Gold Mines, Ltd., was listed on the Curb, as a prospect. On May 25 trading was light both on the Curb and the Exchange.

May 27 the Exchange was inclined to be dull and without special features. The Curb, on the other hand, was active and interest developed in mining stocks. Trading was large in the copper shares, notably Braden, Giroux and British Columbia, which held about even in price. In the Cobalts, Nipissing declined a little, but La Rose and McKinley-Darragh gained. Motherlode gold and Gold Hill advanced on good sales.

May 28 the Exchange lapsed into dullness, with light trading and few changes. The Curb was less active than on the preceding day, but there was good selling of copper stocks. Braden and Greene-Cananea being most in demand. Cobalt shares were easier, and other mining stocks in moderate demand. On May 29 the markets simply followed the lead of the previous day.

At auction in New York, May 23, the following prices are noted: Green River Coal & Coke Co. $1000 bond, $11; 100 shares Batopilas Mining Co., $1.87½ per share; 50 shares United States Reduction & Refining Co., 2% of par value; New Jersey Zinc Co. 31 7-30400 certificate of beneficial interest, $300; lot including 300 shares Electric Lead Reduction Co.; 500 shares Montreal & Boston Mining Co.; 100 shares Ohio Tonopah Mining Co.; 100 shares Central Foundry Co. pfd. (old company); 100 shares Union Copper Mines Co.; 1200 shares Seattle Coal & Iron Co.; 25 shares Chicago Subway Co. $50 for the lot.

Boston, May 28—This market is in the doldrums and copper shares are all but neglected. True, there have been one or two specialties which have shown activity and advancing prices. Calumet & Arizona went up $4.50 to $76.50 on extra-heavy trading and Ahmeek is selling at a new high record at $320. The spurt of activity in Santa Fe, which pushed the price up from $2.50 to $4.87½, has subsided and the price is back to $3.75, with very light trading. Mayflower and Old Colony "the diamond-drill twins" have also lapsed into dullness and lower prices.

By all odds the most important event that has happened in this market for a long time is the decision rendered by the Supreme Court against A. S. Bigelow in the suit brought by the Old Dominion. It caused the price of the receipts to jump from $3.50 to $9, with no sales between the first named price and $7.50 on the Curb, where they are traded in. It is estimated that the amount of the verdict, less lawyers' fees and various other expenses, will yield anywhere from $8 to $12 per share for the 150,000 shares entitled to participate.

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Feb.	March	April
Alaska shipments.	2,662,243	4,987,916	1,243,911
Anaconda....	27,450,000	25,900,000	25,480,000
Arizona, Ltd.. ...	3,020,000	3,150,000	3,100,000
Copper Queen......	6,046,860	7,197,121	....
Calumet & Ariz....	4,452,004	4,652,000	4,104,000
Chino...............	950,000	1,108,381	....
Detroit...	2,068,370	2,246,238	....
East Butte..........	1,440,000	1,480,000	....
Mammoth..........	1,722,954	1,939,310	1,718,450
Mason Valley......	1,100,000	1,140,000	....
Nevada Con..... ..	4,888,790	6,380,000	6,115,095
Old Dominion......	2,039,000	2,432,000	2,167,000
Ray...............	2,140,000	2,300,000	2,612,500
Shannon.	1,300,000	1,388,000	1,544,000
South Utah...	283,838	299,000	284,215
United Verde*	2,250,000	2,250,000	.... ..
Utah Copper Co...	8,612,739	8,160,000	8,615,775
Lake Superior*....	19,000,000	19,750,000	18,250,000
Non-rep. mines*	7,050,000	7,291,619	8,250,000
Total production	98,476,798	104,051,585	....
Imports, bars, etc.	18,976,513	23,519,215	....
Total blister....	117,453,311	127,570,800	....
Imp. in ore & matte	10,432,438	8,736,874	....
Total	127,885,749	136,307,674	....
Miami...............	2,475,996	2,755,000	2,554,352
Brit. Col. Cos.:			
British Col. Copper	860,003	... .	... .
Granby	1,773,496	1,882,073	.....
Mexican Cos.:			
Boleo...............	2,204,720	2,424,800	2,149,280
Cananea	2,948,000	2,834,000	4,654,000
Moctezuma	2,687,712	2,446,731	....
Other Foreign:			
Cape Cop., S. Africa	786,440	725,760	954,240
Kyshtim, Russia...	1,055,000	....	1,545,000
Spassky, Russia....	649,600	638,400	649,600
Famatina, Argen..	....	....	... .
Tilt Cove, Newf'd..	109,059	104,992	119,869
Exports from:			
Chile..............	6,720,000	3,584,000	6,496,000
Australia	7,164,000	8,064,000	9,408,000
Arrivals in Europe†	10,868,680	12,559,680	12,064,640

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

Chino, January, 1,050,000.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
IV, 1911.......	118,085,223	52,407,650	62,129,599
V.	126,962,544	64,543,963	61,978,557
VI............	124,554,312	61,655,561	71,460,519
VII..........	112,167,934	56,982,582	74,880,658
VIII...... ..	125,493,667	59,935,364	69,855,660
IX.	115,588,950	57,311,584	50,824,011
X..	118,255,442	64,068,307	60,084,349
XI...	111,876,601	68,039,776	67,049,279
XII.....	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912...	119,337,753	62,343,901	80,167,904
II..........	116,035,809	56,228,368	63,148,096
III......	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326

VISIBLE STOCKS

	United States	Europe	Total
V, 1911..	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII.	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX.	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I 1912...... ..	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III .	62,939,988	141,142,400	204,082,388
IV . .	62,367,557	136,819,200	199,186,757
V .	65,066,029	134,176,000	199,242,029

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month as brought over from the preceding month.

Davis Daly was the most active Curb feature during the week, advancing to $3.12½, or almost $1. Boswyocolo and Laramie had bad times on the Curb, the former breaking from 8 to 4c., and the latter from 90 to 45c. per share.

Assessments

Company	Delinq	Sale	Amt
Alpha Con., Nev	May 29	June 19	$0.05
Andes, Nev	May 28	June 18	0.05
Best & Belcher, Nev	June 3	June 27	0.10
Black Horse, Ida	....	....	0.02
Black Jack, Utah	Feb. 5	......	0.01
Caledonia, Nev	May 21	June 11	0.10
Cedar-Talisman, Utah	Apr. 20	....	0.005
Challange, Nev	June 8	June 11	0.10
East Tintic, Utah	May 30	June 25	0.005
Ely Con., Nev	....	....	0.05
Exchequer, Nev	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Glen Dale, Utah	May 25	June 25	0.00
Houghton Copper, Mich	May 17	....	1.00
Julia, Nev	May 15	June 5	0.05
Lehi Tintic, Utah	Feb. 29	....	0.01
Lower Mammoth, Utah	Mar. 16	....	0.01
Michigan Cop. & Gold, Utah	May 15	May 30	0.002½
New York Bonanza, Utah	May 8	....	0.02
Ojibway, Mich	Jan. 10	....	1.00
Raven, Mont	Feb. 1	....	0.10½
Savage, Nev	June 4	June 26	0.105
Segregated Belcher, Nev	June 1	June 28	0.05
South Lake, Mich	June 3	....	2.00
Southwestern Miami, Ariz	Jan. 15	....	1.00
Tintic Central, Utah	June 14	July 6	0.005
Union Con., Nev	May 9	May 31	0.15
Utah Antimony, Utah	June 1	....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York 1910	New York 1911	New York 1912	London 1910	London 1911	London 1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	......	24.797	24.583	......
June	53.462	53.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24.428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	.....	25.596	24.594	......
November	55.635	55.719	...	25.680	25.649	.....
December	54.428	54.905	....	25.160	25.349	.....
Year	53.486	53.304	..	24.670	24.592	....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York Electrolytic 1911	New York Electrolytic 1912	New York Lake 1911	New York Lake 1912	London, Standard 1911	London, Standard 1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.081	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.031	70.294
May	11.989	......	12.214	..	54.313	....
June	12.385	......	12.611	....	56.365	....
July	12.163	......	12.720	....	56.673	....
August	12.405	......	12.634	..	56.266	....
September	12.201	......	12.508	..	55.253	....
October	12.189	......	12.370	....	55.170	....
November	12.616	......	12.769	....	57.253	....
December	13.552	....	13.768	.	62.068	.
Year	12.376	...	12.634	...	55.973	....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	....
February	41.614	42.962	August	43.319	..
March	40.157	42.577	September	39.755	..
April	42.185	43.923	October	41.185	..
May	43.115		November	43.125	....
June	44.696	...	December	44.675	.
			Av. Year	42.281	..

Prices are in cents per pound.

LEAD

Month	New York 1911	New York 1912	St. Louis 1911	St. Louis 1912	London 1911	London 1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	......	4.223	......	12.984	.....
June	4.435	......	4.292	......	13.260	.....
July	4.499	......	4.397	......	13.530	.....
August	4.500	......	4.406	......	14.260	......
September	4.485	.....	4.356	......	14.744	......
October	4.265	......	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	.....
December	4.450	......	4.332	......	15.648	.....
Year	4.420	......	4.286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York 1911	New York 1912	St. Louis 1911	St. Louis 1912	London 1911	London 1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.644
May	5.348	......	5.198	......	24.375	......
June	5.520	......	5.370	.....	24.612	......
July	5.695	......	5.545	......	25.006	......
August	5.953	......	5.803	......	26.801	......
September	5.869	......	5.719	.....	27.750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer 1911	Bessemer 1912	Basic 1911	Basic 1912	No. 2 Foundry 1911	No. 2 Foundry 1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	......	14.30	......	14.72	......
June	15.90	......	14.06	......	14.56	......
July	15.90	......	14.03	......	14.53	......
August	15.90	......	14.00	......	14.47	......
September	15.90	......	13.57	......	14.40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14.25	......
December	15.15	......	13.10	......	13.90	......
Year	$15.72	.....	$13.94	.....	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS May 28

Name of Comp.	Bid.
Acacia	.05⅜
Cripple Cr'k Con.	.01½
C. K. & N.	.15¼
Doctor Jack Pot.	.06⅛
Elkton Con.	.64¼
El Paso	.79⅜
Findlay	.04
Gold Dollar	.17
Gold Sovereign	‡ .01½
Isabella	.11⅜
Jack Pot	.01
Jennie Sample	.04
Lexington	‡ .01
Moon Anchor	.01
Old Gold	.03½
Mary McKinney	.69½
Pharmacist	.01½
Portland	.88½
Vindicator	.78
Work	.01

SALT LAKE May 28

Name of Comp.	Bid.
Beck Tunnel	11
Black Jack	‡ 18½
Cedar Talisman	02
Colorado Mining	.18½
Columbus Con.	‡ 14
Crown Point	03
Daly-Judge	‡6.35
Grand Central	.74
Iron Blossom	1.20
Little Bell	‡ .40
Lower Mammoth	02
Mason Valley	11.50
May Day	08
Nevada Hills	1.95
New York	‡ 04½
Prince Con	1.52½
Silver King Coal'n	2.27½
Sioux Con.	‡ 05
Uncle Sam	19
Yankee	‡ 10

TORONTO May 28

Name of Comp.	Bid	Name of Comp.	Bid
Conlagas	‡6.90	Hollinger	10.75
Hudson Bay	‡70.00	Imperial	03
Temiskaming	39	Pearl Lake	16
Wettlaufer-Lor	60	Porcu. Gold.	‡ 11
Apex	03	Porcu. Tisdale	01
Central	‡5.56	Preston E. D.	05
Crown Chartered	16	Rea	30
Doble	25	Standard	‡ 04
Dome Exten.	33	Swastika	18
Foley O'Brien	20	West Dome	16

SAN FRANCISCO May 28

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.10	Belmont	10.00
Belcher	.59	Jim Butler	56
Best & Belcher	.05	MacNamara	.18
Caledonia	1.30	Midway	.59
Challenge Con	.11	Mont.-Tonopah	2.82½
Chollar	.05	North Star	.19
Confidence	.65	West End Con.	2.17½
Con. Virginia	.83	Atlanta	.26
Crown Point	.61	Booth	.10
Gould & Curry	05	C.O.D. Con	.09
Hale & Norcross	20	Comb. Frac.	.17
Mexican	2.85	Jumbo Extension	.40
Occidental	55	Pitts.-Silver Peak	1.25
Ophir	1.30	Silver Pick	.13
Overman	1.00	St. Ives	.30
Potosi	.06	Tramp Con.	‡ 01
Savage	17	Argonaut	2.00
Sierra Nevada	.23	Bunker Hill	‡4.50
Union Con	.95	Cent. Eureka	.72
Yellow Jacket	.60	So. Eureka	3.00

N. Y. EXCH. May 28

Name of Comp.	Clg.
Amalgamated	82¼
Am. Agri. Chem.	62
Am.Sm.&Ref.,com	85½
Am. Sm. & Ref., pf.	107⅛
Am. Sm. Sec., pf. B	88½
Anaconda	42⅝
Batopilas Min.	1¾
BethlehemSteelpf	70¾
Chino	30
Comstock Tunnel	‡.10
Federal M. & S., pf.	42
Goldfield Con.	4¼
GreatNor.,ore.,ctf.	42
Homestake	93
Inspiration Con.	19
Miami Copper	26¼
Nat'nalLead,com.	58⅝
National Lead, pf.	107
Nev. Consol.	21⅞
Pittsburg Coal, pf.	92
Ray Con	18⅞
RepublicI&S,com.	23⅜
Republic I & S, pf.	78
SlossSheffi'd,com.	49
Sloss Sheffield, pf.	90
Tennessee Copper	45¼
Utah Copper	62⅛
U. S. Steel, com	69⅞
U. S. Steel, pf.	110¾
Va. Car. Chem.	51½

N. Y. CURB May 28

Name of Comp.	Clg.
Barnes King	.30
Beaver Con	.46
Braden Copper	5½
B. C. Copper	5⅛
Buffalo Mines	‡1¼
Caledonia	¾
Con. Ariz. Sm.	¾
Davis-Daly	2 3/16
Diam'field-Daisy	14
Ely Con	¼
Florence	1⅜
Giroux	5¾
Gold Hill Con.	
Greene Cananea	9¾
Greenwater	07
Guggen. Exp.	223
Internat S. & R.	124
Kerr Lake	2¾
Keystone	3
La Rose	3⅜
McKinley-Dar-Sa.	1 11/16
Min. Co. of A. new	3
Motherlode Gold.	13/16
Nev. Utah M. & S.	05
Nipissing Mines	7¾
Ohio Copper	1 11/16
Pacific Sm. & M.	3/16
Ray Central	2⅜
South Live Oak	3⅜
South Utah M. & S.	⅞
Standard Oil (Old)	880
Stand'd Oil of N.J.	382
Stand'd Oil Subs.	490
Stewart	1⅜
Tonopah	7 1/16
Tonopah Ex	2 3/32
Tri-Bullion	⅛
Tularosa	½
Union Mines	3/16
United Cop., pfd.	10
Yukon Gold	3⅜

LONDON May 29

Name of Com.	Clg.
Camp Bird	£1 9s 3d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 10 0
Mexico Mines	7 0 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 3 9

BOSTON EXCH. May 28

Name of Comp.	Clg.
Adventure	8¾
Ahmeek	320
Algomah	7
Allouez	44½
Am. Zinc	29
Ariz. Com., ctfs.	5⅞
Bonanza	40
Boston & Corbin	8⅛
Butte & Balak	4⅛
Calumet & Ariz	76
Calumet & Hecla	490
Centennial	24
Con. Mercur	.05
Copper Range	58½
Daly West	5½
East Butte	13⅝
Franklin	12¼
Granby	54½
Hancock	34
Hedley Gold	17
Helvetia	‡1⅜
Indiana	19¾
Island Cr'k, com.	54¾
Island Cr'k, pfd.	90
Isle Royale	28⅛
Keweenaw	2
Lake	38¾
La Salle	6⅛
Mass	7¼
Michigan	3
Mohawk	63
New Arcadian	4⅛
New Idria Quick.	6⅞
North Butte	29
North Lake	6¼
Ojibway	4½
Old Dominion	57¼
Osceola	119
Quincy	88
Shannon	15¼
Shattuck-Ariz.	22
Superior	34
Superior & Best.	2¼
Tamarack	42
Trinity	6⅛
Tuolumne	3⅝
U. S. Smelting	38⅛
U. S. Smelt'g. pf.	48⅞
Utah Apex	2½
Utah Con	12¾
Victoria	4
Winona	6
Wolverine	109
Wyandot	2⅛

BOSTON CURB May 28

Name of Comp.	Last
Bingham Mines	2¼
Boston Ely	1½
Boswyocolo	04½
Butte Central	6½
Cactus	12
Calaveras	2¼
Chief Cons	1⅝
Corbin	2¼
Cortez	1⅛
Crown Reserve	3⅛
First Nat. Cop.	2⅛
Majestic	52
Mazatan	‡ 60
Moneta Pore	‡ 11
Nevada-Douglas.	4⅛
New Baltic	3
Oneco	3
Raven Copper	35
Rhode IslandCoal	35
San Antonio	‡3
S. W. Miami	8½
South Lake	7½
Trethewey	‡1½
United Verde Ext.	.35
Vulture	‡5.00

‡Last quotation.

Issued Weekly by the
Hill Publishing Company
John A. Hill, Pres. Rob't McKean, Secy.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N. W. 7.

Walter Renton Ingalls, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page
Editorials:
  Mining Low Grade Ore During High Prices. 1115
  Lake Superior Iron Ranges................ 1116
  Tharsis Dividends........................ 1116
By the Way.... 1117
Mining in Colorado...... . .William Weston 1118
Correspondence and Discussion:
  Why Mining Languishes ..History of the Cyanide Process.. . Vertical vs. Inclined Shafts... The Pattinson Desilverizing Process . .Separating Blende from Barite.... Pyrite Mines of the World 1119
*Feeders for Belt Conveyors Colby M. Avery 1121
Sir Julius Wernher. 1122
The Rand's New Metallurgy 1123
California Oil Gushers . . 1124
Tonopah-Belmont D 1124
April Operations at Goldfield Consolidated.... 1124
Operations at Chino Continue despite Labor Trouble........ 1124
Details of Practical Mining:
  *Surveyor's Backlight Sconce ...Air Compressor Lubrication Surveying a Raise Connection with Transit .. *A Copper Range Car *Cartridges for Tamping Dynamite . Drying Air in a Mine Telephone *Joint for Drift Timbers Subject to Side Pressure Long Core Barrels for Vertical Boreholes *Pipe Flanges without Gasket *Calculating a Crossover Switch 1125
Details of Metallurgical Practice:
  *Wilfley Tables Kinks Detinning in Alkaline Solution An Adjustable Drafting Board .Grooved Idlers for Flanged Conveyor Belts.. .. 1129
The Cost of Doing Things 1131
Cyaniding at Nova Scotia Mill C. L. Hargreave 1133
*A New Mine Trolley Car 1134
*The Dobbins Core Drill 1135
Yerington District, Nevada . . 1135
A Discussion of Radio-Chemistry. Harry C. Jones 1137
Migration of Miners and Accidents on the Rand .... . A. W. Rogers 1141
Rapid Methods for Proximate Analyses . . 1143
*The Miami Zinc-Lead District, Oklahoma . 1146
Personal, Obituary and Societies 1148
Editorial Correspondence . . 1149
Mining News....... . 1151
Markets 1157
*Illustrated.

The Engineering and Mining Journal

Vol. 93. JUNE 8, 1912. No. 23

Mining Low-Grade Ore during Periods of High Price

It is not uncommon to hear reference made to low-grade ore reserves that will pay to mine during periods of high metal prices, particularly in the case of copper ores. In fact this is not a safe generalization; the advisability of such procedure will depend entirely upon circumstances. For example: Let us assume that a certain copper mine has an assured life of 10 years, producing 360,000 tons of ore per year, which is the maximum capacity; that the normal grade of the ore returns a net yield of 27 lb. copper per ton; also that in one part of the mine there are 360,000 tons of ore that will yield 21.3 lb. copper per ton, and that it is not necessary to mine this ore in connection with ore running 27 pounds.

We will suppose that the production cost is as follows: Mining, $1; transportation, 10c., and milling 60c. per ton, or a total of $1.70 per ton at the mine. For the cost of smelting, refining, marketing and depreciation, we will allow 4c. per lb. of copper.

We will assume (merely for the purpose of the present article) that the normal price is 14.3c., which will make the average profit from the reserves of better-grade ore $338,000 per annum; the cost of copper produced from the 27-lb. ore will be 10.3c. por lb. on the above cost basis. Allowing the same costs for producing copper from the 21.3-lb. ore, we will have a cost of 8c. per lb. at the mine and 4c. for smelting, etc., which will give a total cost of 12c. for producing copper from the 21.3-lb. ore. The profit on this ore will be $176,364, under average conditions.

The total life of the mine is 11 years, therefore the future life of the mine after operating one year will be 10 years, viz., by working the low-grade ore the first year, the reserves will be sufficient to supply 27-lb. ore for 10 years. If the 27-lb. ore is mined the first year, the reserves will contain nine years of supply of 27-lb. ore, and one year's supply of 21.3-lb. ore. Now let us assume that during the first year of the 11 years of production at this mine, copper averages 18c. per lb., but that thereafter the average will be 14.3c. up to the time the last of the ore is mined.

During high prices for metal there usually is an increase in the cost of production, due to higher wages and cost of supplies, but for the sake of argument, we will say that the costs are the same as during the low periods. On an 18c. copper market the profits then will be: On the 27-lb. ore, 7.7c. per lb. of copper; $2.079 per ton of ore, or $748,440 per year. On this 21.3-lb. ore there is a profit of 6c. per lb. of copper; $1.278 per ton of ore, or $460,008 per year.

If the 21.3-lb. ore is mined during the 18c. copper market, the operating profits for the year will be $460,008. Based on the future life of the mine, 10 years, this money should itself earn $289,345 at 5% compound interest up to the time the mine is exhausted, either for the company, by reinvestments, or for the stockholders themselves if paid out in dividends. By working this ore, 360,000 tons of 27-lb. ore is kept in reserve, which will be mined in 10 years under normal conditions. The present value of this ore is $338,000 deferred 10 years at 5%, or $207,198. The total credits from working the low-grade ore are $956,851.

If the 27-lb. ore is mined during the 18c. copper market the operating profits for the year will be $748,440, which, in 10 years, should earn $470,768 at 5% compound interest. By working the 27-lb. ore, 360,000 tons of 21.3-lb. ore will be in reserve, which will be mined in 10 years at 14.3c. copper. The present value of this ore is $176,364, deferred 10 years at 5%, or $108,000. The total credits amount to $1,372,208 at the end of the year by working the 27-lb. ore.

It will be seen by this, that a balance of $370,357 is shown in favor of working the high-grade ore. While this problem could probably be expressed in a better way, it is plain to see that it would be more profitable to mine the best grade of ore possible at all times, and especially during high metal prices. It is evident that the principal value of low-grade ores lies in the possibility of working them, at prices sufficient to yield a profit, after the high-grade ore reserves are no longer sufficient to maintain the desired output. The conditions assumed in this case are, no doubt, extraordinary, but they serve to bring out the point of the discussion better than to assume ordinary working facts.

J. R. Finlay, in his "Cost of Mining," makes the statement: "That a mining property being an asset in process of liquidation, the more rapidly (other things being equal) that asset is distributed and the business wound up, the greater the present value." In other words, it may be said that the ore in a mine does not increase or earn any additional profit itself, but when converted into money becomes active and earns a profit itself. This means that it is most profitable to mine the best ore first.

Lake Superior Iron Ranges

During the last year, public attention, to a greater extent, perhaps, than ever before, has been directed toward the Lake Superior iron ranges and their resources. This has been due to several causes. The Congressional investigation into the affairs of the U. S. Steel Corporation and the latter's announcement of its intention to cancel its leases of ore lands owned by the Hill interests, were chiefly responsible for the publicity given to the situation as regards the future supplies of Mesabi ore. In Michigan, the State Tax Commission caused to be made, last summer, an expert appraisal of mines, which was published at length in the JOURNAL. This appraisal was more complete in certain phases than any other public document yet published regarding Michigan iron mines. In addition to these, the State Geological Survey of Michigan is preparing a volume which is expected to bring the situation up to a recent date, especially as regards the practical results of recent private exploratory work. Some of the advanced sheets of this work have already appeared. Through these agencies unusual publicity has been given to a large amount of material, which otherwise perhaps would never have reached the public.

The sum and substance of this seems to point to the end of profitable openpit mining of high-grade ores on the Mesabi Range within about 50 years. During this time underground mining may be expected to increase rapidly, with its attendant disadvantages and higher costs, as compared to steam-shovel methods. It seems to be the belief of many iron men that the Hill lands have been overestimated, both as to tonnage and quality of ore. It is safe to say that the reserves of the Mesabi Range are not being increased by leaps and bounds, and that the average grade of the ores mined therefrom will not increase as time goes on.

The Michigan ranges offer a remarkable contrast. This is more interesting in view of the fact that Lake Superior iron was first mined in Michigan about 60 years ago. From small beginnings, mining there continued to grow to good proportions, until it was suddenly overshadowed by the more spectacular discoveries in Minnesota. The Michigan ranges have not lost ground, however; not only have they held their own, but they have made distinct advances. It appears now that as regards reserves and grade of ore, the Michigan mines have never been in as good condition as they are today. The prospects for more ore are particularly good. In many of the districts, the limits of the ore area are being extended both horizontally and as to depth, with maintenance of grade. As a field for iron-ore exploration, the Michigan ranges occupy an attractive position, and the state bids fair to regain the position it once held as a producer of iron ore.

Tharsis Dividends

The annual reports of the Tharsis Sulphur and Copper Co. are interesting as the record of a successful mining company extending through a good many years. This company paid its first dividend during the year ended Apr. 30, 1868, and since that time in only two years has it failed to pay a dividend. The actual gross profits up to the end of 1911 were £13,462,095. We judge this to represent what we ordinarily call the operating profit, and the figure is subject to the deduction of £1,348,768 for the cost of administration, and taxes, and the loss through bad debts, etc. A further large sum out of the gross profits has gone into the replacement of plant. When a company has been in operation for about 45 years, there can no longer be any illusions respecting what is or is not depreciation. The result is that out of the gross profits of £13,462,095 the actual net profits were £9,544,550, substantially all of which has been paid out in dividends. After all, the payment of dividends is the best measure of what a mining company is really making, although the passage of a period of years may be necessary to determine this.

The copper market this week seems actually to have run away, the operations for the rise in London having been unbridled and our market having naturally followed. This was the result of the large decrease in the report of European stocks at the beginning of June and the strong belief that the American figures will also show a decrease. The increased production of the smelters seems literally to have vanished, to where no one can say. Some persons are beginning to persuade themselves that there is no increase, arguing that the statistics are wrong. This implies equivocation on the part of the 10 or 20 smelters, who regularly make reports, errors in the government returns, etc., and no sensible persons will take any stock in such arguments. The price for copper is higher than it ought to be, and the penalty will, of course, have to be paid.

An interesting exploration venture has been organized on a large scale by some prominent Canadian and American capitalists, who have created the Canadian Mining & Exploration Co., Ltd., with an "endowment" of $2,500,000. The income from this fund will be used for investigating promising prospects. When desirable properties are found, the development of these prospects will be taken by a corps of competent engineers. Such a plan is followed in a general way by many large mining corporations, but this is one of the few instances where the income from a certain sum is definitely set aside for intelligent exploration.

By the Way

In a recent list of mining and metallurgical patents published in one of our exchanges we note: "A method for firing submarine mines." We presume that this refers to mines that labor under a burden of watered stock.

Actors, statesmen and others in the public eye have been "honored" by having a favorite brand of cigar named after them, but we believe that the recently marketed "Tungsten" cigar is the first case of recognition of the noble or base metals in this way. We presume it "lights" well.

"As to Prospecting," there is Gold in Pennsylvania and in Texas, Silver in Montana, Michigan, Minnesota, Arkansas, South Carolina and Texas, Zinc in Arkansas and a new town in the Cuyuna iron district in Minnesota is called Manganese. Ontario has its Cobalt and the Postal authorities find it also in Connecticut. There are "Cobre" (copper) galore in the Southwest and in Mexico, but no Copper in the United States. Antimony is in Arkansas, and in South Dakota is what seems to be Lead, but isn't. Mercury is rightly in Texas and Uranium in Colorado. There is Radium in Virginia, Minnesota, Kansas, and in Colorado where it really occurs in considerable quantity.

Salt Lake City has long been recognized as a mining and smelting center, being surrounded by the camps of Bingham, Alta, Tintic, Mercur, Ophir, Stockton, Park City, etc. However, it is of interest to call attention to the amount and value of the metals produced close to the city, i.e., within an airline radius of 25 miles. As shown by statistics collected by the National Copper Bank, there was produced in Salt Lake County and those counties immediately contiguous to it, gold, silver, copper, lead and zinc, valued at $29,881,500 during the year 1911. This is nearly as much as the entire metal output of Colorado. If the radius is increased to 50 miles, the value of the metal production totals approximately $2,000,000 more than that for Colorado. Thirteen per cent. of the copper of the United States, including Alaska, is produced within 20 miles of Salt Lake City, and 51.2% of the developed or partially developed porphyry copper ores are within this radius.

One of the largest and most comprehensive relief maps ever constructed, has just been completed by F. A. Linforth and E. B. Milburn, of the geological department of the Anaconda Copper Mining Co., assisted by A. Grimes and P. Billingsley, of the same office. It consists of a papier-maché relief map of the State of Montana, 14 ft. long and 7 ft. wide, colored to represent the different vicinities, the names of which are printed on the surface, and made to an accurate scale of about 4 miles to the inch, for both distances and elevations. On it are shown the railroads, rivers, lakes, valleys, mountains, cities and all of the developed and undeveloped water-power sites in every section of the state. The map was designed for the Butte Electric & Power Co., to show in an accurate and condensed form, the electric-power plants and network of electric lines traversing the state. Miniature poles and wires are placed on the map, showing the different routes. It is a perfect topographical representation of the state, and after it has been on exhibition in the windows of the electric company's office for a short time, it will be placed in a glass frame and kept in the drafting room for reference.

We have previously noted in our columns that the state of South Australia gives aid to prospectors. The method seems scarcely as hazardous as grubstaking, since it consists in giving help where a prospect has already been discovered, which seems promising. Up to date, however, the state has aided 110 individuals and corporations with sums ranging from £10 to £3995, amounting in all to £55,237. Of those so aided, two made sufficient profits to repay the advances and the machinery of five sufficed to pay their debts. Eighteen more made partial repayments, amounting to £1376. The remaining 85 received. Notwithstanding that only £6111 were returned out of £55,237 loaned, the state report comments cheerfully as follows: "A portion of this outstanding debt is represented by machinery which has fallen into the hands of the government; add to this the value of the metals won, and the state in general will probably have benefited beyond the money value of the debit balance."

A new exploration company has been organized on somewhat novel lines by Ambrose Monell, president of the International Nickel Co. and also of the Dome Mines, Ltd. The new company will be known as the Canadian Mining & Exploration Co., Ltd., and will have a nominal capital of $5,000,000 divided into shares of $5000 par. Of this capital, one-half will be paid in, this amount having already been subscribed. This $2,500,000 will constitute an "endowment fund" which is to be invested in standard securities, and the income, only, used for the purposes of exploration. When suitable properties are found, the subscribers to this $2,500,000 fund will be invited to participate proportionately in syndicates to be formed for the development of such properties. For this privilege the subscribers waive interest on whatever amounts they have contributed to the fund. The engineering work will be done by a staff under the direction of William Mein, now consulting engineer of the Dome Mines, Ltd. Properties will be examined and if found desirable, capital will be furnished under the plan described. Although the company is chartered in Canada, it will be international in scope and will undertake operations anywhere if satisfactory profit can be shown. Offices will be established for the present in New York, Toronto and Victoria, B. C. Mr. Monell will act as president without salary. The exploration company is the outcome of the success of the so called Monell syndicate in the acquisition of the Dome mine at Porcupine. A number of prominent Canadians have been interested in the new venture, in addition to those who were associated with Mr. Monell in the first operation. The Americans on the directorate include such men as William E. Corey, E. C. Converse, P. A. Rockefeller, A. H. Wiggin, T. L. Chadbourne, Jr.; J. R. DeLamar, Ambrose Monell, C. H. Sabin, R. M. Thompson and C. L. Denison. The Canadian directors include Sir E. B. Osler, Sir Edmund Walker, Sir Edward Clouston, Sir William Mackenzie, H. S. Holt, Duncan Coulson, D. Lorne McGibbon, Wallace Nesbitt, K. C.; David Fasken, K. C., and P. J. McIntosh. The executive committee will consist of Messrs, McGibbon, Nesbitt, Converse, Rockefeller, De Lamar, Monell and Sabin.

It seems odd to find financial writers in London and Paris commending highly a law enacted in Kansas, U. S. A., says the *Evening Post*. The law approved of is one to make venders of securities responsible for their wares, and check the stock swindler in his work. There is much writing to the same purpose abroad, in which get-rich-quick promoters are called stock thieves. In Paris their industry has been carried so far that a special court has been provided to deal with financial swindlers and frauds. Besides that, an educational campaign is being conducted, both in France and Great Britain, to protect the unwary from the wiles of those who would separate them from their savings. The least this country could do, perhaps, was to furnish a legal pattern, even though it came from Kansas, for the American swindler has preyed upon the French investor as upon no other class of foreigners. The mining scheme is the best bait. Reams and reams of worthless mining stocks have been sold to the French investor, sometimes direct, but more often with the connivance of little French bankers, who get what is called a "rake-off." In some cases the venders, having widely distributed a worthless stock, have had the moral hardihood to assess it, taking a second toll of the credulous. There is no doubt respecting the existence of the evil, but we have doubt about the "blue sky" law of Kansas as a remedy.

Chronology of Mining for May, 1912

May 1—Giroux Consolidated Mines Co. began ore shipments to the Steptoe Valley works.—Workmen struck at the Murray plant of the American Smelting & Refining Co. at Murray, Utah.

May 6—The Eureka & Palisade R.R. resumed operation in Nevada.

May 10—First lot of electrically smelted pig iron shipped from California to Salt Lake City.

May 13—Strike of workmen at Baltimore Copper Smelting & Rolling Co., at Baltimore.—Cave-in at Norrie iron mine in Michigan killed seven men.

May 15—First blister copper made at Hayden plant of American Smelting & Refining Company.

May 16—Government filed suit against the Aluminum Co. of America, to restrain it from illegal practices.

May 23—Fire destroyed the stamp mill of the San Miguel Mining Co., under lease to the Junta mine in the Telluride district, Colorado.

May 20—Ore-washing plant of the Wisconsin Steel Co. started operations at Nashwauk, Minnesota.

May Mining Dividends

May seems to be a lean month for mining dividends. The totals reported last month were only $1,263,015 for U. S. mining companies, $9,574,642 for metallurgical, coal and holding companies, and $468,440 for Canadian and Mexican mining companies. This, however, compares favorably with May, 1911, when the amounts reported were: U. S. mining companies, $569,677; metallurgical, coal and holding, $8,682,158; and Canadian and Mexican, $528,353.

Miami enters the list of dividend payers with a 10% declaration, the first of the Arizona "porphyries" to begin payments. Amalgamated at last fulfilled the prophecies of its adherents, and doubled its dividend. Success and Wasp No. 2 increased their dividends, as did Alaska Mexican and Alaska United.

Among the foreign companies, Standard Silver-Lead, which paid its first dividend in April, made an increased distribution in May, but this was not sufficient to overcome the cut in Coniagas in making up the general foreign total.

Mining dividends (United States companies making public reports) for the first five months of the year amount to $22,047,305, and mining, metallurgical and allied companies in North America, $66,304,108.

United States Mining Companies	Situation	Per Share	Total
Alaska Mexican, g	Alas..	$0.20	36,000
Alaska Treadwell, g	Alas..	0.75	150,000
Alaska United, g. ..	Alas..	0.54	90,100
Arizona, pfd. B., c	Ariz..		53,842
Bunker Hill & Sull., l. s	Ida	0.15	65,400
Bunker Hill Con., g.	Calif	0.15	15,000
Champion, c.....	Mich.	1.00	100,000
Elkton, g......	Colo	0.01	25,000
Fremont, g	Calif..	0.02	4,000
Frontier, z	Wis...	2.00	2,500
Golden Cycle, g. ..	Colo.	0.02	30,000
Hecla, l	Ida	0.02	20,000
Homestake, g. ..	S. D..	0.50	109,200
Knob Hill, g	Wash..	0.00½	5,000
Miami, c..	Ariz...	0.50	332,496
Parrot, c..	Mont..	0.15	34,477
Success, z	Ida	0.02	30,000
Utah Con., c	Utah	0.50	150,000
Wasp No. 2, g	S. D.	0.02	10,000

Coal, Iron, Industrial and Holding Companies	Situation	Per Share	Total
Anaconda, c	Mon	1.00	1,538,880
Cambria Steel	Penn	0.62½	562,500
International Nickel	U. S.	1.50	133,689
Lehigh Coal & Nav.	Penn	1.00	182,936
National Carbon	U. S.	1.75	78,750
[illegible]	Penn.	2.50	113,500
[illegible]	U. S.	1.75	6,301,919
[illegible] L. & S.	U. S..	0.10	59,468

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
[illegible]	[illegible]	0.03	[illegible]
[illegible]	Ont	0.03	30,000
[illegible]	Ont	0.30	240,000
[illegible]	Ont	0.05	88,110
[illegible]	B. C.	0.02½	50,000

Mining in Colorado

By William Weston*

That Colorado is on the verge of a great mining era, may now be asserted without fear of contradiction; but it were idle to make such a statement without evidence to prove it, and here it is. In the first place in Denver alone, the banks have more money in their vaults than ever before, its saving deposits being upwards of $70,000,000. The pockets of capitalists have been buttoned up now for four years, with an entire absence of speculative investment, and as everyone knows, there is a limit to the idleness of capital, and it has been reached. The price of silver, zinc and tungsten has gone up, and within a year, the mining of uranium and vanadium ores has become an important industry.

The deep drainage tunnel of the Cripple Creek mines and the Newhouse tunnel in the Central City district, have rendered available more than 700 ft. in depth of ore area over at least four square miles in each. In the former this was accomplished by simple unwatering, and in the latter by the same process, together with the facility offered of overhead working, and haulage to the surface instead of hoisting, with, of course, the elimination of the great cost of pumping in both. Then we have the absolute knowledge that by new metallurgical methods, ores of a value of say $3 to $5 are being treated at a profit in Cripple Creek, this statement being backed by the incontrovertible evidence of big dividends. This knowledge has spread to the other camps of the state, and the result of all the foregoing is, that more deep drainage and transportation tunnels are being driven and more mills are being built than ever before in the history of the state, and as has been chronicled in the JOURNAL, mines idle for 10 to 20 years are being reopened to get at ores which were left as of no value, but which it will now pay to extract. Then we have proof that the La Plata district, near Durango, and the Gold Brick and Quartz Creek districts, near Pitkin, in Gunnison County, are coming into prominence as producers of both noble and base metals.

Owing to the unusual moisture that our lands have had, it promises to be one of the most successful farming and fruit years in the history of the state, and though this is foreign to the purpose of a mining journal, it should be remembered that when people are making money in these and other lines, those speculatively inclined naturally turn to mining, which is still the leading, and the most attractive industry of the state.

That the railroads realize the truth of all the foregoing is evidenced by the large steel orders given by the Rock Island, Rio Grande, Santa Fé and Hill lines to the Minnequa plant, at Pueblo, which is running day and night with full force in its endeavors to catch up with these heavy demands on its capacity.

Let us not forget too that coal has been the great factor in creating strength of nations and of states, and that in Routt County, Colorado, are 1200 square miles of fine bituminous coal, of an aggregate workable thickness of 50 ft., as yet practically undeveloped and without adequate transportation facilities to make it available for the use of the people of the states west of the Missouri River, who badly need it, and who must soon have it. All this seems to be sufficient evidence to prove the truth of the statement that we are on the verge of a great mining revival in Colorado.

Zest has also been added to the mining game here by the late big strike in the Florence of Goldfield, Nev., which is owned by two Denver men and has made millionaires of them. The stock is reported to have gone from 67c. to $1.20 in one day on the San Francisco market. According to a telegram received by A. D. Parker, the chief owner here, a streak of ore in the vein runs as high as $5000 per ton, and it is such occurrences as these which direct attention to the possibilities of making great fortunes and arouse the spirit of speculative investment.

Peculiar Louisiana Oil

The oil from the well recently drilled by the Myles Mineral Co. at Pine Prairie, La., is remarkable, according to an analysis made by the U. S. Geological Survey, in that it contains no asphalt, gasoline, or paraffin wax. The crude product contains a large percentage of illuminating oil. In composition the oil stands about halfway between the oil of the Gulf and that of the Caddo field.

---

*935 Gas and Electric Building, Denver, Colo.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Why Mining Languishes

In an editorial in the JOURNAL of May 25, 1912, among reasons why mining languishes, the unjustifiable price put on property by mine owners is suggested.

It is questionable whether the owner is often responsible for the price at which the property is offered. My impression is that a great majority of properties come to the would-be purchaser through one or more "go-betweens," or promoters. Men who operate on a large scale know the principal exploration companies looking for developed mines. Few, however, are the properties offered by such operators. More frequently an interest in a promising prospect is purchased from the locator by some dealer in general merchandise or by a saloon keeper, who then furnishes funds to develop the property until it may be called a mine, and this is the man who attempts the sale. Such a man knows no exploration company, but meets the usual mining shark, who frequents promising mining camps. The latter has a friend in the East who presents the property to the exploration company, if, fortunately, it does not go through more hands. Now if the prospector and his partner agree on a price of $100,000, which likely is a reasonable one, and if the partner is honest, the property probably goes to the friend in the East at $150,000, and the price at which it is offered is $200,000. Often the store keeper wants a "rake-off" and adds $25,000 for himself, and the final price to the exploration company is raised to $225,000, or even more, depending upon the number of hands that it goes through.

A mine which, during development, has shipped $200,000 and had considerable ore remaining, was offered in Denver a few years ago for $2,000,000. The simple reading of the report showed that the property was not worth the money. A few years afterward, in conversation with one of the owners, it was learned that the price made by them was $500,000, at which figure an examination on the ground was justified.

Sometimes promoters learn by experience, and there are now some good men who actually visit properties themselves and know what they are offering, who act for a 10% commission. Such men are bound eventually to build up a good business, for those engineers who have spent time and money looking at so called million-dollar properties, which have dwindled on examination to "A hole in the ground owned by a liar," are glad to send clients who may be looking for a property to a reliable promoter.

Other conditions also enter into the question of purchase. Thus, in the last report of the Tonopah Mining Co., its engineer states that "Certain kinds of mines are eliminated because they are outside of the class in which the Tonopah Mining Co. feels that, by experience and equipment, it can rank as a specialist." One of the properties referred to in the report quoted in the editorial was examined and not purchased, but has since been acquired by another company so situated that it can handle the ore more cheaply and advantageously.

GEORGE A. PACKARD.

Butte, Mont., May 29, 1912.

History of the Cyanide Process

I may call attention to one or two manifest errors of dates in the obituary of the late H. Forbes Julian in the JOURNAL of Apr. 27. You say that in 1887, as consulting engineer of the Johannesburg Pioneer Company he erected a cyanide plant and in 1888 he erected a better one at the Roodepoort United Main Reef. It is a well known fact that the first plant to treat ore commercially was at the Crown Mines of New Zealand at Karangahake in 1889. In 1890 the Cassell Gold Extracting Co. erected the first Transvaal plant at the Salisbury battery. This was an experimental one, the good results at which lead next to the erection of a larger commercial plant at the Robinson mine, for which see J. E. Clennell's "Cyanide Handbook," p. 30. The date of the MacArthur-Forrest British patent was July 16, 1888, following a provisional specification lodged Oct. 19, 1887. The granting of this patent was held up for want of a suitable precipitant and on filing specification covering the use of "filiform" zinc on July 14, 1888, the objections of the British patent office were overcome and the patent granted. Two American patents were granted under date of May 14 and Dec. 24, 1889, referring to solution and precipitation respectively. Mr. Clennell in his book, I may say in passing, has been uncharitable enough to refer to my own action in securing a caveat, as "alleged." In fact the records of the patent office will show that I took out a caveat in May, 1886, through my father, being a minor at the time. There was much good fortune attached to my own discovery, but youth and other things prevented my bringing the matter to a successful termination. In attempting to secure capital and assistance in putting it into practice I met with so many rebuffs that I began to doubt its efficiency. Few men could have done as well technically as J. S. MacArthur and it has always been a source of satisfaction to me that a man of his character and integrity should have reaped the rewards that I failed to receive.

LOUIS JANIN, JR.

California, May 3, 1912.

Vertical vs. Inclined Shafts

Referring to the abstract on the above subject (ENG. AND MIN. JOURN., May 18, 1912, p. 985), I would call attention to the danger of misleading many small operators into a disastrous choice of one or the other of the methods, because of lack of explicitness in applying the arguments as advanced for one or the other systems.

I have found that these little items and discussions form a textbook and manual to many prospectors and small miners, and have met with instances wherein the course chosen was the direct cause of failure and loss to those who were putting their labor and money into an operation.

Among the axioms of the practical Western engineer will be found this: "Stay with your ore." This is with reference to prospecting, and especially in developing a new district. Many are the instances in which a vertical shaft well equipped and carefully excavated, has been sunk and sunk till the funds were about exhausted, a crosscut driven on an emergency decision and, if the lode or vein is reached before the final exhaustion of the funds, only to find it in a barren section. After this there is little on which to base a call for additional funds with which to conclude the proper testing by drifting on the lode, which may later, when worked by new people, disclose the ore. The original operators are out their money and labor.

Had the lode been followed by an incline, the ore, its character and quality and much additional information, would have been acquired. The location of the orebodies would have been determined; this, together with the most economical surface arrangement, would determine the location of the main working shaft, which may be vertical or inclined, as business conditions may determine. Such a working shaft may then be raised much more economically than sunk, the water will not hinder and the job can be best done in every respect, and in most of the states, will be in compliance with the laws requiring two openings, and even without such law will be good practice. The foundation has been laid for such a shaft, and the ore will show for and justify the necessary capital outlay for it.

Reason (2), in favor of the inclined shaft, that the ore extracted will partly pay expenses, is valid, and the objection (4), that good ore surrounding the shaft is lost, is not tenable, as this ore will ultimately be recovered, the once main incline being converted into a working raise and the ore from the shaft pillars will be removed, as in the usual course of mining operations.

Reason (3), that the vein is often softer than the country rock, is valid, and offers the additional advantage of presenting the walls, or, at least, one to break to, making the sinking costs in an inclined shaft less than in a vertical, in country rock.

Disadvantage (1), that veins usually carry more water than the walls, is more imaginary than pertinent, and in the end it will be found that the pumping costs in mining will be less with the incline than is usually the case with the vertical. There is not always more water in the lode, but in any event this water is drawn from the contiguous sections of the lode and sinking can be continuous. On the other hand, in the case of the vertical shaft, in a new district, every seam or fissure crossed, and usually these parallel an inclined lode, affords its quota of water, which, at the point cut, presents a head to the standing level of the water and an excessive flow which usually floods out the pumps, delays sinking and adds unnecessarily to the cost.

Once the lead has been reached, this flow is to be cared for through all future time, and comes nearer being all the water of the region than is the case of the incline on the lode which deals with the water of the region of the lode, that must be dealt with in either case.

Of the advantages of the vertical shaft, (1), reaching maximum depth in minimum time, is open to question, and the relative speed will depend on several factors: character of rock; condition of walls at crossings of seams; inflow of water; and length of suspension on cutting a flow, where, as I have seen happen three times in sinking 300 ft., work was suspended for a total of several weeks and the pumps drowned out. To this sinking time must be added the time taken to crosscut, not depth below surface but depth on lode being the desideratum.

As to advantage (2), ease of sinking and timbering, my experience and that of engineering acquaintances, is quite to the contrary both as to speed of driving and ease of timbering, and is that the cost of the incline on the lode is much less than with a vertical shaft. Pumping, as mentioned in advantage (3), will depend on the arrangements for handling the pumps in either case. The best arrangement will depend on conditions and the judgment and ingenuity of the man in charge, and affords considerable room for saving costs and increasing speed of sinking. I can see no reason why this can be better done in one type of shaft than in the other, unless it be that in the incline, the pump can rest on skids and requires less care in suspension, and is more out of the way of blasting, in the incline where it is also easier to reach for packing and repairing.

Into the question of economy of handling the ore, advantage (4), many factors enter. In a mine of nominal capacity as many of the Western mines for gold, silver, lead, etc., the question of maximum capacity does not call for consideration, and rapid hoisting is eliminated. Yet even on this score, the Lake Superior copper inclines present an example of long and justified experience in the large permanent mine workings. Where the crosscut from the vertical shaft begins to lengthen out, especially with a small mine, the constantly increasing costs here tend to offset the seeming advantage in vertical hoisting.

We cannot be too clear as to the relations of points under discussion, and, in the above, I am considering the relative merits of the two types of opening an ore lode, with reference to the earlier operations, those of small operators, and those in new districts.

First, expose the outcrop as far as practical by cuts and trenches, then "Follow the ore" where the surface and economic conditions best justify.

L. S. Ropes.

Helena, Mont., May 26, 1912.

The Pattinson Desilverizing Process

The Engineering and Mining Journal for May 4, 1912, p. 907, has the following item: "John Pattinson, a distinguished chemist and inventor of the Pattinson process of desilverizing lead, died at Newcastle, England, Mar. 12, aged 84 years."

The "Metallurgy of Lead," by John Percy (1870), p. 121, gives the following: "Mr. (Hugh Lee) Pattinson was of humble parentage and born at Alston, in Cumberland, where he was employed professionally as lead assayer to the Commissioners of Greenwich Hospital, and he died at Newcastle-upon-Tyne, Nov. 11, 1858. He was a self-made, observant, ingenious, clear-minded, upright man, whom I knew personally well, and whose memory I much respect. He communicated a paper on the history and nature of his process to the British Association in 1838, which was printed in full in their *Transactions*. He obtained a patent for this invention, dated Oct. 28, 1833, (No. 6497) and entitled 'An Improved Method of Separating Silver from Lead.'"

J. F. Miller.

Trail, B. C., May 28, 1912.

Separating Blende from Barite

In the Journal of May, 1912, Mr. Bryant describes an application of the well known property of barite, of decrepitating at a lower temperature than blende, to the treatment of the zinc ores of the Central Missouri district, and incidentally states, that although the process described has been successfully applied to the ores of 20 mines, it fails on the apparently similar ore of the Black Jack property. It may interest Mr. Bryant to know that I have recently been faced with the problem of separating blende from barite, and although well acquainted with the "decrepitation" method, preferred to apply the Huff electrostatic system, which proved successful both as to percentage recovery and grade of concentrate.

As is well known, blende is not repelled or separated from the barite, if the two minerals are submitted together to electrostatic treatment in their natural condition, but by a simple and inexpensive pretreatment (not partial oxidation), the blende can be completely separated from the barite.

I am not at liberty to give the details of the treatment I refer to, but feel sure, that if Mr. Bryant communicates with the Huff Electrostatic Separator Co., of 60 India Street, Boston, the information will be forthcoming.

Claude Vautin.

London, England, May 24, 1912.

Pyrite Mines of the World

In the Journal of May 4, 1912, is reprinted a statement from the *American Fertilizer*, of Mar. 23, 1912, wherein it is said that our mines at Sulitjelma, Norway, are producing 35,000 tons of pyrites per annum for export. We wish to say that this statement is somewhat erroneous, since our present production of pyrites for export is about 125,000 tons per annum. This pyrites is chiefly sold in Sweden, Norway and Denmark, but also abroad in England and Germany. We also wish to mention that the pyrites contains about 2.75 to 3% copper and about 44% sulphur, and we have determined to increase our output, so that within a few years it will reach 160,000 to 170,000 tons of pyrites for export. In this connection we may also say that besides pyrites we are also producing about 2000 tons of high-grade bessemer copper per annum.

Sulitjelma Aktiebolag.

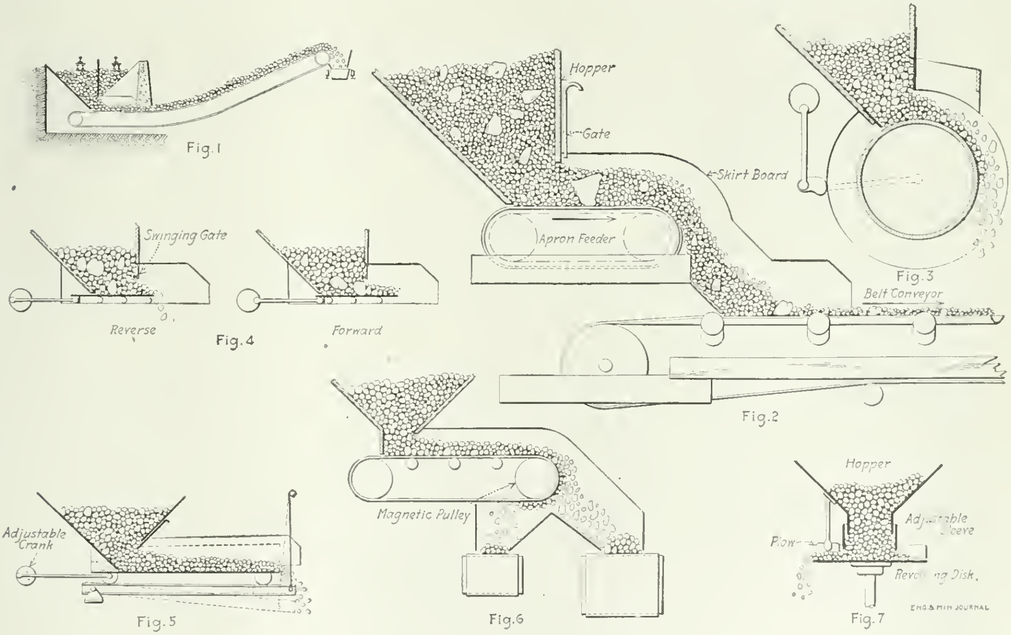
Helsingborg, Sweden, May 17, 1912.

Feeders for Belt Conveyors

By Colby M. Avery*

The heaviest wear on a conveyor belt occasioned by the ore itself occurs just below the feeder and is caused by slippage while the inertia of the ore is being overcome. To reduce this wear the feed should fall upon the conveyor in the direction of travel and while moving at the same velocity as the belt. Feeders that fulfill these requirements are described.

The constantly growing use of the belt conveyor as a rapid and economical device for handling material has resulted in the development of many types of machines for feeding the belt. A study of the causes of belt wear has revealed the fact that slippage of the material on the belt in the ordinary conveyor is the cause of the greatest amount of wear, which by proper refinements in design can be eliminated to a large degree. Of the three causes of slippage, two need not be considered at this time. Excessive incline of the conveyor is a condition that seldom obtains, and the "internal friction" of the load is of small consequence with properly designed carriers. The method of delivering the load to the belt, however, is a variable factor and one to which the greater part of the conveyor-belt wear is largely due. The inertia of the material dropped upon the fast moving belt must be overcome entirely by the friction between the belt and the material. Slippage at this point, before the material has obtained the same speed as the belt, frequently results in rapid wearing of the cover; consequently the belt fails. This action is especially apparent when gritty material is conveyed even when belts of the highest grade and therefore the most costly are used.



Types of Automatic Feeders for Conveyors or Crushers

The belt wear at the loading point is naturally greatest when the material is fed from a chute at right angles to the belt travel and when it is fed in large quantities. Consequently the ideal condition is to feed the material uniformly and to feed it at the belt speed in the direction of the belt. This is accomplished by the use of automatic feeders delivering uniformly by chutes to the belt. The chute must be inclined toward the direction of the belt travel and of sufficient length to discharge the material at the approximate speed of the belt.

The type of feeder used must depend upon the material handled and upon other special conditions. A large number of types of feeders have been developed, but only those found most practical for meeting the various conditions will be discussed.

The apron feeder illustrated in Figs. 1 and 2, has recently been developed for especially large capacities and for handling heavy lumpy material. This feeder is essentially a heavy, corrugated-steel apron conveyor of short centers. It is placed directly beneath the hopper so that the material rests upon the apron, the flow being controlled by the motion of the apron. Apron feeders of extra large capacity have recently been built 48-in. wide by 8-ft. centers for handling run-of-mine ore in sizes up to 18 or 20 in. diameter. They are driven by ratchet-tooth wheels and pawls from an adjustable crank. The apron feeder may be arranged with gear-reduction drives and friction drives and it is built for a number of applications. It is handling ore of all kinds, coke, limestone, converter slag, and is even used for feeding directly into blast furnaces. This feeder also has the advantage of being able to serve as a conveyor and if necessary, may deliver the material at a fairly long distance from the hopper or even above the

---

*Manager mine and smelter department, Stephens-Adamson Manufacturing Co., Aurora, Ill.

hopper. In fact, the chief advantage of a feeder of this type is that it requires little head room and may deliver at any convenient distance from the hopper opening.

Feed May be Accurately Adjusted

The automatic rotary ore feeder illustrated in Fig. 3, is one of the simplest feeders on the market; the only moving parts are the slowly rotating cast-iron drum and the driving mechanism. This type of feeder may be accurately adjusted to deliver any quantity of material. It occupies considerable head room, however, and can only deliver directly beneath the hopper opening, hence it is somewhat limited in its application.

The reciprocating plate feeder illustrated in Fig. 4 is a type largely used where a constant feed is required. This feeder is simple in design and reliable in its operation. It consists essentially of a plate below the hopper opening, upon which the material rests. It is connected to a crank or eccentric so that in its rear position, it extends just beyond the angle of respose of the material. As the plate moves forward, it carries the material with it and as it returns it slides from beneath the material which falls to the chute. This feeder may be adjusted by changing the length of the crank throw, but the quantity of feed can not be as accurately adjusted as in either of the two feeders aforementioned. This feeder can not deliver the material at a distance from the hopper.

The shaking feeder shown in Fig. 5 is also a type largely used. This feeder is set at an angle, usually about 12°, beneath the hopper. It consists essentially of a trough supported on rollers, or by swinging rods, or a combination of both. It is shaken back and forth by an adjustable crank and the angle of inclination is also usually adjustable. This feeder may be extended any distance and is adapted to large capacities. It is also often used as a combination feeder and screen by placing finger bars in the bottom, as its construction is essentially the same as that of the shaking screen.

Magnetic Device for Removing Iron

The belt feeder is a type similar to the apron feeder in its advantages, but adapted to the use of fine material. A very heavy conveyor belt is used, supported on flat rollers closely spaced. This same type of feeder may also be used as a magnetic separator and feeder, by using a magnetic head pulley. Discharge may then be made to a double chute arranged as shown in Fig. 6, for the separation of the magnetic and non-magnetic materials. This arrangement is advantageous where it is desirable to separate the materials.

Another feeder extensively used is the revolving disk feeder shown in Fig. 7. This feeder is adapted to handle finely crushed substances in relatively small quantities. It is easily adjusted for accurate measurements and hence where exact proportions are required, a number of these feeders may be arranged to deliver the various materials to a belt conveyor. This feeder consists of a horizontal disk beneath a hopper opening. An adjustable sleeve is fitted around the hopper discharge spout, which may be raised or lowered relative to the disk thus controlling the area of the disk covered by the material. As the disk revolves, the material outside the sleeve is scraped off by a plow in quantities depending upon the position of the sleeve.

Uniform Feed Permits Using Small Conveyors

There are many types of feeders of practical value, but those described above have been found to meet best the ordinary requirements. The special advantages of each have been mentioned only in a general way, and only so far should the statements be taken as authoritative. The use of a feeder may always be regarded as an economy wherever coarse material is drawn from bins on a belt conveyor. The regularity of the feed, not only saves the conveyor belt, but it also permits a smaller conveyor being used, loaded to its maximum capacity all the time. Some fine material, such as dry sand, will flow regularly from the hopper without a feeder, or the conveyor may even be arranged to serve as its own feeder without wearing the belt. Heavy abrasive material may also be carried with relatively little wear if the feeder and chute are properly arranged. One instance is noted of a single belt properly fed, which according to a registered-tonnage weightometer carried 3,500,000 tons of abrasive ore before it was necessary to replace the belt.

Such economy is an absolute saving, effected only at the cost of a little thought. The cost of the feeder is usually offset by the saving in conveyor width and the chute may as easily be designed to save the belt as to wear it.

The use of a feeder to protect a crusher is also a point deserving mention. It frequently happens that on account of bad judgment a crusher is placed directly beneath a hopper so that when the hopper is full the load rests directly upon the crusher rolls. The result is that if the crusher is not stalled, it operates at double its rated capacity for a short time and is then idle for a longer time. The life of the crusher under this treatment is consequently about half of what should reasonably be expected and the power consumption is greatly increased. Where a crusher must be used, it should always be protected by a feeder and if discharge is made to a conveyor, it should be by means of a properly constructed chute. Inspection of Fig. 7, will show the advantages of this arrangement.

Sir Julius Wernher

Sir Julius Charles Wernher, whose death, on May 21, has already been briefly noted, was one of the strongest influences in the building up of South Africa and the management of its great mining interests. While he was rather retiring in his ways and was never so prominent in the public eye as Cecil Rhodes, Barney Barnato or even his own partner, Alfred Beit, he was in reality a force second only to Mr. Rhodes in his real influence.

Like so many of the South African mine-owners, Sir Julius was of German descent. He was born at Darmstadt, in 1850, from a family of good commercial standing and received an excellent education. Shortly after the Franco-German war, about 1871, he went to Paris, where he was employed by the firm of Porges & Co. A year or later he was sent to South Africa, in company with Charles Nege, who was a partner in the firm, and established himself at Kimberley, where he acted as diamond buyer. He was very successful in this business and also in acquiring some interests in the diamond mines and was made a partner in the firm in 1878. The Porges firm formed the Compagnie Francaise des Mines et Diamants du Cap, which was generally known as the "French Company." When Cecil Rhodes undertook to consolidate the diamond interests at Kimberley, this "French Company" was his chief opponent, and secured a large share in the stock of the De Beers company, in which all the interests were consolidated. Sir Julius Wernher conducted the negotiations on the part of his company, and was made one of the life governors of the De Beers.

When the gold discoveries were made on the Witwatersrand, Sir Julius early saw their importance. He had already, while at Kimberley, associated with him Alfred Beit, who had gone there as diamond buyer for the Lipperts, of Hamburg, and the firm of Wernher, Beit & Co., which established itself at Johannesburg, early, became a powerful influence in the Transvaal. He also became a partner in the allied firm of Eckstein & Co., which was interested in some of the more important of the new gold mines, and together these firms directed and controlled much of the development which has made the Transvaal at the present time the greatest gold-producing country in the world.

During all this time, Sir Julius, in accordance with his usual custom, remained mostly in the background, although he was really the dominating force. After his two firms had been well established in Africa, he removed to London and did not visit the Transvaal again until after the conclusion of the Boer war. It need hardly be said that in the course of these transactions he had accumulated a very large fortune. Indeed, he was said to be one of the richest men in England. He bought Bath House, a well known London mansion, which is filled with pictures and other art objects, although he avoided, as far as possible, all display. Recently he made several arrangements looking to his withdrawal from business. A contract was made toward the end of 1910, by which the Central Mining & Investment Corporation, which had been founded and managed a few years before by him, acquired the business of Wernher, Beit & Co. and of H. Eckstein & Co., with the exception of the diamond business. Sir Julius was made a life director in this corporation, and for a time acted as chairman of the board. Later the diamond branch of the business of Wernher, Beit & Co. was transferred to L. Breitmeyer & Co., of London and Amsterdam, this last transfer taking effect Jan. 1, 1912. The firm of Wernher, Beit & Co. then passed practically out of existence.

Although he controlled so many companies, Sir Julius did not take a prominent titular part in the management of any of them. Outside of his South African companies, he was chairman of Fraser & Chalmers, the manufacturers of mining machinery. He was much interested in mining education and was active in forming the plans for the improvement of the Royal School of Mines in England, to which he was a liberal contributor. He also gave largely toward the establishment of the proposed University of South Africa, and it is understood that that institution will benefit largely by his will, in addition to the large bequest which it received from Mr. Beit.

A singular incident in his career which came prominently before the public some three years ago, was his purchase for £64,000 of an alleged process for making artificial diamonds, invented by a Frenchman named Lemoine. The lawsuit which arose out of this transaction excited much interest.

His heir is his son, Derrick Julius Wernher, born in 1889. What actual disposition of his property has been made by his will is not yet known, but as we have noted above, he seems to have made preparation for his final retirement from active business. He was about the last survivor of the group of prominent and wealthy men, whose fortunes were founded on the diamond and gold discoveries of South Africa, and it is not impossible that some changes in management and methods may follow his death.

The Rand's New Metallurgy

A paper on "The New Metallurgy and the East Rand Proprietary Mines," submitted by H. Stadler to the Chemical, Metallurgical and Mining Society of South Africa, was rejected on the ground that no new technical facts were adduced. Mr. Stadler has appealed to the Transvaal Chamber of Mines requesting that it investigate the charges brought in this paper.

METHODS TOO REFINED

Mr. Stadler's paper was intended to prove his contention that present Rand metallurgical methods are becoming too refined and that a return to old-fashioned methods would result in greater economy. The following paragraphs contain a brief abstract of the arguments advanced by Mr. Stadler.

From figures contained in their memorable paper on "Rand Metallurgical Practice and Recent Innovations," Messrs. Denny drew the logical conclusion that, in order to get a total extraction of 95%, it is theoretically unnecessary to grind ore beyond the point at which 58% passes 100 mesh. In following the ultrafine-grinding policy, operators are considered to have overlooked the following factors:

(1) The higher extraction claimed for finer grinding, in consequence of mistaken deductions, has been grossly exaggerated. Actual figures show that the higher extraction obtained in favor of the fine pulp is only 1.5% or 5.4d. in a 7.5 dwt. ore. This amount is hardly sufficient to repay the higher cost of finer grinding.

(2) Any classifier with its overflow velocity well adjusted acts as an efficient concentrator, in which the specifically heavier pyritic particles are preferably retained in the underflow. Classifiers in which the pulp is partially banked up and disturbed are complete failures as concentrators. The abandonment, therefore, of the old proved spitzkasten in series in favor of cones in sets is a doubtful improvement.

(3) With the extremely fine pulp now generally in use, it is no longer reasonable to take the percentages left on the +60 grade as a criterion for the fineness of pulp. Besides the inaccuracy of screen measurements, it must be remembered that part of the particles left on the +60 grade are of exceptional flat or long shape and more amenable to chemical treatment than a similar volume of spherical form; or they are of specifically lighter materials and of a nature quite different from the ore since they carry neither pyrite nor gold.

AMALGAM EXTRACTION REDUCED

(4) The profit resulting from higher extraction by finer grinding is practically nullified by forfeiting the good effect which the high percentage of extraction by amalgamation has on the total extraction. Crushing by impact in a mortar box is much more adapted to free the pyrite and gold from their gangue than the abrasive action of the tumbling contents of tube mills in which largely the particles are not broken up but ground down by surface wear. Formerly an amalgam extraction of up to 70% was easily reached, while, where the battery plates have been discarded, this extraction has now dropped, in most cases, to 50%. Besides the advantage of quick realization of profits, a high extraction by amalgamation has a far-reaching effect on total extraction consequent on the lowering of the gold content in the final pulp for cyanide treatment where only 85 to 90% is recoverable under the best actual conditions. The East Rand Proprietary Mines and the Crown Mines with up-to-date and costly methods of treatment have not succeeded in raising the percentage of extraction by cyaniding much above the level of 85% which is easily obtained all over the Rand.

(5) So far as Rand ore is concerned, grinding finer than +200 mesh is mere waste of energy and money. The great amount of over-worked slime unnecessarily produced inevitably demands more perfect washing and dewatering equipment in the cyanide works, with consequent additional working costs and additional capital expenditure.

WORKING COSTS HIGHER

The different methods of recording and apportioning costs make a comparison difficult. However, in the progressive mines working costs for reduction work may generally be considered to be 1s. per ton higher than for other mines.

At the time of the introduction of the "New Metallurgy," it was urged that the adoption of the stamp-tube mill combination would result in greatly reduced capital expenditure. A comparison of the results given in the annual reports of companies using the old and new methods does not bear out this contention; the New Kleinfontein Co., which employs single-stamp crushing shows a much less capital outlay than those mills which employ double-stage fine grinding. Further, about a year and a half after the adoption of the new method, it was found that the capacity of the cyanide works at the East Rand Proprietary mine was inadequate to deal with the increased proportion of the slime produced by the score of tube mills.

While emphasizing the better economic efficiency obtained with the sounder and older methods, Mr. Stadler states that it is not his intention to advocate a definite doctrine of single-stage stamp crushing. On the contrary, he believes that multiple-stage crushing should be practiced in every rationally designed plant so as to realize the advantages derived from intermediate classifiers.

Limitations of Tube Mills

The use of tube mills for the purpose of grinding is not in question but rather their abuse. The abuse consists of transferring to them that part of the crushing work which can be more efficiently done with stamps. It has been proved experimentally that the mechanical crushing efficiency increases with the coarseness of the battery mesh. However, the advantage of a high amalgam extraction obtained by double amalgamation before and after tube milling is so marked, that to forfeit this advantage by crushing so coarsely that the battery plates have to be discarded is not advisable, unless the extraction in the cyanide works can be materially raised above the present level of 85 to 90%. The use of fine battery screens will, therefore, be advantageous even at the cost of a possible loss in mechanical efficiency. With classifying well carried out, the suitability of the type of tube mills adopted as a standard on the Rand is doubtful. Other crushing machines may prove more efficient and should be given a trial.

New Kleinfontein Combines Both Methods

When the New Kleinfontein Co. decided to increase its reduction capacity by 10,000 tons per month (25% increase) by the use of stage crushing, they adopted a policy by which both methods were logically combined. Of the 220 stamps only 40 will be made responsible for the increase of output. These will crush through the coarsest battery mesh, while the remaining 180 stamps will crush, as hitherto, through fine-mesh screens. The underflow of the total pulp is to be reground by tube mills which will work at a high efficiency because the 40 coarse-crushing stamps will provide them with the right amount of coarse material to produce the most suitable mixed feed. A high amalgamation extraction will be secured by a double amalgamation of the mill pulp produced by the 180 fine-crushing stamps before or after tube milling.

Mr. Stadler in closing states that his remarks against the wisdom of the all-sliming policy refer exclusively to Rand ore and present Rand practice.

California Oil Gushers

San Francisco Correspondence

The Amalgamated Oil Co. brought in a new well in the Fullerton field on May 28, that is reported as flowing at the rate of 10,000 bbl. per day. This well is only 1400 ft. deep, and is not in what is believed to be the best formation. All other important producing wells in the field are 2500 ft. deep, so the coming in of this gusher at 1400 ft. was a surprise. The gas and oil shot the tools out and shattered the derrick. A large proportion of the first flow was saved by prompt work in digging a sump. It is said the gas pressure will be difficult to control.

The 7000-bbl. gusher of the Pacific Crude Oil Co., near Fellows, which came in on May 30, caught fire on June 2. Two 5000-bbl. tanks and another well are within 100 ft. of the blazing gusher.

Tonopah-Belmont Extensions

Special Correspondence

The recent activity of the Tonopah-Belmont Development Co., or men closely identified with it, in extending operations to other mining districts is in line with the policy being pursued by other mining companies. It was reported a few weeks since, that the company had purchased the App mine in Tuolumne County, Calif., and that considerable development and construction will be done. This mine has been idle for some years but was once a large producer.

Now comes the report that a syndicate of Pennsylvania men interested in the Tonopah-Belmont company, has taken over the control of the Pearl Lake mine in Porcupine. The management will be in the hands of the Hargraves Engineering Co., of which Col. R. W. Stevenson is managing director. Work is to be resumed immediately under the personal direction of Colonel Stevenson. A development fund of $250,000 has been placed in the treasury for operating expenses. It is the intention of the new company to carry on the work along the lines proposed by the old management. The shaft will be sunk to the 800-ft. level and a crosscut will be started from the present 400-ft. level to intercept the veins cut by the diamond drill. There are no veins of importance on the property itself, but the diamond drill showed that the veins from the McIntyre dip that way, and should enter the Pearl Lake property between 400 and 600 feet.

April Operations at Goldfield Consolidated

During April, the total production of the Goldfield Consolidated Mines Co., was 28,360 tons of ore, containing $610,-708, an average of $21.53 per ton. Of this, 27,928 tons were milled with an extraction of 93.77%, and 432 tons were shipped, averaging $28.60. Net recovery from all ore was $20.20 per ton. Net realization was $392,056, or $13.81 per ton. New development totaled 3369 ft., and operating costs were $6.53 per ton, including a construction charge of 25c. Secretary Howe reports a discovery in a crosscut from the 1300 level of the Grizzly Bear workings, which he says is believed to be the downward extension of the base orebody exposed on the 1000 level of the Clermont. The showings in the Mohawk Combination and Laguna are reported satisfactory.

Operations at Chino Continue Despite Labor Trouble

Special Correspondence

On May 28, the steam-shovel crews of the Chino Copper Co., at Santa Rita, N. M., presented a petition, asking for an increase in wages and requesting an answer by June 1. While the matter was being given prompt consideration by the management, the latter learned that two of the leaders had busied themselves with the trainmen, even to the extent of calling some of them out of bed at night to persuade them to join in a demand for an increase in wages. This fact became known to the management, and on the morning of May 29, these two leaders received notice that their services were no longer required.

On leaving their shovel, the two discharged men visited the remainder of the crews, persuading them to quit work. On the night of May 29, a conference was held between the men and the superintendent, and the men were requested to return to work, giving the company until June 15 to consider the matter. The company assured the men that meantime nothing would be done that would in any way prejudice their positions, but it insisted on the discharge of the two leaders.

It was evident that many of the men were not in sympathy with the movement and methods used, but it became necessary, on May 30, to refuse the men's proposition. They declined to go to work until they received higher wages and were promptly given their time.

Work was resumed by the company loading ore on the morning of May 31, and mining operations have continued since without interruption. The mill has not been affected by the trouble and has been run continuously at capacity. Stripping operations have been curtailed, but as there are many months' supply of ore from which the overburden has been removed, there is absolutely no embarassment to mining operations and applications from new crews are coming in.

The movement started at the mine was without the sanction of any of the unions with which the men have been affiliated. The steam-shovel men are being paid wages considerably in excess of the union scale, while the trainmen's wages were equal or in excess of the prevailing rate in this section.

According to *Journal du Four Electrique*, the Oresunds Chemische Fabrique of Copenhagen, which owns the cryolite mines of Greenland, in 1911 exported 6000 metric tons of cryolite as follows: to France 1600 tons, to Germany 1300, to Austria 760 tons, to England 700 tons, and the remainder to other countries.

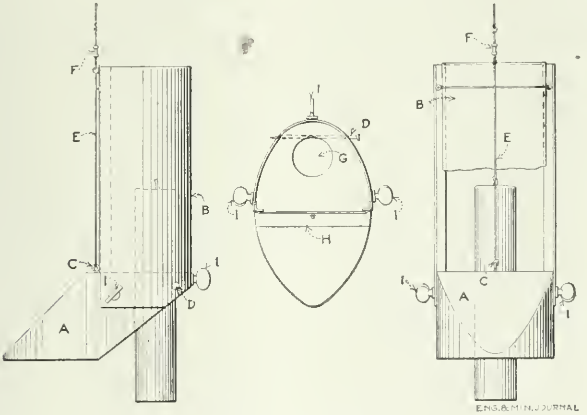
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Surveyor's Backsight Sconce

By F. L. Fischer*

The surveyor's sconce illustrated in the accompanying sketch was designed to throw a light on the backsight in order that the plumb line might readily be seen through the instrument when surveying was being done underground. It has been proved convenient and serviceable in all conditions of air currents and hazy atmosphere in the Boston and Montana mines of the Anaconda Copper Mining Co. at Butte.



Backsight Sconce for Underground Surveys

The sconce consists of a heavy bronze or copper weight *A*, surrounded on the sides and back by a semicylindrical casing *B* of copper sheeting which extends a sufficient distance above the weight to shield the candle from the wind and to reflect its light. A screw-eye *C* is sunk in the weight above its center of gravity. One end of a stiff, steel wire *E* three or four inches long and of as small diameter as can be used to carry the sconce is attached to the screw-eye. The other end of the wire is attached to a swivel *F*, and to the swivel is tied the plumb line. A hole *G* of the same diameter as the candle is bored through the weight *A* and when the sconce is to be used a candle is thrust through this hole and a pin *D* is thrust into a hole made for the purpose to keep the candle from falling out. A piece of tracing cloth or oiled paper *H* is placed between the sighting wire *E* and the casing *B* which causes the wire to show strongly upon the background when viewed through the transit.

When the sconce is hung from the plumb line the weight and casing should remain in balance so that the candle is in an approximately vertical position. The casing and weight are both made of copper or bronze as iron might be attacked by the mine water; the former is secured to the latter by three thumb screws *I*, permitting the reflector to be readily detached for cleaning and polishing.

Air Compressor Lubrication

Explosions within the cylinders of an air compressor are usually caused by the ignition of inflammable gas, the presence of which is due to the use of too much lubricating oil of low flash point. The heat liberated from the air during compression may cause vaporization of the oil and the vapor mixing with the compressed air forms an explosive mixture that may be ignited at the temperature attained by the air in the cylinder.

Excessive use of oil is open to the further objection that oil tends to cause sticking of the valves. Ordinarily, air cylinders and pneumatic tools require less oil than steam cylinders.

A lubricant that is free from the above mentioned objections to the use of oil is soapy water, with which a small quantity of flake graphite has been mixed. The flakes of graphite remain suspended in the water until admitted to the interior of the cylinder, where they exhibit a tendency to attach themselves to the metallic surfaces, imparting a superficial glaze that is smooth, acquires a high polish and prevents actual contact of metal with metal. A small quantity of the mixture provides a safe and sufficient lubricating layer.

As the soapy water may cause rusting, it is advisable to introduce a little oil into the cylinder when shutting down the compressor. The graphite is not affected by any degree of heat attainable in a compressor cylinder; it will not be carbonized or baked into a hard or gummy mass to interfere with the action of the valves, and under no conditions can it be volatilized.

Surveying a Raise Connection with Transit

By H. Y. Russell*

Several years ago I made a survey for a connection between the workings of a large mine in Colorado; some of the results obtained may be of interest.

The workings were in two counties separated by a high divide, and were worked through two tunnels the portals of which were about three miles apart. The drifts to be connected were on the same vein, one being 660 ft. above the other. The vein dipped at a grade of 10 in 100 ft., and the company decided both to sink and raise on the vein to make the connection.

Seven Mile Survey Between Workings

With the site of the collar of the shaft chosen, it was then necessary to run the survey lines out of the upper workings, over the divide and into the lower workings to determine the point at which the raise should start. The surveyed distance was approximately 35,000 ft., or about six miles. The point where the survey line crossed the divide was 2800 ft. higher than the lower workings. The instrument used was a C. L. Berger mining transit reading to minutes, telescope about 8 in. long, and equipped with a complete vertical circle.

As it was necessary to determine the vertical distance between the drifts, the vertical angles were read and the height of instrument was noted at each set-up. The sighting was done to tack heads and the distances between the tacks and the hub of the instrument were measured. The horizontal and vertical distances were then calculated.

---

*Mining engineer, 513 Hennessy Building, Butte, Mont.

*Mining engineer, 423 Guy St., Montreal, Que.

Except the actual work of surveying, the greatest difficulty was to go over the divide, which was a rounded hill covered with slide rock so loose that it was almost impossible to place the instrument where it would not move should anyone come within 10 ft. of it; survey stakes moved in the same way. The divide was so rounded that there was no place at which the instrument could be set from which bases for triangulation on each side of the divide could be seen. It was, therefore, necessary to get up in the slide rock several times to carry the line across the divide.

After some experimenting, it was found that a 25-ft. pole on the divide could be seen from base lines on each side. The base lines were about 3800 ft. from the pole and 1500 ft. below it; they were about 1200 ft. long. As it was impossible to set up at the apex of the two triangles, the horizontal base angles were quadrupled to eliminate error as far as possible, and the vertical angles from the bases to the pole were repeated several times.

In order to carry the bearing over the divide, direct solar observations were taken at 9 a.m. and 3 p.m. of the same day on each base, the instrument being reversed at each observation in order to compensate errors. These observations checked to a minute. This made the whole operation really two surveys, one from the bottom of the raise to the pole, and the other from the collar of the shaft to the same point. Except for the triangulation, the survey consisted of turning the angles and measuring the distances. The underground work was checked by the regular mine surveys that had been made from month to month. In the underground work the vertical angle and the height of instrument were taken and the slope distance measured. The three miles of outside surveying were done in two days, the same distance underground in five days. The mine work was not interfered with at all.

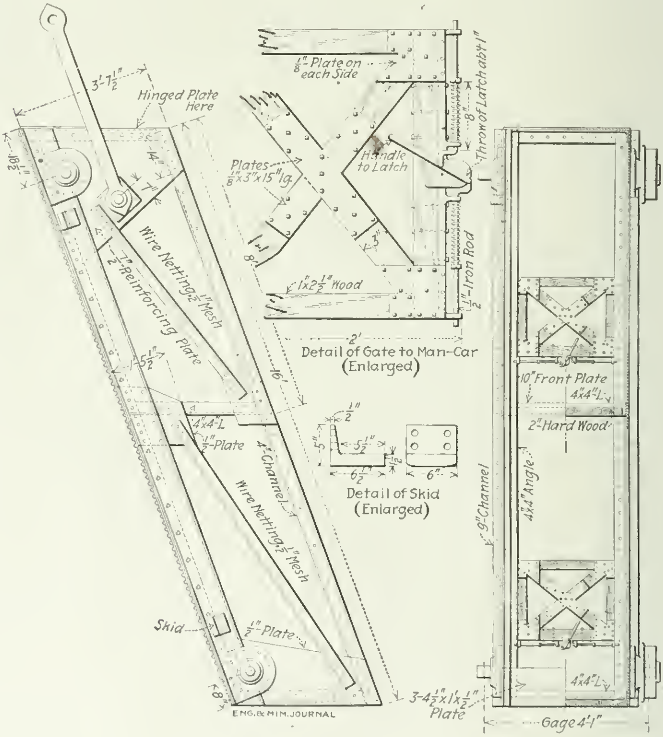
BAD AIR IN MAKING CONNECTION

After the shaft, which was 8x5 ft. and roughly timbered, had been sunk 100 ft., a strike was called by the miners in that county, causing a shutdown, and as there was no natural ventilation, the workings on this side of the divide filled with bad air and became inaccessible. Before the raise was holed through about eight or nine feet of water gathered in the bottom of the shaft and a peculiar accident was barely averted. The raise to the shaft was started 8x4 ft. in the clear, and after it had been carried up a certain distance was made smaller. When it reached 450 ft., the men drove a small drift from the raise, into which they would go after the fuses had been snuffed to wait in safety until the round had exploded. Careful measurements were kept and the men informed as to the distance necessary to connect. With five or six feet to go, the top of the raise was but slightly damp, and there was no suspicion that there might be water in the shaft, the vein being a dry one. When the last round was fired, the crew were sitting comfortably in this drift. The water rushed past harmlessly, but it sucked behind it a quantity of bad air, which threatened for a time to suffocate the men. The air current fortunately changed quickly and good air from below came up in time.

When the loose ground was cleared away from the connection it was found that the raise had come through in the center of the bottom of the shaft. It was also found that the distance actually raised agreed with that determined by the vertical angles and the height of instrument to within 12 inches. Time can be saved by using the transit in this way for leveling, and I think it will be used more often than it now is when the accuracy of a good transit and the way errors compensate are realized.

A Copper Range Man Car

The man car used for lowering and raising men at the mines of the Copper Range Co., in the Michigan copper district, is shown in the accompanying illustration. This skip is designed for use in a shaft sunk at an inclination of 70° from the horizontal. It is a two-deck car, and there is room for 13 men on each deck. The sides of the car are covered with ½-in. mesh wire cloth, and the front is closed by gates, one for each deck, that slide in channel guides, a set of which is provided for each gate at the front of the car. The gates may be locked in position above the men's heads, or waist high by throwing the lever which pushes two rods out through holes in the channels provided for the purpose.



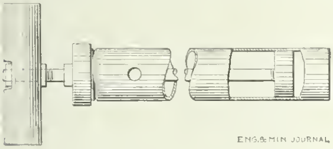
MAN CAR FOR AN INCLINE SHAFT

The flooring of the upper deck is held in place by two pairs of channels, between which it slides, so that it may be removed when timbers are to be lowered. The lower parts of the gate guides are also cut away, so that the gates can readily be removed when the car is to be used for this purpose, and a bolt that hooks into eyes on each side of the car just below the upper deck, and which prevents spreading or bulging at the sides, can likewise be removed to make room for the timbers.

A hood is used at the top of the car and is hinged so that it may be laid back when 30-ft. rails are to be lowered. In order to prevent accidents that might occur if one of the wheels should break while the skip is in motion, two pairs of skids are attached to the under part of the body, which, in the case of such breakage, would support the car upon the rail.

Cartridges for Tamping Dynamite

The article on making cartridges for tamping dynamite published in the JOURNAL of May 4, 1912, suggests a simpler method of procedure, but a more elaborate although simple device is required. The device consists of the molding-tube illustrated in the accompanying sketch. It is made by threading one end of a 9-in. piece of brass tubing of suitable diameter. The bore of the tube is fitted with a plunger tapped to take a 10-in. rod about ¼ in. diameter. The other end of the rod is threaded and attached to a handle by two flat nuts as shown. The threaded end of the brass tube is closed by a cap through which the plunger rod passes as shown in the sketch. A hole ¼ in. diameter is drilled in the side of the brass tube one inch below the cap.



DEVICE FOR MOLDING TAMPING CARTRIDGES

This tube, a small planed board, a few newspapers, and a batch of moist, fine dirt are all that is required to make neat cartridges that will give no trouble in tamping a drill hole. The newspapers are cut into strips 10 in. wide by 8 in. long. The plunger of the molding tube is withdrawn to the cap end and the bore is packed with the moist dirt, the ¼-in. hole at the cap end permitting the air to escape. When the bore has been filled the tube is stood upright upon the planed board and the plunger is pressed down to compact the dirt into a cylinder; the tube is then laid upon its side and the cylinder removed from the tube by pushing on the plunger handle, so that the ejected cylinder of dirt lies upon a piece of the newspaper laid smoothly upon the planed board. To complete the cartridge it is only necessary to roll it up in the paper and fold over the ends.

These tamping cartridges should be carefully placed side by side in an empty powder box as soon as made, and when needed, the box of cartridges is carried to the place where blasting is to be done. As all the cartridges are of uniform size no trouble will be experienced in placing them in the drill holes if the tube is of the proper diameter for the size of hole in which the cartridges are to be used.

Drying Air in a Mine Telephone

BY L. H. EDDY

The South Eureka mine at Sutter Creek, Amador County, Calif. is equipped with four surface telephones and eight underground mine-a-phones. The superintendent's office, the engineer's platform, the master mechanic's shop and the sawmill are directly connected by telephones with the eight working levels at the following depths: 1600, 1800, 2000, 2100, 2300, 2400 2500 and 2730 ft. The cable used in the mine is a duplex lead-covered No. 16 copper wire. This cable is carried in a 1¼-in. gas pipe and brought out through tees at each station. This pipe carries also a duplex rubber-covered cable of No. 6 copper wire brought out through the same tees for electric lighting at each station, and carrying 100 volts. The telephone cable is so arranged that it can be cut out from station to station to facilitate the locating of any trouble that might arise in the line.

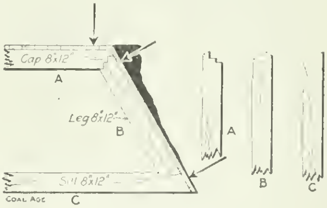
The instruments are of the Stromberg-Carlson type. When first installed trouble was experienced from the effects of the hot, damp air of the mine, which would cause the carbon in the transmitter to swell so that it would not operate. This trouble has been overcome by drilling a hole in the side of the cast-iron telephone box and putting a weatherproof lamp-socket, with a 4-cp. 100-volt lamp inside the box. This lamp gives off sufficient heat to keep the telephone dry. The lamp is connected to the lighting circuit.

The Utica mines at Angels Camp, Calaveras County, Calif., and other mines on the Mother Lode, also use the underground telephone. The only disturbance, that I have observed, caused by damp air or water other than that at the South Eureka, was the rusting of the hinges of one of the boxes in the Cross shaft of the Utica mines. I could not learn positively whether this rusting resulted from the effect of the damp air or dripping water, but evidently the indirect cause was the neglect of the attendant to keep the hinges properly oiled. A mechanic at the mine suggested that a copper or brass pin be substituted for the iron pin in the hinge. Another suggestion was that the hinges and pins be made of bronze. Still another suggestion was that the attendant should be obliged to keep the boxes in order and prevent rusting, as in the care of other equipment. The last suggestion may be objectionable on the ground that it is not possible always to secure careful attention to details of this sort from the class of labor that must be depended upon, and the labor of electricians and mechanics is considered too valuable to be taken up in this way. The interior of this telephone box was not affected, but its usefulness was destroyed by the rusted hinges. It is quite probable that the new box displacing the old one was set in a position where the water or the dampness would not affect it, but even this precaution cannot always be taken, as a dry spot today may be a wet spot tomorrow.

The telephone equipment at the mines mentioned and all others coming under my observation during a recent visit in the Mother Lode region in the three principal counties were reported to be giving complete and satisfactory service. The surprising feature of the observation was that many of the deep mines are without underground telephone equipment.

Joint for Drift Timbers Subject to Side Pressure

The joint for framing the legs into the cap of a three- or four-piece drift set, shown in the accompanying illustration, is designed to give equal areas on the ends of both cap and legs to resist both downward and side pressures. This joint would meet the requirements if it could be cut perfectly. It is, in practice, almost impossible to cut this joint so that all areas of the cut in the cap will bear evenly on all corresponding areas in the leg cut. For this reason the joint is not favored by experienced timbermen.



AN IMPRACTICABLE JOINT

A simpler and more effective joint can be made by bringing the ends of the legs to bear under the end of the cap in which no notch at all is cut, then to the under side of the cap, a piece of timber is spiked, the ends of which bear against the upper ends of the legs immediately below the cap. This piece of timber resists the side pressure exerted against the legs, the cap, in-so-far as side pressure is involved, serving only to carry this piece of timber.

The joint shown in the sketch is liable to result in splitting of the timbers in those places where the wavy shade lines are drawn.

Long Core Barrels for Vertical Boreholes*

By John I. Hoffman†

About two years ago two boreholes were completed on the Rand, special precautions being taken to keep the holes plumb. One of the holes was put down by the Lace Proprietary Mines on the farm of Vlakfontein in the Heidelberg district of the Transvaal, and the other to the south of the Brakpan Mines property, on the portion of Witpoort No. 162 belonging to the South African Lands & Exploration Co. Both holes were put down by the same contractor, William Gallagher, of Johannesburg.

Special core barrels were made having an outside diameter exactly the same as the outside diameter of the crown, but these core barrels were made 30 ft. long instead of 10 ft. as usual, so that there was practically a rigid rod 30 ft. long extending from the cutting face of the crown to the junction of the core barrel with the drill rods. As a rule the core barrel is only a little larger than the rods which, in the case of a Sullivan "B" drill, measure 1⅞ in. outside diameter, whereas the outside diameter of the crown measures from 2 in. to 2$\frac{1}{16}$ in. before the diamonds are set. After the diamonds are set the actual cutting diameter is about 2⅛ in. It is therefore apparent that the ordinary rods are of a diameter ¼ in. less than the cutting diameter of the crown, and consequently immediately above the crown, which is only ¾ in. deep, the core barrel and rods can cant almost ⅛ in. until they touch the sides of the hole. It is, therefore, obvious that once any pressure is put on the crown the flexibility of the rods will allow them to cant against the side of the hole, and consequently there will be more pressure on the crown on the side of the hole to which the rods have canted than on the opposite side, which is often the cause of the drill commencing to deviate from the vertical. As in the case of the two holes mentioned above, where special core barrels were used having the same diameter as the crown, there was only sufficient clearance between the outside of the core barrel and the borehole to allow the water and the cuttings to flow past, and this had the desired effect of keeping the hole plumb in the Vlakfontein borehole for a depth of 1000 ft., after which the drill commenced to deviate, probably owing to the bit entering broken ground.

In the case of the Vlakfontein borehole, the depth reached was 6656 ft. measured along the rods, which is one of the deepest boreholes in the world. Once the hole left the vertical at a depth of 1000 ft., the angle of deflection continued to increase gradually until at the bottom the hole was dipping at 58° from the vertical. From the 1000-ft. to the 2600-ft. depth the rods deflected from the vertical to 44°, but continued at more or less that angle down to 5000 ft., where the deflection again commenced to increase until at 6600 ft., the lowest depth surveyed, the dip of the hole was 58° from the vertical. The vein was cut at 6198 ft. measured along the rods, the calculated vertical depth being 4813 ft. The horizontal distance between the points where the vein was cut and the borehole commenced was 3259 feet.

---

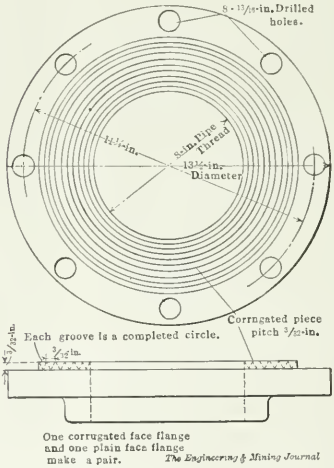
*Excerpt from a paper entitled "Recent Practice in Diamond Drilling and Borehole Surveying," Bull. 91, I. M. M.

†Mining engineer, 216 Moorgate Station Chambers, London, England.

Pipe Flanges without Gasket

By Claude T. Rice

At the Copper Range mines in Michigan the surface air and steam pipes are jointed without any gasket between the flanges, as can be seen in the accompanying sketch which shows the details of a standard 8-in. flange.


8 - 13/16-in. Drilled holes.
14¼-in.
8-in. Pipe Thread
13½-in. Diameter
Corrugated piece pitch 3/32-in.
Each groove is a completed circle.
3/32-in.
3/32 in.
One corrugated face flange and one plain face flange make a pair.
The Engineering & Mining Journal

Grooved Flange for Pipes

One flange is smooth and the other corrugated. These corrugations are complete circles cut $\frac{3}{32}$ in. deep and are $\frac{3}{32}$ in. wide at the base. In cutting them a tool with a saw-tooth edge is used and they are all cut in the face of the flange at one time. The flanges go in pairs. A grooved flange is butted against a flange with a smooth face. The flanges are painted with a mixture of white and red lead and are brought tightly together by means of the bolts. In this way a tight joint is obtained. These flanges have been used, as yet, only upon the surface lines, but in the future they will be used on extensions of the main air lines underground. The flange was designed by W. J. Richards, the master mechanic of the Copper Range company.

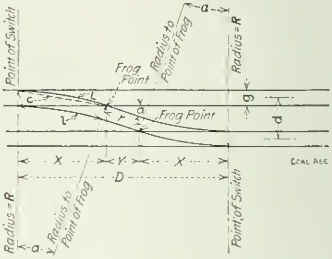
Temperature Correction Chart for Tapes

Attention has been called by F. C. Armstrong, of Boulder, Colo., to errors in the article by H. J. Rahilly, published under the above caption in the Journal of May 18, 1912, p. 982. The word add or added should be substituted where the word subtract or subtracted appears in either the text or chart; *vice versa* the word subtract or subtracted should be substituted for add or added.

Thus the corrections above the 62° abscissa in the chart should be marked "Add," those below "Subtract"; and the last two sentences in the last paragraph should read as follows: This amount will be the increase in the length of the tape in 70 ft. at the temperature of 90° F., and should be added to the tape reading. When the temperature is below 62° F. the correction should be subtracted instead of being added. It is apparent that a tape longer than standard will read too short and a short tape will read too great a distance.

Calculating a Crossover Switch

The following formulas for calculating the lengths and distances required to lay a crossover switch between two parallel tracks in a mine were recently published in *Coal Age*. The data usually given are: The frog number, n; the gage of the track, g; and d, the track centers.



Calculating a Crossover Switch

The data required are found by the following formulas: The chord of lead rail, $c = 2ng$: the radius of lead rail, $R = nc$; the frog angle, $\sin. \frac{1}{2} a = \frac{1}{2n}$; the length of lead rail, $L = \frac{a}{180 \pi} R$; the length of the follower, $l = \frac{R - g}{R} L$; the length of straight track, $r = \frac{d - g(1 + \cos. a)}{\sin. a}$; the lead of switch, $x = R \sin. a$: the frog distance apart, $y = r \cos. a - g \sin. a$; and the distance between switches, $D = 2x + y$. The letters in the formulas refer to the dimensions specified in the accompanying sketch.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Wilfley Table Kinks

By Claude T. Rice

In the mills of the Joplin district, Missouri, it is customary to use a drip spout on the Wilfley tables, on which the finest material is concentrated, to keep water flowing down the tail edge of the table. On the tables on which the coarser material is concentrated a cleat is nailed to the table near the edge of the tail end and under the wash-water box, as shown at *A*, Fig. 1. The motion of the table causes the water to bank up at the cleat and flow down the tail edge, where ordinarily little water flows. Should the water tend to flow away from this edge, say at a distance of half the width of the table from the corner of the wash-water box, a second cleat *B* is nailed to the table which tends to deflect the water back to the edge. This cleat is nailed to the linoleum above the space occupied by the concentrates and far enough from that space so that the water will have spread out evenly below it before the band of concentrates is reached.

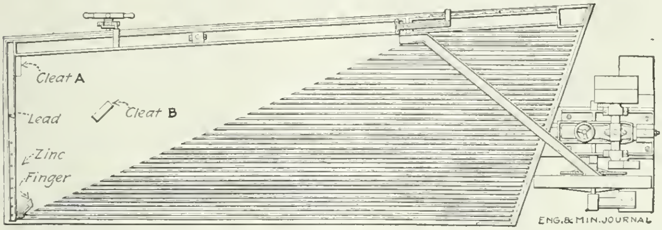
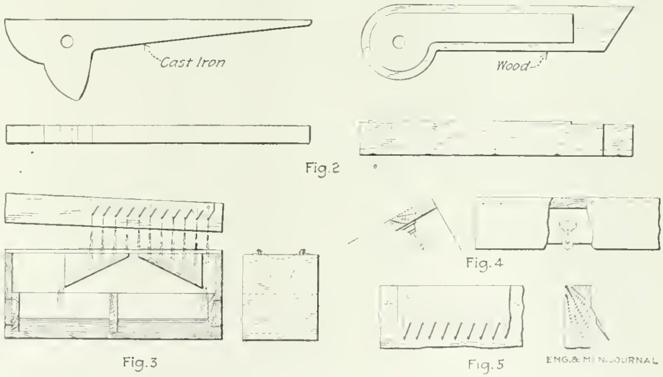


Fig. 1. Cleats and Finger on Wilfley Tables

In order to keep the line of separation between blende and middlings from coming to the corner of the table, where, in order to keep the concentrate clean, closer watching is necessary, it is the custom at many mills to use the finger shown in Fig. 2. This is bolted to the deck of the table so that it can be rotated to cause the concentrates to discharge always at the front edge of the table. This is done because if the band of concentrates works past the corner the line of separation between concentrates and middlings moves back and forth in relation to the dividing partition of the catch box a distance equal to the stroke of the table. Some of these fingers are made of cast iron others of wood with old rubber belting attached to the under side to rub upon the linoleum surface of the deck.

As the tables are used to make a three-mineral separation it is customary to provide the concentrates box with catch spouts that are supported by rods held at the tail end of the table by 2-in. pieces of wood. These sliding spouts are illustrated in Fig. 3. They are required because the line of concentrates frequently changes and with every change it is necessary to adjust the spouts so that the same character of product will always be discharged into the same catch box.



Concentrates Collecting Devices and Lighting Trough for Willey Table

The frequent changing of the line of concentrates necessitates strong lighting of the tables at night. Therefore, a lighting trough, illustrated in Fig. 4, is hung over the tail end of the table. In the trough are several 8-c.p. electric, incandescent lamps, the sockets of which are supported upon a 2x6-in. timber which also carries two pieces of galvanized iron nine inches wide to reflect the light downward. The lighting troughs are suspended from the mill rafters.

In making a three-mineral separation it is necessary to make a sharp distinction between the bands of concentrates and middlings. If the concentrates come from the table in broad bands and the feed has not been closely classified, it is difficult to make a sharp separation between two products by using only the catch spouts. To facilitate making the separation it is the practice in certain Joplin mills to nail a notched lip or piece of galvanized iron to the tail end of the table. This lip is made as illustrated in Fig. 5, the depressions down the center of each of the Vs being made by bending the iron over a 20-d. nail. A portion of the bands of concentrates equal in width to the width of the upper end of the V is discharged from the lower end of each depression, the discharge coming off the table in several drips or streams that permit making a close differentiation between products.

Detinning in Alkaline Solution

As a quick method of detinning, a recent patent of Joseph Weber (assigned to Th. Goldschmidt) advises boiling in a 20% NaOH solution to which has been added 10% $NaNO_3$. The tin dissolves as sodium stannate, which may be crystallized out by boiling, and the mother liquor used again, or the tin thrown out as oxide by sodium carbonate.

An Adjustable Drafting Board

By R. P. Wheelock*

At the Enterprise mine in Arizona, a drawing board 6 ft. long by 3 ft. wide was used, which when placed upon a table in the center of the room not only occupied a large portion of the limited office space, but its size made it necessary for the draftsman at times to work either in a half recumbent and therefore cramped position upon the board or to work from two or more sides. This board was subsequently mounted as shown in the accompanying sketches.

The two upright supports were each made of a piece of ¾-in. pipe, a tee, a short nipple and half of a flange union. These supports in the sketches are lettered *A* and *A'*. The shelf *M* is a piece of 2x4-in. Oregon pine 6 ft. long. A hole of the proper size to permit the insertion of a 1-in. nipple 3 in. long was bored through the shelf on the center line of the 4-in. faces 1 ft. from each end. A coupling *L* was screwed to each end of each inserted nipple, bearing tightly upon the wood to hold the nipple securely in place. The insides of the nipples and the outsides of the uprights *A* and *A'* were dressed with a file and emery cloth until the nipples easily slipped the full length of the ¾-in. pipe. Three 1x4-in. pine cleats, each 2 ft. long, were screwed to the under side of the drafting board, one at the center, each of the other two centered 6 in. from each end of the board as shown in Figs. 2 and 3. The board was hinged to the shelf as shown, with three 4-in. T-hinges.

The legs, *H*, were also made of ¾-in. pipe, 2 to 8 in. long, and were made extensible by inserting in each a piece of ⅜-in. pipe 2 ft. 6 in. long as shown at *J*, Fig. 3. To secure a closer fit and greater stability a cap was screwed on the upper end of each of the legs *H*, and a hole was drilled in this cap of the proper size to permit extension *J* to move freely. A setscrew was provided in the legs, to hold the extension in the position desired.

A ¾-in. nipple 4½ in. long was screwed tightly into each tee on the uprights *A* and *A'*, and on the outer end of each nipple an ell was screwed loosely to provide for the movement of the legs. Into these ells the legs *H* were tightly screwed. Into the upper end of each extension *J* a piece of brass rod about 2 in. long, flattened on the upper end was inserted and pinned in place. This provided for hinging the extension to the end of the cleat as shown in Fig. 3. The rest of these hinges are merely to support a piece of light strap iron for each hinge screwed to the cleat, the end of the strap iron being turned up about one inch and rounded off on the corners; the flattened end of the short brass rod is inserted between the two turned up ends and a pin put through the straps and iron.

The board is counterweighted by a cord attached to the shelf on the center line and as near the front edge as possible to counteract any tendency for the weight of the board to tip the shelf forward and make it bind on the uprights. This cord passes over sash pulleys *O* and *O'*, set in the wall, and suspends a weight hung outside the building. The other cord shown in the sketches serves to keep the shelf level lengthwise and also prevents it from binding on the uprights; it is an endless cord passing over six 1¼-in. screw pulleys as shown in the diagram in Fig. 4. Opposite sides of the cord are fastened to each end of the shelf, the other side passing through holes bored for the purpose. The small double pulley *F*, and screw *G*, are for convenience in taking up any slack in the cord due to stretching.

A strip of molding was tacked on three sides of the shelf extending about ¾ in. above its surface to prevent instruments from being knocked off. Such screws are put in the couplings *L* and *L'* so that the board can be clamped in any position desired, but these are not essential as it was discovered, after the board was mounted and properly counterbalanced, that although some pressure exerted on the front side of the board would suffice to move it to any position desired, there was still sufficient friction to keep it in any chosen adjustment while subject to ordinary use without resorting to the set of screws mentioned.

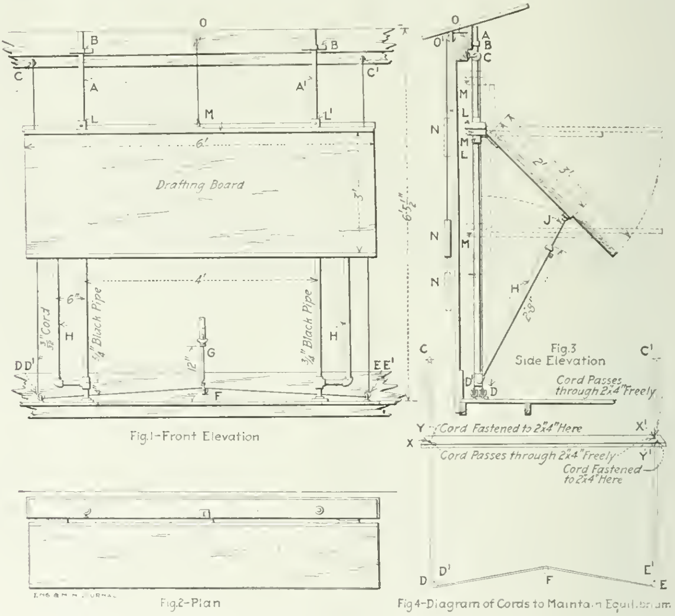


Fig.1–Front Elevation

Fig.2–Plan

Fig.3 Side Elevation

Fig 4–Diagram of Cords to Maintain Equilibrium

Adjustable Drafting Board Supported by Pipe and Fittings

---

*Superintendent, Enterprise Mining, Reduction & Improvement Co., Kingman, Ariz.

Grooved Idlers for Flanged Conveyor Belts

A conveyor belt with flanged sides like the belt of a Frue vanner, was formerly used at mill No. 3, of the Doe Run Lead Co., at Rivermine, Mo., for conveying heavy lead concentrates from the bins to the railroad cars, in which they were shipped to the smeltery at Herculaneum. A flanged belt was used because it was believed that a trough belt would cause annoyance by spilling some of the concentrates if loaded when a little too wet. The flanged belts are more expensive, and, as they last but little longer, trough belts were substituted.

While using the flanged belts, it was found that the bottom or return idlers that supported the belt caused considerable wear on the inside face of the flanges. In order to support the flanges and do away with the cause of this wear, a narrow idler with a groove in the face, of the same depth and shape as the belt flange, was placed on the idler shaft at the outer sides of each pair of idler pulleys. The grooved idlers were not keyed to the shaft, as were the plain idlers, and could move a little laterally, thus accommodating the irregularities of the slightly warped flanges. Larger idlers proved unsatisfactory when applied at the drive wheel.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Unit Costs at Oriental Consolidated in Chosen

At the Oriental Consolidated Mining Co. in the Wunsan district, Chosen, Asia, the average dynamite consumption at the principal mines of the company, as shown by a two-year record, is one pound for every 3.02 tons of ore produced. At the Tabowie mine, 3.19 tons are produced per pound of dynamite used; Taracol mine, 3.24 tons; Kuk San Dong North mine, two tons; Kuk San Dong South mine, 2.83 tons; and at the Chintui mine, 4.09 tons of ore. During the same period, new drill steel for the mines averaged one pound for every 10.6 tons of ore. At the individual mines the production of ore per pound of steel was as follows: Tabowie, 10.9 tons; Taracol, 17.8 tons; Kuk San Dong North, 6.1 tons; Kuk San Dong South, 6.7 tons; and at the Chintui, 9.9 tons of ore.

Of the cyaniding expense, cyanide is about 3.7 lb. per ton of ore treated, zinc 1.39 lb. and borax 0.36 lb. per ton. Approximately one assay is made for every 9.05 tons of ore mined and treated. Oil used in the cyanide mill is as follows: one gallon of engine oil for every 182 tons, and one gallon of cylinder oil for every 376 tons. The quantity of other oils used is not given in the annual reports.

Tamarack Costs

From 1906 to 1910, inclusive, the average yield in copper per ton at the Tamarack Mining Co.'s mine, in Michigan, was 20.9 lb., and the production cost 15.2c. per lb. of refined copper. The 1911 annual report shows that the yield for the year was 19.1 lb., and the cost 15.56c. per lb. Mining, transportation to the mill, stamping and taxes cost for the last four years: 1911, $2.69 per ton of ore stamped; 1910, $2.67; 1909, $2.44, and 1908, $2.57 per ton. The cost per pound of refined copper at the mine and mill, excluding construction, in 1911, was 14.07c.; construction, 0.06c.; smelting, freight on bullion, commissions, eastern office expenses, etc., 1.23c., and interest, 0.20c. per lb. The cost of development work is included in the mining cost and is not given separately, the development work amounted to 1790 ft. in 1911, compared with 2216 ft. in 1910. Hand sorting of ore is practiced at the Tamarack, as is the case at most of the Lake Superior copper mines; 18% of the ore hoisted in 1911 and 22.1% in 1910 was discarded.

From 1906-1910, inclusive, the Tamarack produced 58,314,188 lb. of copper from 2,792,830 tons, yielding 20.9 lb. per ton. The total receipts were $8,737,089, not including receipts from the sale of lands, and the total expense amounted to $8,862,878, showing a loss of $125,788. In 1906, a profit of $413,990 was made on operations, so that during the four-year period, 1907-1910, the property was operated at a loss of $539,778. The average cost of production for the five years was 15,.2c. per lb., of which 14.4c. was for mining, transportation, milling, smelting and selling, and 0.8c. for construction and other expenses.

Anaconda

The annual report of the Anaconda Copper Mining Co., for the year ended Dec. 31, 1911, shows that $14,493,823 were expended for mining and development. The mines produced 3,844,070 tons of ore and 4602 tons of precipitates, which would indicate a mining cost of about $3.77 per ton. Transportation charges on company's ores from mines to the reduction works amounted to $1,242,286, which is equivalent to approximately 32c. per ton, if all ore produced was shipped from the mines. The reduction works treated 4,225,813.78 tons of ore, consisting of: 3,756,235 tons of ore from the company's mines, 499,077 tons of purchased ore and 501.4 tons of precipitates from old works.

The reduction expense is reported as $7,744,570, or $1.82 per ton treated. The cost of transporting metals to the East, refining, selling, administration and interest charges amounted to $4,002,673. Based upon the copper contents of the ore, this is equivalent to 1.54c. per lb. of copper.

The total production from all ores treated was 259,407,093 lb. of copper, 9,731,561 oz. of silver and 48,949 oz. of gold, these figures include the production from purchased ores. The actual yield of the ores from the company's mines is not given, but based upon the total yield of all ores treated, it was approximately 61 lb. of copper, 2.29 oz. of silver and 0.0115 oz. of gold per ton of ore. From these figures, the cost of production from the Anaconda ores may be estimated as follows: Mining, $3.77; transportation from mines to reduction works, 32c.; and treatment at reduction works, $1.82; making a total of $5.91 per ton of ore, or 9.7c. per lb. of copper. To this must be added 1.54c. per lb., as mentioned, for transportation, refining, selling, etc., making the total cost 11.24c. per lb. of copper. Figuring gold at $20, and silver at 50c., the value per ton for these metals is about $1.38, or 2.26c. per lb. of copper, which would make the net cost of producing copper from its own ores about 9c. per lb. on this basis.

Copper Range Costs

The Copper Range Consolidated in the Lake Superior copper district operates the Baltic, Trimountain and the Champion mines. According to the annual reports the costs have been as follows: At the Baltic mine during 1911, 696,795 tons of rock were stamped at a total cost of $2 per ton, consisting of $1.71 for mining, transportation, and milling; 20c. for smelting, refining, freight and marketing; and 9c. for taxes and interest, of which taxes were 8.7c. The net yield per ton of rock stamped was 22.06 lb. making a cost of 9.1c. per lb. of copper. Of the total rock hoisted 8.37% was discarded as waste. Mining charges amounted to $1.28 per ton, which includes 10,512 ft. of drifts and crosscuts, equal to one foot for every 66.2 tons of rock stamped, and 609 ft. of shaft sinking. Labor constituted 76% of the mining cost; rockhouse expense 3.7%; hoisting 4.5%; power drills 4.8%; and powder and supplies 11%. Based upon the total tons hoisted the mining cost was $1.17 per ton. In addition to these charges the surface expense including legal, insurance and general, amounting to 12c. per ton must be added, making the total cost at the mine, $1.29 per ton of rock stamped. Transportation of rock to mill was 14c. and stamp-milling expense 18c. per ton. Credits for rents received were about one cent per ton stamped.

The average cost of producing copper at the Baltic during a five-year period 1906-1910 was 8.9c. per lb.; and in 1910, 8.36c. per lb. with mining, transportation and milling $1.58 per ton and the net yield 22.4 lb. The 1911 costs include $46,955 for new construction which is equivalent to 0.36c. per lb. of copper, the average for the five years previous was 0.64c. per pound.

The Champion mine hoisted 787,416 tons of which 6.7% was discarded by sorting and 734,392 tons stamped yielding 21.29 lb. of copper per ton at a cost of 9.6c. per lb. Mining, transportation, and milling was 8.2c. per lb.; smelting, refining, freight, marketing and general expense, 0.0885c.; and taxes 0.57c. per lb. Mining was $1.19 per ton hoisted or $1.28 per ton mined, of which labor was 74%; rockhouse expense 4.2%; hoisting 4.1%; power drills 5.5%; and timber and supplies 12.5%. Included in these costs is one foot of drifts and crosscuts for every 66.7 tons of ore stamped, and 689 ft. of shaft sinking. In addition to the mining expense as stated, 12c. must be added for surface expenses, making the total cost at the mine $1.40 per ton stamped. Transportation of rock to the mill was 14c. and milling 23c. per ton with credits of about two cents for rents received.

From 1906-1910 inclusive the average cost of producing copper at the Champion was 9.25c. per lb. and in 1910, 7.86c. with mining, transportation and milling $1.76 per ton on ore yielding 26.6 lb. per ton. The 1911 costs include $46,805 for new construction which is equal to 0.294c. per lb. of copper. The average cost for construction during the five-year period was 0.85c. per pound.

At the Trimountain mine 6,120,417 lb. of copper were produced from 347,885 tons of sorted ore yielding 17.59 lb. of copper per ton at a cost of 11.55c. per lb. made up as follows: Mining, transportation and milling, 10.35c.; smelting, refining, freight, selling and general expense 1c.; and taxes 0.2c. per lb. Of the total tonnage hoisted 11.4% was discarded as waste. The cost of mining was $1.22 per ton of rock hoisted and $1.39 per ton of sorted ore, of which labor was 67.3%; rockhouse expense 4.4%; hoisting 7.7%; power drills 7.9%; and powder and supplies 12.7%. Included in this cost was 525 ft. of shaft sinking and one foot of drifts and crosscuts for every 48 tons of rock hoisted or 42.5 tons of sorted ore. The surface expense at the mine including insurance, legal and general, was 17c. per ton, making a total of $1.56 per ton at the mine. Transportation to the mill was 11c. and stamp milling 17c. per ton. Rents received gave a credit of 3c. per ton.

The average cost of producing copper at the Trimountain from 1906-1910 inclusive was 12.8c. per lb. with mining, transportation and milling $1.91 per ton and rock yielding 18 lb. of copper. In 1910 the cost of mining, etc., was $1.90 per ton and the cost of producing copper 12.2c. per lb. The 1911 costs include $37,012 for new construction which is equal to 0.6c. per lb. of copper. During the five-year period mentioned construction cost 0.43c. per lb. The average cost for all three of the properties was 9.74c. per lb. for 1911 but the Copper Range Consolidated only receives one-half of the production of the Champion mine. The general expenses of the Copper Range Co. amounted to 0.28c. per lb. and earnings from the railroad 0.18c. making a net charge of 0.015c. per lb. additional for the company as compared with the Champion costs.

Calumet & Arizona Costs

The Calumet & Arizona Mining Co., operating at Warren, Ariz., states that the cost of producing copper was 7.34c. per lb. The cost may be constructed as follows. By charging $53,445 spent on outside properties, as charged to profit and loss, to operations will make 8.56c. for operations which include all expense at the mine and smeltery, freight, refining, marketing and general expenses. A credit of 1.2c. per lb. of copper for the gold and silver contents will reduce the operating charge to 7.36c.; to which a charge of 0.18c. per lb. must be added for construction as reported. This will make the total cost of producing copper, 7.54c. per lb. Credits from miscellaneous sources amounting to $57,411 are reported, equal to 0.11c. per lb. which will reduce the net charge to 7.43 cents. By charging the money spent on outside properties to operations, the account is treated in the same way as explorations are by a great many companies, particularly the iron-mining companies of the Lake Superior region.

An average of 1382 men were employed during the year; 562 at the Calumet & Arizona mine; 344 at the Superior & Pittsburgh and 476 at the smeltery; at the former mine 435 dry tons per year were mined per man; and at the latter, 596 dry tons; the average for the two was 496 tons of ore mined per year per man. At the smeltery about 950 dry tons including fluxing ore were treated during the year for every man employed. At the Calumet & Arizona mine 10.1 wet tons of ore were mined for every foot of development work performed, compared with 11.2 tons during 1910. A dry ton was equal to 92% of a wet ton. At the Superior & Pittsburgh a dry ton was 94% of the wet weight and in 1911 9.1 wet tons were mined for every foot of development.

Unit Labor Costs for Michigan Cement

According to the mineral statistics of the State of Michigan for 1908, there were 16 portland cement plants in operation, producing 3,210,347 bbl. of cement, which is equivalent to approximately 610,000 tons. The average number of men employed by all the companies was 1878, which indicates an average annual output of 1710 bbl., or approximately 325 tons of cement per man employed. The figures in the report are official, being submitted by the managers in charge of the works; the average annual barrels secured per man varied considerably. The lowest output was by a plant producing 25,000 bbl., at an average of 311 bbl. per man. The highest was by a plant with an output of 210,000 bbl., at an average of 2800 bbl. per man. The largest output by any one plant for the year was 380,726 bbl., but the average was only 1260 bbl. per man employed. The second highest average was at a plant producing 350,000 bbl., at an average of 2520 bbl. per man per year.

Robinson Mine, Transvaal

The 1911 report of the Robinson Gold Mining Co., Ltd., states that 710,000 tons (2240 lb.) were mined at a total cost of $1.80 per ton, which includes the cost of delivering the ore to the crusher; this cost is made up as follows: 59c. for stoping; 8c. for timbering and rockwalling stopes; 24c. for old workings; 4c. for sand filling stopes; 32c. for shoveling in stopes and tramming underground; 39c. for miscellaneous charges and 14c. per ton for development. The development cost per ton of payable ore exposed by driving amounted to 34.3c. per ton. Of the total ore mined, 117,600 tons or 16.6% of the ore mined was discarded by hand sorting.

The mill treated 592,700 tons in 315 days with 250 stamps at the rate of 7.5 tons per stamp per day. The average value of the ore crushed was 11.19 dwt. gold per ton, 68.4% of which was extracted before cyaniding. Of the total tonnage crushed 99% was converted into pulp and treated in the cyanide plant. The average assay value of these heads was 3.53 dwt. and residues 0.531 dwt.; the actual yield was 3.18 dwt. per ton, making a theoretical extraction of 84.9% and actual 90.2%. The extraction by the cyanide department by actual yield was 28.3% of the total gold contents of the ore.

The total cost of reduction per ton was $1.05, made up as follows. Ore sorting and crushing, 15c.; transport to mill, 6c.; stamping and milling, 27c.; tube miling, 14c.; cyaniding, 43c. per ton. Based on the tonnage milled the working costs were as follows: Mining, $2; development, 16c.; milling, $1.05; general expenses, 35c.; a total working cost of $3.56 per ton. The capital expenditures amounted to approximately 38c. per ton, bringing the actual cost for the year up to $3.94 per ton. Of the men employed 423 were whites, 66 Cape boys and Indians, and 2974 natives or a total of 3463 employees, which is equivalent to about one man for every 205 tons of unsorted or 171 tons of sorted ore per year.

Power Costs at Baltimore Copper Works

In testimony recently given before the Public Service Commission of Maryland, it was brought out that power is furnished to the Baltimore Copper Smelting & Rolling Co. at ½c. per kw.-hr. The revenue derived from the copper works by the Consolidated Gas, Electric Light & Power Co. was stated to be about $125,000 per year. Power is furnished by the Falls of the Susquehanna.

Cyaniding at Nova Scotia Mill

By C. L. Hargrave*

The conglomerate ore of Cobalt is highly refractory, the silver occurring chiefly as sulphides and antimonides. The treatment at the Nova Scotia mill, before the shutdown, included rough concentration, pan-amalgamation of concentrates and cyanidation of all tailings. Reducing agents interfered with extraction and precipitation. Close concentration and the use of electrolytic oxygen suggested as remedies.

Owing to the recent forced shutdown of the Nova Scotia mill, a brief review of some troublesome features of cyanidation here may, at this time, be of general interest to cyanide operators, particularly those in the Cobalt district.

ORE HIGHLY REFRACTORY

The conglomerate ore of this district is especially refractory, and cyanidation involves many interesting problems. Silver occurs[1] as native silver, as dyscrasite, Ag_6Sb, as argentite, Ag_2S, and as pyrargyrite, Ag_3SbS_3. The amount of leaf silver is small, most of the silver occurring as sulphide compounds. On the diabase ores of the Nova Scotia mine, however, by far the greater part of the silver is in the leaf form.

Copper also occurs in the conglomerate ores as tetrahedrite, $Cu_5Sb_2S_7$, as bornite, Cu_3FeS_3, and as copper pyrites, $CuFeS_2$. Nickel and cobalt occur as the arsenides, niccolite, NiAs, and smaltite, $CoAs_2$, and as arsenates, nickel bloom and cobalt bloom. Native bismuth and graphite are found in small quantities. The following is a partial analysis of a fairly high-grade conglomerate ore: Iron, 6.45%; sulphur, 1.15; arsenic, 3.4; antimony, 1; cobalt, 1.02; nickel, 0.87; bismuth, 0.05; copper, 0.14%; silver, 287 oz. per ton.

The policy at the Nova Scotia has always been to ship nothing but bullion, even the refractory concentrates being treated in the mill. Most operators here have hesitated to adopt this practice, and in the case of those who make use of cyanide, the mainstay in their recovery system is concentration, which, begun in the mine, is followed up so closely in the mills that they become essentially concentrators with cyanidation playing quite a minor rôle. In my opinion, the latter plan of treatment is fully justified, as I will later attempt to show.

COARSE CONCENTRATION USED

The 40-stamp mill of the Nova Scotia is a custom plant, treating ore averaging about 30 oz. in silver. The treatment consists of stamping in solution through 16-mesh screens, coarse concentration on Deister No. 2 tables and all-sliming of the table tails by tube mills. Amalgamation pans, Dorr settlers, Trent agitators, a Moore filter and Merrill precipitation presses make up the main equipment.

This treatment, while used on the diabase ores of the Nova Scotia, previous to custom milling, was said to be fairly satisfactory, but, when later it was applied to the conglomerate ore from the other mines, it did not give the expected recovery.

It will be noticed that no slimers are used, dependence being placed in the cyanide solutions to make a sufficient extraction on the tails after the first rough concentration. This proved to be the weak link in the system. Different tests which were made on the filter tailing before discharging to the lake, showed that fine concentration was absolutely required. Had the tests been made during those times when concentrates also were being cyanided, or when the filter tailing was abnormally high, the necessity for closer concentration would have been more emphasized.

The concentrate produced by the Deister No. 2 tables usually is from 1 to 1.5% by weight and run about 1000 oz. in silver. It is first pan-amalgamated, the tail reground in a tube mill and cyanided, the solution being precipitated along with the regular mill solution, and the agitation tail being filtered and discharged along with the regular slime tailing. This is the least desirable feature of the whole treatment scheme.

Quicksilver consumption and cyanide losses are extremely high, and silver recovery usually less than that at the smelteries. Besides this, as would be expected, the cyanidation of the pan tail quickly fouls the whole mill solution, charging it with rapidly accumulating reducing agents, which later interfere with the extraction on the regular mill ore. Where jigs are used, followed by close table concentration, from 80 to 87% of the silver content of the ore is removed as concentrate, and with it a high percentage of troublesome cyanicides and reducing agents.

REDUCING AGENTS TROUBLESOME

The quantity of these reducing agents present in the ore and the rapidity with which they go into solution in cyanide when the ore is finely ground, are the chief obstacles in the way of the successful, long-continued use of cyanide, where air alone is employed as an oxidizer. Once formed in solution, these reducing agents remain almost entirely unaffected by air, and I have forced a large excess under 5-lb. pressure through the solution for 40 hours without causing any decomposition. When fresh pulp, particularly the tube-mill feed, was added to this solution, no amount of air prevented a gradual increase of reducing agents.

Insofar as it could be carried out, the regular mill practice confirmed this, but the Trent agitators did not allow the use of as much air as is possible in a Pachuca tank. But the solution itself was aërated at almost every possible point without lowering the quantity of reducing agents.

A sample of the filter tailing, when agitated with fresh cyanide solution which was replaced with fresh solution from time to time, so as to keep the reducing agents at a minimum, was reduced in silver content about 50%, showing that the residual silver was not entirely insoluble. The mill solution, however, was inactive, and longer agitation was not a way out of the difficulty. In fact, it soon became evident that practically all the extraction made in the 72-hours agitation in the Trent agitators took place in the first tank, and that also the greater part of the total extraction by cyanide in the mill was made before reaching the agitators at all. Repeated experiments showed that, whereas a fresh solution of KCN would dissolve a piece of leaf silver in six minutes, the mill solution always required two or three times as long under similar conditions.

Using a $\frac{N}{10}$ $KMnO_4$ solution and 10 c.c. of cyanide solution, the reducing power, as defined by Clennell, varied from 0.5 c.c. to 0.7 c.c. Of this sulphocyanides made up about 70%, ferrocyanides 7% and the remainder was due to organic matter, sulphides and nitrites. Determinations made at other times showed 90% sulphocyanides in the makeup of the reducing agents. Lead acetate to the extent of 1 lb. per ton of ore was used to precipitate soluble sulphides, but, judging from the amount of KCNS in solution, it was not completely effective.

PRECIPITATION HINDERED

The precipitating action of the zinc dust was interfered with considerably by the amount of reducing agents present; also at times there appeared to be resolution of silver in the press, giving a higher tail than head. As precipitation lowers the reducing power slowly, treatment of more solution daily would have been beneficial.

---

*Mining engineer, Phoenix, Ariz.

[1] Report of Ontario Bureau of Mines, 1907, Vol. XVI, part II.

Another feature was prominent, the total and free cyanide were always numerically equal on the mill solutions. In other words, the K_2ZnCN_4 formed in the presses appeared to be almost immediately broken down, possibly by the action of soluble sulphides, and perhaps, to some extent, by the high amount of lime present. The zinc feed was varied from 4 oz. to as high as 12 oz. at times per ton of solution. The accumulation of copper in the mill solution, reaching at times 1 lb. per ton of solution, was another element interfering with the precipitation of the silver.

While on the subject of precipitation, I would suggest that some standardized precipitation method might be used to advantage for buying zinc dust. I have found in some tests that whereas one good lot of zinc would give 96% precipitation, another lot would give only 77% upon the same solution under similar conditions.

To partly offset the effect of some of these reducing agents, it would seem advisable to crush in water rather than in solution, as about 25% of the reducing agents in the finely ground ore is soluble in water, and by dewatering a large amount may be removed, giving better precipitation and extraction with probably only slight increase in KCN consumption.

Experiments with Oxidizers

In order to overcome the effect of the reducing agents, I experimented with oxidizers, chief of which were hydrogen dioxide, H_2O_2, ozone, O_3, oxygen, O_2, taken from a 40-gal. cylinder, and oxygen produced by electrolysis, using direct current and lead electrodes in the solution; practically identical results were obtained by using a graphite anode and sheet-iron cathodes. I tried alternating current on the solution, but at 60 cycles got no action, due probably to the high rate of alternation. All of the oxidizers proved beneficial as regards extraction, but their action on cyanide differed, as the results in the accompanying table show. Cyanide and protective alkalinity (P. A.) are in pounds per ton (2000 lb.) of KCN and CaO, respectively, and reducing power (R. P.) is shown according to Clennell's definition.

Good Results by Electrolysis

The solution after electrolyzing with direct current became quite active, and, using it on ore, considerably lower tailing was obtained than when using untreated mill solution. In making this test, newly treated solution was added to replace that decanted. Continuous use of this current would greatly enliven the solution and should give an extraction approaching that when using freshly made solutions, results which are quite satisfactory, especially on the —200-mesh overflow slime.

This —200-mesh slime, by the way, leaves the concentrating mill running from 7 to 10 oz., and, as it is well washed and ready for agitation, 1 oz. would cover the cost of treatment. This is the best field for cyanide in connection with Cobalt ores at the present time, and its future use here ought to depend largely on whether, by the regular use of the current, foul solutions can be prevented at low cost and whether the mines will continue to produce long enough to warrant the installation of a specially designed plant for this class of ore. In certain cases a small plant, treating this fine slime from several mills, should prove profitable.

I have seen the statement made in some books on cyaniding that oxidizers merely accelerate the dissolving action of the cyanide, and a longer use of air would accomplish the same results. That has not been my experience, and I think the statement does not apply to highly reducing ores. I have given an ore 150-hours' agitation, using mill solution and sampling daily. After getting a tail of 14 oz., I failed to reduce it further, but upon adding hydrogen dioxide, a further extraction of 5 oz. took place. Further addition of dioxide with long agitation failed to lower this tail. Heating of solutions has been tried both in the mill and laboratory, but discontinued from lack of good results.

EFFECT OF HYDROGEN DIOXIDE ON UNPRECIPITATED MILL SOLUTION

Amount Solution, c.c.	H_2O_2, Per Cent.	Free Cyanide	Total Cyanide	P.A.	Reducing Power After 3 hr.	31 hr.	46 hr.
200	none	5.6	5.6	1.9	0.53		
200	5.0	4.1	4.1	1.8	0.48	0.27	0.25

EFFECT OF OZONE ON UNPRECIPITATED MILL SOLUTION

Amount Solution, c.c.	KCN.	P.A.	R.P.	Time
3000	4.3	1.4	0.55	start
	4.3	1.4	0.55	2 hr.
	3.0	0.8	0.52	8 hr.
	0.2	0.2	0.03	30 hr.

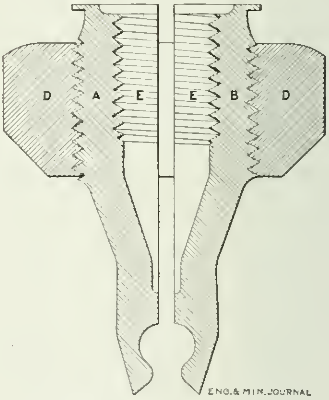
EFFECT OF ELECTROLYSIS ON UNPRECIPITATED MILL SOLUTION

Amount Solution, c.c.	KCN.	P.A.	R.P.	Time	Volts	Amperes
3000	4.3	1.4	0.54	start	4.1	0.20
	4.4	1.4	0.52	1 hr.	4.2	0.195
	4.5	1.0	0.51	10 hr.	6.0	0.19
	4.7	0.7	0.41	27 hr.	6.5	0.19

To summarize: On the Cobalt conglomerate ores, close concentration should precede any and all subsequent forms of treatment and especial care should be taken in crushing to prevent the formation of the rich fine slime. Pan-amalgamation of the raw concentrates is not satisfactory as carried out at the Nova Scotia, and smeltery treatment is better. While cyanidation at present is unsatisfactory, by using electric current as an oxidizer, there is a promising field for it on the untreated overflow slime. A number of details should be worked out; as current is cheap and air oxidization insufficient, the subject is well worth careful investigation.

A New Mine Trolley Ear

A new suspension or ear for trolley wires in mines, which is known as Type B-3 suspension, has recently been introduced by the Westinghouse Electric & Manufacturing Co. The clamp, shown in section in the accompanying drawing, cannot be taken apart, hence none of its parts can be lost or dropped. It consists of the two symmetrical pieces *A* and *B*, threaded interiorly as at *E*, to receive the insulator stud and exteriorly for the nut *D*, which, upon being tightened draws the two symmetrical parts together.



Trolley Ear in Three Pieces

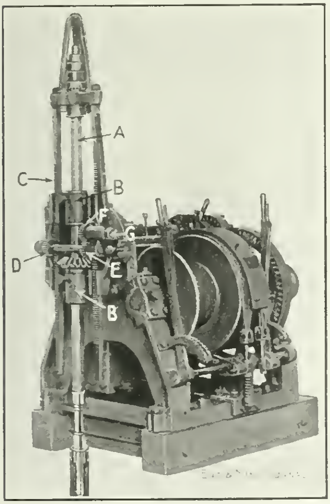
The clamp complete, with nut *D* loosened is screwed on the insulator stud, the wire is inserted in the lips of the clamp slipping freely into place without forcing, then the nut is tightened firmly clamping wire and stud. The ear can be placed in any direction and still be tight on the stud, making it unnecessary to twist the insulator after screwing the ear together. The wire can be drawn through the ear in taking up slack by loosening the nut *D*, without danger of the wire dropping out. All parts of the clamp are sherardized.

Silica in fluorspar should be determined by volatilization of silicon tetrafluoride and decomposing the vapor in water.

The Dobbins Core Drill

The design of the Dobbins core drill is characterized by many improvements upon the older types of core-cutting machines in which steel shot is used. A notable feature is the compactness of the machine. The base measures 3x3 ft., and as an inverted, two-cylinder, slide-valve engine is used, the overall height is but 47 in. The crank shaft is geared directly to the main horizontal drive shaft, and to the hoisting drum which is shown in the accompanying halftone, and which is opposite the engine.

The drill head is hinged so that it may be swung away from above the hole, a feature which permits quick clearing when hoisting or lowering tools or when driving casing. It is swivel mounted so that holes may be drilled at any angle up to 55°. Furthermore the drill head can be removed and the machine used as a winze hoist or for hoisting while shaft sinking, a feature which should commend it for use in prospecting, as a core drill and winze hoist are virtually combined in one machine.



The Dobbins Shot Drill

The drill spindle, *A*, is square in section and slides freely in the long sleeves, *B*, *B*, on the drill head. The feed is effected by the sliding rack-guide, *C*, through the gears, *D*, *E*, and *F*. The gears, *D* and *E*, are mounted upon a short shaft and gear *E* is engaged by gear, *F*. A ratchet lever, shown in the illustration, is attached at *G*, so that a downward movement of the lever causes *F*, to move *D* and *E*, so that the rack-guide moves down. The ratchet lever can be used to apply pressure when starting holes until the weight of the rods is sufficient for cutting to continue without extra pressure. By reversing the ratchet lever the rods may be lifted and the pressure on the bit be relieved without recourse to the hoist. The spindle and guide are unusually long, 30 in., so that time is saved in less frequent additions to the drill rods.

An automatic spring tension in connection with the band brake on the hoisting drum allows for proper cutting pressure. When the brake lever is set to allow gradual slipping of the drum as the core is cut, positive and close adjustment may be obtained by occasionally tightening or loosening the spring tension.

These drills have been used by the Manhattan Drilling Co., 25 Broad St., New York, and have been placed upon the market. One machine is at present being used to drill an artesian well at the Battery Park building in New York; another is in use at the site of the new New York Central railroad station in New York. Both drills are cutting a 4½-in. core with a 6-in. bit. Drilling has been done at the rate of 59 ft. in three 8-hr. shifts; the cost is reported to be 56c. per ft. The usual type of bit, core barrel, sludge barrel and drill rods are used.

California Oil in April

The net production of petroleum in all California fields in April was 6,810,953 bbl., a daily average for 30 days of 227,032 bbl. This is a decrease in total production from March, of 112,955 bbl., but an increase of 3680 bbl. in daily average. The total shipments in April were 5,591,339 bbl., a decrease from March of 439,567. The stocks on hand at the end of April amounted to 43,899,497 bbl., an increase over March stocks of 893,888. The field consumption in April was 421,842 bbl., a decrease of 21,247 from the March consumption.

APRIL PRODUCTION BY FIELDS

District	Bbl.
Fresno County	
Coalinga...	1,544,897
Kern County	
Midway........	1,934,387
Kern River.......	930,482
McKittrick.....	461,267
Sunset-Maricopa....	449,846
Lost Hills.........	105,241
Total Kern County..	3,881,223
Santa Barbara County	
Santa Maria, Lompoc, Cat Canon	439,332
Summerland......	4,350
Total Santa Barbara County..	443,682
Southern Counties and Fields	
Fullerton.	484,574
Salt Lake.	224,537
Coyote...	89,926
Whittier.	56,689
Ventura County.	43,593
Los Angeles.	31,842
Newhall...	9,990
Total Southern Counties aod Fields.	941,151
Total all Fields.	6,810,953

APRIL OIL STOCKS

District	Bbl.
Kern River..	27,079,357
Coalinga...	2,895,860
Midway...	1,812,896
McKittrick...	816,101
Sunset Maricopa.	769,627
Santa Maria.	637,713
Los Angeles.	463,128
Fullerton...	298,383
Lost Hills...	236,502
Salt Lake.	163,974
Ventura....	92,423
Whittier, Coyote, Newhall	62,790
Miscellaneous pipe lines	8,570,743
Total in all fields and pipe lines	43,899,497

The field-development record shows 39 new rigs, 61 completed wells, 5553 producing wells active, 761 producing wells idle, 416 drilling wells active, 364 drilling wells idle, no wells abandoned.

Yerington District, Nevada

Special Correspondence

The Yerington mining district is in a more prosperous condition than at any time in its history. During the last few weeks, to the list of shippers have been added the Malachite Copper Co. and the Yerington Copper Co., as well as a number of independent shippers from properties along the line of the Nevada Copper Belt Railroad.

Favorable Smelting Rates

The smelter situation at Wabuska is unusual in that ores can be shipped to it from points within approximately 90 miles at a cost on medium-grade ores not to exceed $1 per ton, and small shippers receive about the same smelting rate as the large shippers who contract for delivery of a certain tonnage weekly. A number of small owners are taking advantage of this condition and are making shipments to the smelting works of ore that they can sort out of their dumps or gopher out of surface workings. It has furnished an incentive to both development and prospect work in the country from Reno as far south as Laws, California.

There is talk of the Mason Valley Mines Co. increasing the length of its furnaces, so as to handle an increased tonnage, and only run one furnace at a time, holding the other in reserve. A good stock of ore is being bedded at the works, resulting in less lime and coke being required for fluxing.

Shipments from Porphyry Outcrop

The properties situated on the porphyry outcrop near the river, just south of the town of Yerington, are shipping regularly from one to three cars of ore per week. Under this porphyry area there is considerable copper stain, but no gossan, strictly speaking. It is in the more intensely stained areas that the ore is being mined and it is possible that a number of these openings will extend in depth to more or less permanent orebodies. The porphyry area outcropping above the surface wash, is about ¾ by ½ mile in extent.

It has never been successfully worked heretofore, owing to the small furnaces erected and the fact that the ore did not contain sufficient fluxing qualities. When these small furnaces were run, the iron was shipped for long distances and the coke hauled over 14 miles of rough road, consequently the overhead charges were large. One can now ship a 4% ore to the smelter at Wabuska at a slight profit, the profit increasing very materially with a rise in copper contents to 5 and 6%. It is ores of this grade that are now being shipped at a handsome profit to the leasers who are scattered over the property of the Empire Nevada Copper Co. To date, nothing startling has developed in the way of orebodies, outside of the deeply stained porphyry. The copper is in the shape of a superficial coating of malachite, and in places a thorough impregnation of malachite and cuprite is seen throughout the porphyry.

The Yerington Copper Co. is shipping from a quartz vein impregnated with copper, on the contact of a metamorphic limestone and lamprophyre. This contact vein is persistent both vertically and on the strike, and is small and, except in the larger portions, highly siliceous. The vein has an average width of approximately two feet. All of this is not shipping grade. Recently a car of sorted ore averaged 15%, as sampled at the smeltery.

The Malachite property is shipping approximately one car per day of good ore. This property adjoins the Mason Valley Mines Co.'s property on the south. The ore is taken from what appears to be the same orebody that the Mason Valley mine is working. The ore is a highly oxidized garnetiferous lime, impregnated with sulphide and carbonates, and makes an ideal smelting mixture.

Adjoining the Malachite, the McConnell property continues shipments of one to two cars daily, of good ore. This ore is similar in every respect to the Malachite Co.'s ore, and is most acceptable at the smeltery. The properties above mentioned are working from 5 to 20 men, and from general appearances will increase their working forces at an early date.

NEVADA-DOUGLAS SHIPS 2600 TONS WEEKLY

The Nevada-Douglas Copper Co. continues shipments at the rate of approximately 2600 tons per week, the ore averaging over 5%. The tonnage is about equally divided between the Douglas Hill ore and the Ludwig ore. This tonnage will be maintained at and above this figure for an indefinite period. The smelter will accept all the ore delivered, although the contract is for but 10,000 tons per month.

The Douglas Hill workings are being extended in every direction with excellent results and new ore is being opened up almost daily. The surface cuts are showing up exceptionally well, the ore continuing better than 5% in copper. It is mined cheaply. At what is called the Old Meat House Cut, a face of ore about 60 ft. wide has been uncovered on the surface and has every indication of extending into the hill for some distance. Extensive work is planned for future development, among which is a new double-track tunnel from alongside the tram line at a point 125 to 150 ft. below the present workings of Douglas Hill, also a 3-ton ore bin about 40 ft. down the hill from the present upper terminal ore bin, so that sorting of ore will be facilitated and the working of the tramway greatly improved.

The Casting Copper shaft is being sunk, a point 125 ft. from the surface having been reached recently. The shaft is two compartment and is all in garnet lime. This shaft is to be sunk to the 225-ft. level before any further crosscuts or drifts are made. The bottom of the shaft is in ore and the 100-ft. level station shows a good width of shipping ore.

At the Ludwig, chalcocite has been struck in the 619 winze at the extreme south end of the sixth level. The 700 south drift, for one week recently, averaged about 4% in copper. No secondary enrichment was evident on close examination, and the company is highly encouraged at this tenor of ore coming from the primary portion of the vein. The five raises, all under way, are being pushed rapidly, most of which are producing a daily tonnage of good ore. At present no rock assaying less than 2.8% copper is considered ore, and all below this grade is being thrown on dumps.

GYPSUM SHIPMENTS INCREASING

Gypsum shipments are being increased weekly. The quarry is being put in shape for economical extraction of the rock gypsum. A derrick will be installed soon, at which time the quarry floor will be dropped vertically about 20 ft. This will give a face of approximately 70 ft. to work on.

The Yerington district at present is employing at smelting works and mines, approximately 500 men. The district is badly handicapped at present by the influx of 10-day men. The mines are good places to work in, being dry and well ventilated; and no complaint is heard from the men, as far as the general treatment is concerned. Good, steady men with families, or industrious single men wishing steady work, could not do better than to come to the Yerington district, and in time the camp would be made up of men who hold their positions from one year's end to the other, instead of as now, when, with a force of 60 men, a company is compelled to carry on its rolls approximately 100 men during the month. Within five miles of any of the mines, there are ranches, and green foodstuffs are to be had in plenty in season.

Lackawanna Steel Company

This company owns iron and coal mines and extensive steel works, the mills being at Buffalo, N. Y. The report for the year ended Dec. 31, 1911, shows $24,750,000 capital stock outstanding; $25,000,000 bonds; $10,000,000 debentures and $7,058,000 bonds of subsidiary companies.

The company received during 1911, from mines which it owns, or is interested in, and from other sources, 987,314 gross tons of iron ore, and produced a total of 844,829 tons of coke and 735,980 tons of pig iron. It also produced 345,038 tons of bessemer ingots and 453,214 tons of openhearth ingots, a total of 798,252 tons of steel. Shipments of products were: Rails, 244,220 tons; shapes and angles, 152,005; plates, 52,756; merchant steel, 77,010; sheet iron, billets and blooms, 92,967; pig iron and miscellaneous, 141,405; total, 760,363 long tons, being a decrease of 322,152 tons from 1911. Since Jan. 1 the orders have increased largely.

The income statement for the year is as follows:

Gross sales and earnings....	$21,040,387
Manufacturing and operating costs	17,394,307
Net earnings from operation	$3,646,080
Interest and dividends received	584,913
Total income	$4,230,993
General expenses and taxes..	739,515
Net earnings	$3,491,478
Interest, rentals and sinking funds	$2,466,492
Depreciation	942,183
Total charges	$3,408,675
Surplus for the year.....	$82,803

The report says: "The demand for the company's products continued small during the first half of 1911, and though somewhat increased during the latter part of the year, was, as a total, unsatisfactory, as evidenced by the shipments for the year. During the month of May, 1911, there was a serious break in prices, so that the business done during the last half of the year was at the lowest figures, conditions considered, that have ever obtained in this country.

"The properties have, during the last year, been maintained in high physical condition. The new merchant bar mill, mentioned in the report of a year ago, was completed and put in operation during September, 1911, and contributes much to the greater diversification of the company's products. In order to meet the increasing demand for openhearth steel, the company's producing capacity will be increased during 1912 about 35%, by the construction of two 60-ton furnaces and a hot-metal mixer for the openhearth department. Further additions to the openhearth ingot capacity will have to be made in the near future."

A Discussion of Radio-Chemistry

By Harry C. Jones*

The discovery of the X rays excited interest in naturally fluorescent substances, which led to the discovery of the radioactive elements. The study of these leads to a totally new chemical idea: the idea of an unstable chemical atom, and the production of one element from another.

A new branch of physical chemistry has come into existence during the last two decades. The phenomena brought to light in this field are so different in kind from anything known before, that we might almost say that we had here a new branch of natural science. The phenomena in question are known as radioactive, and the branch of science as radiochemistry.

We shall have to deal here with transformations, as we shall see, which differ from any chemical changes hitherto known or even suspected. We shall have to do with unstable chemical elements, and with one chemical element passing over into another, or at least yielding another chemical element as one of its decomposition products; in a word, with the birth of a chemical element—something hitherto undreamed of.

We shall also have to do with the production of heat energy in quantities several million times as great as that of the most exothermic chemical reaction; in quantities so great that when first discovered it raised the question in the minds of some, whether the law of the conservation of energy had not been overthrown, whether we did not have here a system which actually created heat energy.

Conservation of Energy Holds with Radium

To allay any fear in this direction, let it be said in advance that such is not the case; and that the law of the conservation of energy holds just as well today as it did before radioactive phenomena began to be studied.

It will be seen from this preliminary sketch that in radiochemistry we are to deal with phenomena that do not differ simply in degree from those already known but literally in kind.

It is obvious that these papers would be intolerably incomplete and unsatisfactory, were we not to discuss the more important of these phenomena.

We shall, therefore, trace briefly the discovery of the radioactive elements, the investigation of their properties both from the chemical and the physical standpoints, and finally attempt to explain or account for radioactive phenomena.

Discovery of Radioactivity

A paper was published in 1895 by Röntgen "On a New Kind of Radiation." When this paper first appeared it almost immediately attracted worldwide attention. When an electric discharge is allowed to pass through a high vacuum tube there is given off a kind of radiation which has different properties from any other radiation known to man. This radiation, as is well known, has great penetrating power, passing readily through objects opaque to light, and even through films of the metals of considerable thickness.

The important point in this connection is the source of this radiation. Where does it come from? It was first supposed to come from the anode on which the cathode rays impinged, but was later shown to come from the spot on which the cathode rays impinged on solid matter. If the cathode rays were made to fall on the the wall of the discharge tube, the spot on which they impinged became the source of the new kind of radiation which was soon called the "X" ray.

The spot on the glass wall on which the cathode rays impinged and from which the "X" rays started, shone with a greenish-yellow fluorescence for most glasses. The exact color of the fluorescence depended upon the nature of the glass, but this is, for the present purpose, not essential. Whatever the nature of the glass the spot upon which the cathode rays impinged shone with fluorescent light, and it was from this spot that the "X" rays came off.

This led the distinguished French physicist, Becquerel, to conclude that there was probably some connection between the fluorescence produced on the glass by the cathode rays, and the "X" rays which originated from this spot. This conclusion, although erroneous, led to an important discovery. The fluorescence had nothing whatever to do with the production of the "X" rays.

X Rays are Simply Pulses

These are simply a set of irregular pulses in the ether, set up where the cathode rays fall upon solid matter. The irregularity of the pulses is the cause of the great penetrating power of the "X" rays. They do not produce resonance since they are irregular vibrations, and, consequently, most substances are transparent to them.

The thought that there is some connection between the fluorescence of the glass and the origin of the "X" ray, led Becquerel to examine naturally fluorescent substances to see whether they gave off any radiation with properties at all similar to those of these rays. Prominent among the naturally fluorescent substances are the ores and salts of uranium. These substances have a strong, greenish-yellow fluorescence and the salts of uranium can readily be prepared of a high degree of purity.

Becquerel soon found that salts of uranium give off a kind of radiation that in some of its properties resembles the "X" rays, and in others resembles light. The uranium radiation has much greater penetrating power than light, and can penetrate layers of substances that are entirely opaque to light. Further, these radiations have some properties that differentiate them sharply from "X" rays. Without going into unnecessary detail here, it can be stated in general that the uranium radiation occupies a position intermediate between light and the "X" ray.

Early Investigations of Radioactivity

Having found that uranium compounds give off a characteristic radiation—are as we say radioactive—Becquerel suggested to Mme. Curie that she examine uranium ores and minerals in the same connection. The result of her investigation was to show that uranium minerals are, in general, radioactive, and some of them far more radioactive than pure uranium itself. The uranium mineral richest in uranium contains only about 60% uranium.

What was Mme. Curie forced to conclude as to the cause of the high radioactivity of certain pitchblendes? The only conclusion seemed to be that these substances must contain some constituent which was more radioactive than pure uranium itself. Since the known constituents of pitchblende analyzed 100% to within the limit of error of experimental methods, this radioactive constituent of the pitchblende must be present only in small quantity; and, therefore, must have great radioactivity.

Mme. Curie then set about to isolate the radioactive constituent from pitchblende. This mineral is one of the most complex substances known to man, and the problem of obtaining from it an infinitesimal quantity of a supposed substance even of a fair degree of purity, seemed at first thought hopeless. There was, however, one property of this substance which saved the day for Mme. Curie, and that was its great radioactivity. In the chemical transformations to which pitchblende was subjected, the radioactive constituent could always be detected by means of its radioactivity.

---

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

Mme. Curie, by a series of difficult separations, finally succeeded in obtaining from pitchblende a new element, which was about one and a half million times as radioactive as metallic uranium, and this was the element radium.

Radiations Given Out by Radium

The most obvious property of radium and other radioactive substances is to emit radiations. Indeed, this is what we mean by a substance being radioactive. The radiations given out by radium are of different kinds. Some of these radiations have small power to penetrate matter, and are deflected in a magnetic field, but with difficulty. These are known as the alpha radiations.

There are other radiations given out by radium, which have considerable power to penetrate matter, and which are readily deflected in a magnetic field. These are known as the beta radiations.

There is still a third kind of radiation given off by radium, which has enormous power to penetrate matter and which cannot be deflected at all in a magnetic field. These are known as the gamma radiations.

We must look a little more closely into the properties of these three kinds of radiations, to see what these different kinds are.

Take first the alpha particles which make up the alpha radiation. The masses of these have been determined by a method which it would lead us too far here to discuss. It was first worked out by Sir J. J. Thomson in connection with his study of the particles in a cathode discharge tube.[1]

The mass of the alpha particle has been shown to be four times that of the hydrogen atom. This is the mass of the helium atom, and, indeed, it has been shown that the alpha particles are helium atoms. The alpha particles are, therefore, pieces of matter, having a mass of four as expressed in our atomic weight units, shot off from radium with a certain velocity, and what is this velocity?

Properties of Alpha Radiations

The same general method which was employed to determine the mass of the alpha particle, also gave its velocity. It was found that the velocity of the alpha particle is about 2.5×10^{9} cm. per sec., about one-tenth the velocity of light. The alpha particles or helium atoms shot off from radium are, then, the most rapidly moving pieces of matter known to man. Indeed, there is no other known form of matter which moves with a velocity at all comparable with this.

The result of this considerable mass and high velocity, is that the alpha particles have large kinetic energy. They, therefore, ionize a gas through which they pass, affect a photographic plate, produce fluorescence when allowed to fall on a fluorescing screen, etc.

This property of exciting fluorescence has been utilized in the well known instrument, the spinthariscope. Some radium salt is diluted by mixing it with some neutral powder, and a screen covered with zinc sulphide or barium platinocyanide is placed above the radium salt. When the alpha particles are given off from the radium they fall upon the fluorescent substance, and where they strike there is a flash of light. If the radium salt is sufficiently diluted we can see the individual splotches of light upon the screen. When the screen is observed by means of a lens the appearance is that of the milky way on a dark night, the individual splotches of light appearing and disappearing in quick succession.

Since the alpha particles are matter and have considerable size, we can easily see why they cannot pass through any considerable thickness of matter.

The Beta Particles are Electrons

The beta particles have much smaller mass than the alpha particles, indeed, only about one-four thousandth the mass, and they move with different velocities ranging all the way from one-tenth nearly up to the velocity of light.

An exhaustive study of the properties of the beta particles shows that they are nothing but cathode particles such as are set free in the cathode discharge tube. These were shown by Thomson to be isolated charges of negative electricity or electrons as they were termed. The alpha particles were pieces of what we ordinarily call matter charged positively. The beta particles are the units of which all matter is made up. It would lead us too far to go into this in any detail, yet it cannot be passed over without a few words.

It was shown by Sir J. J. Thomson about 15 years ago, that a common constituent can be obtained from all elementary forms of matter. This constituent, which is the cathode particle or electron, was shown to be an isolated charge of negative electricity and nothing else. It had mass and inertia, but isolated electrical charges moving with high velocities through an elastic medium such as the ether, were also shown to have mass and inertia; and not only so, but exactly the mass and inertia which the electrons had. There were, therefore, no properties of the electron that could not be accounted for quantitatively as due to the electrical charge, and there is, therefore, no reason for assuming that the electron contains anything except the electrical charge.

Electrical Charges the Ultimate Unit

Since the same electrons are obtained from all known forms of matter, it is reasonable to conclude that all of the elements are made up of electrons of the same kind. In a word, the ultimate unit of all matter, the unit of which all matter is made up, is not matter at all, but the unit electrical charge.

This raises the question why did we ever suppose that there was any such thing as matter? The answer is, matter was a creation purely and simply of the imagination, for the purpose of having something to contain the electrical energy. We could not at that time think of energy in the abstract; we had to have something to attach it to, and consequently, we imagined the existence of another entity than energy and called it matter. This idea will probably impress one at first repulsively, on account of our preconceived idea of matter, having used this term so long.

Energy the Only Entity

A moments' thought will serve to offset this prejudice. Have we any method of measuring so-called matter? Have we even a method of detecting matter qualitatively? Certainly not. We can detect and measure mass and inertia, but we have just seen that these are properties of the isolated electrical charges. There are, therefore, no properties that are not accounted for by the electron—as isolated electrical charges. Having no properties to account for, why should we assume the existence of any other entity than energy? If we persist in assuming the existence of any other entity than energy, then we must admit that it has no known properties; and since we know things here below only by their properties, we are placed in the embarrassing position of knowing the existence of an entity matter, through its properties, of course, when it has no property known to man.

There is not the slightest reason to-day for assuming the existence of any other entity than energy—the old imagined matter being now only historically interesting.

The beta particles are isolated negative charges of electricity, differing from ordinary cathode particles only in this that they move with higher velocities. This fact alone enables us to understand the properties of the beta particles, including their great power to penetrate matter.

There is a third kind of radiation given off by radium—the gamma radiation. These cannot be deflected in a magnetic field and can penetrate a foot of solid steel. A study of the properties of the gamma rays in general shows that they are very penetrating "X" rays. They occur only when the beta rays occur, and are produced by them. Where the beta rays impinge upon matter gamma rays arise, just as where the cathode particles impinge upon matter "X" rays are sent off.

---

[1] "The Electrical Nature of Matter and Radioactivity," by H. C. Jones.

RADIUM RADIATIONS

It was found in the early study of radium that its salts can give off light; are, as we say, self-luminous. A fairly pure radium preparation can be readily seen in a dark room. Radium has, further, the property of charging itself electrically, under certain conditions. Radium salts shoot off both positively and negatively charged parts. The alpha particles, or helium atoms, are charged positively. The beta particles, or electrons, are charged negatively. If the radium is placed within an insulating box which will absorb the alpha particles, and the beta particles allowed to pass through the insulation and fall upon an outer metal box, they will give up their charges to the metal which will conduct it off to earth, and the radium will become charged positively.

Another physical action of the radium radiations is their power of rendering nonconductors of electricity conductors. Pure liquids, in general, are non-conductors of electricity, are, as we say, insulators. If many of these are subjected to the action of the radium emanation they show appreciable conductivity. This means that these pure liquids are ionized to some extent by the action of the radiations from radium. The question arises which radiations are the most effective in ionizing, say pure liquids? The alpha particles have several thousand times the mass of the beta particles, and although they move only about one-fifth as fast, the kinetic energy of the alpha particles is many times as great as that of the beta particles. We would, therefore, expect the ionization on the surface of liquid dielectrics to be due to the alpha particles. It must, however, be remembered that the alpha particles have little power to penetrate matter; and, therefore, any ionization in the interior of such substances would have to be due to the radiations that have greater power to penetrate matter, i.e., the beta and especially the gamma radiations.

INSULATORS RENDERED CONDUCTING BY RADIUM

The radiations from radium not only ionize liquid dielectrics but also solid. Even the best solid insulators show appreciable conductivity under the influence of the radium radiations. This must be due to a partial ionization of these substances under the influence of the radiations given off by radium.

The action of radium salts upon living tissue is well known. Becquerel, who carried some fairly pure radium bromide in a glass tube in his vest pocket, suffered a severe burn. This action of radium radiations upon living tissue has been used as a curative agent. In certain skin diseases where the cause of the disease is located just beneath the surface of the skin, the exposure of the diseased part to the radiations from fairly pure radium will often serve to destroy the cause of the disease. That radium is a curative agent in such cases there can be no reasonable doubt.

That too much has been claimed for radium in this direction is also certain. That it may have some effect upon so-called skin cancer is probable, but that it has much influence upon this disease after it has progressed well into the deeper tissue is doubtful.

The radiations from radium have the property of effecting some remarkable chemical changes. If a fairly pure specimen of radium bromide is kept in a glass tube for any considerable time, the tube, if of sodium glass, becomes deep brown in color, if of potassium glass it acquires a deep purple hue. I have seen glass tubes in Sir William Ramsay's laboratory, in which radium bromide had been sealed up for some time, so deeply colored as to be only semi-transparent. This was due to the decomposition of the stable silicate, glass, by the radiations, liberating, on the one hand, sodium, and, on the other, potassium. This is, obviously, a remarkable chemical reaction.

Even more remarkable, perhaps, is the production of ozone from oxygen under the influence of the radium emanation. What does this really mean? Ozone differs from oxygen in containing more intrinsic energy in its molecule. This is shown by the fact that when carbon is burned in ozone more heat is liberated than when burned in oxygen. The additional intrinsic energy in the ozone comes from what? In this case from the energy of the radium radiations which are allowed to impinge upon the oxygen, and which transform it in part into ozone.

PRODUCTION OF HEAT BY RADIUM SALTS

One of the most remarkable of the many remarkable properties of radium salts, is the production of heat, and of enormous quantities of heat. This fact was first observed by the Curies and Laborde in 1903. It was noticed that a small pile of radium bromide maintains itself about 1½° C. above the temperature of the surrounding medium. This is, of course, a most remarkable fact, and led quickly to the measurement of the amount of heat liberated by salts of radium.

Two methods were employed in making such measurements. One was to allow a weighed quantity of the radium salt to volatilize liquid hydrogen, and then determine how much liquid was converted into gas in a given time. Knowing the heat of vaporization of hydrogen, it was a perfectly simple matter to calculate the amount of heat liberated by the radium. This method might be characterized as a pyrotechnic one. The method which gave really reliable results was the one based upon the ice calorimeter. This method is based upon the melting of ice by a given quantity of the radium salt, and then determining the amount of water formed in a given time. Knowing the heat of fusion of ice, we have all the data for calculating the heat liberated by radium.

RADIUM MELTS ITS OWN WEIGHT OF ICE HOURLY

The result is most surprising. Radium liberates enough heat to melt its own weight of ice every hour. Since 80 cal. of heat are required to melt 1 gram of ice—a calorie being the amount of heat required to raise 1 gram of water 1° C.—it follows that a gram of radium gives out every hour during its entire life of about 2500 years, about 80 cal. of heat.

This is enormous. Indeed, it has been shown that the amount of heat liberated by radium is between three and four million times that of the most exothermic chemical reaction, viz.: the reaction between hydrogen and oxygen.

The question is, what is the source of this heat? Some at first supposed that the law of the conservation of energy did not hold here, and we had a creation of energy. Others suggested that radium converts some unknown form of energy into heat. This was unscientific. If we must imagine some unknown form of energy in order that radium can convert it into heat, we had as well imagine the heat produced from something that is not energy. The explanation now offered of the source of the heat in radium is that it is produced by the alpha particles striking against some of the solid radium salt. They are stopped, and their large kinetic energy is converted into heat. This, of course, explains nothing. It leaves unanswered the question how did the alpha particles get their high velocities?

To answer this we must consider what the alpha particles are. They are complex masses of electrons moving with enormous velocities within the radium atom. But this is what we call intrinsic energy. The heat then comes from the intrinsic energy of the radium atom, which is enormously great and this, as we shall see, probably accounts for the instability of the radium atom. The bearing of the large amount of heat liberated by radium upon the calculated age of the earth is interesting and important; but for this, see my "Electrical Nature of Matter and Radioactivity," 2nd edition, pp. 112-117. (D. Van Nostrand Co., N. Y.).

THE RADIUM EMANATION

Rutherford noted that when an electroscope is exposed to the action of the radiations from a radioactive substance, and a current of air is blown between the substance and the electroscope, the electroscope is discharged at an inconstant rate. When there are no air-currents the radioactivity is constant. It seemed probable that the constituent removed by the air current was something with the general properties of a gas. This observation was first made with salts of thorium.

Rutherford drove off this gaseous substance from radium, on the one hand by fusing the salt, on the other, by dissolving the salt in water, and bubbling an inert gas, like hydrogen, through the aqueous solution. When the escaping gases were passed through a U tube surrounded by liquid air, the radioactive gas condensed. The liquid formed from the radioactive gas was so small in quantity that it could not be seen in the glass tube. All that could be seen was a fluorescent spot on the glass tube where the gas had condensed. On warming the tube containing the substance it was found that it boiled off at about —150° C. This substance, having the properties of a gas, Rutherford called the "emanation."

The amount of the emanation present in radium salts is almost infinitesimal. A gram of radium yielded only three-fifth's of a cubic millimeter of the emanation in the form of a gas. This shows why the condensed gas could not be seen in the glass U tube.

EMANATION PRODUCED BY RADIUM

If some radium salt is fused and all the emanation pumped out and the salt then set aside for a time, another crop of the emanation can be obtained; and this process can be continued almost indefinitely. This shows that the emanation is produced by radium, and that the process is a continuous one. A physical study of the emanation has been made; a comprehensive chemical study has thus far been impossible, on account of the difficulty, indeed, impossibility of obtaining the emanation in sufficient quantity. It seems to be, like radium, an elementary substance, and thus we have one element produced from another element. This is the first example of the production of a chemical element from another element, or from anything else known to man.

The study of the radium emanation has led to some remarkable results, results so remarkable that they differ in kind from anything hitherto known. We were astounded at the amount of heat given off by radium, but we will be far more astonished to learn that about three-fourths of all of the heat given off by radium comes from the radium emanation. When we reflect what an infinitesimal trace of gas the emanation is, and then think of the amount of heat that it sets free, we realize that we are dealing with phenomena fundamentally different from anything hitherto encountered by the man of science.

INDUCED RADIOACTIVITY

When the radium emanation settles down upon almost any object it renders that object radioactive for the time being. It does not make much matter what the nature of the object is that is brought in contact with the emanation, that object becomes at once radioactive. This phenomenon has been studied carefully, and there can be no doubt of the correctness of this conclusion.

The induced radioactivity, however, lasts for only a short time. It decays as we say and yields a number of products, some of which will be referred to a little later.

EMANATION PRODUCES HELIUM

The radium emanation, as we have seen, lasts for only a short time. It disappears as such, and the question arises what is produced in its stead? It should be stated that the emanation decays at a rate that is entirely independent of temperature or any other condition that can be imposed upon it. The emanation is also formed by radium at a rate which is the same at the temperature of liquid air and at very elevated temperatures. These transformations are, therefore, something different in kind from ordinary chemical reactions; all chemical reactions having a temperature effect, or, as we say, a temperature coefficient.

Sir William Ramsay, in 1903, showed that when the radium emanation decays it yields among other things the element helium. Ramsay, only a few years before, had shown that the element helium, which up to that time had been found only in the atmosphere of the sun, occurs also in the atmosphere of our earth in small quantities. He sealed up some of the radium emanation in a glass tube, into the ends of which he fused platinum wires. After allowing the emanation to stand in the tube for some time, he passed an electric spark between the platinum wires and observed the emitted light through a spectroscope. He showed that the gas which contained no helium at first, now contained helium.

RADIUM DECOMPOSITION NOT A TRANSMUTATION OF THE ELEMENTS

This result has been verified over and over, so that there is now no reasonable doubt that helium is produced from the radium emanation, as one of its decomposition products. Here is an unmistakable example of the production of one chemical element from another.

When this discovery was made there followed not a little sensational literature, to the effect that here was an example of the "transmutation of the elements." One element, the radium emanation, had been transformed into another element, helium; and we read such statements as "the dream of the alchemists had been realized."

A moment's thought will show that this is without the slightest foundation. What the alchemists sought to do was to find some artificial condition, which they could control, for transforming a given chemical element into another element and indeed into gold.

Here we have the radium emanation,—an unstable system, passing over spontaneously into several things, one of these being the element helium; and this transformation not only takes place spontaneously, but it cannot be influenced in the least by any external condition that can be brought to bear on it. We cannot even increase or decrease the rate at which the transformation goes on, by wide ranges in temperature.

We are apparently just as far to-day from effecting a transmutation of the elements, in the sense in which that term has been used, as they were in the days of the alchemists.

The radium emanation, when it breaks down, yields, in addition to helium, radium A, B, C, D, E and F, but it would lead us too far to discuss these substances here.

WHAT RADIOACTIVE PHENOMENA REALLY MEAN

We have seen that radium is continually producing the emanation. When this is removed by fusing a radium salt, or by bubbling a neutral gas through an aqueous solution of a radium salt, more of the emanation is formed. When the second crop is removed a third is formed and so on as long as the radium lasts. Radium is thus producing from itself a radioactive form of matter. A similar fact was discovered in connection with uranium and with thorium.

Sir William Crookes discovered the following: When ammonium carbonate is added to a solution of a uranium salt, the uranium is at first precipitated. The addition of more of the carbonate dissolves the precipitate, but there remains a small residue which does not dissolve. This is the radioactive constituent of uranium. When this uranium X, as it is termed, is separated from uranium, more uranium X is formed, and this goes on apparently indefinitely.

Similarly, a radioactive constituent was separated from thorium known as thorium X, and this is produced continuously by the thorium.

With these facts and those discussed earlier in mind, we can now approach the problem of the meaning of radioactive phenomena. Since uranium, thorium and radium are producing radioactive forms of matter from themselves, it follows that the atoms of these substances are undergoing change—are, as we say, unstable. They are breaking down, yielding other things.

The question that arises is how can a chemical atom be unstable? How can an indivisible, ultimate unit be unstable? It is difficult to conceive of an unstable atom in terms of the older, chemical definition of an atom, but here the recent work of Sir J. J. Thomson comes to our aid.

THE ATOM HIGHLY COMPLEX

Thomson has shown that the simplest chemical atoms are complex, and the atoms with large atomic masses such as uranium, thorium and radium are very complex indeed.

He has obtained the electron or unit negative charge of electricity from many kinds of atoms, and has made it highly probable that the atoms of all substances are made up of unit negative charges of electricity moving in a field of so called uniform, positive electrification. These units, negative charges of electricity, or the negative electrons, are moving with high velocities, and in definite orbits within the atoms, the intrinsic energy of an atom being chiefly the kinetic energy of the moving electrons within the atom.

The atom of one substance differs from the atom of another in the number, arrangement, and possibly the velocities of the electrons that compose it. For further details, see my "Electrical Nature of Matter and Radioactivity," pp. 1 to 40 (D. Van Nostrand Co., New York).

This work of Thomson, which was done just before the phenomena of radioactivity were discovered, furnishes the explanation of these phenomena. In the light of this work we can easily see how an atom can be unstable. The electrons, moving with enormous velocities, may come into positions such that they will be carried entirely out of the atom and fly off into space. Such is the case with the beta particles given off by radium.

We may also think of large groups of electrons coming into such positions relative to the remainder of the atom that they will fly off into space. Such are the alpha particles shot off by radium. We would expect such an unstable atom to be more unstable during the early part of its life history, and more likely to give off groups of electrons than later on and such again is the fact. The alpha particles tend to come off first, and the beta particles later on. The possibility of unstable atoms having been established by the work of Thomson, we can easily account for radioactive transformations—one form passing into the succeeding form with loss of one or more constituents.

Thus, radium loses an alpha particle and passes into the emanation. The emanation loses an alpha particle and yields radium A. Radium A loses an alpha particle and yields radium B. Radium B gives off little or no radiation and passes into radium C, which gives off alpha, beta and gamma rays and yields radium D. Radium D passes into radium E without loss of radiations, while E passes into F with loss of alpha particles. Radium F then probably passes into lead, which may be regarded as the ashes of radium.

The life history of radium is between 2000 and 3000 years. Therefore, none of the radium now in existence was in existence 3000 years ago. The question arises where did the radium now in existence come from?

WHENCE CAME OUR RADIUM?

It was shown that radium occurs in uranium minerals, and that the amount of radium present is proportional to the amount of uranium in these minerals. This seemed to make it probable that radium was formed from uranium, that uranium was the parent of radium.

Uranium salts were carefully freed from radium, and set aside for a time to see whether any more radium was formed in them. It was found that no more radium was produced in the uranium salt, during the time over which observations extended.

This led to the suspicion that there was some intermediate product formed between the uranium and the radium. Such has recently been found and is called ionium; the sequence being—uranium ⟶ uranium X ⟶ ionium ⟶ radium.

We have spoken of the amount of radium occurring in pitchblende as being very small, and, further; that pitchblende is the richest radium ore known to man. The question that arises is this. Is the total amount of radium existing in or on the earth infinitesimal, or an appreciable quantity? It is obvious that we are dealing here with two independent questions. The amount of radium in any one locality is small, but what about the total amount in or on the earth?

It has been recently shown that the total amount of radium is considerable, due to its wide distribution over the surface of the earth. In the deposits on the floors of the seas it is estimated that there are a million tons of radium, while in the waters of the seas it is estimated that there are about 20,000 tons of radium. Thus, the total quantity of radium is large, while the amount in any one place is very small.

The scope of these papers will, however, not permit of any further discussion of these or correlated matters There are many things which I should like to have discussed, but which space prohibits. Enough has, however, been incorporated to give some idea of the nature of the recent advances and what they mean both for science and the industries.

Migration of Miners and Accidents on the Rand

BY A. W. ROGERS*

A short time ago a paper was read before the Chemical, Metallurgical and Mining Society, in Johannesburg, by J. Chilton, on the subject of accidents in mines of the Witwatersrand.

HIGH PERCENTAGE OF MIGRATION

In the discussions which followed the reading of the paper, it was contended by some that the constant migration of the white employees on the Rand from one mine to another, has the closest relation to the number of accidents which occur. The attention of the government mining engineer, R. N. Kotze, was directed to this suggestion, and he called for returns of changes of personnel occurring in a number of mines for the six months ended June 30, 1911, and of the accidents during the same period. From these returns a table was compiled, which shows that the migration of white employees on the Rand is of astonishing frequency. The highest rate for an individual mine during the six months was 31% of the total white employees per month, and the lowest 4%. The average number of men employed on all the mines from which statistics were obtained was 19,582, and the total number of changes which took place was 16,043, or 82%; that is, nearly 14% per month.

It is contended, and seems highly probable, that the fact that an average of one-seventh of the miners employed have been at their mine one month or less, and two-sevenths not more than two months, must have a great influence on the accident rate, both among whites and natives. A large proportion of the accidents underground is due to falls of the hanging wall, and it is obvious that a miner well acquainted with his mine must be better able to recognize and avoid danger than one who is new to it. A miner in charge of a number of natives (it may be 30 or more), in avoiding danger, not only avoids it for himself, but also for those in his care, and thus it is that accidents among white employees, due to lack of knowledge of the mines on which they are employed, are accompanied by corresponding accidents among natives.

---

*Central Mining & Investment Corporation, 1 London Wall Buildings, London, Eng.

Doctor Macaulay presented a table at a later meeting of the Chemical, Metallurgical and Mining Society, showing for the half years ended June 30 and Dec. 31, 1911, the percentage of the total death rate from accidents, among white and colored employees, on the chief producing mines of the Rand, grouped according to the percentage of changes in personnel in the white labor force. The figures are given in the accompanying table.

COMPARISON OF RAND MIGRATION AND ACCIDENT STATISTICS.

Changes per Month, Per Cent.	Death Rate from Accident		
	Jan. to June, 1911, per 1000	July to December, 1911, per 1000	Average for year, per 1000
4 to 5	3.47	0.93	2.2
6 to 10	2.85	2.88	2.87
11 to 15	4.10	4.17	4.13
16 to 20	4.34	3.80	4.07
21 to 25	4.96	5.00	4.98
26 and over	5.10	5.08	5.09

ACCIDENT RATE INCREASES WITH MIGRATION

The figures for the year, with one exception, show that the higher the migration rate, the higher the death rate from accidents. The majority of the natives employed in the mines are engaged for terms of six months, it being impossible to get sufficient numbers to recruit for longer periods. These natives are, in a large proportion, quite new to mining work and totally uneducated. It will be clear to every mining man, therefore, how vitally necessary adequate supervision must be, and how the constant changes in the white labor force, which would be serious enough on a mine manned by white labor only, must militate against efficiency and safety.

The attention drawn to the subject by Mr. Chilton's paper and the discussions which followed it, resulted in a table being compiled, comparing the death rates by accident in the chief mining countries of the world, the data being obtained from the annual report[1] of R. A S. Redmayne, chief inspector of mines of England.

WORLD'S MINING-ACCIDENT RATES COMPARED

The Rand apparently compares very unfavorably with most other countries, but any generalization from the bare figures would be liable to lead one astray. The statistics, in order to present a fair and true comparison would all have to be compiled on the same basis, and this has not been done. As a matter of fact, the bases adopted by the various countries differ widely, and this was pointed out by S. Evans, in a trenchant criticism of these figures. Mr. Evans contends that in no other country in the world are accident statistics subjected to such constant and close government inspection as on the Rand. In many countries, he states, accident statistics are only made out once a year and the mines are rarely, if ever, visited by government inspectors.

Then, in the Transvaal, it is the custom to include in the total of fatal accidents, any accident that directly or indirectly causes death, whether at the time of the accident, or at any later period. In no country does legislation define what is meant by a fatal mining accident. In the United Kingdom the inspectors class as fatal any accident which directly causes the death of the victim within 12 months after the occurrence of the accident. In Belgium, an accident is not considered fatal if it does not cause death within 30 days of the accident, while in France, where there is no definition, only those accidents which cause death within a very short interval are classed as fatal. In various other countries, too, for an accident to be termed fatal, immediate death must be caused.

FATAL ACCIDENT RATE PER 1000 EMPLOYED IN MINES THROUGHOUT THE WORLD.

Country or District	1908		1909	
	Coal	All Mines	Coal	All Mines
Alberta	..	..	..	1.73
Algeria	..	0.85	..	1.64
Australia	..	1.42	..	1.16
Austria	1.10	1.01	1.13	1.10
Belgium	1.07	1.06	0.95	0.95
Bohemia	..	1.36	1.20	1.15
Bosnia	2.67	1.78	2.77	2.30
British Bornea	..	..	11.88	11.88
British Columbia	2.96	3.99	8.88	7.62
British Guiana	..	0.69	..	0.85
Bulgaria	0.92	0.92	..	....
Cape Colony	..	2.35	1.23	1.25
Ceylon	..	0.24	.	0.11
Egypt	..	..	..	3.08
France	0.95	1.08	1.17	1.38
Gold Coast	..	2.66	..	3.71
Greece	..	0.88	..	1.55
Hungary	..	1.73	..	2.47
India	1.38	1.50	1.07	1.42
Italy	..	1.29	..	1.31
Japan	1.93	1.55	3.51	2.85
Kimberley	..	2.19	..	1.63
Malay States	..	0.74	..	0.90
Mexico	..	4.64	..	5.78
Natal	11.13	10.38	3.08	2.85
Netherlands	2.36	2.36	1.03	1.03
New S. Wales	1.16	1.36	0.75	0.93
New Zealand	1.28	1.45	1.67	1.64
Nova Scotia	3.40	3.12	2.98	2.70
Ontario	..	2.77	..	2.87
Orange River	..	1.56	..	1.12
Portugal	..	1.26	..	1.35
Portuguese E. Africa	..	2.02	..	1.03
Prussia	2.62	2.42	2.02	1.88
Queensland	1.79	2.02	1.17	1.99
Rhodesia	.	4.28	..	4.92
Russia	4.27	2.52	..	..
Saxony	1.19	1.30	1.88	1.81
Servia	..	1.01	..	2.73
South Australia	..	0.28	..	0.14
Spain	.	2.28	..	2.31
Sweden	0.48	1.11	..	..
Switzerland	12.20	3.19	..	2.17
Tasmania	..	0.93	..	0.99
Transvaal	3.71	4.03	4.44	5.32
United States of America	3.42	..	3.35	..
Victoria	1.86	0.93	..	0.77
Weat Australia	3.57	2.32	..	1.85

Mr. Evans states that there are probably no accident statistics for mines which are compiled in such a way that they can fairly be compared with those of the Transvaal. Leaving apart, therefore, the special circumstances which obtain on the Rand, in regard to the constant changes of personnel, and the employment of untrained natives who outnumber the whites by about eight to one, he contends that Rand figures do not really compare so badly with those of other countries. It may here be remarked that the United States figures are high, but this is largely accounted for by the fact that the rates given relate to the principal coal-producing states only.

Iron Ore in Mississippi

Director Lowe, of the Mississippi Geological Survey, has prepared a report on the iron-ore deposits in Marshall and Benton Counties in the northern part of that state. Attention was first directed about three years ago to these deposits in the vicinity of Potts Camp, on the Frisco R.R., in Marshall County. Doctor Lowe had made a surface examination of three areas, designated as Potts Camp, Winborn and Hickory Flat. In the first named, three ledges of carbonate ores were found, 8, 14 and 20 in. in thickness. In all three areas another stratum of ore was found, 6 to 8 ft. thick and 20 to 30 ft. below the surface. Doctor Lowe estimated the ore in sight, available at a cost not to exceed $1 a ton on board cars, at 500,000 tons. Other estimates run up to 1,500,000 tons.

Analyses made by W. L. Pardue, of the Mississippi State University, show the following average content for the oxide ores: Metallic iron, 49.53 per cent.; manganese, 8.69; sulphur, 1.38; phosphorus, 0.057; silica, 18.88. The carbonate ores averaged 62.15 metallic iron, 5.77 manganese, 0.87 sulphur, 0.122 phosphorus and 13.345 silica. Calcining increased the percentage of metallic iron. Doctor Lowe's report was optimistic as to the commercial importance of the iron-ore deposits of Mississippi, based on the results of the limited explorations thus far made. One company, incorporated in New Jersey, owns 15,000 to 20,000 acres, and another has had representatives in the field for several months.

U. S. Phosphate Production

The production of phosphate rock in the United States continues to increase steadily, according to Frank B. Van Horn, of the U. S. Geological Survey. The production in 1911 is given at 3,053,279 tons; for 1910, 2,654,988 tons; for 1909, 2,338,264 tons. Florida still continued to lead in production, with 2,436,248 tons; Tennessee second, with 437,370; and South Carolina third, with 169,156 tons.

The feature of the year was the prospecting of a new area in central Kentucky. New deposits were also discovered in Montana, and it is now estimated that there are over 2,500,000,000 tons of mineable rock, carrying over 70% of $Ca_3(PO_4)_2$, in the Western fields.

---

[1] "Mines and Quarries. General Report and Statistics for 1909." Part IV. "Colonial and Foreign Statistics."

Rapid Methods for Proximate Analyses

The scheme of analysis here presented is for the determination of insoluble, Fe, Al_2O_3, CaO, Zn, Pb, S and Cu, in the presence of the usual constituents of ores and slags. The results reported should be within 0.25% of the truth, except on copper.

FIRST METHOD FOR ORES

For the general analysis, weigh out two 0.5-gram samples into casseroles, moisten with water, add 5 to 10 c.c of conc. HNO_3, and take to dryness on a hot plate; add 5 c.c. of HCl to each, and after digesting for a few minutes at a moderate temperature, add 20 c.c. of dilute H_2SO_4 (1:3), and carry the assays rapidly down to white fumes. Cool and dilute to about 100 c.c., to (1) add 5 c.c. of HCl; to (2), 10 c.c. of dilute H_2SO_4, and boil both for a few minutes. In (1) insoluble, SiO_2, Fe, CaO and Zn are to be estimated; in (2) Pb, Cu and Al_2O_3.

(1) *Insoluble*—The hot solution is filtered through an ashless paper and washed thoroughly with hot water, the filtrate is removed and the residue washed with a hot solution of ammonium acetate, the washings are thrown away, and the filter with contents is ignited and weighed as "insoluble."

The filtrate in a 600-c.c. beaker is diluted with hot water to 300-400 c.c., about 10 grams of pure ammonium chloride added, and if manganese is present 10 to 20 c.c. of strong bromine water, then an excess of NH_4OH. The solution is brought to a boil, the precipitate allowed to settle and then filtered, washing with hot water, or better, if much zinc is present, with a hot dilute ammoniacal solution of ammonium chloride. The filtrate and washings are received in a liter beaker and the hydrate precipitate is redissolved in HCl and reprecipitated as before (not forgetting the bromine water, if necessary) in a rather smaller bulk, combining the two filtrates.

Iron—The hydrate precipitate is either redissolved in dilute H_2SO_4, the iron reduced and titrated cold with standard potassium permanganate, or the precipitate is dissolved in HCl, reduced and titrated with standard potassium bichromate.

Lime—To the combined filtrates 20-30 c.c. of a 2% solution of ammonium oxalate are added, the solution is brought to a boil and allowed to stand in a warm place for half an hour, by which time the calcium oxalate should be settled out and the solution clear. The calcium oxalate is filtered off, washed thoroughly, dissolved in warm dilute sulphuric acid, diluted with hot water and titrated hot with standard potassium permanganate.

The outline of a scheme for the quick, but commercially accurate, determination of silica, iron, alumina, lime, zinc, copper and lead in ores and slags.

Note—Abstract of a paper, entitled "Quick Combination Methods in Smelter Assays," by A. T. French; bull. 89, I. M. M.

Zinc—The filtrate from the calcium oxalate is acidified with HCl, adding 5 c.c. in excess. A current of H_2S is passed through it for 5-10 minutes, the solution is then boiled for five minutes, filtered if necessary (usually this is not the case), cooled to about 30° C., and titrated with standard potassium ferrocyanide. The second portion is allowed to stand until cold in order that the lead sulphate may separate out and settle. It is then filtered, washing by decantation with cold water, adding a little dilute H_2SO_4 to the wash water from time to time.

Lead—To the residue in the beaker are added 5-10 grams of ammonium acetate, a little acetic acid and 100 c.c. of hot water. The filter paper is dropped into it and the beaker placed on the hot plate, brought to a boil, and, when all the lead sulphate is dissolved, about another 100 c.c. of hot water is added, and the solution is titrated hot with standard ammonium molybdate.

The filtrate, to which a little strong HCl may be added, is heated to near boiling and a current of H_2S is passed for 10 minutes. The sulphides are filtered off, using a rapid filter and washed with hot water (H_2S water should be used if the filtrate comes through at all cloudy, but this is rarely the case).

Copper—The sulphides are washed back into the beaker, opening out the filter paper and placing it on the side of the beaker; a few drops of bromine water are poured over it to oxidize the traces of sulphides retained in the pores of the paper; then 5 c.c. of HNO_3 and a little hot water, and the paper is removed. A small quantity of iron is added, about 0.05 gram, the beaker is placed on the hot plate and boiled down to dryness. After cooling, 2 or 3 c.c. of HCl are added, and the copper estimated by the permanganate method.

Alumina—The filtrate from the sulphides is boiled to expel H_2S, oxidized with 2 or 3 c.c. of HNO_3, a slight excess of NH_4OH is added, and the solution boiled until it no longer smells of NH_4OH. After standing a minute or two to settle, the hydrates are filtered off, washed slightly, washed back into the beaker and redissolved in a little HCl, pouring the acid first over the filter paper. The solution is just neutralized with NH_4OH, 2½-3 c.c. of HCl are added, and the alumina is estimated by the phosphate method.

Sulphur—On siliceous and burnt ores, 1 gram is taken, on pyritic ores ½ gram, moistened with water and about 5 grams $KClO_3$ and 10 c.c. HNO_3 added. The assay is taken to near dryness on the hot plate, avoiding baking, taken up with 5-10 c.c. acetic acid (1:1) and 150-200 c.c. of hot water; about 10 grams of ammonium acetate are added, the solution is brought to a boil and titrated, boiling, with standard barium chloride.

EXAMINATION OF "INSOLUBLE" SILICA

When the "insoluble" is white, as in treating most raw ores and others easily attacked by acids, the residue obtained in the first part of the analysis is fused in a platinum dish or crucible with 10 times its weight of fusion mixture (K_2CO_3 and Na_2CO_3). The melt is dissolved in HCl, transferred to a porcelain capsule or casserole, taken to dryness on the hot plate, taken up with 5-10 c.c. HCl, diluted, and the silica filtered off, dried and ignited. After cooling in a dessicator the SiO_2 is weighed and an addition made for the SiO_2 still left in solution. The filtrate from the SiO_2 is rendered slightly ammoniacal, the solution boiled until it no longer smells of NH_4OH and, after standing a few minutes, the hydrates are filtered off, washing thoroughly with hot water. The filter and contents are dried, ignited and weighed, reporting as Al_2O_3 and Fe_2O_3.

When the insoluble is black or red, as in treating burnt ores and substances not easily attacked by acids, the residue is fused as above and the SiO_2 filtered off, ignited and weighed. The filtrate is tested for Cu and Pb by passing H_2S. If any is found, the sulphides should be filtered off, dissolved in HNO_3 taken to fumes with H_2SO_4, diluted and cooled; the $PbSO_4$ is filtered off and added to the main portion and the copper in solution also added to the main portion obtained in the first part of the analysis, before precipitation with ammonium sulphocyanide. (The free sulphuric acid should be just neutralized with NH_4OH).

The filtrate from the sulphides, or from the silica in absence of Cu and Pb, is boiled to expel H_2S, oxidized with HNO_3 or $KClO_3$. NH_4OH is added until the solution darkens, or, in absence of much iron, until the solution is only faintly acid, and 5-10 grams of sodium acetate are added. The solution is brought to a boil, allowed to stand and the precipitated basic acetates of iron and alumina are filtered off.

After washing with hot water the acetates are washed into a porcelain dish, about 1 in. of caustic soda or potash added, and digested at a gentle heat for a quarter of an hour. The Al_2O_3 goes into solution, the iron precipitate is filtered off, redissolved, reduced and titrated as in the first part of the analysis. The filtrate is acidified with HCl and the Al_2O_3 either estimated by the phosphate method or a slight excess of NH_4OH is added, boiled off, the precipitate filtered off, dried, ignited and weighed as Al_2O_3. (If the quantity of iron and alumina is large, the acetates should be dissolved in HCl and reprecipitated with NH_4OH, boiling off excess before extracting with caustic, but usually this can be omitted.)

Lime—To the filtrate from the acetates about 10 c.c. of NH_4OH and 20 c.c. of a 2% solution of ammonium oxalate are added, and the calcium oxalate precipitated and filtered off. This precipitate is dried and ignited, weighing as CaO; it should be tested for iron, and, if any is found, the weight of Fe_2O_3 is subtracted from the CaO, and the calculated amount of Fe added to that previously found.

Zinc—The filtrate from the lime is acidified, gassed, boiled, cooled and titrated with standard potassium ferrocyanide.

Method for Slags

The sample should be chilled—this is usually done at the furnace, the molten sample of slag being poured into a bucket of water. Otherwise the slag in lump form may be heated to redness in the muffle and thrown into water before grinding, the effect being to make the slag easily attacked by acids, anything up to 50% SiO_2 giving a white insoluble containing not more than 1 to 2% of substances other than silica.

For the analysis, two ½-gram samples are weighed into 300-c.c. beakers or casseroles. The slag is moistened with 2 to 3 c.c. of water, the beaker is held over a spirit lamp, keeping the contents in motion, and when near boiling 3 c.c. of strong HCl are added and a few drops of HNO_3. The heating is continued for 2 to 3 minutes, when gelatinous silica separates out and the beaker may be placed on the hot plate and taken to complete dryness.

Insoluble—The two portions are taken up with 5 c.c. HCl diluted to about 100 c.c. with hot water, and the insoluble filtered off (use of the filter pump is unnecessary if the SiO_2 has been properly dehydrated), dried, ignited in the muffle and weighed.

Filtrate (1) is diluted to about 300 c.c. with hot water, about 10 grams of NH_4Cl are added and bromine water, if manganese is present, and then NH_4OH in excess. The solution is boiled, the precipitate allowed to settle, then filtered into a liter beaker, washing with hot water, the hydrates are redissolved in HCl, NH_4Cl and bromine water (if necessary) added, reprecipitated with NH_4OH and filtered off, combining the two filtrates.

Iron—The hydrate precipitate is redissolved in dilute H_2SO_4, reduced and titrated with standard permanganate, or HCl may be used, and the solution, after reduction, titrated with bichromate.

Lime—To the combined filtrates, which should be strongly ammoniacal, 20 c.c. of a 2% solution of ammonium oxalate are added, the solution brought to a boil, and allowed to stand in a warm place until the calcium oxalate settles. This is then filtered off, washed, dissolved in dilute H_2SO_4 and titrated hot with standard permanganate.

Zinc—The filtrate from the lime is acidified with HCl, adding 5 c.c. in excess, a current of H_2S is passed for 5 to 10 minutes, and the solution is boiled, cooled to about 30° C., and titrated with standard potassium ferrocyanide.

Alumina—Filtrate (2) is just neutralized with NH_4OH, 2 to 3 c.c. of HCl are added, and the alumina estimated by the phosphate method. If much Cu and Pb, etc., are present, the filtrate should be gassed, filtered, H_2S boiled off and the solution oxidized before proceeding as above; but the author has not found this to be necessary in dealing with ordinary slags.

Copper—For copper, 5 grams are weighed into a 600-c.c. beaker, about 250 c.c. of hot water added, and the beaker placed on the hot plate. When boiling, 30 c.c. of strong HCl are carefully added and the solution stirred until decomposition is complete. If pure acid has been used, the sulphides of Cu, etc., which are not attacked, can be filtered off, but it is safer to pass H_2S for a few minutes before filtering. The sulphides are washed back into the same beaker, cleaning the paper with bromine water, and dissolved in HNO_3. The copper is then usually estimated by titration with cyanide or colorimetrically. A more accurate, though rather longer, method is to take to complete dryness, take up with HCl, and estimate the copper by the permanganate method.

Interferences and Sources of Error

Lead and lime are both present as sulphates after taking down the assay to white fumes with sulphuric acid, and it is difficult, if not impossible, to effect a satisfactory separation by washing out the $CaSO_4$. This difficulty is avoided in the method suggested by doing the lead and the lime on separate portions; keeping back all the lead and a little lime in one, and dissolving all the lime and most of the lead in the other.

As manganese interferes, it must be removed before the zinc titration. Small quantities of manganese, say up to one-fourth the iron present, can be thrown down with the hydrates by adding bromine water before adding NH_4OH to the solution. In case the hydrate precipitate is almost black, the acidified filtrate should be tested by adding more bromine, and making alkaline again. Manganese does not appear to interfere with the estimation of lime by permanganate, nor does oxalic acid interfere with the zinc titration.

Phosphate Method for Alumina

To a cold, neutral, oxidized solution of the bases, freed from large quantities of As, Sb and Cu, 2 to 3 c.c. of HCl solution containing 2 grams of sodium phosphate and 10 grams of sodium hyposulphite are added, then 15 c.c. of acetic acid (glacial acid one part, water one part). The solution is made up to about 300 c.c., boiled vigorously for 20 minutes, filtered, washed with hot water, ignited in the front of the muffle and weighed as $AlPO_4$.

$$Al_2O_3 = AlPO_4 \times 0.4185.$$

(2) *Extraction by caustic*—To an acid solution of the bases a slight excess of NH_4OH is added and the solution boiled until it no longer smells of ammonia; the precipitated hydrates are filtered off, washed, and then washed back into a glazed porcelain dish; 1 to 2 in. of pure stick caustic soda or potash are added, and the dish placed in a warm place for a quarter of an hour. The solution is then filtered through the same paper. Al_2O_3 passes through into the filtrate. The filtrate is acidified with HCl, a slight excess of NH_4OH added, the solution boiled until it no longer smells of ammonia, and the precipitate filtered off, washed well, dried, ignited and weighed as Al_2O_3.

With small quantities of alumina and large amounts of zinc, lime, sulphates, etc., in the solution, the phosphate method is apt to give erratic results. Under these conditions it is safer to throw down the hydrates, redissolve in 2 to 3 c.c. HCl and then add the phosphate, etc. The extraction method is more tedious, but gives good results on small quantities of Al_2O_3. If more than 0.05 gram of Al_2O_3 is present (10% in ½ gram assay) the aluminum hydrate should be redissolved and reprecipitated or the two methods may be combined, extracting with caustic, acidulating the filtrate with HCl, adding 2 c.c. in excess and then the phosphate, etc.

Copper in large quantity is thrown down by the hyposulphite and brings the results high. Smaller quantities (as in slags) do not interfere, probably being kept in solution as acetate. When thrown down, Cu colors the $AlPO_4$ blue or black, according to quantity. Lead and manganese in ordinary quantity do not interfere. Arsenic and antimony, when in considerable quantity, are thrown down and color the precipitate, which, however, burns white. Results come a little high.

PERMANGANATE METHOD FOR COPPER

The copper is brought into a solution containing 2 or 3 c.c. free hydrochloric acid. If in nitric solution, it must be taken to dryness, and taken up with HCl. If in sulphuric, the solution is neutralized with NH_4OH and 2 or 3 c.c. HCl added. If much insoluble is present this is filtered off; a little iron (about 0.05 gram) should be added if none is present, as in treating a sulphide precipitate or in standardizing.

The bulk of the solution should be 150 to 200 c.c. To this is added 20 c.c. of a 10% solution of sodium sulphite (it is convenient to filter the solution into a beaker containing the sulphite) and then 5 c.c. of a 10% solution of ammonium sulphocyanide. The beaker is placed on the hot plate and brought to a boil, by which time the solution should be decolorized; otherwise more sulphite is added After boiling a few minutes, the solution is filtered through a double close-grained filter paper and washed three times with hot water. The funnel is then placed over a flask and washed with a hot 8% solution of caustic soda or potash. The beaker in which the precipitation was performed is also washed with caustic, and the washings poured through the funnel. The precipitate in the funnel is now washed three times with hot water, filtrate and washings made up to about 300 c.c. with cold water, acidified with dilute H_2SO_4, adding at least 10 c.c. in excess, and titrated cold with standard permanganate (5.7 grams per liter. 50 c.c. = 0.1 gram Cu).

The same permanganate solution is used as for iron, the copper value of the solution being five times the iron value, but it is well to standardize on electrolytic copper. Water, acid and caustic solution used should be tested for anything which would affect permanganate. The advantage of adding iron to the checks and sulphide precipitates is shown by the following experiment: (0.2 gram Fe required 19.9 c.c. permanganate.) 0.1 gram Cu required 49.5 c.c.; 0.1 gram Cu + 0.1 gram FeS_2 required 50.3; 0.05 gram Cu required 24.6 c.c.: 0.05 gram Cu + 0.1 gram FeS_2 required 25.0· 0.025 gram Cu required 12.0 c.c.: 0.025 gram Cu + 0.1 gram FeS_2 required 12.5. The iron is conveniently added as FeS_2 when the copper or sulphide precipitate is being dissolved in HNO_3, but iron wire or any pure iron salt will do equally well.

PERMANGANATE METHOD FOR IRON

The sulphuric-acid solution of the iron, which must be free from HCl and even traces of nitrates, is warmed with 10 to 15 grams of pure granulated zinc until a drop of the solution removed on a glass rod and added to a drop of ammonium-sulphocyanide solution on a white plate, remains colorless or only gives a faint pink tinge. The solution is then poured through a rapid filter into a flask, cooled, made up to about 500 c.c. with cold distilled water and titrated with standard permanganate. The reduction is best made in a solution containing only a little free acid; 10 c.c. of 1 : 3 acid is usually enough, but more acid must be added if the reaction slackens before reduction is complete; 20 c.c. more 1 : 3 acid should be added before titration.

In reducing with H_2S, the sulphuric-acid solution of the iron, which must be free from much HCl (traces of nitrates do not interfere), is gassed with H_2S for 10 minutes. Reduction is most rapid in faintly acid solutions—a large excess of acid should be nearly neutralized with NH_4OH; the solution is boiled for about 10 min. and tested by holding a piece of filter paper saturated with lead-acetate solution in the issuing steam. When no blackening of the paper occurs, the beaker is removed from the hot plate and the solution filtered into a flask containing about 20 c.c. dilute H_2SO_4, tested for ferric iron with ammonium sulphocyanide, cooled, made up to about 500 c.c. with cold distilled water, and titrated with standard permanganate.

BICHROMATE METHOD FOR IRON

For the bichromate method, the iron in hydrochloric solution, containing about 5 c.c. free HCl, should be warm and concentrated. It is carefully reduced with a solution of stannous chloride (15 grams Sn, 350 c.c. HCl per liter) added from a burette and performing the reduction over a white plate. When colorless, two drops of the $SnCl_2$ solution are added to make sure of having a slight excess, the solution is diluted with cold distilled water to about 300 c.c., 10 c.c. of a saturated solution of mercuric chloride are added (giving a white, cloudy precipitate) and the solution titrated at once with standard potassium bichromate (4.4 grams $K_2Cr_2O_7$ per liter, 20 c.c. = 0.1 gram Fe), using a 1% solution of potassium ferricyanide as indicator. Spots of the indicator are placed on a white plate, and, after mixing each addition of the bichromate with the solution, a drop is withdrawn and added to one of the spots on the plate. A dark blue color at first appears, gradually becoming fainter as the oxidation proceeds. Failure to color after standing half a minute shows the end point. It is to be noted that a small spot of ferricyanide should be taken for the final test.

The solutions of permanganate or bichromate are standardized by taking a weighed quantity of piano wire, or ferrous ammonium sulphate, and treating exactly as the assay. The piano wire usually supplied may be taken as containing 99.5% pure iron, ferrous ammonium sulphate as containing $^1/_7$ its weight pure iron

Comparing the three methods, the H_2S-permanganate is probably the safest, removing as it does most, if not all, sources of interference. The Zn-permanganate method is commonly used; care must be taken in testing the zinc used, and also that the solution is free from any trace of nitrates; the hydrates precipitated from a solution containing nitric acid carry down sufficient nitrate to interfere with the assay if simply dissolved in dilute H_2SO_4.

The $SnCl_2$-bichromate method is the quickest, but requires more attention in reducing and titrating than does the permanganate; a good light is essential. In most ores the small quantities of impurities carried down by the hydrate precipitate do not interfere with this method; it should be checked, however, against the H_2S permanganate.

LEAD—MOLYBDATE METHOD

Sulphate of lead, thrown down and filtered off as described in the analysis, is dissolved in a hot solution of ammonium acetate, slightly acidified with acetic acid. Spots of a freshly prepared solution of tannic acid are placed on a glazed porcelain plate, and the assay titrated hot with standard molybdate (9.5 grams per liter, 10 c.c. = 0.1 gram Pb), withdrawing a drop after each addition of the standard solution, and adding to a spot of tannic acid on the plate. The end point is shown by the appearance of a yellow color.

The basic sulphate of iron formed in the course of the analysis is soluble with difficulty; insufficient boiling after dilution and insufficient washing of the residue result in leaving some iron with the $PbSO_4$; this gives a black color with the tannic acid, spoiling the assay. The molybdate solution may be standardized on pure lead or on pure lead acetate, of which 0.183 gram = 0.1 gram Pb.

LIME—PERMANGANATE METHOD

Calcium oxalate, thrown down and filtered off as described in the analysis, will carry down an appreciable amount of magnesium oxalate, if much MgO is present. In this case it should be redissolved and reprecipitated.

The filter paper containing the pure calcium-oxalate precipitate is opened out, and the precipitate carefully washed back into the beaker with a jet of hot water. The paper is then placed on a large clock glass, and 10 c.c. of dilute H_2SO_4 (1 : 3) are poured on it; after a minute or two the acid is poured off into the beaker containing the bulk of the precipitate and the paper washed with hot water. A second treatment with acid and hot water will remove all the oxalate from the paper. The assay is brought to a boil, and when all the calcium oxalate has dissolved, the solution is diluted to about 300 c.c. with hot water and titrated hot with standard permanganate.

INSOLUBLE

The insoluble obtained after attacking the ore with acids (after washing with ammonium-acetate solution to free it from any traces of lead sulphate) is fused in a platinum dish or crucible with ten times its weight of fusion mixture ($K_2CO_3 + Na_2CO_3$). After cooling, the melt is moistened with a few drops of water and 2 to 3 c.c. of strong HCl, keeping carefully covered with a small watch-glass. When the action of the acid has nearly ceased, the liquid is washed out into a porcelain capsule or casserole, and the process repeated. In this way the whole of the melt can be dissolved and transferred to the capsule in a few minutes, and the bulk of the solution should not exceed 100 c.c. The capsule is placed on the hot plate and boiled to dryness—care must be taken to avoid spitting just at the moment when the salts are solidifying. When completely dry, as shown by the absence of condensing moisture on the cover glass, the capsule is removed from the hot plate and allowed to cool. About 10 c.c. of HCl are added, 50 to 100 c.c. of hot water, and, after bringing to a boil to dissolve everything soluble, the residue is filtered off, washed, dried, ignited and weighed as SiO_2.

A small amount of SiO_2 remains in solution after this treatment, and can be recovered, by a second and third evaporation to dryness. An allowance can be made for this of: 1% on the SiO_2 found, if more than 50%; 2% on the SiO_2 found, if between 10 and 50%; 4% on the SiO_2 found, if less than 10%.

Sulphur—The standard solution is barium chloride, 38 grams per liter, 20 c.c. = 0.1 gram S. Either 0.5, or 1 gram of ore, according to its richness in sulphur, is weighed into a 600-c.c. beaker, 5 to 10 grams of $KClO_3$ are added, 5 to 10 c.c. of water, and 10 to 15 c.c. of strong HNO_3. The assay is heated, gently at first, and afterward boiled down to near dryness. Ten cubic centimeters of 1:1 acetic acid and 5 to 10 grams of ammonium acetate are added, about 250 c.c. of hot water, the beaker is placed on the hot plate, brought to a boil, and the assay is ready to titrate.

Three cubic centimeters of HCl may be used instead of the acetic acid, and if the assay has been taken to complete dryness, it gives better results, as basic sulphates are formed which are soluble with difficulty in the acetic-acid solution. The acetic acid seems to give a slightly clearer end reaction, but the difference is small.

For the titration the solution should be boiling, and the beaker is kept over a small spirit lamp. Spots of $BaCl_2$ solution and of dilute H_2SO_4 (about 9 c.c strong H_2SO_4 per liter) are placed in parallel rows on a glass plate, supported about 6 in. above a dark surface. After each addition of $BaCl_2$, a small portion of the solution is withdrawn by means of a glass tube, dropped into a filter and from the filter on to two of the spots on the plate. At first a dense precipitate shows in the $BaCl_2$ spot, gradually fading as the titration proceeds. Finally, a slight cloudiness appears in both spots and when this is equal in intensity, the assay is finished. A few more drops of $BaCl_2$ may be added and another test should show a distinctly denser precipitate in the H_2SO_4 spot. The $BaCl_2$ solution may be standardized on pure ferrous ammonium sulphate; 0.613 gram of this salt, containing 0.1 gram of sulphur, is weighed out and treated exactly as the assay.

The above treatment with HNO_3 and $KClO_3$ leaves $BaSO_4$ undecomposed; ores which contain this substance should be mixed thoroughly with about 10 times their weight of a mixture of 1 part Na_2CO_3 and 4 parts ZnO, placed in a porcelain crucible and covered with a gram or so of the mixture.

The crucible is heated to redness for a quarter of an hour, cooled and the mass extracted with water and washed; the filtrate is acidified with HCl, adding about 3 c.c. in excess, boiled a few minutes until all CO_2 is expelled and the sulphur estimated either gravimetrically or volumetrically. The volumetric method gives excellent results, the end reaction in this modification being especially distinct.

The end point may seem a little doubtful at first, but practice will enable it to be determined with certainty within 0.2 c.c. and concordant results obtained.

ZINC—FERROCYANIDE METHOD

The standard solution is potassium ferrocyanide 43.1 grams per liter; 10 c.c. = 0.1 gram Zn. The ammoniacal filtrate from the iron in which lime has been estimated, may contain copper, antimony, etc., but not manganese, and is acidified with HCl, adding 5 c.c. in excess. H_2S is passed for 5 to 10 min. and the solution boiled until H_2S is expelled. It is then titrated with standard potassium ferrocyanide, using spots of uranium acetate solution (8%) on a white plate as indicator. The temperature of the solution may be near boiling if oxalates are absent, but if present the temperature should not exceed 30° C.

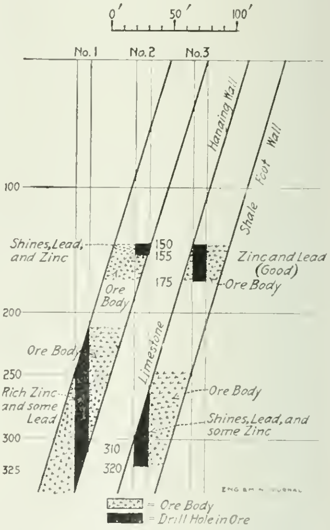
The thorough gassing of the solution before titration is important, and should never be omitted.

It is reported that a Swiss syndicate has secured a number of mining claims at St. Joachimsthal and incorporated a company at Zurich under the name of Société Minière de Radium de St. Joachimsthal, S. A., for the purpose of extracting, working and selling radioactive and other mining products. The authorized capital is 500,000 francs.

The Miami Zinc-Lead District, Oklahoma

BY TEMPLE CHAPMAN*

In the JOURNAL for Dec. 23, 1911, there appeared a graphic article on the Oklahoma Lead and Zinc Fields. The development of the Miami (Okla.) camp accentuates the parallel-channel occurrence of the groups of orebodies which constitute the camps of the Joplin district. The accompanying map shows the ore occurrence by camps from Carthage on the east to Miami on the west. The Oronogo-Webb-Duenweg camp has been the most vigorously mined for the longest time, and therefore its once isolated mines have become a solid chain of workings 10 miles long by two miles wide, and with greater length indicated by new discoveries beyond both ends. The Miami camp is even more regular in its range of ore, although not yet developed one-tenth as much in time or area as the Webb City camp.



SECTION THROUGH DEEP DRILL HOLES, MIAMI CAMP, OKLAHOMA

KNOWLEDGE OF TREND OF ORE SYSTEMS IMPORTANT

Of course, the practical value of knowing the general trend and occurrence of ore is that thereby we may do our exploratory work and "wild-cat" prospecting in regions which, though yet virgin, lie within definitely marked ore ranges, and are therefore reasonably likely to have ore. In a level farming country like the Joplin district, where no ore protrudes and there are no surface indications to guide the prospector, a practical and trustworthy theory of geological formations and trend of ore systems is of great importance.

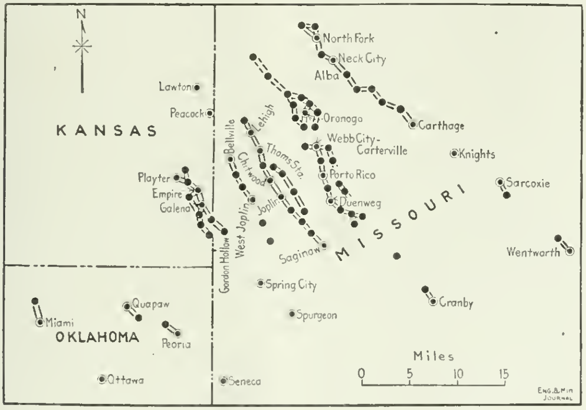
---

*Mine operator, Webb City, Mo.

Many Small Operators

Our individual mines here are said to be short-lived (due in part to cutting up one orebody into a number of small leases worked by different companies), but our main ore systems are now known to contain extensive masses of ore, requiring many years to work out. It might here be said that had this region been exploited by big, modern companies owning the land, instead of by small companies leasing it, some of such companies would have found themselves possessed of great bodies of ore, comparable in extent with the lead mines of southeast Missouri or the great porphyry copper mines.

While the Miami ore development is a guide to the rest of the district because of the emphasis it puts upon the regularity of the parallel "ten-o'clock" ore ranges, it also has its own peculiar features. An accompanying engraving gives a conventional vertical cross-section of one of the Miami ore channels. The Miami prairie has a clay soil and is flat as a pancake. When the first mines were opened and showed the same kind of ore at the common level, about 100 ft., it was supposed that the ore was of a blanket formation. Much shallow drilling (deep as the then workings) was done, which missed the ore. After a couple of years' work, it began to be noticed that the ore lay in regular channels or veins, which pitched to the north. Drilling then began to be done deeper and ore was found first to 250 ft. and then to 300 and 350 ft. in depth, but still apparently connecting with the first shallow mines.



Zinc-lead Fields, Showing Parallel Runs of Ore

Drilling Results Variant

This section also illustrates a difficulty in drilling which arose from finding such widely varying results from holes bored vertically and close together, viz., 30 ft. apart, which struck ores varying 100 ft. in depth and very different in metal content. The sketch shows how holes placed at 30-ft. intervals across the known course of an ore run might thus vary in character. Miami being a new camp and yielding such peculiar drill results (often phenomenally rich in zinc and lead), it has been necessary to do a large amount of drilling to instill full confidence in the new "deep-level" companies, who must be prepared to both sink deep and take care of a large and not fully understood water problem. The character of the shale found next to the ore has helped greatly in shaping plans to conquer the water problem.

Co-operative Drainage Would Be Advantageous

From the beginning of the camp, it was found that if one pumping station lowered the water at its shaft to a certain depth, the water level all through the camp would stand at that level. Also, the volume of water pumped from a deeper level seems to be no greater than the volume that had been the normal flow at a shallower level. Before any mining was done a sulphur spring existed near the south end of the present camp, and this has been slowly lowered until it now stands at 210 ft. below the surface. Although the pumping has drained a large saturated area, there is no water in the vast bodies of shale which lie around and over the open ore channels.

When drilling showed the confines of the ore and the situation of the deep beds of shale, it became practical to sink shafts in this dry, water-tight shale to a depth equal to the bottom of the ore and 100 ft. below the water level; to arrange pump chambers and install pumps; and to avoid cutting into the ore until the pump equipment was ready to handle the water that would be encountered with the ore.

By installing a good triple-expansion steam pump, with a capacity of several thousand gallons per minute from 330 ft. depth (bottom of developed ore) the water of the whole camp can be easily taken care of. With the growth of the camp now in sight and the consequent future milling demand for water, there is not likely to be more than enough water to go around, and some equitable system of sharing the cost of pumping the water from a single pump station is likely to be evolved.

Many Similarities Throughout District

While there is an unusual similarity of formation, ore occurrence and direction, water flow, etc., throughout the Miami camp, there is also an equally remarkable regularity of lead and zinc yield from the different mines along the main ore channel. The ore from the whole Joplin district might be classed as a 4 to 6% ore, which, with a 66% recovery, yields 2.5 to 4%. By actual measurements of the Miami mine workings, the tailing piles, the weights of concentrates sold, and assays of losses in tailings, the following results are reported by Mr. Church, an engineer actively connected with the camp: Zinc and lead in crude ore in place, 24%; concentrates recovered, 16%; loss in tailings, 8%; proportion recovered, 66%. Average commercial value of ore in place as since extracted, $5 per ton. The royalties in Miami have been high and so have the costs, each averaging about $1.50 per ton. This leaves to the operator a profit of $2 per ton on rock mined, with nearly as much more to the landowner and other royalty recipients. The gross value of ores mined in other parts of the Joplin district hardly average $2 per ton.

The larger operations now under way in the Miami camp will undoubtedly yield such good results as to attract many prospectors in the near future, and by them a larger area of ore will be found than has yet been indicated. The camp is fortunate in having good American labor, railroad facilities, mining supplies, good water and cheap natural gas and coal.

The extension of the Miami channel workings and the constant spreading out of the workings of the Webb City and other sheet-ground areas, should afford data upon which the geologists may develop working theories valuable in the exploration of the still large undeveloped areas of the Joplin district. Until quite recently, scientific men have had little else than small, isolated, soft-ground "diggins," maybe muddy and timbered, which disclosed but sparingly the earth's interior, from which to form their hypotheses, and thus their theories of ore deposition have been of slight practical help or importance to the district.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Frank Nicholson, of Joplin, Mo., is visiting New York.

Albert Burch, of San Francisco, is in Nevada on professional work.

Fred T. Williams has been in California and Arizona on a combined business and pleasure trip.

Eli T. Connor expects to make a professional trip this week to Newfoundland, where he will be for a week or 10 days.

H. R. Conklin, manager of the Lluvia de Oro Mining Co., was a visitor in New York this week. He will shortly return to Mexico.

Reginald E. Hore has returned to Houghton, Mich., after a visit to the Cobalt silver mines, and the Sudbury nickel mines in Ontario.

S. R. Guggenheim has been chosen a director of the International Pump Co., in place of Benjamin Guggenheim, who was lost on the "Titanic."

James Jacoby has resigned as manager of the Ely Central Mining Co., to look after his personal mining interests. He will have his headquarters at Denver.

Thomas A. Varden, of Butte, Mont., has been making an examination of two silver-lead properties in the Warm Springs district, near Helena, Mont., the past month.

H. W. Hardinge left New York on June 1, for Norway and Sweden, by way of London. Before returning he will visit the iron mines north of the Arctic Circle in Norway.

Ernest Levy, manager of Le Roi No. 2, Ltd., at Rossland, B. C., returned from England last month. Work is progressing on the mine, but no new developments are reported.

Godfrey Hughes has been appointed consulting engineer and metallurgist to the Orient Coöperative Mining Club, of Spokane, Wash., and will establish an assay office and laboratory there.

George L. Holmes, of San Francisco, has completed the remodeling of the gold-saving tables of the Cache Rock dredge, operating in the stream of the middle fork of the American River, California.

W. R. Crane, dean of the School of Mines of the Pennsylvania State College, will leave for Alaska about June 15, and will spend the coming year studying the mineral resources of that country.

G. Caetani, of San Francisco, has returned from a professional visit in Colorado, where he remodeled the mill at the Smuggler mine, in Marshall basin, near Telluride. He is remodeling the Tomboy mill in the same camp.

Samuel D. Warriner, has been chosen president of the Lehigh Coal & Navigation Co., in place of the late William A. Lathrop. Mr. Warriner has been for some time past vice-president of the Lehigh Valley Coal Co., and is well known in the anthracite country as an engineer.

W. B. Pattison has been appointed superintendent of the Breiting mines at Humboldt and Negaunee, Mich., to succeed Capt. Hodgson, who has gone to the Copper Queen in Ariona. Mr. Pattison has been assistant to Capt. Hodgson, and is a graduate of the Michigan College of Mines.

August Thyssen, now the most prominent figure in the German iron trade, celebrated his seventieth birthday, May 17, and the German newspapers devoted much space to sketches of him. He is the creator of the great iron and coal establishment Deutscher Kaiser, and director in other steel and coal companies.

E. F. Lake, consulting metallurgist, Bayonne, N. J., has merged his business with that of Nixon & Raab, and the consolidation will be known as Lake, Nixon & Raab, with office at 156 Fairview Avenue, South Orange, N. J. This firm will specialize in the heat treatment of steel and in the treatment of other metals and alloys.

Dr. Eugene A. Smith has retired from his position as professor of geology and dean of the Engineering Faculty of the University of Alabama. He has been connected with the university for 45 years. Dr. Smith will devote his time to his duties as state geologist of Alabama, a position he has filled most acceptably for many years.

Howland Bancroft has resigned from the United States Geological Survey with which he has been connected since 1907, and will enter practice as a consulting mining geologist. He will make a specialty of economic geology and the commercial possibilities of metalliferous deposits. His headquarters will be at No. 730 Symes Building, Denver, Colorado.

The American Metal Co. on June 1, 1912, celebrated its 25th anniversary by a series of festivities in which its staff participated and with special honors to Mr. Jacob Langeloth and Mr. Berthold Hochschild, who have been connected with the company since its organization. The senior members of the staff received gold badges, of a design following the seal of the company, with the addition of the words *"Labor, unitas, fidelitas."*

Charles Hartman Jr. and Fred P. Walters of the U. S. Geological Survey returned from Middle Fork cañon of Feather River to Sacramento, Calif., on May 29 by way of Oroville. They left Oroville in April with 10 other survey men. The 10 other men were unable to complete the proposed trip and before reaching Bald Rock cañon made their way out to Nelson Point. Hartman and Walters continued alone, without the pack animals, which had been sent back before the party was broken up. In Devil's cañon they discarded all cumbersome baggage, including blankets, retaining only necessary clothing, and beans, coffee and rice actually essential to subsistence.

OBITUARY

Marion Aubury, mining engineer, died of typhoid fever, at Yuma, Ariz., May 28. He was born in Sacramento, Calif., and was 52 years old. He was instrumental in the opening of the Bodie mine, in Mono County, Calif., and of mines at Tombstone, Ariz. At the time of his death he was connected with the Federal reclamation work, near Yuma. He was a brother of Lewis E. Aubury, former state mineralogist of California.

Societies and Technical Schools

Mine Inspectors' Institute of the U. S. A.—The fourth annual meeting will convene at Columbus, Ohio, June 18, and conclude June 21. The executive committee will hold a business meeting on June 17. All members of the institute as well as all state, territorial or provincial mine inspectors in North America are invited to attend the meeting and those not now members are invited to present their applications for membership. The Ohio inspectors have made extensive provision for the entertainment of those who may attend, and the meeting has promise of being the most successful of any yet held.

International Society for Testing Materials—The Organizing Committee, under whose auspices the congress will be held, makes provisional announcements regarding the details of preparation for and program of the congress. The congress will be held in the Engineering Societies Building, New York, during the first week of September. On Sept. 2. the headquarters will be open for the registration of members, acceptance of the credentials of the delegates, assisting foreigners and strangers to the city to secure lodgings, etc. In the evening there will be an informal reception, under the joint auspices of the American Society for Testing Materials, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers. On Sept. 3 the congress will convene at 10 o'clock, at which time there will be an address of welcome by the acting president of the International Association, Dr. Henry M. Howe, and by national, state and municipal officials. The various sections will then arrange for their sessions, which will last three days. A large number of papers have been received and are being printed.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

May 29—It now appears that the $18,000,000, bond fund, voted for by the people of California and appropriated by the legislature for the construction of state highways is inadequate. At any rate it will not be sufficient to give certain counties the laterals they were led to believe would be a part of the system. The tentative plan is to build two highways extending north and south through the state, one on each side of the coast range of mountains. The plan contemplates the omission of the mining counties along the westerly line of the Sierra foothills, notably the Mother Lode counties. The promise seemed to be assuring, when the counties were asked to vote, that every county seat in the state would be tapped either by the main highway or by laterals. There is some chance that Tuolumne County may be given a lateral from Sonora to Stockton and it is possible that Nevada and Shasta counties may be on the main line or connected by laterals. But the indications at present are that the mining counties generally will not be benefited greatly. However, much depends upon the activity of these counties in demanding a just apportionment of the moneys. There is no industrial section of California that stands in greater need of public highways than the metal-mining districts. In many of the districts poor road building has been done. There is no lack of good road material within easy reach of the roadways, and this is true of almost every mining district in the state. In some districts an attempt has been made to build oil and macadam roads, and in many instances the roads have been failures, because of improper construction. The introduction of automobiles is having an influence for better road building. At present an effort is being made by mining men and others in Inyo County to join the mining and commercial associations of Goldfield and Tonopah in support of a transcontinental auto route which will extend from Utah through Nevada, via. White Pine, Nye and Esmeralda Counties in Nevada and through Inyo County across the White Mountains to connect with the road south to Los Angeles.

Charles W. Eberlein, former land agent of the Southern Pacific R.R. Co., has proved a valuable witness for the government in the suit brought to cancel the railroad landholdings in the Elk Hills, as reported in the JOURNAL of June 1, p. 1067. Mr. Eberlein declined positively to give any information to the government agents preceding the taking of testimony before Leo Longley, special examiner in the Department of Justice, and refused to produce any papers or correspondence until subpœnaed as a witness and even then refused until he had been sworn to testify. But he declared if the government legally obtained possession of any documentary evidence, he would as a sworn witness tell all that he knew. Mr. Eberlein's testimony related chiefly to the lease of the S. P. R.R. Co. lands to the Kern Trading & Oil Company.

Butte

May 29—In sinking an artesian well, a flow of natural gas was encountered on the Michael Wagner farm, near Kalispell, recently. In efforts to locate the flow of artesian water, the well had been sunk to a depth of 350 ft. when the gas was struck. It burned several hours after ignition, the flames rising several feet above the ground, and at last stopping abruptly, probably due to a cave-in of the well. It had been the contention of many for years that several sections of the Flathead Valley are underlaid by petroleum, but this was the first actual indication. Much excitement was occasioned by the discovery and quite a rush made to the district. Mr. Wagner will begin soon to sink the well to find the main gas belt.

Denver

May 30—The American Smelting & Refining Co. has just put in two Dwight & Lloyd sintering machines at its plant in Pueblo, two at Leadville and two at the Globe.

It is reported here that Fred T. Smith, of Denver, and V. C. Ward and Alfred Fossman, of Green River, Utah, have located a group of claims near the San Rafael River about 100 miles west of Grand Junction, Colo., and have taken out several cars of 12% uranium and vanadium ore which are ready for shipment.

The old project of a railway, mining and drainage tunnel through the Mosquito Range in the Leadville basin, is now being revived. The surveys, maps and engineer's reports were made years ago but until now conditions were not favorable for construction. The length would be 9¾ miles, through a proved mineral range, cutting the London and other great veins of the Alma-Fairplay district at approximately 2500 ft. below the surface, rendering it possible, by a new line of railway through South Park, to deliver Leadville ores by a downgrade haul, to Denver smelters at about one-fifth the present cost, and shortening the route between this city and California 173 miles. The owners of the tunnel property have held their rights by continuous work and have driven the tunnel 1200 ft. and are also said to have acquired mining property for two miles in length along the course of the tunnel. There are large mining possibilities in this project.

At Creede there is a great deal doing, and less is being said than of any prosperous camp in the state. There are 12,000 tons of Creede ore at the Pueblo smeltery now, and 250 tons per day of crude ore are being produced. The Triune Co., under W. F. deCamp, general superintendent, formerly in charge of the Portland mine at Cripple Creek, is building a power house and starting to sink a large working shaft below the level of the drainage tunnel in the old Amethyst mine.

At Cripple Creek the Miners Protective Association has made it necessary for all mine owners and officers as well as the miners, to have cards, and during the last seven weeks 2740 have been issued, 37 applicants being refused.

Salt Lake City

May 30—The strike at the lead plant of the American Smelting & Refining Co., at Murray, has been settled, and the furnaces are running at the same capacity as before. Five or six furnaces out of eight are in blast. The demand for an increase in wages by the unskilled foreign laborers on the charging floors and in the yards, was refused, and the matter settled by bringing in new men, and by allowing part of the American laborers to return to work. No further trouble is anticipated. Shipments are being received at the usual rate.

The International Smelting & Refining Co. is ordering material for the third lead stack at the Tooele smeltery. Arrangements were made to add a third stack if necessary, when the other two furnaces were built, and work on the foundations, etc., is in progress. The amount of lead ores being received is increasing, and new ores have been contracted for from some of the Cœur d'Alene mines. Arrangements have also been made with the

Goldfield Consolidated for certain gold ore, carrying copper and silver, which was not adapted to treatment by the Consolidated mill. The fourth reverberatory furnace is in operation on copper ores. In the copper and lead plant, combined, approximately 1000 tons per day are being smelted.

Phoenix, Ariz.

May 30—The subject of taxation of mines and products is causing some uneasiness among operators throughout the state. Some mining men, who have recently visited here, hope that a bullion tax law will be passed by the legislature, now in special session. The latest information is that no attempt will be made to pass a bullion tax bill, but that a bill providing for the assessment of mines under the "ad valorem" system will undoubtedly be adopted.

A bullion-tax law is not entirely equitable, for the cost of producing bullion varies in different places, and under different conditions. The mine owners say, however, that they prefer to pay on their bullion output rather than to have their claims assessed on the basis of ore reserves.

Porcupine

May 31—A matter of great interest to northern Ontario is the purchase of the Porcupine Power Co.'s system, by the Wawaiten Falls Syndicate. This syndicate recently purchased and undertook to complete the plant under construction by E. A. Wallberg, at Wawaiten Falls. This plant is now being rushed to completion and the contractor expects to be able to deliver power in October. The Porcupine Power Co. is the only concern supplying power in this district, and serves the majority of the mines in the Pearl Lake area. Lorne McGibbon, of the La Rose, is president of the Wawaiten Falls Syndicate and David Faskin represents the Cobalt and Haileybury interests, so that the deal embraces most of this northern country.

Chihuahua

May 26—Mexico's revolutionary status has affected the Chihuahua mining industry less than was anticipated at the outset, inasmuch as the revolutionists have generally avoided direct molestation of mines and particularly those owned by Americans or other foreigners. This does not mean that mining has not been interfered with, but that the interference has been only that which would be incidental to a similar revolution in any country. Wilful or prearranged molestation of mining properties or operations has been almost entirely absent, as was the case with last year's Maderista revolution.

Comparatively few of the larger mines have suspended. For instance, the majority of the Santa Eulalia mines are maintaining an almost normal production, as are those in the Naica, Cusihuiriachic, Dolores, Batopilas and Ocampo camps. At Parral, the San Francisco del Oro, Palmilla, Maria, Tecolotes and El Rayo companies are operative and productive, but many of the others are shut down. At Guadalupe y Calvo, as well as in the Durango camps of Indé and Guanacevi, things are practically at a standstill, and will continue so as long as disturbances exist. Along the Orient railway, east of Chihuahua, all the mines have suspended, as is the case with properties on the extension of this road west of Minaca, but these cessations are due to shortage of supplies and to the difficulty of securing additional material on account of uncertain railroad communication.

The Chihuahua smeltery of the American Smelting & Refining Co., has been in steady commission with five furnaces in blast, and has on hand sufficient ore and fuel to operate for three months at least, even though the mines should shut down or the railroad service be discontinued unexpectedly, as is the constant fear of everyone. The Terrazas copper smeltery is operating steadily.

The supply of fuel and dynamite is still a serious matter for the mines and reduction works, on account of the uncertain railroad communication and because of the attitude of the United States Government toward the exportation of explosives into this country, which might be construed as munitions of war and thus an aid to the revolutionary cause. The first of these uncertainties still exists, although communication to date has continued quite regularly over both the National and Mexico Northwestern lines to El Paso, the former road being operated from Jiminez to El Paso by the revolutionists. On several occasions the United States Government placed a ban on the exportation of both coal and dynamite, but speedily lifted it on a better understanding of the hardship thereby imposed on American-owned mines, and on adequate guarantees from the revolutionists that the goods would not be confiscated. There is now sufficient of both articles for at least two months, and as additional lots are coming in, it is not probable that operations will cease for lack of either. An idea of what the closing down of the present operative mines means is apparent when it is understood that at least 5000 men would be thrown out of employment, and these men, none of whom have enough money ahead to live longer than a week, must either take sides in the revolutionary cause or exist by looting and robbery, and in the latter case it is doubtful if the American or foreign interests generally would be greatly respected.

While foreign operators have little fear of personal violence or wilful molestation on the part of the organized forces, there is, nevertheless, an apprehension due to the uncertainty of what may happen from one day to another. With this uncertainty to guard against, it has been considered wise to send the women out of the camps, particularly those more remote from the railroad settlements. Bullion shipments to the United States are now being made via both the National and Mexico Northwestern railroads. The Cusi Mining Co. has perfected plans for the erection of a concentration-cyanidation plant, as soon as disturbances cease.

Johannebsurg

Apr. 29—The mines of the Rand are strongly opposing the provisions of the Miners' Phthisis bill, which proposes to deduct 30s. per month from wages of rock drillers and 15s. from all other underground employees. The mine owners argue that, as the government draws huge profits from the industry, they should not be compelled to bear three-quarters of the cost of the scheme. The bill has been referred to a committee for revision. There will be no compulsory regular examinations of miners to discover those suffering from tuberculosis, as at first proposed. It is doubtful if the main features of the bill will be much altered.

Owing to the almost total failure of the rainy season in Rhodesia, a serious shortage of water is being experienced in many mining districts, and several batteries have already stopped work. The Lonely mine has cut the reef at the eighth level, 800 ft. vertical, assaying about 1 oz. gold over 4 feet.

The Hay mine is giving disappointing returns, but rich ore is being encountered in the third level of the large Shamva mine. The lode in the ninth or bottom level of the Eldorado mine has been cut, showing high-grade ore. The shares recently fell heavily on the report that the rich oreshoot was narrowing in depth. The consulting engineer states, however, that developments and prospects are satisfactory. The Cam & Motor mine will soon have 1,000,000 tons of ore developed, worth about 45s. per ton. An experimental roasting and cyanide plant, on West Australian lines, is now at work treating 300 tons per month with satisfactory results.

The Consolidated Gold Fields is floating the Golden Koppie mine, near Eldorado. The orebodies consist of irregular lenses of schist, highly mineralized, lying on the font wall of banded limestone between granite and limestone areas. The lenses are from 6 to 32 ft. in width and the gold-bearing zone extends for five miles; only about 4500 ft. have been developed to date. About 176,000 tons have been fully developed, valued at 33s. 6d. per ton. It is proposed to treat 10,000 tons per month at a cost of 18s. 6d. per ton.

The Mining News

The Current History of Mining

Alaska

CORDOVA DISTRICT

The increased price of copper metal has greatly stimulated copper mining in this section of Alaska. Properties that had been lying idle have resumed active prospecting in many instances, and producing mines have increased their shipments to the Tacoma smeltery.

Bonanza—The mine is now shipping 50 tons per day, but has been shipping 100 tons most of the winter. It is stated that the concentrator will be ready to begin operations June 1, after which time it is expected shipments will reach 150 tons per day, including the concentrates and the high-grade copper glance now being sent to the smeltery.

Alaska Consolidated Copper Co.—Alfred B. Iles, manager, was in Cordova recently, *en route* to the property, near McCarty station, on the railroad. New York and Pennsylvania men own the mine. Mr. Iles said that he would immediately arrange to ship the high-grade ore by pack train to the railroad, 18 miles, and hoped to ship a car per day. An air compressor and power plant may be installed this summer.

Northern Development Co.—A leaching plant will be installed on the property, at Copper Mountain. E. R. Gray is manager.

Regal Mines Co.—This mine, operated by the Northern Development Co., E. R. Gray, manager, is situated across the glacier from the Bonanza. Prospecting is being done on high-grade ore, and if depth is attained, motor trucks may be installed to transport the ore across the glacier to a shipping point.

ELLAMAR DISTRICT

Three-Man Mining Co.—This company, at Landlocked Bay, will probably start regular shipments soon to the Tacoma smeltery.

Cliff—This mine recently changed owners.

Ellamar—A small compressor has been ordered to operate an air-lift to pump seepage water from the coffer-dam. It will also drive a small dynamo for lighting purposes.

PORT WELLS DISTRICT

There is some activity in this district. Several prospects continued development during the winter, and good specimens, showing free gold, were brought out.

Arizona

GILA COUNTY

Inspiration Consolidated—Over 400 men are employed and the force is being increased. Three development shafts are being sunk and ore from development is being hoisted through another. Grading is being done on the site of the two concrete, three-compartment working shafts, which will be sunk 50 ft. apart and near the Inspiration camp. Ore from the Live Oak mine will be conveyed by underground haulage through the Keystone mine and hoisted through one of these shafts. Grading has not started yet for the 7500-ton concentrator. Preliminary surveys for the railroad to the mine and to the concentrator have been finished and the dam across Pinal Creek will be finished soon. The engineering force contains 24 engineers and their assistants, of whom 14 are employed on construction and 10 in the mine, besides the engineers at the Live Oak mine. W. C. Browning, formerly chief engineer at the Inspiration mine, has been made assistant superintendent of that mine, and E. G. Deane is now chief engineer. The firm of Repath & McGregor, consulting construction engineers, has charge of all construction work. Associated with it are F. J. Brule, H. J. Wallace and W. C. Holman at the head of a corps of 14 engineers.

Miami—Diamond-drill hole No. 1 is 125 ft. below the 570-ft. level, and has shown commercial ore for the entire distance, which may be taken as a favorable indication that the ore deposit extends to a greater depth than was estimated, all previous estimates having allowed only 50 ft. of ore below this level. The tailing elevator is finished and working satisfactorily. All tailing is now elevated 60 ft. and conveyed by a launder to the gulch east of the mill, where it is impounded. One churn-drill is exploring the northeastern part of the property.

Barney—Churn-drill hole No. 3 is 675 ft. deep and in silicified schist, after passing through conglomerate and dacite.

Southwestern Miami—Three churn drills are in operation, but drilling has been proceeding slowly, on account of caving. Ore is not expected for some time in any of the holes.

Arizona Commercial—The Copper Hill shaft has been retimbered to the fourth level, and a drift is being run on that level to connect with a drift from the Gray shaft of the United Globe mine of the Old Dominion.

Superior & Boston—The southeast crosscut on the 12th level is reported to be breasted in favorable looking ground, carrying considerable quartz and limonite. Ore is being shipped from the stope below the sixth level, 20 cars having been shipped in May. About 50 men are employed.

South Live Oak—Churn-drill hole No. 1 is 640 ft. in granite, carrying a considerable amount of the carbonates of copper. Carbonates were first encountered at a depth of 435 ft. and at 455 ft. chalcocite was encountered and the samples have since shown varying amounts of carbonates and chalcocite.

Copper Reef—The face of the main crosscut tunnel is being advanced and is now in over 1000 ft. The drift from this tunnel on the California vein is in 60 ft. from the tunnel and breasted for its full width in vein material, consisting of red hematite and clay gouge. Charles Saxman is superintendent and 11 men are now employed.

California

AMADOR COUNTY

Central Eureka—It is reported that most of the indebtedness has been paid and that a new compressor will be installed.

South Amador—A cave was encountered in the 500-ft. level which is being unwatered. When the mine is thoroughly drained, extensive prospecting will follow.

Lincoln—Driving the 2000-ft. level toward the Wildman is in progress. The large vein in the Wildman is said to be 160 ft. wide and in the earlier days the ore averaged $4 per ton on the 1400-ft. level. W. J. McGee, Sutter Creek, is manager.

Zeile—Fred O. Zeile and other directors recently visited Jackson, to consider future action regarding operations. An examination was made in February for possible purchasers.

Keystone—The mine has been unwatered to the 1400-ft. level, the lowest working. The shaft will be deepened 500 or 600 ft. C. R. Downs, Sutter Creek, is manager.

CALAVERAS COUNTY

Mother Lode-Mizpah Gold Mining Co.—This is a new company organized to operate mining properties near Mokelumne Hill. The capital stock is $1,000,000. The directors are P. B. Whitfield of Mokelumne Hill, E. Owen McCann and George C. Schoen, of San Francisco.

Penn—The copper smeltery at Campo Seco is treating about 150 tons of ore per day. The main shaft is down 1520 ft. A. P. Busey Jr., is manager.

Eldorado County

Sherman—It is reported that this mine will close down as the ore in sight has been exhausted. It will be necessary to sink a new shaft and either move the mill or build a new one.

Melton—This mine at Poverty Point, recently purchased by A. Baring-Gould and associates, has been reopened. The mill has been enlarged and the property is now in operation. The first car of concentrates was shipped in May.

Inyo County

Independent Lead-Silver Mining Co.—This company will start systematic development of the Santa Rosa mine recently acquired. Mr. Zabriskie, of New York, and B. F. Edwards, of San Francisco, both of the West End company, of Tonopah, are interested. S. H. Brady, general manager of the West End and Halifax companies, of Tonopah, is general manager. It is the intention to install 5-ton Pierce-Arrow auto trucks for transporting ore and supplies between Keeler and the mine. H. J. Meisel, formerly field engineer for the West End company, is superintendent.

Tiptop—About 15 cars of sorted ore await shipment. One team is employed, though an effort is being made to obtain more. The installation of motor trucks is contemplated. Chafey, Thorndike and McMillan, of Bishop, are owners.

Skidoo—During April, 1068 tons of ore were crushed. Only 10 stamps were in operation, on account of water shortage. Total yield was $12,508; development, $1468; operation, $7525 and $3515 profit.

Kern County

In the vicinity of Isabella, the following mines are operating on a small scale: Glen Olive, Early Sunrise, Keyes and Big Blue.

Mammoth—The force has been increased to operate the 10-stamp mill, two shifts on development ore. The main adit, now 1300 ft. long, is being pushed southward and raising is in progress in two places. Sinking will soon be in progress on the main orebody, already exposed 100 ft. above and below the adit. Leyner drills are used throughout. The ore is free milling and extraction averages 95%. A. G. Keating is in charge.

King Solomon—Operations are being resumed at this mine, three miles from Havilah. There is a 5-stamp mill on the property. The mine has eight main workings. A contract has been let to supply timber for fuel and mine purposes.

Mariposa County

Original—A mill is being installed at this mine, near El Portal. John E. McLean, of Mt. Bullion, is manager.

Modoc County

Two hundred men, representing about one-third of the miners, prospectors and others in the Highgrade district, at a meeting in Fort Bidwell recently considered proposed changes in location and assessment rules. An effort was made to extend the time for staking claims from 60 days to 90 days on account of the snow delaying the work, but the majority objected. Twenty days are allowed for setting stakes, and the balance of the preliminary work must be done within the 60 days. The report of Norman C. Stines was adopted as a fair and accurate estimate of the district.

Nevada County

Champion—A good vein carrying a pay shoot is reported to have been disclosed in the Merrifield shaft. The unwatering of the 2400-ft. Champion shaft is nearing completion.

Delhi—The line of the proposed new 5½-mile flume is being brushed out. The sawmill for getting out the flume lumber is about completed. Hamilton Eddy is mine superintendent.

Placer County

Trinidad—This mine in Sailor Cañon is reported sold to San Francisco men. There is a 10-stamp mill on the property.

Moss—Mr. Jeffry, of Oakland, is cleaning out and retimbering the shaft of this mine at Forest Hill, preparatory to developing the vein. He has installed a gasoline hoist and pump.

Plumas County

Long Bar—The mineral character of this claim is being contested by Susan Belden who sold the claim to Dr. P. F. Bullard. Mrs. Belden has since made a homestead entry which covers a part of the mining claim. The land is at Belden station on the Western Pacific Railroad.

Trinity County

Trinity Consolidated Hydraulic Mining Co.—The three placer mines operated by this company, near Weaverville, are running with a full head of water for the first time this year. The season has been the driest in 30 years. The Union Hill placer, operated with 3000 miners' inches of water under a 460-ft. head, is moving 6000 cu.yd. of gravel per day, and the Hupp and Brown placers about 1500 yd. per day each.

Trinity Exploration Co.—This company was organized to acquire 700 acres of gold-bearing river channel, at Carrville, and to test it for dredging. To date it has drilled, with Keystone drills, 280 acres of the ground at a cost of $15,000, with such satisfactory results that this much of the 700-acre tract has been purchased outright and the options on the balance extended for such time as is necessary to complete the examination.

Tuolumne County

Black Oak—The new mill, now in operation, has been pronounced a success. All sliming, cyanidation and vacuum filtration are used.

App—The 20-stamp mill is operating on low-grade ore. The mine is said to be in poor physical condition, due to the cave-in last year. The United States Smelting, Refining & Mining Co. sampled the mine last winter, but the results are said to have been unsatisfactory. The Tonopah-Belmont Development Co. recently purchased the mine and a 100-stamp mill is contemplated, also an electric hoist and new headframe. W. A. Nevills is owner and manager.

Sierra County

Telegraph—The electric equipment is being improved and a large amount of supplies has been hauled in preparatory to extensive development work this season. J. W. Finney is superintendent.

North Fork—A recent fire, caused by a short-circuit of electric wires, destroyed the hoisting works, with a loss of about $5000. They will be rebuilt immediately. George F. Stone is superintendent.

Willoughby—The mill above Downieville is being put in order for crushing the ore, which has been taken out since Jan. 1, 1912 by the owners, Dr. R. L. Jump, of Fruitvale, E. M. Farrell, of Downieville and their associates. E. M. Farrell is superintendent.

Tightner—Litigation recently brought to court has been settled by compromise for $14,000. H. L. Johnston retains title.

Colorado

Clear Creek County

Richmond—This old producer of high-grade lead-zinc ore is being operated by Crandall & Hurley and is shipping ore to the Mineral Chief mill.

Morning Star—This property on Saxon Mountain, idle for 20 years, is being worked by Mottschall and Patton, who have from 2 to 3 ft. of high-grade zinc ore carrying 40 oz. silver per ton.

Bard Creek Mining Co.—This company owns a group of claims on Lincoln Mountain, and it is said that during the winter 200 tons of smelting ore were extracted in development on the Ohio vein.

Capital—The mill is making a satisfactory saving. About 60 oz. of amalgam worth about $4 per oz., and 20 to 30 tons of gold, silver and lead concentrates are obtained in one 12-hr. shift, the concentrates averaging about $40 per ton. The production is reported to be close to $50,000 per month gross. A report is current that the property has been sold for $2,000,000 to an English syndicate.

Raymond Tunnel Co.—The Paris & Baltic group of 10 claims on Griffith Mountain has been taken over by this company and miners will be put to work soon developing the veins which were intersected by the crosscut tunnel, 850 ft. from the portal.

Eagle County

At the head of East Lake Creek, a group of claims is being worked by A. Y. Stubbens, who is driving a crosscut tunnel to develop them and he has cut several veins. He intends to erect a mill to treat the low-grade ore at the dump.

Fremont County

United States Reduction & Refining Co.—The Union plant at Florence is operating on the old chlorination dump. Leaching with cyanide is the process.

Lake County-Leadville

Yak Tunnel—The output for the month will be about 12,000 tons. The tunnel is in Vega territory. The lessees are doing well and are taking out a heavy tonnage of good ore.

Double Decker—This mine, under Manager Covey, is shipping a car per day of good-grade ore.

Nevada—A 5-ft. vein of ore has been opened that nets the lessees $30 per ton. It is lead ore with gold. Three cars per week are being shipped to the Arkansas Valley smeltery.

Kyle Mining Co.—The mill which was erected to work the gravel from the Kyle placer, near Soda Springs, is now treating 50 tons per day, under the superintendence of B. C. Nelson. The free gold and black sand are being saved by crushers, rolls and tables, and it is stated that the material runs $1 per cubic yard.

Waterloo—The shaft has been repaired and Mr. Cramer, superintendent, says about 50 tons per day are being hoisted

Denver City—The shaft has been retimbered and at the 300 level prospecting is being done for carbonate of zinc ore.

Jolly & E. K.—The lessees have opened a body of good iron ore and want the Colorado & Southern R.R. to extend the old Bison spur to the Jolly shaft, so as to load the ore directly into the cars. The railroad officials are considering it.

Mineral County

Creede-Triune—The foundation of the 300-hp. generating station is finished, and the cutting of the station has been completed on the 12th level of the Amethyst, preparatory to shipping.

Mollie S.—After several years idleness, the mine is resuming operations, under lease to R. S. Light.

Creede Mines Co.—This company has finished installing three Wilfley slime tables and has erected a large settling tank to separate sand and slimes in tailings, so that the slimes may be sluiced to the settling pond.

Ouray County

Indiana—This mine, owned by the Brown Mountain Smelting Co. and situated near Ironton, has 2½ ft. of good-grade copper ore. Three large snow slides, that ran across the road have to be cleared before ore hauling will be possible. The pyritic smeltery will start about July 1. M. C. Canfield is superintendent.

Barstow—This gold mine near Ironton has its stopes and bins full of ore.

Routt County

The Yarmony district has been prospected for 15 years but only recently has any ore been developed. Copper is the chief mineral sought. It occurs in sandstone forming a contact between Cambrian limestone and quartzite. In 1911 this deposit was opened by a 385-ft. incline and 150 ft. of crosscuts. The oreshoot was found to be about 50 ft. wide, with good ore in the breast of the tunnel. The ore is a carbonate and oxide, with a little native copper, and averages about 5% copper. A Leadville man is planning the erection of a mill in the district, of which McCoy is the center.

Saguache County

Rawley Mining Co.—This company, operating at Bonanza, ended its first year's work on its 6250-ft. drainage and development tunnel, May 11, having advanced 4025 ft. during that period. The bore is 7x8 ft. in the clear. The record month was March, 1912, when the heading was advanced 470 ft. with two shifts of machine men and three shifts of muckers. In April, water retarded progress for several weeks. The tunnel is now in good ground again. The plant is equipped with Leyner drills and other modern machinery. A. C. Russell is manager.

San Miguel County

Junta—The 110-ton San Miguel mill under lease to this company, was recently destroyed by fire.

Smuggler—The stamp mill is being remodeled by G. Caetani; the Gilpin bumping tables are being replaced with Wilfley tables and Hardinge mills are being used. The cyanide plant is being reconstructed under the direction of Supt. Walter L. Reid.

Tomboy—The mill has been overhauled, and Hardinge mills installed for re-treating middlings. Wilfley tables are used. G. Caetani had charge of this reconstruction.

Teller County—Cripple Creek

It is stated that 10 electric hoists have been installed in the district within the last two months and that more are projected.

Ajax—The Colburn-Clancy mill is to be closed for alterations and improvements and the sampling plant is to be enlarged. This will take about 30 days and the time of the lessees will be extended for that period.

Isabella—It is estimated that the May output will be 55 cars, the royalties from which will be about $4000. About 30 sets of leasers and 15 machine drills are at work.

Last Dollar—The output for May will be about 400 tons of mill ore. Six cars, shipped to the Portland mill, at Colorado City, ranged from $20 to $40 per ton.

Stratton's Independence—During April, production totaled 3004 tons of ore, averaging $16.12 per ton. Low-grade mine and dump ore, amounting to 10,600 tons, was milled. Net working profit at mine and mill was $16,000, and $2000 were spent on special development.

Idaho

Idaho Tungsten Co.—The company's mine at Patterson, Lemhi County, is developed by tunnels. The 500-ft. tunnel is being worked and good ore has been opened, 2 to 10 ft. wide. The upper tunnel is 900 ft. long, and is reported to show ore almost the entire distance. Several other tunnels from 20 to 150 ft. long, show ore. A 100-ton mill is under construction. A 2x3-ft. flume will furnish power. G. W. Kessler, Patterson, is superintendent.

Illinois

Press dispatches recently reported that a well, drilled by the city of Joliet, to increase its water supply, had turned out to be an oil well when the pumps were applied. The facts are as follows: The well is within 200 ft. of an old gas works. Apparently refuse gas-house products were encountered in the limestone at 225 ft. After casing to 300 ft., drilling was continued to 1571 ft. After passing through the Potsdam sandstone, the pumps were put on. Immediately oil, gas and a tarry substance were obtained in sufficient quantity to pollute the water for domestic purposes. This continued for a month. After extending the casing to 900 ft., the trouble was lessened. Analyses are being made to determine the origin of the oil and gas.

Michigan

Copper

Osceola Consolidated—No. 6 shaft at the old Osceola branch, resumed work with about 50 men, on June 3, after a shutdown since April, 1910. The Consolidated expects to spend about $150,000 during 1912 for new construction at the mines and mills.

Franklin—At present about 325 men are employed, and this number is being increased. It is said that in April, for the first time in many months, copper was produced at a profit.

Isle Royale—It is reported that a new shaft, No. 7, will be sunk at a point south of No. 6, now the most southerly shaft. Good ground has been opened in the southerly workings from No. 6 shaft. Judge Sessions, at Marquette, June 3, denied G. H. Hyam's petitions, to restrain this company and the Tamarack from entering upon the mill plans proposed by the Calumet & Hecla company. These plans will be carried out.

IRON

Lucky Star—An Ingersoll-Rand, 800-cu.ft. compressor has been installed at this new Breitung-Kaufman mine, at Negaunee. About 15 ft. of quicksand were recently encountered in sinking the shaft.

Breitung Hematite—A steam shovel is shipping from the high-grade stockpile.

Lucy—This Cleveland-Cliffs mine, at Negaunee, is shipping ore from stockpile, but the underground workings are idle.

Youngs—This mine, of the Huron Mining Co., at Iron River, has shipped no ore so far this season, although a heavy shipper in previous seasons.

Caspian—This large mine, of Pickands, Mather & Co., at Iron River, has been shipping about 1200 tons of ore per day from the pocket and 2000 tons from the stockpile.

Bengal—At this new Pickands-Mather mine, at Stambaugh, the shaft has been completed to bedrock at a depth of 140 ft., by William Harris, of Gwinn. The shaft was started a year ago and was almost abandoned several times, on account of quicksand and water. At the Barras shaft, no ore has been shipped, on account of lack of transportation facilities. Tracks will soon be extended to the shaft and meanwhile adequate machinery will be installed.

Minnesota

Wisconsin Steel Co.—This company's new washer at Nashwauk started operations recently. The plant has an annual capacity of 500,000 tons per year. It is operating on ore from the Hawkins mine.

Montana

BUTTE DISTRICT

Davis-Daly—On the 1900-ft. level of the Colorado mine, a strike of rich ore was made, May 24. The vein where first encountered was 2 ft. wide, but it has widened to 6 ft. Underground conditions have been gradually improving in the last few months.

East Butte—Robert H. Gross, president, recently made an inspection of the property. He is pleased with conditions. During April, 1,300,000 lb. of copper were produced, the ore averaging 6.13% copper, most of it mined from the 800-ft. level. This is the largest month's output of the company to date. The 1000-ft. level is being opened and the ore so far uncovered exceeds in grade any of the ore in the levels above.

Butte & Superior—The mine has been closed down for extensive improvements, and probably will not be running again for over a month, except for development and repair. A new hoisting plant, capable of hoisting from a depth of 3500 ft., a new steel gallows-frame, and 5-ton skips, will be the main features of the new equipment. The new mill will, in the meantime, be operated continuously, as ore has been provided to be used during the shutdown. The mill is working successfully, and it is expected that it will soon be treating 500 tons of ore per day.

LINCOLN COUNTY

Hazel T.—A shoot of ore was recently encountered at this mine, near Libby, containing good gold, silver and lead ore. George H. Chandler is president.

MADISON COUNTY

With the opening of the roads into the Silver Star district, general activity is again being shown there and the prospects are for a good season.

Hudson—At this mine, owned by the Largey estate, of Butte, 10 men are at work, and the mill is being operated continuously.

SANDERS COUNTY

Montana Gold Mines—Preparations are being made to resume development at this property, and miners have been hired in Spokane by Frank McCaffrey, manager. Considerable development has already been done. The ore contains free-milling gold, and a quantity of ore is said to be blocked out.

Nevada

CLARK COUNTY

The region in the vicinity of Nelson consists of dikes and veins, the latter carrying from $6 to $20 per ton in gold and silver, over widths of from 4 to 25 ft., and opened to depths up to 500 ft. Development is retarded by large ownerships vested in few men, who prefer not to exploit the district at present.

ELKO COUNTY

Idaho men are planning to bring electric power into the Gold Circle camp. One mill is now in operation in the district.

Success—This and the Rock Creek claims, recently under option to George Wingfield, have been incorporated and further development will be done.

Bluster—Good milling ore has been opened on the footwall of the main vein.

Alpha—This group under option to Chicago men, is being developed rapidly. A trail is being built to take in a hoist The 75-ft. shaft will be sunk to 200 feet.

Esmeralda—This group in the Gold Circle camp has been sold by McMahon & McCauley for $45,000 to George H. Davis. The mine is stated to be a large, low-grade property. A mill may be erected.

ESMERALDA COUNTY

Goldfield Consolidated—The estimated May production was 30,209 tons; gross value about $500,000; net, $300,000 and $200,000 operating expenses for the month.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended May 23, are as follows:

Mines	Week	Year to Date
Tonopah Mining....	3,450	68,969
Tonopah Belmont.....	1,550	42,976
Montana-Tonopah.	1,084	21,346
Tonopah Extension.....	1,035	20,102
West End....	750	14,934
Midway......	..	180
MacNamara.	450	7,270
North Star..	..	80
Totals...	8,319	175,857
Estimated value.	$208,925	

New Jersey

New Jersey Zinc Co.—For over a year past, a diamond drill has been at work on the old Marshall mine, at Ogdensburg, three miles from Franklin Furnace, in Sussex County. This mine was at one time a large producer of zinc ore, but has not been worked for 17 years. The company has now put a force of men at work, repairing the old headframes and machinery and cleaning up generally. It is reported that a new shaft is to be sunk.

New Mexico

SIERRA COUNTY

Hopper-Bigelow—This company, of 100 Broadway, New York, controls the following companies in this county: Victoria Chief Copper Mining & Smelting Co., Wellington Copper Mining Co., Statehood Mines Co., Vanadium Queen Mining Co., and the Cutter Townsite Co. Of these the Victoria Chief and Statehood are the most important. The former was equipped with a good camp, general store, fine engines, expensive machinery, etc., but profitable ore was not found. These two companies have now gone into the hands of receivers.

SOCORRO COUNTY

Deep Down—The leasers are sinking the winze and have been shipping 15 tons of ore per day to the Deadwood mill, taken out in development.

Treasure—The old ore bins were destroyed by fire on May 25, and the mine crew was put to grading for new ones, which will be in commission soon. A good ore reserve at the mill will likely prevent any shutdown before the ore teams are again at work.

Ernestine—The two cleanups for the first 20 days of May yielded 21,725 oz. of gold and silver bullion, and 22,550 lb. of high-grade concentrates. This is the best 20-day record of the company thus far. The last week's ore treatment was 698 tons.

Oaks—The Pacific and Johnson mines shipped 30 tons to the Deadwood mill from 21 ft. of development.

Oklahoma

The Emma Gordon and Turkey Fat mills are the only ones operating steadily. Most of the other mines are sinking to the lower orebody. The 30-acre, Miami Royalty Co. and Chapman & Lennan are erecting five new mills. Shafts are being sunk by the Carson-Dodson, Donna, Prairie, and George Moore & Co., and mills will be erected on these leases soon. Many drills are at work in the district. There are about 20 mills at present and about 10 more are either under construction or contemplated.

Chapman & Lennan—At the Emma Gordon lease a 3000-gal., triple expansion, condensing Prescott steam pump is being installed at the 275-ft. level. This is expected to lower the water level of the entire camp to 300 feet.

Oregon

Lane County

Vesuvius—F. J. Hard, manager of this mine at Bohemia, reports a fire, which destroyed the tunnel houses and other buildings, with a loss of over $2000. Work will be delayed some on account of the fire. The property is owned by Boston men.

West Coast—The electric power plant at this mine is said to be running satisfactorily. Superintendent Hogue is at the mine after a short trip. Several bricks have been shipped recently and the company is a steady producer.

Lincoln County

Platinum & Gold Extraction Co.—This company has been incorporated, with principal offices at Newport, Ore. The purpose is to search for platinum-bearing placer ground in the county and state, also to develop beach placers near Newport. The incorporators are George L. Stoney, R. L. Warner and G. A. Hartley.

South Dakota

Black Hills District

Columbus Consolidated—During the last few days a number of the obligations have been paid, including $16,234.14 delinquent taxes, and judgments to Fred Rossiter for $10,032 and C. D. Taggart, $5018. The judgments run until Oct. 5, and unless they are redeemed before that time the property will pass into the hands of J. T. Milliken, president of the Golden Cycle Mining Co., of Colorado, who furnished the money to meet the three obligations. The property consists of about 600 acres, adjoining the Homestake on the north, and supposed to contain the extension of the Homestake vein system.

Golden Summit—Canfield and associates are operating the mill, at Hill City, on ore that is running $25 per ton, saved on the plates.

Utah

Salt Lake County

Utah Copper—The April production was 9,069,237 lb. copper, as compared to 8,160,300 for the month before. From 18,000 tons to as high as 24,000 tons of ore are reported to have been handled in one day.

Montana-Bingham—Copper ore, largely of milling grade but carrying portions as high as 8%, has been cut by this company's tunnel from McGuire's gulch. This tunnel is being driven to develop this company's ground, and to reach the Bingham Amalgamated, Fortuna, Copper Glance, Congor, Starless and other properties at depth. This will enable these properties to send out their ore to the Copper Belt Ry., as the transportation facilities are poor on the east slope of the range.

Ohio Copper—No report as to mine conditions or operations has been published for two years, and it is hoped that something definite will be given out at the annual meeting in Portland, on June 5. The mill is said to be doing fair work, and is handling about 2000 tons per day.

Bingham Mines—A report, showing the financial condition of this company, has been made, according to the Massachusetts law. According to the report, the value of real estate and mines, construction, equipment, cash receivable, mining stocks, sinking fund, etc., is placed at $2,122,296, for 1911. The liabilities, capital stock, accounts payable, floating and funded indebtedness, together with accrued interest, etc., are placed at a like amount.

Utah Metal—There still remains 2200 ft. to be driven of the 11,000-ft. development and transportation tunnel between Bingham and Tooele slope.

Bingham Copper—The stockholders' protective committee has received over 465,000 shares of the 750,000 outstanding, these being relative to the proposed reorganization. The recent assessment will be used to pay off the company's indebtedness, and to put things in better shape generally. The claims cover 125 acres adjoining the Utah Apex and Utah Consolidated.

Columbus Extension—Drifting east from the tunnel level has been discontinued, and work to the west is underway to reach the contact between the white and blue limestone.

Michigan-Utah—Shipments have been started on several hundred tons of ore, which have accumulated during the winter.

Summit County

Thompson-Quincy—The new raise, being driven through the quartzite toward the overlying limestone, is nearing the contact.

Silver King Coalition—The electric traction line through the Alliance tunnel has been completed and will facilitate an increased output. The Silver King ore zone has been opened at several new points. About 300 men are on the payroll and the output varies from 500 to 800 tons per week.

Daly West—Milling is expected to be resumed within the next two weeks, as the water supply in the Bonanza Flat lakes is increasing. About 35 men will be added to the present force. The present output is about 500 tons per week.

Wisconsin

Grant County—The Cudahy interests of Milwaukee and Chicago have subleased this mine and have commenced underground work; the property lies between the Empire and Old Homestead mines.

Wisconsin Zinc Co.—The Wisconsin Zinc Co. has shown a continuation of the Klar-Piquette range on the Seitz land, held under 60-day option for $75,000.

Kruse—A local company has started prospecting on this land just west of the Klar-Piquette.

Mound City Mining Co.—The company has begun drilling on the old Hodge property within the city limits.

New Enterprise—This company has developed a good body of zinc ore in the old Enterprise, the pioneer zinc mine of Platteville, which has lain idle for three years.

Beloit-Elmo—Mining operations have been resumed again with crude oil engines to generate power.

Vinegar Hill Zinc Co.—The company is constructing a small test mill on the Gritty Six-Raisbeck tract.

Wyoming

At the second annual convention of the Wyoming oil men's association, held at Caspar, a resolution was passed favoring the examination of persons or companies desiring to do business, as to their resources, etc., and the issuance of a certificate to legitimate concerns, this being done in order to prevent wildcatting.

Victoria Gold Co.—It is reported here that free-gold ore has been found in this company's mine on Middle Fork, near Centennial. Free gold is found in pockets and some of the ore showing no free gold assayed high. A. F. Lindsley of Centennial is president and general manager.

Canada

BRITISH COLUMBIA

Reports have been circulating in New York during the last week that the smelting works at Trail, B. C., had been closed. We have been officially informed that there is no truth whatever in those reports.

Hastings Exploration Syndicate—The company at Nelson closed down operations at the Arlington mine on May 1, and has given a lease to W. J. Barker, late foreman, to clean up the remaining ore. Leslie Hill is consulting engineer.

Blue Bell—This mine at Riondel, S. S. Fowler, manager, is installing a 40-drill compressor, driven by a 9-ft. impulse wheel. The order was filled by the Nelson Iron Works.

Granite-Poorman—Good ore has been found on the Hardscrabble vein, with development well ahead of requirements. The company will soon resume experiments on the treatment and recovery of iridium and other metals of the platinum group, which occur in a 12-ft. peridotite dike.

ONTARIO

Elizabeth—At this gold mine, in the Atikokan district, a 10-stamp mill will soon be ready for operation. Five stamps have been installed and 20,000 tons of ore are blocked out.

McKinnon—These claims, near Dane, were worked for some time by a Montreal syndicate. Two shafts have been sunk in ore, one of which is down 150 ft., one of the walls being solid chalcopyrite with some bornite assaying high in copper. Several cars of ore are on the dump. G. McMurty has come from Arizona to take charge of operations.

Cordova Mines, Ltd.—No. 1 shaft is being enlarged and retimbered, and a double-drum, 10x12-in. geared hoist is being installed. No. 3 shaft is being cleaned out, preparatory to sinking 40 ft. to the 500-ft. level. At the power plant, a 250-kw., 3-phase, 60-cycle generator, initial voltage 2200, is being installed and direct connected to a turbine. This is an auxiliary to the 5000-ft. Walker, rope-driven compressor, run by an 800-hp. Leffel turbine, which is at present supplying power to the mines and mill, 2½ miles distant, air being carried through a 12-in. pipeline. The 30-stamp mill is being supplied by No. 3 mine and is showing increased extraction since the introduction of 45-mesh, slotted screens, and raising of the discharge 7 in. Extraction by amalgamation is averaging over 76%. The concentrates are cyanided with fair returns, which are expected to be increased by the installation of regrinding machinery. A large, central shaft is contemplated, through which all ore will be hoisted. Charles Mentzel, Cordova Mines, is manager.

ONTARIO—COBALT

Shipments of ore and concentrates, in tons, from Cobalt for the week ended May 31, and for the year to date, are:

La Rose	179.95	1,459.26
Coniagas	41.70	813.50
O'Brien	......	263.24
Right of Way	......	148.60
Chambers-Ferland	......	193.60
McKinley-Darragh	119.73	1,140.36
Nipissing	32.57	825.18
Hudson Bay	......	312.62
Buffalo	30.15	442.72
Crown Reserve	......	210.26
Cobalt Townsite	31.50	536.78
City of Cobalt	......	145.84
Trethewey	33.18	207.39
Colonial	......	41.60
Kerr Lake	......	319.66
Cobalt Lake	31.15	207.41
Drummond	18.55	318.77
Temiskaming	63.27	383.91
Beaver	55.55	187.89
Wettlaufer	...	111.21
Provincial		22.22
Casey Cobalt		24.50
Totals	637.33	8,185.52
Bullion shipments in ounces		
Nipissing	104,112.03	1,587,763.75

Peterson Lake—The attempt to overturn the present directorate has failed. Operations during the last year were conducted at a loss. The company is now operating the Little Nipissing lease.

McKinley-Darragh—The management estimates that the production for the first six months of 1912 will amount to 1,500,000 oz., which is considerably in excess of the amount produced during the corresponding period last year. The increase is mainly due to two new swamp veins, on which work was begun in April. Both veins yield ore running approximately 4000 oz. per ton, and average 4 in. wide, carrying occasional rich pockets of argentite.

Nipissing—In a raise from the intermediate level on vein No. 122, ore has been encountered 60 ft. from the surface. A good tonnage of low-grade ore has been found in the east drift of No. 73 vein, on the third level.

La Rose—A party of directors made an inspection of the property, May 29.

Trethewey—Work has commenced on shaft No. 6, situated near the mill, and it will be put down 175 ft. At this depth it is intended to drift east and develop along the eastern line of the property, adjoining the Nipissing.

Cobalt Townsite—This company is negotiating for the control of the Cobalt Station Grounds property.

Nova Scotia—On May 20, this property, the liabilities of which amounted to $245,000, was sold for $82,000 to D. M. Steindler, of New York, a director of the company and one of its largest creditors.

W. S. M. K.—On this property, formerly the Green-Meehan, the vein encountered at the 200-ft. level as a mere stringer has been followed for 125 ft., and has widened to 9½ in. of high-grade ore, with wall rock for several feet on each side, furnishing good milling ore.

ONTARIO—PORCUPINE

Moneta—A thousand feet of diamond drilling will be done from the crosscut at the bottom of the shaft.

Porcupine Gold—The mill will start producing soon, as practically all the machinery is in place.

Hollinger—The management has decided to install 10 additional 1500-lb. stamps, bringing the total complement to 50. It will not be necessary to install additions to the crushing and cyanide plants, as these were originally designed for a capacity of 500 tons per day.

Dome—All the stamps are in steady operation, the only stoppage being to clean the plates, which puts five stamps out of action. A fourth shipment of gold will be made soon.

Pearl Lake—This company has been transferred to the control of a syndicate of New York and Philadelphia men, who have provided for the payment of its liabilities, amounting to about $100,000. Development will be resumed in charge of Col. R. W. Stephenson, under the direction of the Hargraves Engineering Co., of Philadelphia. M. J. Ramsay and J. E. Wright, of Philadelphia, have been elected directors.

Achilles—This property has been sold.

Success—This property may be reopened soon. More money is needed.

McEneany—This mine has shipped 30 tons of ore for treatment, to determine the kind of a mill for handling its ores. Arrangements have also been made to put 100 tons through the McIntyre mill.

McIntyre—A quartz vein, 27 ft. wide, has been cut on the 200-ft. level, near the center of the west end of Pearl Lake. The force has recently been reduced, owing to lack of air power.

Mexico

CHIHUAHUA

It is reported that W. D. Ross, general manager of the Metropolitan Bank, of Toronto, Can., and a number of other wealthy men of that city, have formed a syndicate, capitalized at $10,000,000, which has taken over a number of mines in the Parral district, the total consideration being more than $1,000,000 gold. The mines embraced in the transaction are the San Patricio, Santa Ana y Anexas, La Revenda, Sierra Madre, Union and Trinidad.

Cuba

Daiquiri—Reports state that some damage was done to these mines of the Spanish-American Iron Co., during the recent revolutionary disorders.

Asia

CHOSEN

Oriental Consolidated—Cable advices state that $129,500 was the amount of the May cleanup.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, June 5—Coal trade in the West seems to be moving now with a fair degree of smoothness. Supplies at all the large consuming centers are large, and prices are rather weak. The Lake trade is not opening as briskly as had been expected. There are plenty of vessels to be had, but deliveries at the ports are rather slow, except in the case of West Virginia coal. Ohio coal is coming forward rather slowly.

The Seaboard bituminous trade is dull, although demand is pretty good for the season. The supplies hurried to tidewater in anticipation of a strike are still a load on the market and are being worked off very slowly.

Anthracite trade is slowly swinging back into its usual course and nearly all the collieries are making shipments. A tidewater schedule has at last been agreed upon, or at any rate adopted—the anthracite companies do not like to talk about agreements. The new schedule is $5 for broken, $5.25 for egg and stove, $5.50 for chestnut and $3.75 for pea, all f.o.b. New York harbor. From these prices a discount of 30c. per ton will be allowed for June.

United States Foreign Trade—Imports of coal and coke into the United States four months ended Apr. 30, long tons:

	1911	1912	Changes
Authracite	....	30	I. 30
Bituminous	521,341	488,591	D. 32,750
Coke	39,917	27,367	D. 12,550
Total	561,258	515,988	D. 45,270

Canada furnished this year 437,526 tons of coal and nearly all the coke; Australia, 43,630 tons of coal.

Exports of coal and coke from the United States, with coal furnished to steamships in foreign trade, four months ended Apr. 30, long tons:

	1911	1912	Changes
Anthracite	984,064	811,465	D. 172,599
Bituminous	3,044,786	3,561,816	I. 517,030
Coke	349,369	258,275	D. 91,094
Bunker coal	2,092,205	2,459,734	I. 367,529
Total	6,470,424	7,091,290	I. 620,866

The bunker or steamship coal is practically all bituminous. Canada took this year 2,676,466 tons of coal; Cuba and the West Indies, 638,580; Mexico, 112,657; Panama, 139,370 tons.

IRON TRADE REVIEW

New York, June 5—The iron and steel markets show practically little change from our last report. The mills generally are filled up, as specifications come in on a liberal scale. New business is not quite as active as it has been, except in a few lines; but the new orders are nearly, if not quite, sufficient to make up for shipments.

While the situation remains perfectly sound, it is no doubt true that the general tone of the market is less favorable than it has been. There is a lull which does not affect current operations, but which if continued will affect the future unfavorably. In some quarters the view is held that after the party conventions, and after the next crop reports are out, a fresh accretion of enthusiasm will come and the market will then brighten up all around.

The general advancing tendency in steel products is over for the present. In bars, plates and shapes, although the mills are very well sold up, there is no definite trend toward higher values. An illustration of this situation is that hoops remain at 1.25@1.30c., which has been the market for months, during which time merchant bars advanced from 1.05 or 1.10c. to 1.20c., while hoops have in the past always commanded more than merchant bars, frequently $4 a ton.

Pig iron is a little less active for foundry, but there is a strong demand for basic pig both in the East and in the Central West. Southern basic has been sold in considerable quantity, one large order going to St. Louis. There is a strong demand for low-grade iron from the pipe foundries, all of which seem to be very busy on contracts.

The Alabama Consolidated Coal & Iron Co. seems to be in trouble over its financing. It has been unable to place a new issue of bonds from which it was expected that the floating debt could be paid off. The Baltimore Trust Co. recently advertised a sale of $1,250,000 new bonds, which had been given as collateral for money borrowed and overdue. A temporary injunction, however, has been obtained against the sale.

Birmingham

June 3—Pig-iron manufacturers in Southern territory are not rushing last-quarter business, being confident there will be need for all the iron that can be produced for that period of the year. The books are nicely covered for the third quarter of the year and inquiries are in hand which will result in further business being procured before that time sets in. The iron quotations are firm with $11.25 per ton, No. 2 foundry, as the minimum, and $11.50 as a general quotation. The corporations are not quoting under $11.50 for the last quarter of the year, in fact, there is no inclination to dispose of iron under that price. The make in the South shows no improvement worthy of mention. The reduction of stocks continues and within a few weeks the statement can be made that there is less iron on furnace and warrant yards in this part of the country than has been seen in two years and more. The furnace companies are dealing carefully with future business so far as the lower grades of iron are concerned, the sales so far made in that line being such as to warrant care. Cast-iron pipe makers have been healthy purchasers of pig iron so far this year and are in the market again for a good quantity, the pipe makers having very bright prospects.

The machine shops and foundries are using a little more iron and efforts are being made to secure business to keep them well supplied through the summer at least.

Reports are satisfactory, considering, as to steel in Southern territory. Some small orders for rails were recently received by the Tennessee Co. and business for other steel shapes is being worked out. The demand for basic iron is steady.

Baltimore

June 3—Exports for the week included 2,690,450 lb. steel billets, 178,885 lb. tinplates, 22,400 lb. rails, 23,680 lb. frogs and 903,780 lb. sheet bars to Liverpool; 336,700 lb. iron pipe to Antwerp. Imports included 50 tons silicospiegel from England; 10,424 tons pyrites from Huelva, Spain; 12,850 tons iron ore from Cuba.

Chicago

June 4—The demand for pig iron continues small, but prices are firm and conditions warrant the belief that there will be a steady sale in small lots of a large aggregate of iron for the next week or two. A few inquiries are out for lots of as much as 1500 tons, but melters in general seek lower prices than the furnace representatives will make, on last-half deliveries. Sales in general run from a carload to 300 or 400 tons. Northern No. 2 brings $14.50@15 at furnace, and Southern No. 2 brings $11@11.50, Birmingham, or $15.35@15.85, Chicago. Lake Superior charcoal holds to $15.75@16.25, and is in light demand.

Activity continues in the market for iron and steel products of almost every sort. Railroad supplies are in good demand, from standard rails down to spikes and bolts, at unchanged prices. Structural material continues in demand for work throughout Western territory and much more work appears in sight; prices are constant at 1.43c. for beams and channels of 15 in. or smaller. Bars are in very good condition for the selling interests, and producers are pushed to make deliveries even reasonably behind scheduled dates. Iron bars bring 1.25@1.30c. and soft-steel bars 1.38@1.43c. base, the lower prices being the rule. Plates and sheets are in very good demand, at unchanged prices. Billets have a fair sale at $28, for openhearth forging, the local demand being normally light. General trade conditions continue good.

Cleveland

June 3—Iron ore is coming down freely now. Sales are apparently over for the season.

Pig Iron—Numerous sales of moderate size have made up a heavy total of new business. Prices are a shade higher. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.50 for No. 2 foundry, $13 for forge and $15.75 for Lake Superior charcoal.

Finished Material—New business is moderate only, but specifications are heavy, and some mills are behind in deliveries. Plates and structural steel are in especial demand.

Philadelphia

June 5—The anticipated general buying movement in pig iron has not yet set in; most furnaces are sold ahead but there is no disposition shown by makers to yield a point. A good many inquiries are on the market from the larger buyers for delivery later in the year. Southern furnaces are selling freely and are naming higher quotations for the last quarter. The pipe interests have made extensive purchases, some for third and some for fourth quarter. Much comment is made on the possibility within 30 or 60 days of a shortage of steel-making irons and there are some surface reasons to apprehend it. Foundry iron is more actively inquired for and basic still more so. There is a greater probability of an advance in pig probably late in this month or early in July. Consumers, large and small, are showing a willingness to accumulate stocks where they find it possible to do so at something less than current asking prices.

Billets—Production of billets is on the increase and maximum capacity will be demanded. Forging billets are particularly active.

Bars—Bars continue to move freely and recent inquiries indicate a still larger movement.

Pipes and Tubes—The activity in pipe is quite marked over two weeks ago. The tone of the market is strong and work for 30 to 60 days delivery is more abundant than for months. Tubes continue to move freely at the advance.

Plates—Premiums have been paid on several lots of plates for prompt delivery and there is more business of this sort pending today. A great many inquiries are in the market for plates, mainly from car builders.

Structural Material—Some business has been delayed in view of the possibility of lower prices that were expected to develop during June. The situation today indicates strong prices for shapes throughout the summer except in two or three instances where negotiations have been hanging fire for two or three weeks for New York and eastern delivery. Minor building orders are quite numerous.

Scrap—The heavy recent purchases of scrap have covered urgent requirements but a fair business is still being done.

Pittsburgh

June 4—New business in iron and steel products has grown still lighter, and the market is relatively quiet in this respect. In specifications against old contracts, however, the activity continues at almost as high a rate as formerly and at a rate in excess of current shipments. The majority of buyers are contracted through the third quarter, some of them through fourth-quarter also, and great activity in new buying is not essential to the continued operation of the mills over the next few months at the current rate.

Under date of June 1 the National Tube Co. advanced merchant steel pipe and oil country goods one point, or about $1.90 per ton, on all sizes 6-in. and less, making the regular discount on jobbers' carloads of merchant pipe, card weight, ¾ to 1½ in. inclusive, 80% off list instead of 81%. Merchant weight is one point greater discount, or one point lower price, while there is a regular discount to large jobbers beyond the regular card rate. The advance was promptly concurred in by the independents, although the fact is that for the past six weeks the regular market has been shaded in the case of attractive business, the cuts being only fractions of a point, and each order being quoted against separately. The mills have thus accumulated a good lot of specifications. Existing contracts at the old prices run through this month, and good specifications are to be expected against them, as a result of which July 1 will likely find the pipe mills provided with specifications for say 60 days' run, and they will then be in position to quote the advanced prices on new business.

Pig Iron—There is considerable brokerage inquiry for basic pig iron and the market may perhaps be on the verge of a decided change. As to actual transactions there is nothing new. The basic average for May, compiled by a trade authority from actual sales of lots 1000 tons and over, is announced at $13, Valley, or $13.90, Pittsburgh, and this average confirms the view taken in these reports that rumors of sales of basic above $13 Valley in the past month have not represented actual transactions. The bessemer average, similarly compiled, is announced at $14.2345, Valley, or $15.1345, Pittsburgh. Foundry iron continues quiet. The merchant furnaces now in operation are well sold up, and it would require very little buying to advance the market. We quote: Bessemer, $14.25; basic, $13@13.25; malleable and forge, $13; No. 2 foundry, $13.25, all f.o.. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—High prices continue to be paid for small lots, up to $55@57 for carloads, Baltimore, while the regular contract market, which is more or less nominal, remains at $48.50, Baltimore.

Steel—The shortage of billets and sheet bars is still more pronounced, and fancy prices have to be paid for prompt steel, up to $22 or higher, while $23 has been paid for small billets. The regular market prices for extended delivery, upon which term contracts are based, are approximately as follows, f.o.b. maker's mill, Pittsburgh: Billets, $20.50@21; sheet bars, $21@21.50; prices f.o.b. maker's mill, Youngstown, being about 50c. less. Wire rods are $24.50@25, Pittsburgh, having grown weaker in the past fortnight.

Sheets—Specifications continue good, and the mills are operating at a slightly better rate, with specifications coming in just about fast enough to maintain as much business ahead as formerly. Prices are unchanged, the higher figures representing the minimum of the American Sheet & Tin Plate Co.: Black sheets, 1.90@1.95c.; galvanized, 2.95@3c.; blue annealed, 1.40c. for 10 gage.

St. Louis

June 3—The pig-iron market remains about the same. The demand is fairly active with the market mostly in the hands of the sellers. Producers are all sold up for the next two months. While the market has a strengthening tendency there will probably be no further advance in prices for the summer months, as the usual summer lull will undoubtedly offset the strengthening market for the time being. No. 2 foundry is still being quoted at $11@11.50 per ton Birmingham or $14.75@15.25 per ton St. Louis. Northern No. 2 iron is quoted around $15, St. Louis.

Coke is a little bit easier and is being quoted at $5 per ton St. Louis for good foundry.

Iron Ore Trade

Contracts have been made for 250,000 tons of ore to be shipped from Ashland, Wis., to Canadian ports. The point of shipment indicates that the ore will come from mines on the Gogebic.

Exports and imports of iron and manganese ores in the United States four months ended Apr. 30, long tons:

	1911	1912	Changes
Iron ore, imp.	466,105	619,782	I. 153,677
Iron ore, exp.	10,527	27,332	I. 16,805
Manganese, imp.	59,643	90,120	I. 30,477

Iron ore imports this year included 48,695 tons from Spain, 125,549 from Sweden and 437,850 from Cuba.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for four months ended Apr. 30, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1911	1912	Changes
Exports	$83,807,086	$91,518,136	I. $7,711,053
Imports	10,413,646	8,533,623	D. 1,880,020
Excess, exp.	$73,393,440	$82,984,613	I. $9,591,073

Increase in exports, 9.4%; decrease in imports, 13.1%. The leading articles of iron and steel were, in long tons:

	Exports		Imports	
	1911	1912	1911	1912
Pig iron	63,114	76,343	57,662	33,476
Scrap	29,427	31,744	6,190	3,716
Billets, blooms, etc.	95,599	76,085	14,840	6,869
Bars	47,161	59,854	14,415	6,263
Rails	159,709	116,926	....	1,002
Sheets and plates	108,645	158,632	877	1,016
Structural steel	66,174	77,340	.....	748
Wire-rods	6,537	20,815	5,888	6,118
Wire	68,280	66,446	.....	......
Nails and spikes	26,206	34,290	.....	......
Tinplates	15,726	26,329	8,190	746
Pipe and fittings	64,961	77,552	.....	......

Imports of wire are not reported in quantities; values were $143,386 in 1911 and $235,313 in 1912. Exports of mining machinery in 1912 were valued at $2,076,484, a decrease of $286,289 from last year.

Metal Markets

New York, June 5—The metal markets have been strong this week, generally with an advancing tendency.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Apr. 1912	$ 1,816,816	$ 3,892,599	Imp. $2,075,783
" 1911	1,505,634	4,524,835	Imp. 3,019,201
Year 1912	21,774,902	16,306,794	Exp. 5,468,108
" 1911	3,364,658	23,990,572	Imp. 20,625,914
Silver			
Apr. 1912	4,941,259	4,189,512	Exp. 751 747
" 1911	7,610,154	4,251,532	Exp. 3,358,622
Year 1912	21,897,247	16,039,732	Exp. 5,857,515
" 1911	23,611,196	14,898,313	Exp. 8,712,883

Exports from the port of New York, week ended June 1: Gold, $600; silver, $1,046,064 chiefly to London. Imports: Gold, $295,752; silver, $90,282, mainly from Central and South America.

Gold—The price of gold on the open market in London continued at the usual bank rate, 77s. 9d. per oz. for bars, and 76s. 4d. per oz. for American coin. An unusual movement was the taking of £300,000 for Turkey. In New York there was a light movement to Argentina.

Platinum—The market remains quiet, the fall demand from the jewelers not having set in yet. There are some reports of weakness in the foreign market, but there is no change here. Dealers continue to ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of May 23 that at Ekaterinburg the offers of platinum by the starateli are increasing, because most of them are at work. The quotation there for crude platinum, 83% metal, is 9.80 rubles per zolotnik—equal to $36.85 per oz. At St. Petersburg buyers are looking for lower prices, but sellers are firm, and consequently little business has been done. The quotation for crude metal is 37,500 rubles per pood—equal to $36.75 per oz. The Compagnie Industrielle du Platine, which controls 85% of the output, is putting in new machinery at its mines and expects thereby to increase production.

Iridium—The market continues unchanged and the current price is $64 per oz., New York.

Silver—Business with India during the latter part of May was quite brisk. For the beginning of June inquiries continue good, but at slightly lower figures.

SILVER AND STERLING EXCHANGE

May-June	30	31	1	3	4	5
New York	....	61	60⅞	60¾	60⅞	60⅞
London	28⅛	28$\frac{1}{16}$	28	27$\frac{15}{16}$	28$\frac{1}{16}$	28
Sterling Ex.	....	4.8720	4.8715	4.8700	4.8695	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to May 23, as reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India	£3,628,300	£2,626,300	D. £1,002,000
China	822,800	630,000	D. 192,800
Total	£4,451,100	£3,256,300	D. £1,194,800

India Council bills in London averaged 16d. per rupee for the week.

Gold in the United States, on May 1, is estimated by the Treasury Department as follows: Held by treasury against gold certificates outstanding, $1,034,296,369; in treasury current balances, $170,858,482; in banks and circulation, $605,360,930; total, $1,810,515,781.

Copper, Tin, Lead and Zinc

NEW YORK

May-June	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
30	......	......	....	....	......	......	......
31	16¾ @16⅞	16.66 @16.65	45½	4 20	4 12½ @4.15	6 70 @6 80	6 55 @6 65
1	16⅞ @17	16.70 @16.80	45¼	4.20	4 12½ @4.15	6 75 @6 85	6 60 @6 70
3	17⅛ @17¼	16.80 @16.90	45½	4.20	4 12½ @4.15	6.75 @6 85	6.60 @6 70
4	17⅛ @17¼	16.95 @17.00	45½	4.20	4 12½ @4.15	6.75 @6.86	6.60 @6.70
5	17⅛ @17¼	16.95 @17 05	45¼	4.20	4 12½ @4 15	6 75 @6 85	6 60 @6 70

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

May-June	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
30	75$\frac{7}{16}$	75$\frac{15}{16}$	80½	203½	....	16⅝	25⅞
31	75$\frac{7}{16}$	75$\frac{15}{16}$	80½	200	195	16$\frac{11}{16}$	25⅞
1	......	......	......	......	......	.....	......
3	76$\frac{13}{16}$	77$\frac{5}{16}$	82	203½	197¼	16$\frac{11}{16}$	25⅞
4	77⅛	77$\frac{11}{16}$	82½	200¾	196	16¾	26
5	77⅞	78⅜	82½	200	194	16⅞	26⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, ± £1 = ± 21¾c.

Copper—From May 29, the date of our last report, the market continued to advance, and on June 3, when the remarkably favorable European statistics became known, there was a wild upward movement in the London standard market, followed by a sharp advance in this market. On that date certain of the agencies raised their asked price to 17¼c., delivered, usual terms, but most of the agencies continued to sell at 17c. and manifested a disposition to supply copper freely in order to temper the violence of the advance. On June 4, however, 17¼c., delivered, etc., became the prevailing price. In the aggregate a large business seems to have been transacted in spite of the advancing price Certain agencies report a predominance of sales for export and others report a larger domestic business.

Reports received from Europe as well as in this country are all to the effect that consumption is very heavy, and manufacturers are receiving orders both for early and future shipment. In consequence, they have been in the market for all deliveries, and considerable copper has already changed hands for September shipment. Producers are now well booked up; some of them are sold out for June and July, and there seems to be but little copper still unsold for August.

At the close Lake copper is quoted at 17⅛@17¼c., and electrolytic copper in cakes, wirebars and ingots at 16.95@17.05c. Casting copper is quoted nominally at 16.55@16.65c. as an average for the week.

The London standard market has been active and has steadily advanced, and it closes at £77 17s. 6d. for spot, and £78 7s. 6d. for three months. Transactions have been large.

Copper sheets have been again advanced to 22@23c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 18@18¼c. base, carload lots at mill.

Copper exports from New York for the week were 7366 long tons. Our special correspondent gives the exports from Baltimore at 1054 tons.

Visible stocks of copper in Europe on June 1, are reported as follows: Great Britain, 30,630; France, 5260; Rotterdam, 1750; Hamburg, 6250; afloat from Chile, 1800; afloat from Australia, 6900; total, 52,590 long tons, or 117,801,600 lb.; a decrease of 2970 tons from the May 15 report.

Tin—The London market continued to decline, and on June 3 spot closed at £203 10s. and three months at £197 5s,, at which prices it ruled on June 4. On June 5 it closed at £200 for spot and £194 for three months.

The violent fluctuations of the London market have quite bewildered consumers, and they are holding off pending developments. Stocks on this side are small, and as there is little tin afloat due here in June, any increase in the demand for early shipment is likely to increase still further the premium for early deliveries. At the close, tin for early delivery is quoted at 45¼ cents.

Visible stocks of tin on June 1 were: United States, excluding Pacific ports, 3270; London, 8331; Holland, 2744; total, 14,345 long tons; an increase of 2452 tons during May.

Lead—There has been a somewhat better demand, and the market is firmer at 4.12½@4.15c., St. Louis, and 4.20c., New York.

The London market is also firmer, Spanish lead being quoted at £16 17s. 6d., and English 2s. 6d. higher.

Spelter—Certain of the leading consumers have been in the market during the last week and have purchased a considerable tonnage of spelter at advancing prices, chiefly for July and August delivery. This market continues to be erratic and a wide variation in prices is reported. We quote 6.60@6.70c., St. Louis, and $6.75@6.85c., New York.

The London market is also higher, good ordinaries being quoted at £25 17s. 6d., and specials at £26 2s. 6d. per ton.

Base price of zinc sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7 1/16@7⅛c. per lb., New York, in carload lots.

Other Metals

Aluminum—Trade in New York is fair. The low-priced lots which have been holding down the market are apparently cleaned out, and prices have advanced to about the level set by the convention abroad. We quote 22½@23c. per lb. for No. 1 ingots, New York.

Antimony—Business remains about the same, and the market is steady at last prices. Cookson's is held at 8c. per lb. and Hallett's at 7¾c., while 7⅛@7¼c. are asked for Chinese, Hungarian and other outside brands.

Quicksilver—Business is fair and the market steady. New York quotations are $41@42 per flask of 75 lb., with 60c. per lb. charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. The London price is £8 5s. per flask, with £8 2s. 6d. quoted from second hands.

Nickel—Large lots, contract business, 40@50c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Imports and Exports of Metals

Exports and imports of metals in the United States, four months ended Apr. 30, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	119,129	64,064	Exp. 65,065
Copper, 1911	107,855	51,364	Exp. 56,491
Tin, long tons	250	18,856	Imp. 18,606
Tin, 1911	137	17,748	Imp. 17,611
Lead, short tons	24,799	32,413	Imp. 7,614
Lead, 1911	28,047	32,774	Imp. 4,727
Zinc, short tons	4,579	2,220	Exp. 2,359
Zinc, 1911	1,621	800	Exp. 821
Nickel, lb.	8,927,231	11,798,334	Imp. 2,871,103
Nickel, 1911	7,669,531	9,341,802	Imp. 1,672,271
Antimony, lb.	40,320	5,355,172	Imp. 5,314,852
Antimony, 1911	150,704	2,614,125	Imp. 2,463,421
Platinum, oz.	....	30,732	Imp. 30,732
Platinum, 1911	47	33,854	Imp. 33,807
Aluminum, lb.	9,656	9,383,070	Imp. 9,373,414
Aluminum, 1911	....	....	....
Ores, etc.			
Zinc in ore, lb.	10,353,607	9,842,887	Exp. 510,720
In ore, 1911	7,702,936	12,364,108	Imp. 4,661,172
Zinc oxide, lb.	12,168,255	....	Exp. 12,468,255
Zinc oxide, '11	12,033,157	....	Exp. 12,033,157
Zinc dross, lb.	384,695	....	Exp. 384,695
Zinc dross, '11	1,551,837	....	Exp. 1,551,827
Chrome ore, l.t.	......	18,351	Imp. 18,351
Chrome ore, '11	......	11,479	Imp. 11,479

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 19,175 tons; exported, 9182. Imports of aluminum were not reported previous to July 1, 1911. The metal exports given above include reexports of foreign materials.

Zinc and Lead Ore Markets

Joplin, Mo., June 1—The high price of zinc sulphide ore this week is $61, the base per ton of 60% zinc $54@58.50. Zinc silicate sold at $27@30 per ton of 40% zinc. The average price, all grades, was $54.44. The high price of lead ore is $56, and the average price, all grades, was $52.84 per ton.

SHIPMENTS, WEEK ENDED JUNE 1

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,997,070	......	1,104,040	$141,725
Joplin	2,013,590	......	323,440	64,788
Galena	643,070	......	250,300	24,512
Alba-Neck	626,350	......	......	18,163
Duenweg	530,330	......	18,390	15,326
Oronogo	452,520	......	139,140	14,531
Miami	345,750	......	229,930	14,254
Carl Junction	342,120	......	54,070	11,641
Spurgeon	185,520	189,010	115,970	10,858
Cave Springs	293,820	......	......	8,520
Granby	113,700	210,520	......	5,540
Springfield	86,000	......	85,000	4,800
Jackson	121,220	......	9,040	3,498
Sarcoxie	72,330	......	......	1,952
Lawton	60,190	......	......	1,684
Wentworth	63,710	......	......	1,600
Quapaw	52,130	......	......	1,303
Aurora	51,810	......	......	1,295
Totals	10,051,330	399,530	2,329,320	$345,990
22 weeks	222,021,800	13,225,210	37,535,980	$6,699,351

Blende val., the week, $278,525; 22 weeks, $4,483,743
Calamine, the week, 5,925; 22 weeks, 193,612
Lead value, the week, 61,540; 22 weeks, 1,022,096

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41 85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40 21	45.75	39.16	43 31	54 46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38 88	52.00	37 47	50.36	55 37	54.18
May	38.25	55.30	36.79	53.27	55 21	52.45
June	40.50	......	38.18	......	56 49	......
July	40 75	.. ..	38 36	......	58 81	......
August	42 50	......	41 28	......	60 74	......
September	42 63	......	41 29	......	59 33	......
October	42.38	......	40.89	......	54.72	......
November	45.40	......	43.25	......	67 19	......
December	44.13	......	40.76	......	62 03	......
Year	$41.45	......	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., June 1—The highest price paid this week for zinc ore was $56 per ton; the base price, 60% inc, was $55@55.50. The base price paid for 80% lead ore was $52@53 per ton. The high price of zinc ore and the shortage of supply, particularly of lower grades, has stimulated the mining industry and much prospecting is again in evidence.

SHIPMENTS, WEEK ENDED JUNE 1

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	979,830	.....	....
Benton	954,200	62,500	590,300
Platteville	622,600	......	250,000
Cuba City	351,470	117,040	151,900
Galena	336,900	. .	....
Shullsburg	319,000	64,000	....
Hazel Green	265,000	134,500	....
Linden	168,250	. . . ..	60,000
Harker	127,480	. ....	......
Dodgeville	......	111,300	......
Total	4,124,730	490,240	1,052,200
Year to date	85,745,230	3,572,410	11,557,450

Shipped during week to separating plants, 1,621,020 lb. inc ore.

Chemicals

New York, June 5—The general market continues fairly active, and a good business in heavy chemicals is reported.

Copper Sulphate—The market is strong and prices are unchanged. An advance is expected on account of the rise in copper metal.

Arsenic—White arsenic is quoted at \$3.87½c., nominally, for spot, but there is none to be had. Futures are quoted at \$3.50 per 100 lb. Mexican supplies are said to be on the way, but no receipts have been reported. The Anaconda company promises July deliveries. For some unknown reason, Canadian producers seem to be unable to ship and have made purchases in England against their July contracts. Some English arsenic is coming here for the first time in three years. Meantime, the market is practically bare.

CURRENT WHOLESALE PRICES

Ammonium sulphate	cwt.	3.27½@3 35
Arsenic, white.	lb.	0 03½@0.03⅞
Barytes, ground	sh. ton	12 50@14.00
" floated	sh. ton	16 00@17.00
Calcium acetate, gray	cwt.	2.50@2.55
carbide, tons lot f.o.b. Niagara Falls	sh. ton	70.00
Carbons, good drill quality	carat	75 00@85.00
Cement, Port., Am.	400-lb. bbl.	1.33
Chrome brick, f.o.b., Pittsburg	M.	175.00
ore, 50%, ex-ship, N. Y.,	lg. ton	14.00@16.00
Copperas, bulk.	cwt.	0 55
bbl.	cwt.	0 60@0 85
Cpoper sulphate	cwt.	5 25@5 50
Fluorspar, lump, f.o.b. Pittsburg	ton	8 00@9 00
Magnesite, crude, 95%	lg. ton	7.50@8.50
calcined, powdered		26 00@35 00
brick, dom., f.o.b. Pittsburg	M.	160@180
Paints, litharge, Am. powd	lb.	0 05½@0 06
red lead, American	lb.	0 06½@0 07
white laed, Am., dry	lb.	0 05¼@0 05¾
zinc white, Am., dry	lb.	0.05¼@0 05¾
zinc white, Am., dry	lb.	0.05⅛@0 06¼
Phosphates, acid:		
*Fla., hard rock 77%		5 75@6.25
land pebble 68%		3 70@3 80
†Tenn., 78@80%		5.00@5 50
75%		4 75@5.00
68@72%		4 25@4 50
†So. Car land rock 60%		3 50@3 75
Potassium cyanide, 98@99%	lb.	0 19
Pyrite:		
Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit		0 12@0 12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines		0 11½@0 12
Imported, non-arsenical, furnace size, ex-ship, per unit		0 13½
Imported, arsenical, furnace size, size, ex-ship, per unit		0.12¾@0.13
Imported, fines, arsenical, ex-ship.		0.11@0.12
Imported, fines non-arsenical, ex-ship, per unit		0 12½

Pyrite prices are per unit of sulphur. A deduction of 25c per ton is made when ore is delivered in large lumps.

Sodium cyanide, 120 to 130% KCN (per 100%)	lb.	0 18
nitrate 95% spot	cwt.	2 40@2 42½
95% future	cwt.	2 45@2 47½
Sulphur, Louisiana prime, N. Y,	lg. ton	22 00@22 50
roll.	cwt.	1 85@2 15
flour.	cwt.	2 00@2 40
flowers, sublimed	cwt.	2 20@2 60
pow com., bags	cwt.	1 50
Sicilian, crude brimstone	lg. ton	22 50
Zinc chloride, granular	lb.	0 04¼@0 04½

*F.o.b. Florida or Georgia ports †F.o.b Mt Pleasant †On vessel Ashley River, S.C

Note—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in their selling output on private contract.

Petroleum

California production in April is reported at 7,208,672 bbl.; deliveries, 6,406,913 bbl. Stocks on Apr. 30 were 43,387,622 bbl. During April there were 75 wells completed and 11 abandoned. On Apr. 30 there were 5316 wells producing.

MINING STOCKS

New York, June 5—On May 31, the Exchange opened weak after the holiday of the previous day. There was heavy selling and a recession in prices on all the prominent stocks. On the Curb there was a fair business in coppers with no material change in quotations. Cobalts were off a little, while other mining stocks were dull and weak.

June 1 the Exchange was still heavy and weak, with declines in prices on all sides in a market mainly professional. On the Curb, mining stocks were dull and generally off in price. A new stock, Butte & New York, made its appearance.

June 3 the Exchange was quiet with few price changes. The Curb showed fair dealings in mining stocks. Copper shares were rather heavy; Kerr Lake advanced, but other Cobalts were unchanged.

June 4 there was a general recovery on the Exchange, mainly on inside trading. The Curb was firmer and mining stocks more in demand, especially the copper stocks, which generally advanced in prices. On June 5, both Curb and Exchange were fairly strong.

The Transactions on the New York Stock Exchange for the month of May amounted to 12,832,000 shares, against 15,855,000 in April and 11,608,000 shares in May, 1911. Dealings in bonds aggregated \$60,500,000, against \$65,100,000 in April, and \$91,500,000 in May of last year.

Boston, June 4—Little consolation could be derived from the copper-share market until today, when some active and strong spots developed. It is noticeable, perhaps, that the continued advance of copper has resulted in the withdrawal of many selling orders which is certainly a good sign. Any demand for a stock causes a sharp advance although the lethargy is pronouneed.

Calumet & Arizona has been the most active issue, advancing \$3.25 to \$76.50 on anticipation that the dividend would be increased, but the failure to increase the payment caused some realizing. The declaration of the usual 50c. quarterly rate by the Copper Range Consolidated failed to exert any influence on the price of the shares. Those aristocrats, Calumet & Hecla and Ahmeek, have made a good record during the week, the former going to \$500 per share, the first time this year. This is an advance of \$15. Ahmeek is up \$30 to \$345, a record price.

Butte & Superior has been a prominent feature, advancing \$6.25 to \$42.50. This

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	March	April	May
Alaska shipments.	1,987,916	1,243,911	....
Anaconda	25,900,000	25,480,000	25,800,000
Arizona, Ltd.	3,150 000	3,400,000	....
Copper Queen	7,197,121	6,806,425	7,021,087
Calumet & Ariz.	4,652,000	4,104,000	4,421 000
Chino	1,108,381	....	......
Detroit	2,246,238	2,506,708	2,092,478
East Butte	1,480,000	....	
Mammoth	1,939,310	1,718,150	.
Mason Valley	1,140,000	... ..	. ..
Nevada Con	6,380,000	6,115,045	.
Old Dominion	2,432,000	2,167,000	.
Ray	2,300,000	2,612,500	....
Shannon	1,389,000	1,544,000	1,461,000
South Utah	299,000	284,215	. ...
United Verde*	2,250,000	....	.. . .
Utah Copper C	8,160,000	8,615,775	. .
Lake Superior*	19,750,000	18,250,000	.
Non-rep. mines*	7,291,619	8,250,000	. ....
Total production	104,051,585	.. ..	.. ...
Imports, bars, etc.	23,519,215	26,842,014	....
Total blister	127,570,800	....	... .
Imp. in ore & matte	8,736,874	9,350,972	... .
Total	136,307,674	....	.
Miami	2,755,000	2,554,352	.
Brit. Col. Cos. :			
British Col. Copper	... .	... .	.
Granby	1,882,073	1,941,797	.
Mexican Cos. :			
Boleo	2,424,800	2,149,280	.
Cananea	2,834,000	4,654,000	.. ...
Moctezuma	2,446,731	2,797,718	2,892,521
Other Foreign :			
Cape Cop., S. Africa	725,760	954,240	. .
Kyshtim, Russia.	... .	1,545,000	. . .
Spassky, Russia	638,400	649,600	.
Famatina, Argen.	....	....	.
Tilt Cove, Newf'd.	104,992	119,869	.
Exports from :			
Chile	3,584,000	6,496,000	..
Australia	8,064,000	9,408,000	.
Arrivals in Europe†	12,559,680	12,064,640	. . .

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
V, 1911	126,962,544	64,543,963	61,978,557
VI.	124,554,312	61,655,561	71,460,519
VII.	112,167,934	56,982,582	74,880,658
VIII.	125,493,667	59,935,364	69,855,660
IX.	115,588,950	57,311,584	50,824,011
X.	118,255,442	64,068,307	60,084,349
XI.	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912.	119,337,753	62,343,901	80,167 904
II.	116,035,809	56,228,368	63,148,096
III.	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326
V.	....	....	....

VISIBLE STOCKS

	United States	Europe	Total
VI, 1911	165,995,932	202,540,800	368,536,732
VII.	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX.	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912.	89,454,695	158,323,200	247,777,895
II	66,280,613	154,851,200	221,131,813
III.	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757
V	65,066,029	134,176,000	199,242,029
VI	....	117,801,600	.... . .

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

is a prosperous zinc proposition, recently floated. Old Dominion rose to $59.25 on the increasing of the quarterly dividend rate. Boswyocolo fell to 2c. against a selling price just under 10c. a short time ago. Old Dominion receipts have dropped back.

Assessments

Company	Delinq	Sale	Amt
Alpha Con., Nev	May 29	June 19	$0.05
Andes, Nev	May 28	June 18	0.05
Best & Belcher, Nev	June 3	June 27	0.10
Bingham Copper, Utah	June 1	....	0.05
Black Horse, Ida	.. ....	....	0.02
Black Jack, Utah	Feb. 6	....	0.01
Caledonia, Nev	May 21	June 11	0.10
Cedar-Talisman, Utah	Apr. 20	....	0.005
Challange, Nev	June 8	June 11	0.10
East Tintic, Utah	May 30	June 25	0.005
Ely Con., Nev	....	....	0.05
Exchequer, Nev	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Glen Dale, Utah	May 25	June 25	0.00
Houghton Copper, Mich	May 17	....	1.00
Julia, Nev	May 15	June 6	0.05
Lehi Tintic, Utah	Feb. 29	....	0.01
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	May 8	....	0.02
Ojibway, Mich	Jan. 10	....	1.00
Raven, Mont	Feb. 1	....	0.10½
Savage, Nev	June 4	June 26	0.105
Segregated Belcher, Nev	June 1	June 28	0.05
South Lake, Mich	June 3	....	2.00
Southwestern Miami, Ariz.	Jan. 15	....	1.00
Tintic Central, Utah	June 14	July 6	0.005
Union Con., Nev	May 9	May 31	0.15
Utah Antimony, Utah	June 1	....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York 1910	New York 1911	New York 1912	London 1910	London 1911	London 1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28.038
June	53.462	53.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24.428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53.486	53.304	......	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York Electrolytic 1911	New York Electrolytic 1912	New York Lake 1911	New York Lake 1912	London, Standard 1911	London, Standard 1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.034	70.294
May	11.989	16.031	12.214	16.245	54.313	72.352
June	12.385	......	12.611	......	56.365	......
July	12.463	......	12.720	......	56.673	......
August	12.405	......	12.634	......	56.266	......
September	12.201	......	12.508	......	55.253	
October	12.189	......	12.370		55.170	
November	12.616	......	12.769		57.253	
December	13.552		13.768		62.068	
Year	12.376		12.634		55.973	

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	...
February	41.614	42.962	August	43.319	...
March	40.157	42.577	September	39.755	...
April	42.185	43.923	October	41.185	...
May	43.115	46.053	November	43.125	...
June	44.696		December	44.655	...
			Av. Year	42.281	..

Prices are in cents per pound.

LEAD

Month	New York 1911	New York 1912	St. Louis 1911	St. Louis 1912	London 1911	London 1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	4.194	4.223	4.072	12.984	16.509
June	4.435	......	4.292	......	13.260	......
July	4.499	......	4.397	......	13.530	......
August	4.500	......	4.406	......	14.260	......
September	4.485	......	4.356	......	14.744	......
October	4.265	......	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	15.648	......
Year	4.420	......	4.286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York 1911	New York 1912	St. Louis 1911	St. Louis 1912	London 1911	London 1912
January	5.452	6.442	6.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.644
May	5.348	6.679	5.198	6.529	24.375	25.790
June	5.520	......	5.370	......	24.612	......
July	5.695	......	5.545	......	25.006	......
August	5.953	......	5.803	......	26.801	......
September	5.869	......	5.719	......	27.750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.796	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer 1911	Bessemer 1912	Basic 1911	Basic 1912	No. 2 Foundry 1911	No. 2 Foundry 1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.16
May	15.90	15.14	14.30	13.90	14.72	14.12
June	15.90	......	14.06	......	14.56	......
July	15.90	......	14.03	......	14.53	......
August	15.90	......	14.00	......	14.47	......
September	15.90	......	13.57	......	14.40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14.25	......
December	15.15	......	13.10	......	13.90	......
Year	$15.72	......	$13.94	.....	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS June 4

Name of Comp.	Bid.
Acacia	.05¼
Cripple Cr'k Con.	.01⅞
C. K. & N.	.17¼
Doctor Jack Pot	.06
Elkton Con	.65
El Paso	.69½
Findlay	.04
Gold Dollar	.17
Gold Sovereign	.01¾
Isabella	.11
Jack Pot	.04
Jennie Sample	.04
Lexington	.02
Moon Anchor	.01
Old Gold	.03
Mary McKinney	.71
Pharmacist	.04
Portland	.90
Vindicator	.79
Work	.01

SALT LAKE June 4

Name of Comp.	Bid.
Beck Tunnel	.11
Black Jack	.15½
Cedar Talisman	.02
Colorado Mining	.18
Columbus Con.	‡.14
Crown Point	.02½
Daly-Judge	6.25
Grand Central	.72
Iron Blossom	1.22½
Little Bell	.41
Lower Mammoth	‡.02
Mason Valley	‡11.50
May Day	.09½
Nevada Hills	‡1.95
New York	‡.04½
Prince Con	1.55
Silver King Coal'n	2.30
Sioux Con.	.05
Uncle Sam	.19
Yankee	‡.10

TORONTO June 4

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡6.90	Hollinger	10.50
Hudson Bay	‡70.00	Imperial	.03
Temiskaming	.41	Pearl Lake	.18
Wettlaufer-Lor	.58	Porcu. Gold	.40
Apex	.03	Porcu. Tisdale	.01
Central	‡5.56	Preston E. D.	.04
Crown Chartered	.14	Rea	.25
Doble	.25	Standard	‡.01
Dome Exten	.33	Swastika	.15
Foley O'Brien	.18	West Dome	.15

SAN FRANCISCO June 4

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.06	Belmont	10.00
Belcher	.45	Jim Butler	.51
Best & Belcher	.14	MacNamara	.25
Caledonia	1.30	Midway	.51
Challenge Con	.03	Mont.-Tonopah	2.87½
Chollar	.03	North Star	.19
Confidence	.60	West End Con.	2.05
Con. Virginia	.58	Atlanta	.27
Crown Point	.42	Booth	.10
Gould & Curry	.04	C.O.D. Con	.10
Hale & Norcross	.16	Comb. Frac	.17
Mexican	2.82½	Jumbo Extension	.36
Occidental	.55	Pitts.-Silver Peak	1.22½
Ophir	1.15	Silver Pick	.14
Overman	1.00	St. Ives	.35
Potosi	.04	Tramp Con	‡.01
Savage	.15	Argonaut	‡2.00
Sierra Nevada	.21	Bunker Hill	‡4.50
Union Con	.84	Cent. Eureka	‡.72
Yellow Jacket	.55	So. Eureka	3.12

N. Y. EXCH. June 4

Name of Comp.	Clg.
Amalgamated	84
Am. Agri. Chem.	61
Am.Sm.&Ref.,com	84
Am. Sm. & Ref., pf.	107
Am. Sm. Sec., pf. B	88¼
Anaconda	42⅞
Batopilas Min.	1½
BethlehemSteelpf	70
Chino	30⅝
Comstock Tunnel	‡.10
Federal M. & S., pf.	41
Goldfield Con.	4⅜
GreatNor.,ore.,ctf.	42
Homestake	93
Inspiration Con.	18¼
Miami Copper	26⅜
Nat'nalLead,com.	57¼
National Lead, pf.	107½
Nev. Consol.	22⅛
Pittsburg Coal, pf.	90¼
Ray Con.	19
RepublicI&S,com.	24⅛
Republic I & S, pf.	80¼
SlossSheffi'd,com.	60
Sloss Sheffield, pf.	90
Tennessee Copper	44½
Utah Copper	63¾
U. S. Steel, com.	68½
U. S. Steel, pf.	110⅝
Va. Car. Chem.	61⅛

BOSTON EXCH. June 4

Name of Comp.	Clg.
Adventure	8½
Ahmeek	340
Algomah	7
Allouez	45
Am. Zinc	29¼
Ariz. Com., ctfs.	5¾
Bonanza	.40
Boston & Corbin	7
Butte & Balak	4¼
Calumet & Ariz.	75⅜
Calumet & Hecla	490
Centennial	25
Con. Mercur	.05
Copper Range	58⅞
Daly West	5¾
East Butte	13⅞
Franklin	12½
Granby	64
Hancock	33
Hedley Gold	16½
Helvetia	1½
Indiana	19¼
Island Cr'k, com.	55
Island Cr'k, pfd.	89
Isle Royale	29
Keweenaw	1¾
Lake	40
La Salle	6⅛
Mass	7¼
Michigan	9
Mohawk	65
New Arcadian	4⅜
New Idria Quick.	6⅞
North Butte	29½
North Lake	6¼
Ojibway	4½
Old Dominion	59¼
Osceola	122
Quincy	89½
Shannon	15⅜
Shattuck-Ariz.	21½
Superior	35
Superior & Bost.	2
Tamarack	44½
Trinity	6½
Tuolumne	3⅛
U. S. Smelting	38¾
U. S. Smelt'g. pf.	49
Utah Apex	2½
Utah Con.	13½
Victoria	3⅛
Winona	6½
Wolverine	110
Wyandot	2⅜

N. Y. CURB June 4

Name of Comp.	Clg.
Barnes King	‡.30
Beaver Con.	.46
Braden Copper	6⅞
B. C. Copper	5¾
Buffalo Mines	‡1¼
Caledonia	¾
Con. Ariz. Sm.	⅝
Davis-Daly	2 5/16
Diam'field-Daisy	13
Ely Con.	5/16
Florence	1
Giroux	5⅝
Gold Hill Con.	[illegible]
Greene Cananea	10
Greenwater	.06
Guggen. Exp.	223
Internat. S. & R.	124
Kerr Lake	2¾
Keystone	2½
La Rose	3½
McKinley-Dar-Sa.	1¾
Min. Co. of A. new	3
Motherlode Gold	11/16
Nev. Utah M. & S	.05
Nipissing Mines	7⅞
Ohio Copper	1½
Pacific Sm. & M	¼
Ray Central	‡2⅜
South Live Oak	3⅛
South Utah M. & S.	¾
Standard Oil (old)	865
Stand'd Oil of N.J.	377½
Stand'd Oil Subs.	490
Stewart	1 3/16
Tonopah	7
Tonopah Ex.	2 9/16
Tri-Bullion	½
Tularosa	‡[illegible]
Union Mines	3/16
United Cop., pfd.	10
Yukon Gold	3⅜

LONDON June 5

Name of Com.	Clg.
Camp Bird	£1 10s 0d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 10 0
Mexico Mines	7 5 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 4 4½

BOSTON CURB June 4

Name of Comp.	Last
Bingham Mines	2¼
Boston Ely	1 11/16
Boswyocolo	.05¼
Butte Central	6¼
Cactus	.11
Calaveras	2¼
Chief Cons.	1⅛
Corbin	2 1/16
Cortez	1 3/16
Crown Reserve	3 1/16
First Nat. Cop.	2¾
Majestic	.54
Mazatan	.50
Moneta Porc.	‡.11
Nevada-Douglas	3½
New Baltic	3¼
Oneco	3
Raven Copper	.31
Rhode IslandCoal	.32
San Antonio	‡3
S. W. Miami	7½
South Lake	9
Trethewey	‡1
United Verde Ext.	.35
Vulture	‡5.00

‡Last quotation

Issued Weekly by the
Hill Publishing Company
John A. Hill, Pres. Rob't McKean, Secy.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N. W. 7.

Walter Renton Ingalls, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page
Editorials:
  What Constitutes a Valid Mining Claim? 1163
  The Cyanide Cleanup.......... 1164
  The Origin of Zinc Smelting.......... 1164
  Katanga Copper 1164
Correspondence and Discussion:
  On the Careless Use of Powder ....Physical Chemistry and Cyanidation....New Kink in Iodide Assay....Rapid Methods for Proximate Analyses 1165
East Tintic Claim Decision.......... 1167
Sulphur Production in 1911.......... 1168
Union Minière du Haut Katanga... 1168
Geological Survey Appropriations.. 1168
Details of Practical Mining:
  *A Cripple Creek Ore and Waste Plant....Concrete Chute Bridging a Level....*Hints for Prospectors....*Shaft Station Safety Gates....Rope Capacity of Drums ....Cartridges for Tamping Dynamite....*Two Cores from One Borehole 1173
Details of Metallurgical Practice:
  Stationary Dewatering Screen.... *Steel Tray and Support for Hancock Jigs....*Lacing Belts with Wire 1177
Work of the Bureau of Mines.......... 1169
The Aluminum Trust Suit.......... 1171
Ore Strike at Florence-Goldfield... 1171
*The Abbé-Frenier Sand Pump.......... 1172
Patricia District, Ontario.......... 1172
Notes from Current Literature:
  Carnotite in Pennsylvania.... Prevention of Mine Explosions.... Platinum and Gold in the Urals ....Cyanide Poisoning of Cattle ....Determination of Oxygen in Copper....Concentration of Carnotite....Siberian Tin....Defective Concrete Sands....Disintegration of Cinder Concrete.... Oxygen Additions to Iron Furnace Blast....Desulphurizing Zinc Sulphate....Clark Placer Mining Apparatus 1179
*The Sublevel Stoping Method.
  F. W. Sperr 1181
Henry Johns, an Early American Copper Refiner.
  Benjamin S. Johns 1183
Ore Separation by Decrepitation.
  Henry E. Wood 1184
*The Origin of Zinc Smelting.
  W. Hommel 1185
Iron-Ore Railroads at Lake Superior 1188
*Electric Furnace at Lluvia de Oro.
  H. R. Conklin 1189
New Publications 1193
Personal, Obituary 1194
Editorial Correspondence.......... 1195
Mining News 1197
Markets 1203
  *Illustrated.

The Engineering and Mining Journal

Vol. 93. JUNE 15, 1912. No. 24

What Constitutes a Valid Mining Claim?

Mining men and prospectors in the West are manifesting alarm and openly criticising a recent ruling of the Department of the Interior relating to mining claims. The opinion, which is given in full upon another page of this issue, illustrates clearly the attitude of the government officials in their construction of the laws at present in force, and announces a policy widely and seriously at variance with that hitherto pursued in the granting of patents for mineral lands.

The first requirement in the initiation of title to a mining claim is that of discovery. Before a lode claim can be located there must be discovered a vein or lode in place, carrying gold, silver, cinnabar, lead, tin, copper or other valuable metal. Until recent years there had been no disposition on the part of the Land Department officials to inquire whether or not the lode so discovered could be worked at a profit. They deemed it their duty to grant a patent when such a lode had been discovered, staked, developed at a cost of at least $500, surveyed and paid for at the rate of $5 per acre. But, finding that mining claims were sometimes located for timber or some other non-mineral commodity, the agents of the government instituted the policy of inspection. At first when it was found, as in the case here referred to, that "the surface of the claims contains no timber of commercial value; that there is no water course through or upon said claims, and the land embraced is essentially mineral in character and useless for agricultural purposes" there did not seem to be any good reason for refusing patent and patent generally followed, or frequently at some indefinite and very much delayed date.

Now the prospector is confronted with a new interpretation of the law. The land may be worthless for any other purpose than mining, but unless there is exposed "a vein or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes" patent will be withheld, and the government inspector is the individual upon whom is placed the burden of deciding whether or not the lode has a prospective value. The prospector himself, who has expended time and money in its discovery and development and who is willing to pay the government price for the land, is compelled to accept the verdict of whatever inspector happens to be called upon to render an opinion. If the inspector happens to have seen a mine developed in such a lode and under similar geological and working conditions or if he is in a good humor he finds that the vein has prospective value; otherwise his report is adverse.

The poor prospector can no longer expect to go out and locate and acquire for himself a valuable mining property. He must be financially able to develop to the point where it is certainly valuable, under the conditions where it is found or is forced to sell it for a fraction of its value to some one with capital enough to prove that it is a mine good enough for Uncle Sam to part with. The incentive to explore is largely withdrawn and the mineral wealth of the unexplored public domain will be conserved for the man who already has surplus money to spend.

Most modern nations offer liberal reward to the discoverer of new deposits of valuable ores. The United States has developed more rapidly than other countries in its mineral industry and in material prosperity largely because of its liberal policy for the disposal of its mineral and agricultural lands. Any future legislation or new interpretation of present statutes which has a tendency to curtail opportunity or lessen the reward for honest labor and enterprise is not likely to result in the spread of prosperity or the settlement of untenanted regions, nor will it be received with approval by the public at large.

Here is another illustration of the crying need for rational revision of our mining laws. If the discovery provision were eliminated entirely and a prospector were permitted to stake his claim and hold it so long as he performed a reasonable amount of real development work, most of this particular variety of trouble and expense would be obviated.

The Cyanide Cleanup

Probably no branch of the cyanide process is more susceptible to the application of the principles of scientific management than the cleanup with its attendant operations. At one mill where the cleanup proper was spread over three days the time was reduced to one day by planning the work so there was practically "no lost motion." Under the new scheme, by the time the boxes were cleaned up and repacked, the acid treatment of short zinc was well under way, being completed soon enough to allow the product to be dried by morning, when the melt was started.

The acid-treatment part of the cleanup requires attention to determine the proper strength of acid to use. If too concentrated a solution is used, zinc-sulphate crystals will be formed, which are difficult to dissolve, giving trouble in subsequent smelting operations. Care must also be taken by the operator in working over the acid tank to avoid inhaling the gases given off, some of which may be poisonous. Sodium bisulphate is claimed by some to be cheaper, more efficient than sulphuric acid and is productive of practically no objectionable products. This salt is largely used on the Rand.

If, therefore, the necessity for the acid treatment of precipitate could be eliminated time and labor would be saved and one great source of trouble would be avoided. It was for this purpose that the Taverner process was devised. This process consists essentially of smelting the partly dried precipitate with a litharge flux, and cupelling the resulting lead button for the gold and silver contained therein. This method was not entirely successful and acid treatment is still the accepted intermediate step.

In this connection the description in this issue of the JOURNAL by H. R. Conklin of the use of the electric furnace for melting precipitate and smelting concentrate at Lluvia de Oro is of interest. It will be noted that the precipitate is melted without preliminary treatment, while the short zinc is merely roasted before being sent to the furnace. The ease with which a fairly good bullion is obtained from dirty precipitate is sufficient to make many cyaniders envious of Lluvia de Oro conditions, where power costs for this purpose are nil.

It is possible, however, that the electric furnace may find a field in those districts where high fuel costs now make it advisable to ship precipitate to refiners In some of these districts electric power is comparatively cheap and may permit cyanide operators to handle their precipitates in this manner, with obvious advantages.

The Origin of Zinc Smelting

For many years the art of zinc smelting was supposed to be relatively modern among metallurgical processes and to be due to the invention of the Abbé Daniel Dony, a chemist of Liège, the story of whose accidental discovery in 1805 is classical. The particular type of Belgian furnace may indeed be credited to Dony, but it has long been doubtful whether he was entirely unacquainted with previous undertakings. Thus, it is well known that the manufacture of spelter was begun in Upper Silesia about 1798-1800 by Johann Ruhberg, who learned the art in England (where zinc smelting was then being carried on by the English process of distillation downward) and Bergrath Dillinger began zinc smelting in Carinthia in 1799. As remarked by Ingalls in "Production and Properties of Zinc:" "It is incomprehensible indeed that 10 years later there should have been no knowledge in Belgium of what was being done in this branch of metallurgy in England, the two countries being separated only by a narrow strip of water, while the news had previously penetrated eastward to the Polish frontier."

The first zinc smelting works in England were built about 1740 (authorities differ as to the precise date) at Bristol by John Champion. Such zinc as was used in Europe previous to that time came from India and China, and there is reason to believe that Champion derived his ideas from the experience in the far East. The paper by W. Hommel, published elsewhere in this issue, is a valuable contribution to the history of this branch of metallurgy and establishes conclusively the eastern origin of zinc smelting and the great antiquity of the art. The Koschi apparatus used in India apparently developed into the English process of distillation *per descensum*, which continued in use until about 1860.

Katanga Copper

The statements of M. Jadot, the chairman of the Union Minière du Haut Katanga, always give a different impression from the ever optimistic language of Mr. Robert Williams, of the Tanganyika company, which is largely interested in the Union Minière. We suppose that this is due to a difference in temperament.

According to a recent statement to his stockholders by M. Jadot, things have not been going very well in Katanga. It is considered to be necessary to open the Etoile du Congo mine below water level. It is difficult to secure sufficient labor and it may be necessary to import Chinamen. In smelting, the fuel difficulty is serious. It is hoped that Wankie coke at £5 10s. per ton may be forthcoming, but it may be necessary to import coke from Europe. Anyway, the furnace, which made intermittent campaigns from Aug. 20, 1911, to Apr. 11, 1912, producing 2000 tons of copper, is not to be started again until next October.

Nothing has ever been said about the metallizing process since the plant for it was ditched in a railway accident. In the meanwhile, experiments with electric smelting are being carried on in Europe. We should be the last to deprecate research, but it does not look well that the company should be so strenuously casting for a new process. New processes and new mines do not go well together.

The record of copper mining in Katanga up to date has been just what we prophesied. It is now generally recognized that no considerable quantity of copper from this source will figure in the market for a long time to come.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

On the Careless Use of Powder

When I was a boy I was taught that the world was becoming weaker and wiser. But even at that time it was said that some miners had such good judgment in charging a hole that they would bite a grain of powder in two rather than give the hole too much. Of course, that was a long time ago, 40 or 50 years. But if the world is getting wiser, the miner is not, or if he is, he is very wasteful, according to C. B. Hanson's experience.

Mr. Hanson, in the JOURNAL of Apr. 29, 1912, said that it is invariably the case in underground work for the most experienced men, and in ground with which they are all perfectly familiar, to load a hole with twice too much powder. Now I have had 30 or 40 years' experience in mining and I supposed I knew something about mining and miners, but I find I know little or nothing after reading Mr. Hanson's article. I have charged hundreds of holes with the old kind of black powder, and while I have never bitten a grain in two, I believed I could tell within 2 or 3 in. of powder in a hole how much it required to break it. That was before the machine drill was in use.

But I have also charged thousands of machine-drill holes and I presume hundreds of times have broken a stick of powder in two, believing to give it the full stick would be too heavy a charge. And I never learned until I read Mr. Hanson's article that I did any differently from other miners, as I have worked with several miners and always consulted my partner in charging a hole. If Mr. Hanson had worked as I have for 20 years on a machine drill on contract and had to pay from $15 to $20 per case for powder, I think he would see the wisdom in not wasting powder as he thinks the miners do. And what about the management of the mines where the powder is wasted that way? It must be interesting to the powder companies to have it wasted, but to a mining company that is running 100 drills it means from $50,000 to $75,000 per year.

I presume there is some careless management, but not so bad as that. I think it makes little difference where the primer is, whether in the bottom, middle or top of the powder or which way the cap is in the powder; if the cap and powder are good they will do the same work. It is the custom to make a hole in the side of the stick of powder, put the cap in, and bend the fuse back so that the closed end of the cap is toward the collar of the hole. And in some ground there is considerable slip, and when there is danger of leaving what miners call "bull rings," pieces of wood about 6 in. long are placed between the sticks of powder, and the powder explodes just the same.

JOSEPH HOCKING.

Osceola, Mich., May 10, 1912.

Physical Chemistry and Cyanidation

Among the recent articles in the JOURNAL there are none more stimulating to thought than those of Prof. H. C. Jones As it is editorially expressed in the issue of Apr. 20, 1912, these are of "especial interest to cyanide workers of the old school." I am confessedly not altogether abreast of modern physical concepts and all the contributions to cyanide chemistry of recent years. Recently however, I had occasion to read an article by Dr. Samuel Sloan, of Glasgow in the February *Medical Brief* of St. Louis, on electrolysis applied to therapeutics, containing for the benefit of his professional colleagues a brief summary of the dissociation theory. This paper also contained a table which I quote, the last column of which I calculated, showing the effect of dilution on the passage of an electric current of 50-volts potential through an electrolyte of common salt solution.

NaCl Strength of Solution Per Cent	Milli-amperes	Milliamperes Calculated to 1 Per Cent NaCl
36.0	600	16.6
18.0	575	32.0
9.0	500	55.5
4.5	350	77.7
2.25	240	106.6
1.125	140	124.4
0.56	80	142.8
0.28	45	160.7
0.14	24	171.4
0.07	13	185.7

You will observe that the amount of current measured in milliamperes diminishes with the dilution of the solution. This fact I observed in certain experiments made in Glasgow in 1894, in connection with the Pillsticker patent suit, which results I contemplated, but did not use, in the suit as a contention that Pillsticker's electric process could not take advantage of the dilute solutions which practice had shown to be essential for good work, since his electrolyte would then be too dilute to receive benefit from his electricity. But on reading Dr. Sloan's article, which I will quote in part later, I thought I saw the reason underlying the use of the dilute solution, in the increased relative ionization of solutions by dilution. When I plotted a curve using as ordinates the percentage of NaCl, and as abscissas the milliamperes per 1% of NaCl, the curve was regular, something like the logarithmic cooling curve, so a definite law was apparently indicated. I had observed and had published (ENG. AND MIN. JOURN., Dec. 28, 1888), in the initial paper on cyanide as a means of ore treatment, that metallic silver was more soluble in a dilute than in a strong solution. To this day I have never seen a satisfactory theory accounting for this but when we come to consider the dissociation theory we have one at last. In the ENGINEERING AND MINING JOURNAL of Apr. 20, 1912, Professor Jones says, p. 802: "The way to test whether ions are the active chemical agents is to increase the number of ions present and see whether chemical activity increases. This has, of course, been done with the general result that chemical activity was found to increase, and proportionally to the number of ions taking part in the reaction."

To a cyanide worker of the old school this would not indicate that the dilution of a solution would increase its efficiency though the interpolation of *relative* before number would cover that ground also. It may be that Arrhenius' researches have made the matter so plain and the adoption of his theories has made the circumstance so elementary that it has been accepted by all. Yet I have seen no mention of it in such cyanide literature as has been available to me in the last few years. Acting then on the supposition that the matter is as new to others as to me I will quote Doctor Sloan at greater length. He says:

> Observe from the table what I have found to be the results of continued dilution in this case. You will see that each solution gives the indication of containing more free ions than would be expected from the amount of the dilution especially this is the case in more concentrated solutions. This relation diminishes, however, as the dilutions increase, you will observe, till the dilution of about 1% has been reached. By this time practically all the molecules have become dissociated, and with further dilutions the amount of the current is practically directly proportioned to the amount of concentration.
>
> Suppose in the strong solution there were 100 original molecules, 20 dissociated, then the total number of particles for each 100 molecules would be

20 (sod-ions) plus 20 (chlor-ions) plus 80 molecules of NaCl, or 120 particles in all. If this be diluted with an equal quantity of water then for each original 100 there will be left in the diluted liquid 20 separated ions and 40 molecules. Suppose by the further dilution 10 of these molecules become dissociated, this will give of separate particles 20 plus 10 plus 10 plus 30 equal 70, and of these 70, 40 will be ions. Thus to influence the osmotic pressure there will be 10 more particles than were in half of the original solution; while there will be the same number of ions as there were in the more concentrated solution; and so the same currents can be obtained from the weaker solution as was obtained from the stronger if the same voltage were used.

This relative increase in the number of free ions, by further dilution continues, as I have just remarked, till we reach the stage where there is about 1% of the saline solution, when practically all the molecules have evidently been dissociated [I shall note here that Doctor Sloan has considered the amperage only quantitatively, and not in relation to a unit such as 1% as the third column of the table has done]. They are not permanently so, though at no time can there be more than the merest fraction of the molecules undissociated, since there will be occasional reunion, but the free flight space has so much increased that these are less likely to occur. These reformed molecules, however, will be almost immediately broken up owing to conflict with some flying ions.

You will see now how the conclusion is forced upon us that a saline solution contains even in its most concentrated form, a large number of ions; and that by dilution the number of these has become relatively increased.

It is admitted, I believe, that it is the ion which is the chemical agent as well as the carrier of electricity, so in applying this theory to the solution of precious metal in potassium-cyanide solution there is only one hypothetical step, that is, the assumption that kal-ions and cyan-ions will act as sod-ions and chlor-ions. As to the point that might be raised, that in dissolving silver chloride by hot concentrated brine, concentrated solutions were necessary, it may be submitted that the character of these latter solutions is materially different as their formation does not involve a chemical change but the brine in the Augustin process envelopes the uncharged chloride-of-silver molecules. To draw upon physiology for an illustration it may be said that dilute salt solutions such as accompany food are undoubtedly more efficacious in causing the secretion of ptyalin from the salivary gland than more concentrated ones, but what reactions are at the base of this I am not prepared to suggest. A metallurgist can do no better than apply the discoveries of the experimental physicists to matters within his knowledge and I have attempted to do this in this case. It will remain for better equipped men to elaborate such views if they are worth while and are considered correct. Any light which may be given as to the causes underlying such primary reactions as the solutions of gold and silver may be of considerable practical benefit as well as theoretical interest.

LOUIS JANIN. JR.

California, May 15, 1912.

New Kink in Iodide Assay

The use of hyposulphite (sodium thiosulphate) in the iodide method for copper, described by Mr. Popper (ENG. AND MIN. JOURN., May 25, 1912, p. 1021), is the first appearance in print, to my knowledge, of this modification of the iodide method, which, as he says, is largely used in Western laboratories and also by assayers in Mexico.

The use of hypo to replace aluminum foil in this assay has the advantages of requiring less boiling during precipitation, more convenient manipulation and no danger of copper loss due to oxidation. When a muffle is at hand, I am confident any assayer will find this modification more satisfactory than the use of aluminum.

With over three years' perfectly satisfactory use of this modification, I believe that a more complete consideration of the reactions than is contained in Mr. Popper's article will be interesting; and a modification of his details, while not necessarily affecting the accuracy, will expedite the work.

The principal reactions which occur may be represented as follows:

(1) $2\,CuSO_4 + 2\,Na_2S_2O_3 = Cu_2SO_4 + Na_2SO_4 + Na_2\,S_4O_6$.

(2) $Cu_2SO_4 + Na_2S_2O_3 + H_2O = Cu_2S + Na_2SO_4 + H_2SO_4$.

(3) $2\,Na_2S_2O_3 + 2\,H_2SO_4 = 2Na_2SO_4 + 2\,H_2SO_3 + S_2$.

Arsenic, antimony, bismuth and other sulphides are also precipitated, though in the original treatment of the ore, the amount of antimony and bismuth which will remain in solution after evaporation to SO_3 fumes is limited. The removal of arsenic and antimony, though quite unnecessary, can be readily effected by washing the precipitate with sodium sulphide. If not removed at this point they are largely driven off during ignition of the sulphides, particularly the arsenic.

The main objection to Mr. Popper's procedure, which is duplicated by many other assayers, is the large amount of hypo used. According to the above reactions, 100 mg. of copper require 580 mg. of $Na_2S_2O_3 + 5\,H_2O$. More than this is required, but one gram is sufficient. $Na_2S_2O_3$ in excess of this is decomposed by acid according to the reaction (3), with liberation of sulphur. Thirty cubic centimeters of a saturated solution of hypo, as recommended by Mr. Popper, will contain at ordinary temperatures about 20 grams of $Na_2S_2O_3 + 5\,H_2O$ (at 68° F., 100 c.c. of water will dissolve 108 grams of the salt). This hypo is apt to be completely decomposed by the sulphuric acid present (5 c.c. H_2SO_4 will decompose 23 grams of $Na_2S_2O_3 + 5\,H_2O$), giving a large amount of free sulphur. This large amount of free sulphur requires long boiling, 15 to 25 min., to obtain a good coagulation of the precipitate and rapid filtration, has a tendency to cause bumping, interferes with washing, particularly if arsenic and antimony are to be removed, and melts on ignition, increasing the chances of residue adhering to container and also hindering the conversion to oxide.

The procedure recommended is as follows: The filtrate from the decomposed ore after evaporation to SO_3 fumes should be about 50 c.c. and contain approximately 5 c.c. of sulphuric acid. For every 100 mg. of copper add 1 gram of hypo in solution—a 20% solution is convenient. The addition may be made either hot or cold, then boil for two to five minutes. If this boiling is performed on a moderately hot stove, there is no trouble from bumping.

The filtration and washing of this precipitate is remarkably rapid and the copper sulphide differs from that thrown down with H_2S in that there is no danger of its oxidizing and running through the paper, even on long standing between washing, which washing is performed with hot water.

The ignition should be done at a bare red heat, preferably in a muffle, and if the furnace has a strong draft clay annealing cups are more desirable than scorifiers. If the ignition has been properly carried out, the residue will be completely oxidized and will readily dissolve in two to three cubic centimeters of 1:1 nitric acid without the production of red fumes. The regular iodide method is applied from this point.

E. J. HALL.

New York, June 8, 1912.

Rapid Methods for Proximate Analyses

In regard to the copper-oxalate determination, given in the JOURNAL of June 8, 1912, in French's article, it should be noted that this precipitation is quantitative only under certain conditions. The volume of the liquid must not be too great, and the copper must exceed a certain minimum. Favorable conditions are brought about by freezing the solution, or by making it consist of 50% of alcohol, or by adding 2 grams of oxalic acid per 50 c.c. of solution to be tested, after making said solution carry at least 50% of glacial acetic acid and 5 to 10% HNO_3. (Cf. H. L. Ward, in *Am. Journ. Sci.*, May, 1912.)

C. C.

Newark, N. J., June 10, 1912.

East Tintic Claim Decision

In view of its importance with relation to the patenting of mining claims, the decision of the General Land Office in the case of the East Tintic Consolidated Co., of Utah, is reprinted in full, with introductory excerpts from the mining code relative to "discovery" on lode claims.

Note—Decided by the General Land Office on Sept. 11, 1911. Comment is made in the editorial columns of this issue.

To constitute a valid discovery upon a lode-mining claim for which patent is sought there must be actually and physically exposed within the limits thereof a vein or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes.

The exposure of substantially worthless deposits on the surface of a lode-mining claim; the finding of mere surface indications of mineral within its limits; the discovery of valuable mineral deposits outside the claim; or deductions from established geological facts relating to it; one or all of which matters may reasonably give rise to a hope or belief, however strong it may be, that a valuable mineral deposit exists within the claim, will neither suffice as a discovery thereon, nor be entitled to be accepted as the equivalent thereof.

ADAMS, First Assistant Secretary:

On Apr. 12, 1909, the East Tintic Consolidated Mining Co., filed application for patent, serial No. 03220, to the Great Eastern Nos. 1 to 8, inclusive, Great Eastern Fraction No. 1, Snowbird, September, East Fraction, Kidnapping, Sunbeam Nos. 1 to 4, inclusive, Great Irish Change, and September Fraction lode mining claims, surveys Nos. 5740 and 5883, situate in T. 10 S., R. 2 W., S. L. P. M. M., Salt Lake City land district, Utah After due publication and posting of the notice of said application, mineral entry was allowed for all of these claims except the Great Eastern Fraction No. 1, Sunbeam No. 4, Great Eastern No. 8, East Fraction and Kidnapping.

Upon consideration of the case, the commissioner of the General Land Office, by decision of Mar. 20, 1911, found that the only showing as to discovery of mineral upon any of the claims embraced in the entry consisted of a statement in the application to the effect that the claims bore "gold, silver and other precious metals." and deeming this insufficient to establish discovery within the limits of each of the claims, directed attention to the concluding portion of paragraph 41 of the Mining Regulations, and instructed the local officers to inform the claimant that compliance therewith would be required.

He also held that two Keystone drill holes situated upon the Great Eastern No. 6 claim, an undivided one-seventh of whose total cost (given as $3527) was sought to be accredited in satisfaction of the $500 expenditure for patent purposes required by law, to that and the September, September Fraction, Great Irish Change, and Great Eastern Nos. 1, 2 and 7 claims, were not acceptable as common improvements for their benefit, and directed that the claimant be notified that he would be required to show that other and satisfactory improvements had been made upon or for the benefit of the September, September Fraction, and Great Eastern Nos. 1, 2 and 7 claims, the remaining two of the seven locations having otherwise sufficient available patent expenditures. Thirty days from notice was allowed claimant within which to make the showing required, and it was stated by the commissioner that to the extent default should be made in complying with the requirements, or to appeal, the entry would be canceled.

Notice of this decision was duly served upon the claimant. From so much thereof as challenged the availability and sufficiency of the drill holes as common improvements for the benefit of the claims to which their cost was sought to be accredited, the company appealed. At the same time, and apparently with a view to showing a valid and sufficient discovery upon each of the several claims of the group, the claimant submitted the affidavit of B. F. Tibby. This affidavit, omitting the formal portions thereof, reads as follows:

> Benjamin F. Tibby, whose post office address is Salt Lake City, Utah, being first duly sworn according to law, deposes and says that he is by occupation a civil and mining engineer.
>
> That at the instance and request of the East Tintic Consolidated Mining Co. he surveyed for patent and made an examination of the ground embraced within the Great Eastern Nos. 1, 2, 3, 4, 5, 6, 7, Sunbeam Nos. 1, 2 and 3, Great Irish Change, September, September Fraction, and Snowbird lodes, surveys Nos. 5740 and 5883, known as mineral application No. 03220, and situate in unorganized mining district, Utah County, State of Utah.
>
> That each and every one of said claims is based upon a discovery of mineral-bearing rock in place, in iron-stained rhyolite or in quartz or iron croppings, such as in this locality is recognized as being indicative of pay mineral, and that with development may lead to a pay mine of gold, silver, lead, iron, or copper; said indications being of the same general character as are found on adjoining mining claims throughout said district that are producing ore of such values as to justify a prudent person in the expenditure of money in the actual development of these claims by reason of such showing.
>
> That small quartz veins, stringers or seams, due to fissuring of the rhyolite capping, are disclosed on the surface of each of said locations, and assays taken from these seams or veins show values varying from a trace to $10 per ton in gold, silver and iron.
>
> A few tons of ore have been shipped from the tunnel on the Great Irish Change lode to test for fluxing purposes, bringing, however, only a small return, the exact figures of which are not available, otherwise no ore has been marketed, and ore in shipping quantities and quality is not now being produced, but the affiant believes from the showing of these seams and croppings, due apparently to the fissuring of the rhyolite, and from his knowledge of the geological conditions of the district, that with development into the ore-bearing limestone beneath, ore will be found in commercial quantities.
>
> The surface of the said claims contains no timber of commercial value. There is no water course through or upon said claims, and the land embraced is essentially mineral in character and useless for agricultural purposes.

In a report by a special agent of the General Land Office it is stated that on the Sunbeam No. 2 there are some deposits of iron ore of good quality, which had been worked to some extent in the past, and that iron float and iron ledges are frequently encountered on the ground embraced in the entry.

The foregoing, together with the formal statement made in the notice of location of each of the several claims, to the effect that the location is made on a "lode, vein, or deposit, bearing gold, silver and other precious metals," comprises all that is contained in the record relating to this entry, which is regularly before the department, and presumably complete, that tends in any degree to show a discovery of mineral upon any of the claims.

To entitle an applicant to enter and receive patent for a location made under the lode-mining laws, it is required by paragraph 41 of the Mining Regulations, approved Mar. 29, 1909 (37 L. D., 728,-766), that:

> The vein or lode must be fully described, the description to include a statement as to the kind and character of mineral, the extent thereof, whether ore has been extracted and of what amount and value, and such other facts as will support the applicant's allegation that the claim contains a valuable mineral deposit.

To the same effect, also, is the decision of the department in Silver Jennie lode (7 L. D., 6), wherein it was held (syllabus) that:

> Evidence as to the discovery of the alleged vein or lode should be furnished showing the place where and when such discovery was made, the general direction of the lode or vein, and all the material facts in relation thereto; and such evidence should be clear and positive and based on actual knowledge and the witnesses' means of information be clearly set forth.

By the term "vein or lode," as used in the foregoing, the department is not to be understood as having had in mind merely a typical fissure or contact vein, but, rather, any fairly well defined zone or belt of mineral-bearing rock in place.

It is evident from the record before the department that the deposits alleged to have been exposed on these claims are regarded by the applicant as possessing practically no economic value, but that, on the other hand, title to the claims is sought essentially on account of their possible value for certain unexposed deposits supposed to exist at considerable depth beneath the surface, and having no connection, so far as shown, with any deposits appearing on the surface.

The exposure, however, of substantially worthless deposits on the surface of a claim; the finding of mere surface indications of mineral within its limits; the discovery of valuable mineral deposits outside the claim; or deductions from established geological facts relating to it; one or all of which matters may reasonably give rise to a hope or belief, however strong it may be, that a valuable mineral deposit exists within the claim, will neither suffice as a discovery thereon, nor be entitled to be accepted as the equivalent thereof.

To constitute a valid discovery upon a claim for which patent is sought there must be actually and physically exposed within the limits thereof a vein or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes; and before patent can properly be issued or entry allowed thereon, that fact must be shown in the manner above stated.

The showing made by the claimant in the present case, even if it be regarded as supplemented by the report of the special agent, above referred to, is manifestly too vague, general and indefinite to warrant its being accepted as fulfilling the requirements above set forth, or as establishing the existence of a valid discovery of mineral upon any particular one or more of the claims embraced in the entry. For this reason, therefore, and aside from any other consideration the entry, in its entirety, will be canceled.

Sulphur Production in 1911

The production of sulphur in the United States in 1911, came from Louisiana, Utah and Wyoming, all three states showing an increase over 1910. The output of the first, of course, far exceeds that of the last two. The total production was 265,664 long tons. Imports amounted to 29,144 long tons, and exports to 28,103 long tons.

In spite of byproduct sulphuric-acid recovery by copper smelteries and the use of blende, low-grade copper ores, and other such materials for acid production, pyrite mining has been on a steady increase, and the production for 1911 reached the record output for the United States of 299,904 tons. The importations of pyrites also exceeded all previous records, amounting in 1911 to 1,006,310 tons. The output of sulphuric acid, calculated to 50° Be., amounted to 2,688,456 tons.

Union Miniere du Haut Katanga

At the recent meeting of the Union Minière du Haut Katanga, at Brussels, M. J. Jadot outlined the policy to be pursued at the mines. At the Star of the Congo mine there had been originally between 180,000 and 270,000 tons of 11% ore, of which about 20,000 had already been worked. The directors were now convinced the mine must be opened below water level. Meanwhile the labor question was a difficult one, the supply still remained insufficient, and it would probably eventually be necessary to import Chinese labor. They were looking forward to the arrival of the railroad at Kambove at the end of the year, to begin vigorous work there.

Lack of fuel was the chief cause of low output. The water-jacket furnace (blown in on June 30, 1911) ran 88 days up to Nov. 19, producing 996 tons of 90% ingots. It was blown in again on Dec. 17, but an explosion in the dust chamber again shut it down. It then operated from Jan. 3 to Mar. 4, and from Mar. 23 to Apr. 11, 1912, when it blew out for lack of coke. In the second period of 73 working days there were 1002 tons of 95% ingots produced.

A five-year contract had been entered into with the Wankie colliery, the latter to begin furnishing 1200 tons of coke monthly within seven months at about $27 per ton. The Union also purposed erecting its own ovens, to be completed about the middle of 1913, at which time they expected coke to cost about $22 per ton.

On this basis, they expected to begin smelting again in October, on Wankie coke, but if necessary, some coke could be shipped in from Europe for the purpose. A second water-jacketted furnace was to be ordered in a few days, to be ready in a year's time, when the new ovens would also be in position. A briquetting plant must be ordered. The experimental work with the small furnace has not been altogether satisfactory, but better fuel supply will, it is hoped, eliminate many of the troubles.

Experiments in electric smelting have been carried on at Ugines on 50 tons of Katanga ores, in a steel-refining furnace. The experiments were to be continued in a specially designed furnace on 500 tons of material, and if the furnace worked satisfactorily it would be sent to Katanga. A sub-company will be organized to finance these electrical experiments. Another new plan is to work a tin mine at Kinsangi, after the railroad to Kambove is completed.

Geological Survey Appropriations

WASHINGTON CORRESPONDENCE

The House Appropriations Committee, on June 4, reported to the House the following appropriations for the Geological Survey. They are expected to pass the House in substantially this form, and there is at present no reason to expect serious modification in the Senate.

Office of the director of the geological survey: For director, $6000; chief clerk, $2500; chief disbursing clerk, $2500; librarian, $2000; photographer, $2000; assistant photographers—one at $900, one at $720; clerks—one at $1000, four at $900 each; four copyists, at $720 each; watchmen—one at $840, four at $720 each; janitor, $600; four messenger boys, at $480 each; $35,340 in all.

Scientific assistants of the Geological Survey: For geologists—two at $4000 each, one at $3000, one at $2700; two paleontologists, at $2000 each; one chemist, $3000; geographers—one at $2700, one at $2500; two topographers, at $2000 each; $29,900 in all.

General expenses of the Geological Survey: For every expenditure of the Geological Survey, including personal services in the District of Columbia and in the field, to be expended under the regulations from time to time prescribed by the Secretary of the Interior, and under the following heads, namely:

For pay of skilled laborers and various temporary employees, $20,000; for topographic surveys in various portions of the United States, $350,000; for geologic surveys in the various portions of the United States, $300,000; for continuation of the investigation of the mineral resources of Alaska, $90,000; for chemical and physical researches relating to the geology of the United States, including researches with a view of determining geological conditions favorable to the presence of deposits of potash salts, $40,000.

For the preparation of the illustrations of the Geological Survey, $18,280; for the preparation of the report of the mineral resources of the United States, $75,000; for gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and the preparation of reports upon the best methods of utilizing the water resources, $150,000.

For the purchase of necessary books for the library, including directories and professional and scientific periodicals needed for statistical purposes, including payment in advance for subscriptions to publications, $2000; for engraving and printing the geologic maps, $110,000; for continuation of the topographic surveys of the public lands designated as national forests, $75,000, to be immediately available; in all, $1,295,520 for the U. S. Geological Survey.

The production of metallic tin from Bolivian ore in 1911 was 22,200 metric tons against 23,129 metric tons in 1910.

Work of the Bureau of Mines

In response to the Senate resolution of Mar. 25, 1912, asking for information with respect to the operations in the Bureau of Mines in the Western states, Walter L. Fisher, Secretary of the Interior, has just sent to the Senate the following statement of the work of the bureau:

Metal Mines Investigations Limited

The Bureau of Mines has not yet been able to undertake any extensive inquiries or investigations in connection with the metal-mining industries of the public-land states. Its activities in these states have been limited to the following:

(1) Two mine-rescue cars engaged in demonstrating mine-rescue and first-aid methods at coal mines of the Rocky Mountain and Washington coal fields have incidentally given safety and first-aid demonstrations at a few of the larger metal-mining camps of that region. It has not been possible, however, to follow up these demonstrations by giving to the miners the training necessary for a continuance of the work, nor are the men with the cars familiar with metal-mining methods, nor has all the equipment of the cars been especially adapted to metal-mining conditions.

(2) In coöperation with the Department of Justice, a limited investigation has been undertaken concerning the conditions under which smeltery fumes are given off in a few of the Western states where government property was reported as being injured or destroyed.

(3) The bureau has inaugurated an inquiry concerning methods and safety appliances used in driving tunnels, in which kind of work a number of lives have been lost, and concerning mineral waste and accidents in lead mines, and an inquiry has been made concerning the nature and extent of metal-mining accidents. But this work has been preliminary in character and limited in extent.

(4) In coöperation with the Public Health and Marine-Hospital Service the Bureau of Mines has made a preliminary examination of the larger metal-mining camps of Colorado and the conditions producing lung trouble among the miners, and has found in several such camps conditions seriously in need of improvement.

(5) Through the aid of a committee of eminent mining engineers an effort has been made to bring together a digest of existing laws and regulations relative to safety in metal-mining operations.

Bureau Criticized

This department and the Bureau of Mines have been criticized frequently because of the seeming neglect of the metal-mining industry. And this criticism has been strengthened by the fact that for many years prior to the creation of the bureau the demand for Federal recognition and aid for the mining industry came mainly from the Western metal-mining states. Bu this delay in undertaking needed investigations in behalf of the metal-mining industry does not appear to indicate a lack of interest or favorable intent in the matter with either this department or with Congress.

In response to a Senate resolution Secretary Fisher reported on the work of the Bureau of Mines. Its investigations have been devoted chiefly to coal-mine disasters and their prevention. Measures to increase efficiency and safety in metal mines are urgently needed and a plan is outlined aiming to accomplish this without competing with private assayers or discouraging state and private investigations.

In establishing the Bureau of Mines. Congress transferred to it the then existing appropriation of $100,000 for the investigation of fuels belonging to or for the use of the Government, and, with widened scope, the appropriation of $150,000 for the investigation of mine explosions; and it increased this latter appropriation to $310,000, with the evident intent that the $160,000 added should be used mainly, if not exclusively, for the establishment and maintenance of the much-needed rescue work in connection with the coal-mine disasters. * * *

Metal-mining Investigations to be Undertaken

The department has endeavored to carry out the evident intent of Congress that this work in relation to coal-mine disasters should first be well organized; and it has been able to carry on only such other limited technologic investigations as came over from the Geological Survey or were incidental to the mine-safety work. Meanwhile, the need of investigations relative to safety and efficient development in behalf of the metal-mining industries is now fully recognized, and I feel sure these needs will be provided for by Congress without further delay.

The serious need for inquiries and investigations in behalf of the metal-mining industries is shown by the fact that in many parts of the West their progress has not kept pace with agriculture, which has been so largely stimulated by the governmental researches. Meanwhile, the mining journals have been discussing the "causes of paralysis" in Western mining camps; and the loss of life in the metal mines during the past several years has been proportionately almost as large, and in many metal-mining regions larger, than in the coal mines of the country.

Another condition which has proved a source of widespread criticism and embarrassment to the Bureau of Mines is the fact that while the demands upon it from all parts of the country for information concerning all branches of the mining industry—demands coming from the mine workers even more than from those interested in the ownership or operation of the mines—have increased rapidly and largely, the appropriations available for actual investigation, instead of increasing, are in reality smaller than were the appropriations for investigations under the technologic branch of the Geological Survey four years ago.

Investigations Recommended for 1913

The inquiries and investigations in behalf of metal mining in the public-land states, which I deem it important that Congress should authorize at this time, may be properly grouped under the following wording: "Inquiries and investigations into the mining and treatment of ores and other mineral substances."

Under an appropriation item so worded it is expected that the bureau would take up these subjects with special reference to the prevention of waste, problems of safety, and the improvement of conditions in the mining industries other than the mining of coal, within the public-land states.

It was mainly with a view to inaugurating such investigations in the metal-mining states that the department included in its estimates for the work of the Bureau of Mines during the fiscal year 1913 an item of $100,000 for "the treatment of ores and other mineral substances," as authorized in the existing organic act. The incorporation in the item of an investigation of coking coals, gas, petroleum, and miscellaneous minerals was based on the recognized importance of such investigations in the wise development of the mining industry in the public-land states, and also in the prevention of the enormous waste now taking place under the system of handling and developing the Government's own property.

Great Waste of Natural Gas

In fact, the money value of the natural gas wasted unnecessarily in the public-land states largely from land still under government control was, during the past year, more than ten times greater than were the total appropriations for the Bureau of Mines for that year.

In that estimate special emphasis was

given to the problem of waste, just as in the coal-mining investigations special emphasis has been given to the problems of safety, because of the extensive coal-mine disasters; but both in the coal-mining and metal-mining industries the fact is clearly established that the problems of safety and waste are inseparably associated.

The primary purpose of such investigations as are here proposed for the Bureau of Mines will be to make careful researches into the nature of the different types of ores and other mineral substances found in the public-land states, and to obtain in this way such fundamental data concerning them as will be helpful in their efficient mining, treatment, and economic development, will reduce mineral waste, will facilitate the rational sampling and preparation of such materials, and will make possible the prevention or control of poisonous gases, unwholesome dust, or liquids developed in their treatment, and thus lead to an improvement in mining and metallurgical conditions. These investigations meet with the approval of experienced mining men as being of fundamental importance to the industry.

The scope of the proposed investigations, as outlined also in the estimates for the fiscal year 1913, includes:

(*a*) An examination into the coking and gas industries with special reference to the coking qualities of the coals found in the public-land states, and their utilization in connection with the development of the metallurgical industries; (*b*) petroleum and natural-gas industries, with special reference to their waste in the public-land states, and their utilization for metallurgical operations; (*c*) miscellaneous mineral industries, especially as to waste, and with reference to their utilization and development.

How Work Can Best Be Done

In answering the inquiry as to how this work in behalf of mining in the public-land states can best be conducted, I may add that in the investigations concerning the treatment of ores and other mineral substances it is not proposed that the Bureau of Mines make assays or analyses of such materials for private parties, nor that it should determine for private parties by what processes their particular ores or minerals may best be treated. For work of this character there are numerous well equipped private laboratories in the country, and the effect of the investigations conducted by the Bureau of Mines should increase rather than diminish the work of these private laboratories.

It is believed that such work as is here recommended can, for the most part, be best conducted within the limits of the metal-mining states under consideration, where those carrying on the investigations will have every opportunity and incentive to keep in close touch with the practical phases of the industry; and by combining the investigations in the laboratory with carefully made examinations in the field.

The investigations of the Bureau of Mines will be limited to problems of general importance and interest, leaving to the states and private corporations problems of local or private interest. They should and will be conducted in such manner as will stimulate rather than discourage these local inquiries and investigations on the part of private companies and the states.

Through the adoption of such a policy the Bureau of Mines will avoid competition with the private laboratories of the country, and at the same time will do much to foster and develop the industry through the accumulation and dissemination of such general and fundamental data as will prove useful to the miners, to the mine operators, and to the states, as well as to the government in connection with the wise development and uses of the mining industry.

Investigations Will Stimulate Private and State Effort

There is no foundation for the fear sometimes expressed that if such investigations as are here recommended be undertaken by the government private corporations will unload their local problems on the government laboratories. The result of recent experience has been just the reverse. When, in 1904, the Federal Government began the testing and analyzing of coals, and later took up similar investigations of explosives, mine accidents, and mine-rescue work, similar objections were raised in each case; but in every such case private corporations and private laboratories have been stimulated to greater activities in the investigation of new problems at their own expense. * * *

Since the establishment of the U. S. Geological Survey the number as well as the activities of the state geological surveys has largely increased. The testing of coals by the Federal Government has stimulated to similar activity at their own expense not only many private mining companies but many states, municipalities, private institutions, and private manufacturing corporations.

And so it will be with the investigations of the Bureau of Mines in behalf of the mining industry; they will stimulate inquiries and investigations by both the state and private corporations; they will neither compete with nor interfere with but will rather increase the work of the private laboratories.

Other Important Investigations

The few lines of investigation above described have been recommended as deserving immediate action by Congress, not because of their being more important, but because of their being more urgent than other necessary lines of investigation for which, I believe, provision should be made at an early date. But I take it that the purpose of the present inquiry on the part of the Senate is to determine what work should be provided for at this time.

No less in need of investigation on behalf of both safety and efficiency in the metal-mining industry are the problems of ventilation; mine timbering; mining, quarrying, and metallurgical equipment with special reference to safety appliances; explosives; electricity, fire protection; and the collection and dissemination of data relative to safety; and the improvement of mining conditions. Such problems can be made the subject of helpful inquiries and investigations without in any way encroaching upon the work of private laboratories or lessening the individual initiative and enterprise of private mine operators. These are problems which have no state or other local boundaries; and there is no reason, therefore, why the cost of their investigation should devolve upon any one individual, community, or state. They are general in their character and application; and in the interest of both economy and efficiency they should be conducted by the Bureau of Mines for the benefit of the industry in the country, under proper congressional authorization. * * *

With the increasing complexity of the conditions controlling the mining industry, and its growing importance as a basis of our national welfare, it is becoming, not only more appropriate, but more necessary that the government, through its inquiries and investigations, aid the miners in much the same way that it has with such generosity and success aided the farmers of the country. The failure of the government to do this in the past is to be explained only by the fact that the conditions have not been adequately understood.

Government Largest Mineral-land Owner

There are special reasons why the Federal Government should aid the mining industry in the public-land states. The Government is still the largest owner of mineral lands in those states. Even were these states sufficiently wealthy to grant appropriations without reserve there would be, if the work were all done by these states, costly duplication in effort and expenditures, as for the most part the problems are common to all of them.

No better illustration can be given of the extent to which the mining industry has been relatively neglected and the agricultural industries fostered in the general plans for industrial development than the fact that during the past 10 years not only has the Federal Government expended large sums from the Public Treasury in behalf of investigations looking to agricultural development, but it has expended in behalf of the reclamation of arid lands for farm purposes in the public-land states the proceeds of the sale of all public lands ($65,000,000), including even the proceeds of the sale of mineral lands, the latter aggregating nearly $7,000,000. It would certainly have been reasonable and fair if during this period the proceeds of the sale of mineral lands in these states had been devoted to investigations looking to the upbuilding of the lagging mining industry there.

Meanwhile, during this period, stimulated by this aid from the Federal Government, the agricultural products of the public-land states have increased from an average annual valuation of $966,000,000 during the five years from 1901 to 1905, to an average annual valuation of $1,365,000,000 for the five years from 1906 to 1910. During similar periods the average annual valuation of the mineral products in the public-land states (including the precious metals, copper, lead zinc, coal and petroleum) increased from $287,000,000 during the first period to $358,000,000 during the second period; while in the production of the precious metals there has been a decrease from an average annual valuation of $136,000,000 during the first period to an average annual valuation of $127,000,000 during the second period.

COST OF INVESTIGATIONS

The following is an estimate of the cost of the work it is recommended that Congress authorize to be carried on by the Bureau of Mines in the public-land states west of the Mississippi River during the fiscal year 1913:

For inquiries and investigations into the mining and treatment of ores and other mineral substances, and for equipment, supplies, travel, and other expenses incident thereto, $100,000. The more important items of expenditure under this appropriation are estimated to be as follows:

Salaries, $55,580; traveling expenses, freight, express, rent, etc., $15,800; equipment, including instruments, and supplies for field and laboratory work, $28,620.

An itemized statement in detail of the estimated expenditures under the above proposed authorization has been prepared by the department. The reply to the Senate inquiry has been delayed until ample opportunity could be given for conference with men thoroughly acquainted with Western mining conditions.

The Bunker Hill & Sullivan Mining & Concentrating Co. has just paid its 177th dividend. The total return to stockholders has been $13,519,350, on a capitalization of $327,000, or 413 per cent.

The Aluminum Trust Suit

In the United States Court, at Pittsburgh, June 7, a decree was entered against the Aluminum Co. of America. Following the government's civil suit, filed a few weeks ago, charging the corporation with monopolizing the industry, the decree abrogates alleged unlawful contracts and restrains the defendant company from negotiating similar undertakings or pursuing unfair methods toward competitors.

The decree was accepted by the Aluminum company as a result of protracted negotiations with Attorney General Wickersham prior to the filing of the suit. The mandate was drawn and accepted by both the government and the defendant before the suit was initiated. This is the first time a decree has been agreed upon under the Sherman law before court proceedings had been started.

The company is forbidden to participate in any combination or agreement to control the output or prices of aluminum. It is enjoined from combining, by stock ownership or otherwise, with other manufacturers for this purpose. The decree places a long list of specified unfair methods of competitors under the ban of the court.

Provisions of alleged agreements to suppress competition between the Aluminum company and the so called Swiss, or Neuhausen, Co. of Europe; the General Chemical Co., the Norton Co., the Pennsylvania Salt Manufacturing Co., Gustave A. Kruttschnitt and James C. Coleman, both of Newark, N. J., are abrogated by the decree.

Whenever it is shown that substantial competition has arisen in the aluminum industry, the decree may be modified upon the production of evidence that it is working an injustice. Application for modification cannot be made oftener than once in every three years.

Molybdenum in Steel

The Primos Chemical Co., of Primos, Penn., has written as follows in response to an inquiry regarding the use of molybdenum in steel:

"There is a little more demand for molybdenum now than there has been for the last seven years. From 1900 to 1905, the consumption was at its greatest, our firm alone producing upward of 50 tons of metallic molybdenum per year. Consumption then dropped to a few tons per year, but is now gradually coming up again to an average of two tons per month in the United States. Both molybdenum and ferro-molybdenum are now used little in straight molybdenum tool steels, but are used in connection with tungsten in most of the high-class tool steels; also in connection with vanadium. In certain steel castings and other railroad work, molybdenum is also used up to 1%. Some of the European armor plates contain up to 2% of molybdenum.

"The Primos Chemical Co. is also manufacturing an alloy known as ferro-molybdenum-tungsten, containing molybdenum and tungsten in the proportions of 3:1; vanadium is sometimes added in amounts ranging from 1 to 7%, according to specifications. The price of ferro-molybdenum is about $1.60 per lb. of molybdenum contained in the alloy. Ore prices vary from 25c. to 40c. per lb. of molybdenum sulphide, depending on the composition of the ore."

Ore Strike at Florence-Goldfield

Press dispatches accredit R. Dewey, manager of the Florence mine, at Goldfield, Nev., with having made statements in regard to the strike of rich ore in that mine substantially as follows: The strike was made on the 250-ft. level in extending a crosscut to the east. At a distance of about 1600 ft. from the shaft and in virgin ground, a high-grade streak 3½ ft. wide was cut, but no particular attention was paid to it, as a wider streak of milling ore appeared against it on the far side. The milling-ore streak is about eight feet wide; assays of the samples show that the ore contains between $20 and $30 in gold per ton.

The narrower streak has been drifted upon for a distance of 15 ft. to the south and a like distance to the north. Samples from the north face assay about $26 per ton: those from the south face about $10. The oreshoots dip slightly to the east and trend northward, between walls of altered dacite.

Mr. Dewey entertains the opinion that the newly discovered ore is in the same vein that the owners of the Zinn lease on the Jumbo worked, as apparently it comes directly from those workings into Florence ground. Between 75 and 80 tons of ore have been broken, which will be shipped to the Western Ore Purchasing Co. It is said that this ore contains between $200 and $500 in gold per ton.

Geology between Porcupine and Gowganda

SPECIAL CORRESPONDENCE

J. G. McMillan, who was commissioned to examine the territory along the line of the proposed extension of the Porcupine branch of the Temiskaming & Northern Ontario Ry. to Gowganda, a distance of about 60 miles, reports that the country does not present any important agricultural possibilities, but that gold has been found in places and the rocks would probably repay careful prospecting. In the vicinity and northeast of the Height of Land, the Keewatin formation is overlain by areas of Huronian sediments, which dip at small angles to the east and southeast. These form ridges resembling those in the Cobalt district. Diabase occurs in the Huronian, as dikes less than 100 ft. in width, but the intrusions are unimportant as compared with those of Cobalt or Gowganda. Small quartz veins occur in the Keewatin schists in many parts and in the vicinity of the granitic intrusions veins of good size have been found. Gold has been discovered in some of these and in associated porphyry dikes, but development has not been sufficient to determine if it exists in paying quantities. The iron formation, so far discovered, is not regarded as of economic importance.

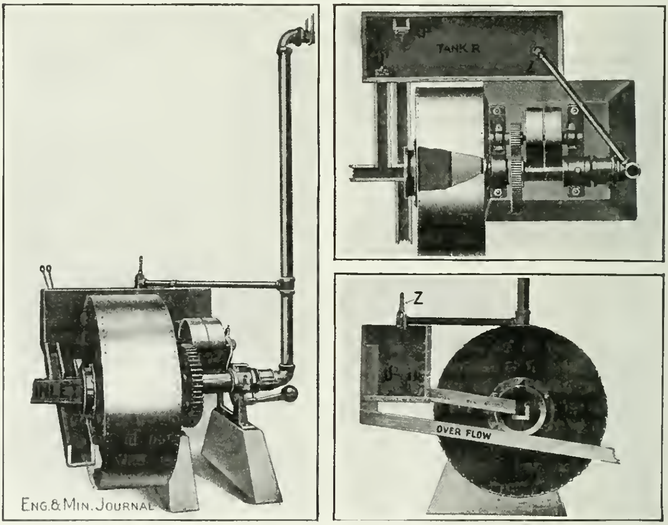
The Abbe-Frenier Sand Pump

The sand pump shown in the accompanying illustration differs from the old type Frenier pump chiefly in that no inclosing box is required, and the pump wheel, made of $\frac{3}{16}$-in. steel, is divided by a diaphragm wall into two equal compartments. The wheel overhangs from the main bearing, no outboard bearing being required. The compartment on the bearing side of the wheel is occupied by a spiral similar to the spiral of the older Frenier pump, and which terminates at the hollow trunnion, through which the pulp is discharged. The outer compartment is simply a receiving chamber; connection with this and the outer coil of the spiral in the other compartment is effected by an opening in the diaphragm.

Pulp is delivered to the pump by the launder that leads into the central opening in the side of the receiving compartment of the wheel. From the receiving chamber a quantity of the pulp passes through the opening in the diaphragm at each revolution, thence through the spiral and trunnion and up the discharge pipe. An overflow launder is provided, which disposes of excess pulp that may overflow from the receiving compartment of the wheel. This launder extends up to the receiving tank *R*, and into it the contents of the tank can be drained by opening valve U^2. A horizontal pipe from the vertical discharge pipe is equipped with a valve *Z*, which should be opened before the pump is stopped and after valves U^1 and U^2 have been closed, so that all the pulp in the pump and discharge pipe will have drained into the tank before the pump is stopped. Of course, the supply of pulp is stopped by a gate in the inlet launder before stopping the pump. When the pump is restarted the trap valve U^1 is opened, allowing the pulp stored in the tank to flow into the inlet launder, joining the main supply to the pump.

The pump is driven preferably by a countershaft with pinion and gear for the larger sizes, or by a pulley on the main shaft for the smaller sizes, but they may also be driven by chain and sprocket. The maximum speed of the countershaft is 90 r.p.m. for the 14x25- and 20x55-in. pumps, and 100 r.p.m. for the 14x47- and 20x47-in. sizes; 18-in. pulleys are used on all sizes. As the pump is not obliged to cut through the pulp, as in the case of the older type, coarser material can be raised and less power is required for its operation; the manufacturers specify between 1 and 2 hp.; 15 to 20 r.p.m. is the proper speed of revolution for the pump wheel.

The sizes, capacities and other data regarding these pumps are given in an accompanying table, taken from the catalog of the manufacturers, J. H. Frenier & Son, Rutland, Vt. The lifts given in the table are calculated for altitudes of 1000 ft. or less above sea level; for higher elevations, deduct 4 in. per 1000 ft. The pump is furnished complete, except the foundations, launders, tanks and pipe. It is advisable to have on hand an extra packing joint, pinion and elbow.



ABBE-FRENIER SAND PUMP

ABBE-FRENIER SAND PUMP DATA

No.	Size in.	Capacity gal per min.	Max Lift ft	Shipping wt. lb.	Discharge in.	Price f.o.b. Rutland
1	20x55	60–90	22	2150	$3\frac{1}{2}$	$260
2	20x47	50–80	15	1850	$3\frac{1}{2}$	210
3	14x55	30–60	22	1800	3	220
4	14x47	25–50	15	1650	3	200

Patricia District, Ontario

TORONTO CORRESPONDENCE

Prof. W. G. Miller, provincial geologist, has issued a preliminary report on the new district of Patricia that was added to Ontario during the last session of the Dominion Parliament. That portion of the old district of Keewatin, now belonging to Ontario, embraces an area of approximately 156,000 square miles. The characteristics of the new district are much the same as the older northern parts of the province; the elevation, the presence of numerous lakes and water courses, the nature of the rocks and vegetation, throughout a part of the district, at least, being similar. The pre-Cambrian rocks predominate, but along the coast of James and Hudson Bay, from the mouth of the Albany River to the Manitoba boundary, the rocks are similar to those along the northern shores of Lakes Ontario and Erie. Little detailed work has been done, but judging from what is known of the geology, the district should contain important mineral deposits. There are large areas underlain by rocks, similar to those which, in the older northern districts, contain deposits of gold, iron and other ores. There are also rocks which are similar to those in which occur the nickel deposits of Sudbury and the silver deposits of Cobalt. Limestone and other rocks along the coast may contain deposits of petroleum, natural gas, gypsum, salt and other valuable minerals.

Details of Practical Mining

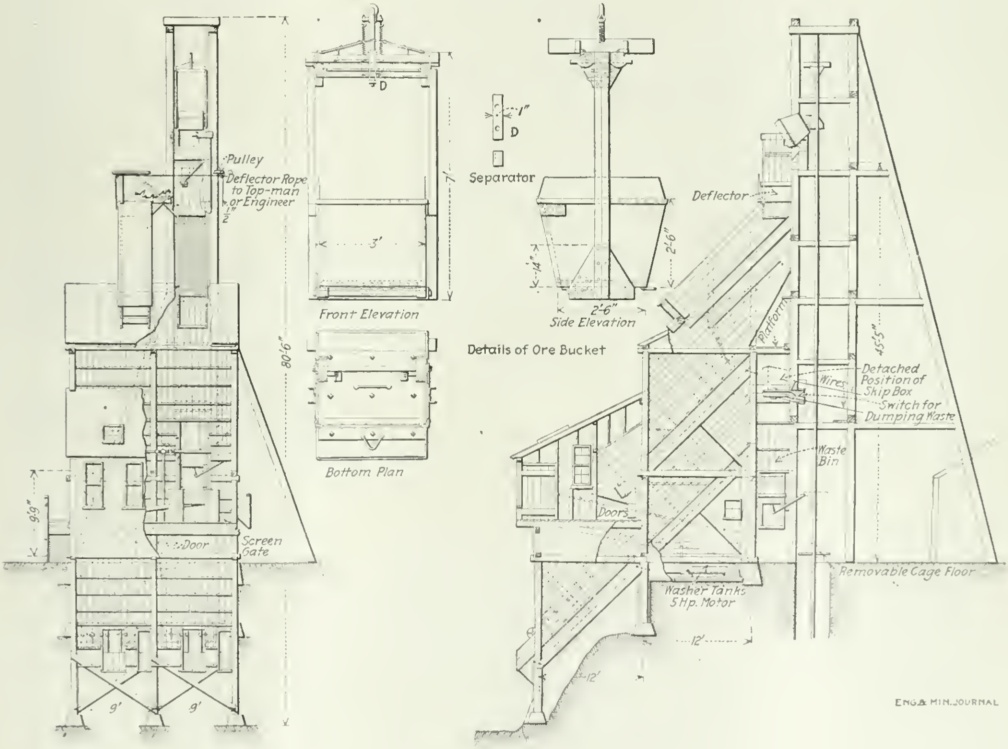
Accounts of Useful Ways of Doing Many Things in the Day's Work

A Cripple Creek Ore and Waste Plant

By S. A. Worcester*

The plant shown in the accompanying drawings was designed by me with the intention of adding later a third unit of bins, screen and washer, if the mine production justifies it; the addition to be made on the southwest side. Ore and waste are hoisted in the skip, which is shown in detail. Its capacity exceeds that of one mine car (1800 lb.) so as to avoid spilling when the car is dumped from the mine level directly into the skip without the use of chutes or aprons. The caps of the cast-iron boxes on the bottom of the skip-body are hinged so that they can be swung open by sliding endwise the pin that holds the cap. The pins are normally held in place by spring cotters which also prevent them from being dropped and lost. The skip-box is easily removed from the frame and hung out of the way over the waste bin in the position shown by the dotted lines in the general drawing of the plant. The hanger rod is hooked into the loop or eye at the bottom edge of the skip-box and supports the box, with its rollers resting in the dumping guides. The removable floor is then placed on the crossbars of the skip-frame, quickly converting it into a cage for hoisting men and timbers, or making repairs in the shaft.

Among the features of the skip may be mentioned the safety dogs or catches which have long projections for engaging the outside of the guide shoes, so as to prevent the dogs from rotating further than they should when engaging the wooden guides. A number of accidents are on record where ordinary dogs of nearly round shape have turned completely over, breaking the chains which held them, and allowing the cage or skip to fall to the bottom of the shaft. Another feature of this skip is the "Champion mower" spring, which I use frequently in my machine designs because of its reliability. It is made by spring manufacturers who test every spring with a special testing machine, extending its length from 13 to 18 in., after which test the spring must return to its original shape, retaining an initial tension of 400 lb. This spring can be duplicated at small cost at any agency of the In-



Front and Side Elevations of an Ore House, and Details of Hoisting Bucket ternational Harvester Co. Most manufacturers do not make such a reliable and powerful spring for occasional orders for skips and cages, as I know from several unsatisfactory experiences. The situation of these springs, between the top cross-bars of the skip frame, where they are protected from accidental injury, and the ease with which they are removed, replaced and adjusted are desirable features. I believe this arrangement of safety catches has important advantages, in simplicity and reliability, over the more common arrangement of chains, flat springs and eccentric dogs, and my belief is well supported by the operating record of 8 or 10 skips of my design on which these safety devices are now used.

---

*Mechanical engineer, Victor, Colo.

When the skip is used for hoisting waste, which goes direct to the waste dump without being sorted, the steel guide switch, or the lower dumping guide in the illustration is slid horizontally toward the hoist, so as to engage the dumping rollers of the skip, and throw the load into the waste bin. When crude ore is being hoisted to the orehouse for screening, washing and sorting, the switch, consisting of one right and one left hand dumping guide, is slid away from the hoist so as the clear the skip rollers and the skip then passes up to the stationary dumping guides near the top of the headframe. Here it dumps into a main spout on which is a deflector that directs the ore to one grizzly or the other. This deflector is operated by ropes guided by pulleys to the engineer's station. The skip switch is also operated by the engineer, who uses a lever placed near the hoist, connected to the switch guides by wires equipped with eye-rods by which the tension can be adjusted.

The crude ore drops from the spout into which the skip dumps, upon the grizzly, the coarser material passing over to the crude-ore bin, while the fines pass through to the wire-cloth screen having about one-inch openings. Rejections or middlings from the screen join the crude ore; screenings fall through the large spout to the screenings bin below, and are shipped without further treatment. The inclination may be adjusted by raising or lowering the upper ends of the screens. The slope is thus made to suit the character of the ore, whether dry or sticky.

The washers at the open mouths of the crude-ore bins, are chutes or troughs 36 in. deep and wide and 6 ft. 3 in. horizontal length, with perforated plate bottoms inclined at 30°. At the lower ends or mouths of the washers are gates operated by hand levers, opening on the sorting tables which are covered by perforated plates. A centrifugal pump, driven by an induction motor, forces water through the parallel spray pipes above the washers. The water issues from these perforated pipes in jets of considerable force, striking the ore as it lies in the washer. The slime adhering to the ore is washed off, and passing through the perforated bottom of the washer is carried by launders to a tank in which the slime is deposited and the water is partially clarified. The tank is provided with baffles at the inlet and outlet for reducing the disturbance caused by ingoing and outgoing currents as much as possible and promoting rapid and effective settling. The same water is used repeatedly. The tank is a cheap and simple structure made of boards that are not tongued and grooved, being nailed and spiked together. On one side is a steel-plate liner so arranged as to form an exhaust-steam heater, using the exhaust from the hoist in cold weather.

For sorting ore, a mine car is run under the projecting edge of the sorting-table and the waste rock is scraped into the car, while the ore is scraped into one or the other of the vertical spouts and drops to the shipping bin below. Two men can work at each table. Washing has the effect of making the colors of the rock distinct and rendering accurate sorting easy. In the corners of the bins for shipping ore are closed spouts which carry the screenings from the screenings bins and deliver at the same level as the shipping-ore bin gates. The waste from the sorting-tables is trammed to the dump north and south of the sorting-room and the waste from the mine is trammed from the waste bin to the dump. For a plant of small size this one is economical, the only hand labor of any importance being the sorting of ore and tramming of waste.

Concrete Chute Bridging a Level

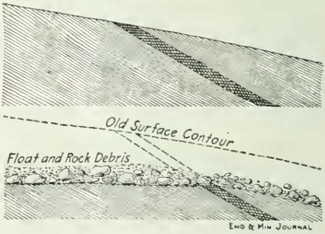
Concentrating hoisting at a few levels is a practice that is growing in favor at many large mines. At the Osceola, No. 13 shaft of the Calumet & Hecla company, the ore from five levels, each 100 ft. apart, is delivered at the level through a chute in the shaft pillar. This chute is inclined at an angle of 40° from the horizontal. The ore is drawn from it into a car of 7½ tons capacity, the flow of ore being controlled by a chute gate of the hinged type.

As this chute was cut after the levels were driven, it was necessary to continue it from the opening in the roof of the drift diagonally across to the similar opening in the floor, near the opposite wall. This was done by bridging the gap with a long, reinforced-concrete box without ends. The bottom of the box was made 21 in. thick, and was reinforced with old 30- and 40-lb. rails. Large blocks of rock from the vein walls, some of which were 16 to 18 in. diameter, were imbedded in the concrete in making the bottom, as it was believed that this material would withstand abrasion by the ore better than concrete alone; a 1:2:5 concrete mixture was used. The sides of the box were made 12 in. thick at the floor and tapered to a thickness of 6 in. at the roof. The cover or top of the box was made of concrete 12 in. thick, and it, as well as the sides, was reinforced with old rails. An opening in one side of the box at the floor on each level afforded means of dumping ore into the chute. A grizzly was placed over the opening, and was held in place by a 12x12-in. timber, to which the grizzly bars were screwed.

Hints for Prospectors

By E. M. Weston*

It is almost always assumed in textbooks offering the prospector advice in searching for new deposits of ore, that the outcrop of a vein is always to be sought for on higher ground than that from which the float came. This is not always true. Whether it is true or not in a specific case depends upon the nature of the denuding agencies, the character of the vein and of the inclosing rock, and above all on the dip of the vein itself. The high veldt of South Africa offers some interesting examples of exceptions.



Original and Eroded Outcrop of Vein

Take for example a quartz vein or banket bed in slate in country where denudation is gradually taking place by the removal of decomposed rock by rain falling on a moderate slope. It is at once evident from the accompanying sketch that the float and boulders from the vein have fallen over *in situ*, perhaps a few having rolled down hill from the outcrop. Should the prospector carry on his operations in the time-honored manner of searching up-hill from the float, he would waste time and money in sinking and trenching and might fail to discover the orebody. From the examples I have seen I believe that in the case of flat veins this occurs more often than is supposed and may account in some American districts for failures to discover the source of float. It is a fact well worth bearing in mind.

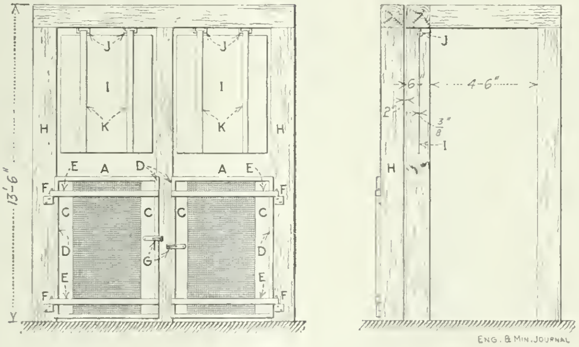
---

*Union Club of South Africa, Johannesburg, Transvaal.

Shaft Station Safety Gates

By F. L. Fisher*

In several of the Anaconda company's mines at Butte, where ore is hoisted in skips, it has been found necessary to protect the openings from the shaft to the stations from occasional falls of small quantities of ore which are often spilled in loading. It is impossible to catch every piece of ore as it flows from the skip chutes; some of it bounds over the edge of the skips, or the momentary sticking of an unusually large piece in the jaws of the sliding door of the chute when the skip is about full causes an overflow before the obstruction can be loosened and the door closed. Although these escaping fragments are in the majority of cases small, yet in falling several hundred feet they attain a velocity which makes them a menace to safety regardless of size, and often they zigzag from side to side of the shaft and bound into the station with great force. There is a record of one man being struck and killed by such a piece of ore while standing about 20 or 30 ft. away, and several lesser accidents have occurred. To insure against repetitions of these accidents swinging gates have been devised.



Station Gates in a Butte Mine

The main gates *A*, are made of two wide vertical strips of ⅛-in. iron sheeting *C*, and a central screen of 1-in. mesh, No. 8 iron wire, all bordered by a 2-in. angle iron *D*, and crossed horizontally by two strips of ⅜-in. iron *E*. The doors are hung on hinges *F*, and locked with lift-latch *G*, which can be operated from either side. They are attached to the outward faces of the first station sets *H*, which are separated from the shaft timbers by a space of two inches. Above and back of these doors is a second set of doors *I*, hung from the center of the cap at the top of the shaft-station sets by hinges *J*, so that the doors can be swung in and out of the shaft, to facilitate the unloading of long timbers from the cages; the doors being simply swung up away from the shaft as the timbers are dragged through. The bottoms of the upper doors are 12 in. above the tops of the lower, and 22 in. back toward the shaft. They are made of ⅛-in. iron sheeting, strengthened by two vertical strips of ⅜-in. iron *K*, and of their own weight they tend to deflect downward any falling pieces of ore to the turnsheet below, where the lower gates prevent them from bounding into the station. The opening between the gates, and the wire screens on the lower gates are for the purpose of admitting light to the shaft.

---

*Mining engineer, 513 Hennessy Building, Butte, Mont.

Cartridges for Tamping Dynamite

By John T. Fuller*

The articles recently published in the Journal describing the cartridges used for tamping dynamite in the Lake Superior and other mines, recall to mind the similar practice in the diamond mines at Kimberley, South Africa.

As is well known, the diamond-bearing rock or "blue ground" is comparatively hard and compact, but it disintegrates upon exposure to the atmosphere. There is always a plentiful supply of finely pulverized rock, and dust to be found on the floors of the tunnels, which, when mixed with water in the right proportions forms a plastic mud.

During a shift while the "drill boys" are drilling the holes two or three "pickaninies"—native boys from 14 to 18 years old—are delegated either to collect this mud from the wet places on the level or to form enough by mixing the dust with water to make tamping cartridges.

The dynamite used in these mines is packed in 50-lb. cases containing the sticks in bundles or packets of about 20 sticks each, and each packet is wrapped in paraffin paper. The pickaninies collect this paper and each with a pile of mud, much resembling a big batch of black dough, deftly balanced on top of his head retires to some cool spot, preferably near an air-pass and proceeds to make cartridges.

This they do, first by taking a handful of mud and rolling it out on a board until they have formed a rough cylinder of mud six to eight inches long, and an inch or more in diameter. After having rolled sufficient mud cylinders to make the required number of cartridges they cut the paraffin paper to the required size in the form of rough squares and roll the papers about the mud cylinders; sometimes square across and sometimes on the bias. One end is then turned over and the cartridges struck one or two light taps on the board to compact the mud; the other end is then turned over and the cartridge is formed. I have sometimes seen these boys form cartridges in the same way as is in the Lake Superior practice, by forming a paper cylinder around a piece of old shovel handle and then thrusting the mud inside. The paraffin paper sticks closely to the mud cylinder and no fastening other than the turned-over ends is required. The cartridges retain their shape and withstand handling before tamping. In loading the holes one or two of these mud cartridges are tamped tightly down on the charge.

In my opinion these Kafir-made cartridges are better for the intended purpose than a cartridge wrapped in several layers of newspaper, as described in the Journal, as the very rigidity mentioned tends to destroy the purpose of the cartridge, which is to form an air-tight tamping for the charge. With the thin paraffin paper the cartridge after being placed in the hole, bursts under the pressure of the tamping stick and the mud is thus forced into every crack.

In connection with this similar practice in two such widely separated districts it would be interesting to know who is responsible for its introduction. I strongly suspect that the Cornish miners are responsible as there are many in both districts.

---

*Consulting engineer, 505 Park St., Honesdale, Penn.

Rope Capacity of Drums

The rule used by the A. Leschen & Sons Rope Co., for computing the rope capacity of any size of drum, is as follows: Add the depth of flange in inches to the diameter of the drum, and multiply this result by the out to out width of the drum. This product is then multiplied by the figure below corresponding to the size of the rope used:

1/4 in.	4.16	1 3/8 in.	0.138
3/8 in.	1.86	1 1/2 in.	0.116
7/16 in.	1.37	1 5/8 in.	0.099
1/2 in.	1.05	1 3/4 in.	0.085
9/16 in.	0.828	1 7/8 in.	0.074
5/8 in.	0.672	2 in.	0.066
3/4 in.	0.465	2 1/8 in.	0.058
7/8 in.	0.342	2 1/4 in.	0.052
1 in.	0.262	2 3/4 in.	0.046
1 1/8 in.	0.207	2 1/2 in.	0.042
1 1/4 in.	0.167		

This rule applies, of course, to a drum on which the rope is to be wound in successive layers up to the full height of the flange.

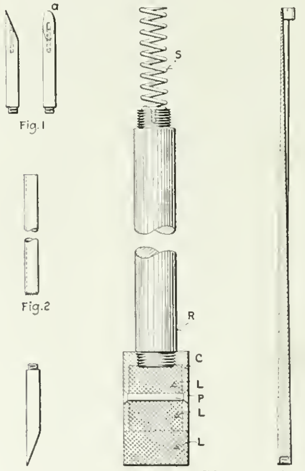
Two Cores from One Borehole*

By John I. Hoffmann†

Two deep boreholes were sunk a few years ago in South Africa, one by the Lace Proprietary Mines on the farm Vlakfontein, in the Heidelberg district of the Transvaal, and the other south of the Brakpan Mines property, on the portion of Witpoort No. 162, belonging to the South African Lands & Exploration Co. The idea of taking another core from the vein from the same borehole was conceived by Mr. Welldon, at one time foreman driller on the Apex borehole. Because the expense of drilling these deep boreholes and only getting one core was great, the proposed method was favorably received and was improved upon and carried out by A. Payne-Gallwey, of Johannesburg, so that another core could be taken in any desired direction by means of a deflecting wedge. This contrivance consists of a pilot wedge, a guide wedge and a main deflecting wedge, and the method of procedure is as follows:

In the case of a Sullivan "B" hole, 2 1/8 in. diameter, a pilot wedge, Fig. 1, is made of round iron, 2 in. in diameter and 18 in. long over all, the wedge face being 6 in. long. The end opposite the wedge face is threaded to fit a piece of 1 1/2-in., inside diameter, black pipe. A 3/4-in. hole is drilled in the face of the wedge and tapped, and a nick *a* is made with a chisel on the top of the wedge along its longitudinal axis. This nick is for surveying purposes, as will be explained later. This wedge is screwed into a piece of 1 1/2-in. piping about 3 ft. long, Fig. 2, the piping being toothed at the opposite end, to which this wedge is screwed. The borehole is then filled with water and the pilot wedge and piping are dropped down the hole, wedge face upward. The main rods are then lowered to find out whether the pilot wedge and pipe are resting on the bottom of the hole. If not, the wedge has to be lifted by means of the tapped hole referred to above and again dropped, until it is found that the wedge and pipe are resting on a solid bottom, or at any rate are fast and rigid somewhere near the bottom of the hole.

The position of the wedge is surveyed by the device shown in Fig. 4, which consists, for a "B" hole, of a brass rod *R*, about 1 1/8 in. diameter and 3 ft. long, threaded at both ends. To one end is fixed a spiral spring *S*, similar to that fixed at the bottom of the surveying instrument described in the Journal of May 18, 1912. To the other end a brass cup *C*, 2 in. in diameter, is screwed, in which a brass pin *P*, 1/4 in. in diameter, is riveted across the diameter of the cup. This cup is filled with lead, which projects 1 in. beyond the edge of the cup and which is turned to the same diameter, 2 in. The end of the rod with the spiral spring is screwed to the bottom of the instrument, in place of the bottom plug. The survey is made as follows:



Borehole Deflecting Wedges and Surveying Device

The relative position of the pin point on the gimbals to the guide inside the case of the instrument described in the Journal of May 18, 1912, being known, the position is marked on the outside of the case, and the line continued along the brass rod, cup and projecting lead. The top end of the instrument is screwed into a brass tube 10 ft. long and that again screwed to the end of the drill rods. The whole device is lowered in the hole until the lead is resting on the top of the wedge, which, with its chisel cut, makes an impression on the lead, a photograph of the magnetic needle being taken at the same time. On raising the rod, the disk of lead with the impression is sawed off and the direction of the wedge calculated.

The guide wedge, Fig. 3, is an exact counterpart of the pilot wedge, and the butt end of this is screwed into the butt end or bottom of the main deflecting wedge. The main deflecting wedge, Fig. 5, is made of a solid piece of 2-in. round steel 7 ft. long. The bottom end is drilled and tapped to receive the butt end of the guide wedge. The top end is drilled with a 1 3/4-in. bit to a depth of 2 in., thus leaving a ring of metal 1/8 in. thick. The solid portion of the 7-ft. steel is then planed, commencing from the under side of the metal ring down to about 1 ft. from the bottom, in such a manner that a wedge is formed with a concave face with a radius of 1 in., and having a thickness of 1/8 in. at the top and 2 in. at the bottom end.

For surveying purposes, a chisel cut is made in the top of the ring along its diameter coincident with the longitudinal center line of the wedge, as shown in Fig. 5. The direction of the face of the pilot wedge now being known from the survey, the guide wedge is screwed into the main deflecting wedge in such a way that when the faces of the pilot and guide wedges are together, the main deflecting wedge is facing in any predetermined direction.

The end of a "C" rod, 1 5/8 in. diameter, is now placed in the metal ring at the top of the main deflecting wedge and riveted thereto with two 1/4-in. copper rivets. To the other end of the "C" rod is attached a 10-ft. length of "B" rod, 1 7/8 in. diameter, on the top end of which is screwed a ball-bearing swivel, and the main drill rods are connected to the top of the swivel. The whole contrivance is then lowered in the hole, and, as soon as the point of the guide wedge touches the face of the pilot wedge, the swivel allows the guide wedge, and with it the deflecting wedge, to revolve until the faces of the guide and pilot wedges are coincident, the top one sliding on the bottom one until they jamb. If the weight of the rods is not sufficient to shear the rivets, hydraulic pressure is put on the piston of the drilling machine and the copper rivets sheared off, leaving the main deflecting wedge in position at the bottom of the hole. The main rod, together with the "C" rod, which was riveted to the top of the main deflecting wedge, are now withdrawn from the hole, and the direction of the main deflecting wedge is surveyed to ascertain if it is in the required position. If the position of the main deflecting wedge is correct, "C" rods with a "C" bit are now attached to the main rods, and these are lowered in the hole, entering the ring at the top of the main deflecting wedge, which acts as a guide. Drilling is commenced with the "C" bit and continuing along the face of the main deflecting wedge, the bit is thrown over into solid rock.

---

*Excerpt from a paper entitled "Recent Practice in Diamond Drilling and Borehole Surveying." Bull. 91, I. M. M.

†Mining engineer, 216 Moorgate Station Chambers, London, England.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Stationary Dewatering Screen

By Claude T. Rice

Four stationary screens inclined at an angle slightly greater than the angle of repose of the material are used in the Leadwood mill of the St. Joseph Lead Co., in the Flat River district of Missouri, for dewatering the tailing from Hancock jigs before it is discharged upon a conveyor belt.

Each screen is 24 in. wide by 28½ in. long and is held in place in a stationary frame by 1-in. cleats on each side. Across the lower end and on the upper surface of the screen a cleat is nailed that holds a thin layer of tailing on the screen's surface, which layer protects the wire cloth from excessive wear. The capacity of each screen is about 875 tons per 24 hr. Tyler No. 58 woven-wire, or No. 18 cold-rolled, hand-punched, staggered long-slot, steel screens are used. The slots of the latter are 0.058 in. wide by $\frac{15}{32}$ in. long. The wire screens cost $1.94 each, last 14 days and screen 12,250 tons of tailing, while the punched screens cost $1.65 each, last 20 days and screen 17,500 tons.

The screen may be set at an angle as low as 26° and the tailing will move over it. The observation has been made that these screens, if movably supported and given a slight jerking motion in a forward direction by an eccentric, could be set at a much lower angle, and the capacity and possibly the life be increased at a nominal expense for the power required. Shaking screens of this type have been used successfully in other mining districts, but only for sizing dry ore. When used for dewatering thin pulp the motion should prevent blinding.

The efficiency of a Frenier sand pump decreases rapidly as the height of the discharge pipe is increased. When two or more pumps are to be used in series, one dischaging into the other next above, the height of discharge pipe for the upper pumps should be slightly less than that of the lowest, then there will be little possibility of stoppage by the lowest pump supplying more material than the others can lift.

Steel Tray and Support for Hancock Jigs

A steel tray and steel support are used in the Hancock jigs in the No. 3 mill of the Doe Run Lead Co., near Rivermine in the Flat River district of southeastern Missouri. The steel supports are shown in detail in Fig. 1, and are said to be preferable to wooden supports.

The steel tray that carries the jig screens is shown in detail in Figs. 1 and 2. The screening surface of a steel tray is 4-in. longer and wider than the surface of a wooden tray. To the sides of the tray auxiliary angle irons are riveted to which the hangers are attached, for it has been found that if the hangers are attached directly to the tray and no angle irons are used, the sides of the frame may be distorted when the connecting bolts are drawn tight. The auxiliary angles are separated from the upper angle iron of the frame by using spreaders of 1-in. pipe over the hanger bolts.

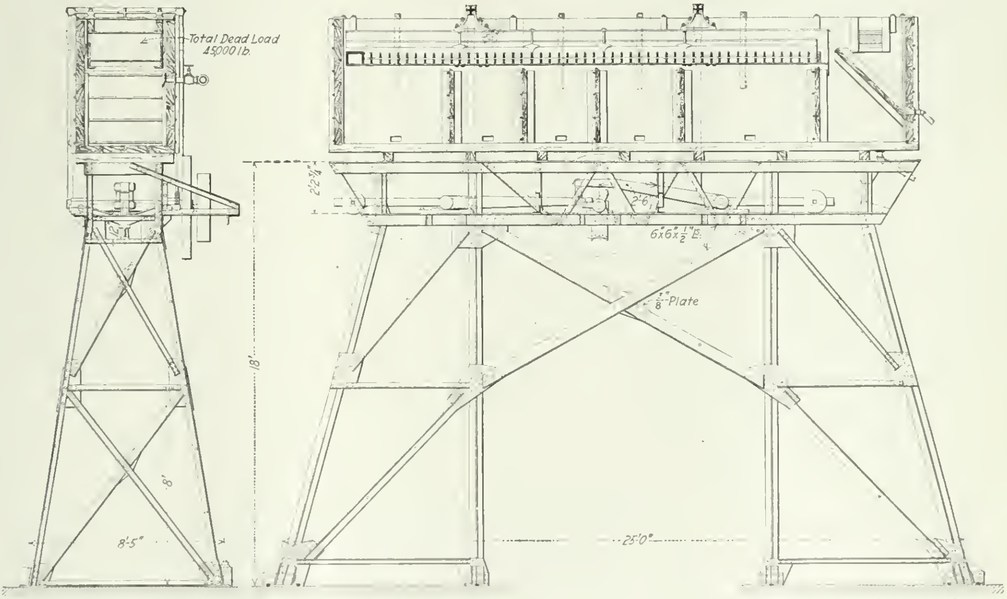
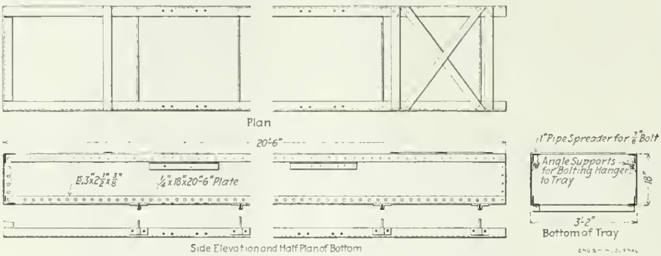


Fig. 1. Hancock Jig and Steel Support Used in Doe Run No. 3 Mill, Southeastern Missouri

The steel frame of the tray is tied together by cross braces at the top, but no braces are required at the bottom because the slats that are used on the top of the screens to prevent the bed from creeping and to reinforce the screen against vibration, affords all the bracing necessary. The screens are tacked to wooden frames which are made in 5-ft. sections as shown in Fig. 3, each consisting of two end pieces of 2x3-in. oak. The end pieces are notched at 5-in. intervals to take the 1x3-in. oak cross slats, which are put in with the greater dimension vertical. These frames, are supported in the bottom of the tray by the lower longitudinal angle iron.


Plan
20'-6"
L3x2½x⅜"
¼"x18"x20'-6" Plate
1" Pipe Spreader for ⅞" Bolt
Angle Supports for Bolting Hanger to Tray
18"
3'-2"
Bottom of Tray
Side Elevation and Half Plan of Bottom
ENG & MIN. JOURNAL

STEEL TRAY FOR HANCOCK JIGS

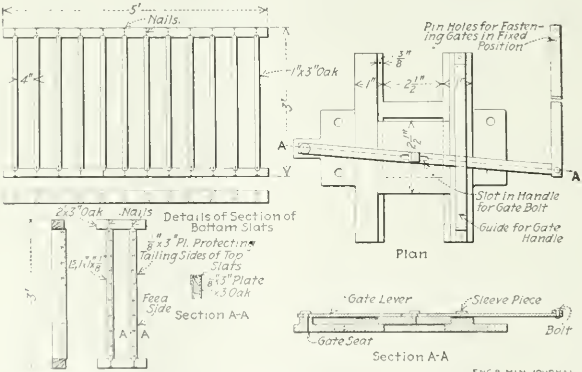


Fig. 3
Details of Section of Top Slats

Fig. 4
Details of Hutch Gate

SLATS AND HUTCH GATE USED IN HANCOCK JIGS OF THE DOE RUN MILL

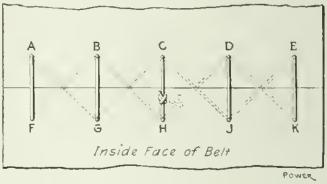
The top slats which rest upon the tops of the screens and prevent the bedding or "ragging" from creeping are made of oak in sections of two slats as shown in Fig. 3, the greater dimension of which is, vertical as is the case with the lower slats. The end pieces of each section extend out beyond the sides of the slats for two inches or half the width of the opening between slats. The slats are protected from wear from the rubbing of the ragging and the movement of the pulp by a piece of iron plate ¼-in. thick that is screwed to the back side of the slat and by a 1x1x⅛-in. angle iron on the top and front side. The sections of slats are held in place by keyboards or pieces of 2-in. pine 8-in. high that are placed on top of the slats at the ends and parallel with the long side of the tray. The keyboards are wedged into place by a series of double wedges about 10-in. long sawed from 2-in. pine boards; the wedges being used between the top of the keyboard and the bottom of the upper angle of the tray. This system of keying facilitates removal of the upper slats when screens have to be changed.

The type of gate used to control the discharge of middlings and concentrates from the hutches of the jigs used in the Doe Run and St. Joseph mills is shown in Fig. 4. These jigs are operated with constant discharge of middlings through the partly opened hutch gate.

The Hancock jig is usually supplied with clean feed water that enters at the hutches and flows upward thus introducing the classifying power of a stream of water as a factor in jigging. This upward flowing stream has the effect of partly offsetting or neutralizing the strength of the suction. The supply of feed water is automatically controlled at the Leadwood mill of the St. Joseph Lead Co., by a float in the tailing discharge compartment which acts upon a butterfly valve in the feed-water pipe.

Lacing Belts with Wire

To lace a belt with wire so that the joint will not produce a tendency to throw the end of belt out of line, particularly when subjected to sudden stress, use a piece of lacing wire the length of which is about ten times the width of the belt, and find the middle point of the wire. With the end of the belt squared and the holes marked, begin by drawing the wire up through *C*, as shown in the accompanying illustration, and down through *H*, pulling the wire until the middle point is between *C* and *H*; then carry the end of the upper section of the wire up through *G*, down *B*, up *F*, down *A*, up *F* again, down *A* again, up *G*, down *B* and up *H*. This will complete half of the joint. With the other end follow the same plan in holes *D*, *E*, *J* and *K*, thus completing the operation. The two ends will now be at holes *C* and *H* of the outside face of the belt. They should be twisted together and pounded into the leather with the rest of the lacing.



SHOWING METHOD OF LACING A BELT WITH WIRE

To those who have never made a wire joint, states W. J. Hawley in *Power*, I would say that after the ends of the belt are squared, a line should be drawn parallel to the end edge and about 1/16 in. more than the thickness of the belt back from the edge. Such a line would join *A* and *E* of the illustration. The holes should be marked off on the line with a pencil; the ends of the wire may be filed to a point to facilitate their entrance into the hole. It is better to make the holes as they are needed rather than make all of them before starting because the holes will close up some as the belt is handled, thus making it difficult to push the ends of the wire through the holes.

An awl for punching holes may be made by taking a 4-in. piece of round steel wire tempered and ground to a point and inserting it in a handle. A wire-faced joint can be made quickly and when made properly it will run as smoothly over the pulleys as any other part of the belt.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Carnotite in Pennsylvania

Carnotite has been discovered by Edgar T. Wherry near Mauch Chunk, Carbon County, Penn. (*Am. Journ. of Sci.*, June, 1912. He summarizes his conclusions about it thus:

The material agrees in composition with material from Colorado and South Australia, and these agree among themselves better than has usually been supposed, hence carnotite is entitled to be classed as a distinct mineral species, with the formula $(Ca,K_2)\ (UO_2)_2\ (VO_4)_2$, belonging to the uranite group.

The vanadium and probably the uranium also have been extracted by circulating surface waters from black shales, which have been formed in the midst of conglomerates by mechanical concentration of dark minerals from the crystalline rocks to the south and east, following the change from arid to moist climatic conditions at the beginning of Pennsylvanian time. As the Colorado deposits occur in a similar position, their origin may have been the same, and it is suggested that the frequent association of these elements with coal may also be connected with such a climatic change.

Prevention of Mine Explosions

A novel idea for the prevention of mine explosions was advanced by Dr. John Harger, at a meeting of the Manchester Geological and Mining Society, Feb. 27, 1912. He stated that apparently the worst explosions occurred in the best ventilated coal mines, so that he had been led to believe that there could be such a thing as over-ventilation. By experiment, he had shown that methane would not burn in an atmosphere containing only 17½% of oxygen. At this figure acetylene lights still burn, while a man has no difficulty in respiring. This last postulate he claimed could immediately be seen to be true for sea-level elevations, because air at that altitude containing 17½% of oxygen would still contain as great a weight of oxygen per cubic foot as would free air at 5000-ft. elevation containing 21% of oxygen. Consequently he deduces that if the percentage of oxygen in the air could be artificially reduced to about 17½%, danger of explosions would immediately disappear.

However, his proposal that this lowering of the oxygen content of the atmosphere should be brought about by diverting combustion products down the shaft, does not sound practical, owing to danger from carbon monoxide.

Platinum and Gold in the Urals

The decrease from 260,760 to 250,240 oz. in the gold production of the Urals from 1910 to 1911 is attributed by E. de Hautpick (*Min. Journ.*, May 25, 1912), to the proposed state platinum monopoly, the fear of which produced an increased activity in the platinum industry, in order to export the metal promptly. This took away the gold miners in the busiest season, and completely stopped gold production. With the high price of platinum, the free workman could do much better with a poor platinum yield, than with a good gold yield.

Five of the 11 gold-mining districts in the Urals slightly increased their production, five showed small decreases, while in the Miassk district a decline from 82,763 oz. to 72,548 oz. took place, a falling off almost exactly equal to the entire decline in the Ural fields.

Cyanide Poisoning of Cattle

In a communication to the Mexican Institute of Mines and Metallurgy, Samuel J. Lewis, consulting engineer of the Amparo Mining Co., reviews the danger of stock poisoning by cyanide discharge. When the Los Jiminez mill was first started, it discharged from 40 to 50 tons of unfiltered slime per day. After two months' working, poisoning of cattle took place below the mill. When the tailings were impounded and allowed to go down the stream during the rainy season, poisoning took place as much as 14 km. from the mill. Discharging in this way during the rainy season, the creek itself seemed safe, but pools were invariably formed which resulted in poisoning some cattle. During eight months of storage, no decomposition of cyanide took place in the impounded slime.

The treatment of the residues with sulphate of iron seems impractical except in a limited degree. In the first place, the lime must be exactly neutralized with sulphuric acid; otherwise, the ferrous sulphate added is acted upon by the lime, forming ferrous hydrate and calcium sulphate, and although this ferrous hydrate will precipitate potassium cyanide as potassium ferrocyanide, when freshly precipitated it rapidly absorbs oxygen, forming ferric hydrate. Consequently, much of it is lost.

Moreover, the reaction between the potassium cyanide and ferrous sulphate does not take place unless the exact proportions of the chemicals are present. When the cyanide solutions can be exposed to the sun and air, which, of course, is not the case with that solution held entrained in the slime, the potassium cyanide is completely decomposed, and it is also decomposed by heat. In regard to this, it is stated that dogs eating poisoned animals died of the poison, whereas poisoned cattle were immediately cooked for eating by the laborers in the vicinity with no ill effects observable, which seems to indicate that the heat breaks up the cyanide. In this particular mill, filtration and storage of the slime is to be the future treatment, but it is expected, in case the filters cannot be worked, to neutralize partially with sulphate of iron and then conduct the solutions over a series of launders of good width with sufficient fall between them to allow of some aëration, finally allowing the treated solution to flow over level ground where the effect of the sun will be at a maximum. It has been found that 0.008% potassium-cyanide solution will kill cattle.

Determination of Oxygen in Copper

The determination of oxygen in copper, as ordinarily performed, is an inexact process, consisting only of reducing the filings in hydrogen. This results in driving off a certain amount of occluded gas and moisture with the oxygen, producing a plus error, if the determination be made by differential weighing of the drillings. There is, in addition, a minus error, due to absorption and retention of hydrogen by the copper drillings. The original occluded gases can be driven out of the copper by heating in carbon dioxide, as can also the hydrogen retained after driving off the oxygen (George L. Heath, *Journ. Ind. and Eng. Chem.*, June, 1912).

It is recommended that carbon dioxide for analytical purposes be generated by Bradley & Hale's method (sodium-bicarbonate paste), rather than with marble, and a most complicated purifying train is advised, consisting of: (1) Saturated, neutral $KMnO_4$; (2) glass-stoppered U-tube, sealed at the bottom with silver sulphate; (3) a Bowen's potash bulb, filled with strong sulphuric acid, followed by a short tube of anhydrous calcium chloride; (4) a tube of dry chromous chloride; (5) a tube of stick phosphorus; (6) two tubes of phosphorus pentoxide; (7) short tube of dry calcium chloride. The expensive chromous chloride can be regenerated by passing pure hydrogen through it as long as HCl or H_2O is given off.

The purifying train for hydrogen is scarcely less complicated. The one recommended is: (1) A bulb carrying 10% KOH, saturated with $KMnO_4$; (2) a Bowen's bulb, carrying concentrated sulphuric acid; (3) a palladium-asbestos tube, heated by an alcohol lamp, after the air is expelled; (4) an Allihn 250-c.c. washing bottle, containing 100 c.c. of water, 100 grams KOH (alcohol free), and 5 to 10 grams pyrogallic acid; (5) two tubes of dry calcium chloride.

The ignition is conducted in a hard-glass tube about 30 cm. long and 6 mm. in diameter, with one long or two round bulbs in the center. About a 50-gram sample is introduced into this. To determine absorbed gases, pass carbon dioxide through the system for 30 min., to sweep out the air, then light the burner and keep at full red heat for 20 min., cool, and wash out with air.

For total oxygen and sulphur, pass in hydrogen for 15 min., then keep at a red heat for one or two hours, dependent on whether the sample is filings or drillings. Pass the exhaust gases through a U-tube containing 10 c.c. of a solution of ammoniacal cadmium chloride (20 grams per liter), to absorb the sulphur.

Then by means of a three-way cock turn in carbon dioxide again, and pass for 20 min., to drive out the occluded hydrogen, cool the tube with an air blast until the copper is only slightly warm, and replace the CO_2 with air before weighing. The cadmium solution is titrated with standard iodine (2 grams per liter) after dilution and addition of hydrochloric acid.

Concentration of Carnotite

It is claimed by Siegfried Fischer (*Met. and Chem. Eng.*, June, 1912) that carnotite occurs only as a coating on other minerals. As a consequence, if these minerals can be ground with abrasion, the carnotite can then be floated off as a slime, obtaining in this way a concentration of about 3:1. A flow sheet of a mill operating along these lines is given. The ore first goes through three sets of rolls in series, after which the ground material enters a Dorr classifier. It is stated that the metal shoes which convey the tailings out of the classifier serve to abrade the ore sufficiently, while the movement of the rabbles is sufficient to suspend the valuable mineral. The overflow then enters a Dorr slime thickener, where the slime settles, and is freed from part of its water content. From the thickener it goes to a dryer and is then ready for shipment. [While the description is given as though the process were in actual operation, there is nothing else to show that it is more than a process in the laboratory stage.—EDITOR.]

Siberian Tin

A group of German capitalists of Berlin and Hamburg, with the coöperation of the St. Petersburg International Bank, has formed a company for the exploitation of tin mines in the Neichinsk district of Transbaikalia, 3½ miles from Olovyanka, on the Transbaikal Ry., says the *Mining Journal*, May 25, 1912. Tin ore has been known to exist here since 1811. Recently investigations were made, and it was seen that the veins are of considerable extent and of great number. They do not pinch out, and their content is 1 to 2%. In the neighborhood of the Pervonachalny placer there are sandy strata with stanniferous ore 2/3 to 2½ ft. thick. In this district there are also the known Kulundinsky, Sharanaisky, and Zavitinsky tin placers. The Transbaikal Tin Smelting Works will be the pioneer of the tin industry in Russia, which imports all it requires of this metal. This year the importation will amount to £1,000,000 sterling.

Defective Concrete Sands

In a symposium in *Engineering News*, May 20, 1912, attention is called to the fact that often concretes mixed with certain sands have only one-third or less the strength which they should show. This seems to be due to some modification of the grains of sand due to tannic acid, or to some form of albuminoid ammonia, apparently through these substances existing in a colloidal solution which coats the particles of the sand. The fact that such sands exist is a reason why a seven-day test should be made with any sand which it is intended to use for concrete. Furthermore, the mere fact that a sand gives a concrete of no strength with one kind of cement is not proof positive that it will not give good results with another, so the cement used in the seven-day tests should be those which it is purposed to use in the actual work, while if a sand gives poor results with any given cement it should be tried with another.

Disintegration of Cinder Concrete

The use of cinders as the aggregate for concrete is a common practice. According to George Borrowman (*Journ. Ind. and Eng. Chem.*, June, 1912), there is an element of danger here, for if the cinders contain unoxidized sulphur, the coke contained in the cinders will carry enough air to oxidize it, setting up internal stress, and often producing cracks and general disintegration. Tests on cinders which produced disintegrating concretes showed that after they had been completely oxidized by the weather, there was no further trouble.

Oxygen Additions to Iron Furnace Blast

According to a report by Dr. F. W. Lührmann to the blast-furnace committee of the Verein Deutscher Eisenhüttenleute (*Iron and Coal Trades Review*, May 24, 1912), the managers of furnaces in Mülheim-Ruhr, in Ougrée, and in Kratzwieck are using small oxygen additions in the blast whenever the furnace is working cold. The oxygen is added in the form of "Linde air" (50% O, 50% N), a liquid-air product.

An installation to furnish 17,500 cu.ft. of oxygen per hour occupies a space about 125 ft. square, requires about 800 hp. to operate it, and costs about $100,000. Doctor Luhrmann finds that for each per cent. of oxygen added, there is a theoretical rise of 100° F. in blast-furnace temperature.

The manufacturers interested state that 1% of oxygen on a 240-ton furnace, costs about 50c. per ton of pig. If this cost be correct, the process is worth investigating for an emergency reserve.

Desulphurizing Zinc Sulphate

A new process for desulphurizing zinc sulphate (Fr. pat. 432,556) is that of Hermann Pape, who heats zinc sulphate in an intimate mixture with zinc oxide, thereby expelling the sulphur as sulphurous acid. The most advantageous method is stated to be that of mixing a saturated solution of zinc sulphate to the finely pulverized zinc oxide to make a paste, drying and heating to such temperatures that the zinc sulphate is decomposed. The mixture of sulphurous acid and oxygen should be used for the manufacture of sulphuric acid.

Clark Placer Mining Apparatus

In the Clark placer-mining apparatus (U. S. pat. No. 1,011,321) the gravel is delivered into a riffle-bottomed trough, through which it is moved by conveyor paddles. The gravel is washed in water which stands in the trough, and is finally propelled up an incline, where it drains. The entire apparatus can be readily moved from place to place, as neighboring gravel becomes exhausted. The idea is to treat gravel in dry regions with a minimum amount of water.

The Sublevel Stoping Method

By F. W. Sperr*

This name is suggested as best suited to a method that has been known by various other names for 10 years. Many small deposits can be mined advantageously by this method. Among the important features are a large number of funnel-topped raises and the employment of the caving principle. The method is in use on the Michigan iron ranges.

The method of mining known as the sublevel stoping method has been in use for at least 10 years, and is still in use now in a number of mines, but has not yet been given a distinguishing name that seems to be satisfactory. It is locally designated as "subbing," but other methods are known by the same name.

NOMENCLATURE

The first reference to the method for publication was made at the meeting of the Lake Superior Mining Institute, in 1910, by P. S. Williams, in his paper on "Underground Methods of Mining Used on the Gogebic Range." He did not attempt to name the method, but referred to it as a combination of underhand and back stoping. But it also involves drift stoping in the development of the benches at the ends of the subdrifts. In the discussion of the paper, the term substoping was suggested. This term was accepted by Fred C. Roberts in a fuller description of the method presented to the meeting of the Lake Superior Mining Institute in 1911. Objection has been made to this term also, because it is already applied to a different method and is not completely descriptive.

Other terms have been suggested and objections offered as follows: (1) Sublevel back stoping; this is incompletely descriptive, because underhand and drift stoping are also involved. (2) Back stoping by breaking downward from sublevels; same objection as the preceding, besides being too cumbersome. (3) Bench stoping; this would suggest underhand stoping to mining men unfamiliar with the other method. (4) Sublevel bench stoping; same objection as the preceding, beside being more confusing. Perhaps a better term than any of the foregoing would be "sublevel stoping." While it is true that sublevel stoping is sometimes applied to a method which involves caving, the latter is more generally and consistently called sublevel caving. No great violence would be done to custom and practice if the name, sublevel stoping, were applied only to the method of mining by means of sublevels without caving, and sublevel caving to the method of mining by means of sublevels and caving. However, a better term will be welcome if one shall be offered.

SUITABLE FOR SMALL DEPOSITS

In iron-ore mines, many of the smaller deposits, often called pockets, and the narrow ends of large lenses of ore, can be mined advantageously by this method, if the physical characteristics of the ore and of the inclosing walls are right. The ore may be from 12 to 100 ft. wide. It should not be so hard as to make the cost of driving the sublevels excessive. It should be sufficiently tough so that the back will stand fairly well after being trimmed, and so that the benches will not break down of their own weakness. The inclosing walls should be rather strong, so as to permit the stopes to be of rather large dimensions. The foot wall should dip at a sufficiently high angle to permit the broken ore to run off to the chutes. The method is applicable to a great variety of conditions within the limitations specified above, making it necessary to work out the details in a variety of ways. The general method and a few details are described below.

HAULAGE LEVELS 100 FT. APART

A haulage main level is laid out at every 100 to 150 ft., in vertical depth, on the orebody. On this level a main drift is carried lengthwise through the ore. From this drift, crosscuts are driven to determine the width of the ore. The crosscuts are so spaced that the chutes for drawing the ore from the stopes into the tram cars, may be put in from 20 to 30 ft. apart from center to center. The chute raises are driven up a distance of about 25 ft. above the floor of the level. If the ore is not more than 25 to 40 ft. wide, the chutes may be put in on the sides of the main drift, staggered from side to side.

From the end of the level, the ore in going upward usually trends forward or backward; seldom has it a vertical end. In any case, the end raise is carried up along the end of the ore to the top, or to the level above. If the ore extends forward, as shown in Fig. 2, the triangular block *ABC* is stoped underhand ("beaten down") into the inclined raise and drawn off through the end chute. This operation must precede the regular method in order to avoid the loss of a large quantity of ore which would hang up beyond the line *AD*, broken ore standing with a nearly vertical side in a stope, if the other three sides are supported. While the block *ABC* is being mined out, the ladderway and the sublevels 1, 2 and 3 are put in. If the ore extends backward, as shown in Fig. 3, the sublevels are started from the end raise as well as from the ladderway.

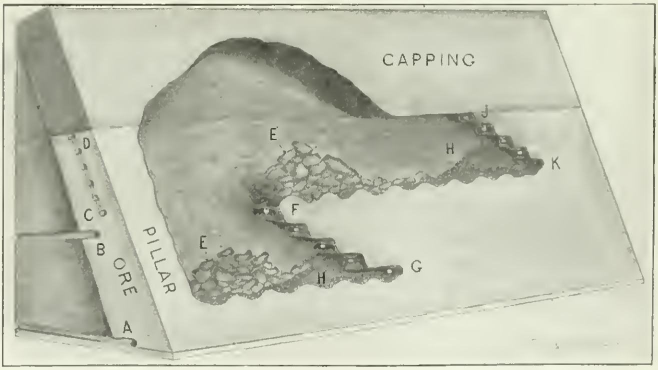


FIG. 1. PERSPECTIVE VIEW, HANGING WALL REMOVED

SUBLEVELS ABOUT 25 FT. APART

The best practicable distance between sublevels is about 25 ft. from floor to floor. The first will be driven to cut off the tops of the chute raises, and the others will be driven above this, as shown in the figures. If the ore is not more than 40 ft. wide, the substopes can be worked with single drifts through the middle of the ore. In such cases the first subdrift is widened out from wall to wall, beginning at the end and working toward the ladderway. Down holes are drilled around the tops of the raises and upper holes are drilled in the back. The down holes are blasted first, giving a funnel shape to the tops of the raises. Then the upper holes are blasted, breaking down 8 or 10 ft. of the back for the whole width of the ore and for 12 ft. lengthwise at each round. The broken ore falls into the funneled raises and is drawn off through the chutes on the main level.

---

*Professor of Civil and Mining Engineering, Michigan College of Mines, Houghton, Mich.

After the bottom substope has been drawn back 20 to 30 ft., the next one above receives a cut back. About 12 ft. of the end of the drift are widened out from wall to wall, by means of side holes started from the subdrift. This forms a bench over the stope below, and the drill is set up along this bench. From each position of the drill, down holes are put in for the purpose of blasting off the bench, and upper holes are drilled for the purpose of breaking down 8 or 10 ft. of the back; this is shown in Fig. 4. In like manner, one after another of the higher substopes is started, for any number, to the top of the ore, or to the level above. Each main level in turn forms the top sublevel of the series. The substopes are drawn back uniformly, each 20 to 30 ft. in advance of the one above. By the time the ladderway is cut out, the subdrifts to a new ladderway farther back must be ready for use.

Vertical and Horizontal Pillars

Where a long stretch of ground is to be mined out in this way, it may be necessary to leave pillars at certain intervals, to divide the excavation into vertical panels. The height of the panels may be limited again by horizontal pillars. In one instance, such panels have been laid out 250 ft. long and several hundred feet high. In this instance, it is designed to fill the upper panels from surface, and then to mine out the vertical pillars by topslicing the ore and caving the filling material. Each lower panel will be filled from the one next higher, through winzes in the horizontal pillar. Then the horizontal pillar and the next set of vertical pillars may be mined out by topslicing or subslicing (sublevel caving) methods.

In Fig. 1, the accompanying perspective view, in which the hanging wall is omitted, is shown an excavation made by the sublevel stoping method, leaving a vertical pillar opposite the shaft. The crosscuts from *A* and *B* lead to the shaft, which is back in the foot wall. The upper haulage level was driven from *B* to *F* and beyond, as far as the ore went. There is a ladderway from *C* to *D*, in the pillar from which the subdrifts of the upper level were started. In this case the stopes were started at the pillar and worked away from it. The ladderway in the pillar serves no purpose after the stoping begins, until the extraction of the pillar takes place. The tops of the funneled raises of the upper main level are shown from *F* to *K*. Presumably the end of the ore is along the face from *J* to *K*. The broken ore at *E* and *H* will fall into the raises of the second level, unless there is another shaft to the right to which tramming may be continued after the end of the first level has been cut off by the stope from below.

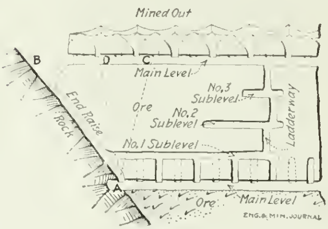


Fig. 2. Ore Extending Forward

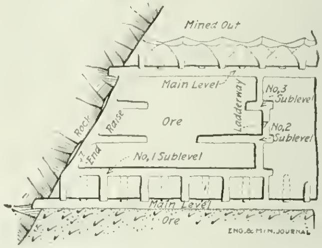


Fig. 3. Ore Extending Back

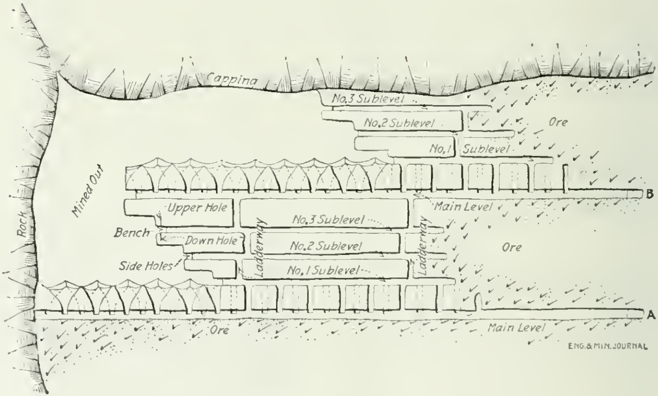


Fig. 4. Side View from Plane through Main Level

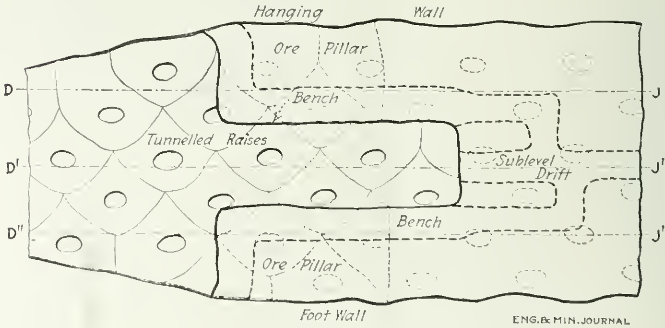


Fig. 5 Top View along Line of Dip

When the Ore Is 50 to 100 Ft. Wide

Where the ore is from 50 to 100 ft. wide, a narrow stope of about one-third of the width of the ore is drawn back through the middle, leaving a pillar of ore standing on each side; this is illustrated in the perspective view. After this stope has been advanced from 60 to 100 ft., more or less according to circumstances, crosscuts are driven on the sublevels, a certain short distance from the end of the stope. From these crosscuts, subdrifts are extended to the end of the midstope and from there on continued as benches in the sides of the pillars of ore left standing against the walls. When the benches reach the end of the pillar, they are carried across the pillar to the wall. Then the pillar is mined out by means of down and upper holes from the cross benches, each lower substope being kept in advance a safe distance beyond the one next higher. Side views on vertical planes through the lines *DJ* and *D'J'* would appear somewhat similar to Figs. 4 and 1. A side view on a vertical plane through the line *D'J'* would show the midstope worked back to a vertical face.

Orebodies suitable for mining by this method are as yet more generally mined by back stoping on broken ore or by stoping on square-set timbers. In the ordinary backstopes, the miners are more exposed to danger from falls of rock than they are in the sublevels. In the operation of shrinkage backstopes, there is also danger from the development of caves and rushes, into which the miners may be drawn. Mining on square sets is expensive in the use of timber.

Henry Johns, an Early American Copper Refiner

By Benjamin S. Johns*

Henry Johns, my father, came to the United States from Swansea, Wales, his birthplace, in 1846, in his twenty-first year, under contract to work at the Baltimore Copper Works, his brother-in-law, David D. Davis, being superintendent of refining there at that time. While he was employed at Baltimore, some Lake Superior copper ore, a few tons, was treated, but not according to my father's views as to the correct method of treating such ore.

The next year, 1847, he left Baltimore and went to Pittsburgh, going to work at first in the iron mills. There were rumors at that time that a copper works was to be started at Pittsburgh, and shortly after his arrival, my father heard that Dr. C. G. Hussey was interested in the movement and called to see him upon the subject. After several interviews as to the manner in which the Lake ores should be treated, Doctor Hussey concluded to make a trial of it, and an agreement was reached, by which my father and his oldest brother, William Johns, who had also come from Baltimore, were to build a furnace and take out a charge of refined copper before they would receive any compensation therefor, all materials to be furnished by the firm, which was known as the Pittsburgh & Boston Mining Co. Although neither of the brothers was a bricklayer, they managed to build the furnace and a stack 45 ft. high without any help except the building of the foundation of the stack—bricklayers being scarce at that time—doing all the blacksmithing also, and so well was the work done, that the stack remained for 50 years, though many times during that period the waters of the Monongahela surrounded it during freshets.

The first charge of refined copper was taken out on a Saturday in July, 1847, only one operation being necessary, the charge of ore being placed in the furnace during the afternoon, melted down during the night, all the dross removed by morning and the charge of metal refined before taking the metal out of the furnace. This was the first successful smelting of Lake Superior copper ore, and the method has never been improved upon since.

Handling Large Masses of Copper

Great difficulty was experienced in handling the large masses of "mineral," some of which weighed as much as 10 tons. All sorts of plans were devised by other men, one of which was to hang the mass in the cupola by means of a heavy iron chain and use blast to smelt it. Of course, as soon as the chain became heated it broke, and the mass of copper fell and clogged the cupola. Another plan tried was to tear down part of the side of the refining furnace and roll the mass in on the bottom. This plan invariably would destroy the bottom of the furnace. Sometimes the mass would be so long as to extend some distance outside the furnace, and when the part inside melted, the outside piece would fall to the floor, and then it would be necessary to go through with the operation at another time with the piece remaining. This method was almost as bad as the one with the chain, inasmuch as the bottom or hearth of a copper-refining furnace is a most important and costly part of the furnace, and once broken, cannot be repaired satisfactorily. These are only two of the experiments tried. How many others were made it is hard to tell.

To overcome this difficulty, my father devised a plan, which, while simple and efficient, was prophesied to be doomed to failure by many expert furnace builders. The plan, briefly, was to build a large door in the roof of the furnace, having a movable cover, then by means of a large crane to lift up the heavy masses and lower them through the roof door down on to the hearth. In this manner, it was possible to place the heaviest mass in the furnace without injury to the hearth. The size of the roof door had to be so large, at least 5x6 ft., that the critics said it would be impossible for the roof to stand, but by an ingenious arrangement of braces and arches, the feat was accomplished, and thereafter little difficulty was experienced in handling large masses.

From the time of this first successful building and operation of a furnace for refining Lake ores, the method of handling and refining has been the same, only slight changes in the manner of taking out the refined metal having been made.

The Present Form of Recessed Ingot Devised by Mr. Johns

A great part of the refined product of Lake copper was cast into the form of short ingots with a square section for use in making brass, which was the form of ingots in general use at that time. Before Lake copper came into use, it was an easy matter to break these ingots by simply supporting one end of the ingot about an inch or more above the other end and striking a heavy blow with a sledge hammer. The copper not being tough, was readily broken. But when the Lake copper was cast into the same shaped ingots, it was found to be utterly impossible to break the ingots in this manner, as refined Lake copper will bend double without any sign of breaking. In order to offset this toughness, a form of ingot having grooved recesses in the bottom was devised and used by my father, and soon came into universal use.

It should be remarked here that William Johns, the elder brother, was given the preference as to position by Henry Johns' desire, for although Henry had every claim for first consideration, he waived this in favor of William, who was made head refiner, though it was mutually understood between them that the authority was divided. William Johns was one of the best refiners of his time, and but for an unfortunate fall into the river during the cold weather while recovering from an illness, resulting in his death within a few hours, he would certainly have made his mark in the world, as he was a man of powerful physique and possessed excellent judgment. He, in connection with the younger brother Henry, should receive credit for the first successful refining of Lake ores in one operation, and also in the improvements above noted.

Dr. C. G. Hussey, as promoter and holding largest interest in the company for which the Johns brothers worked, has, in several instances, been given the credit for originating these improvements and ideas in the manufacture or rather refining of Lake copper. He should be given due credit for recognizing their practical value and for encouraging their use, but not for originating them, as he was not an expert on furnace building or on practical work of refining copper, but confided implicitly in the Johns brothers in all such matters.

After the death of William Johns, his brother became the superintendent of refining, and held that position with the parent company and its successors for a period of over 52 years.

Representative Mondell of Wyoming, has offered a bill providing that lands containing phosphate deposits shall be subject to entry only under the placer-mining laws.

---

*Pittsburgh, Penn.

Transvaal Mining Notes

JOHANNESBURG CORRESPONDENCE

The declared gold output for March on the Rand was a record one due to the inclusion of 126,875 oz. of gold from reserve stocks. The mines controlled by the Corner House alone declared about 60,000 oz. These declarations were due to several of the groups, in deference to wishes expressed by European shareholders, having decided to abandon the practice of keeping reserves to equalize monthly outputs. Several groups still maintain the practice and as the groups which have abandoned it were in the habit of publishing the amount of reserve gold, there seems little reason for giving up the practice. As a matter of fact, if it is considered necessary to equalize monthly yields, it can be managed easily enough by slightly varying dates of cleanup and increasing or decreasing the severity of the cleanup in battery or cyanide departments.

The Way-Arbuckle plant at the Benoni mine has given such trouble that the mine is now closed down awaiting the provision of further capital and Mr. Bosqui's report. Provisional arrangements have been made for a scheme of amalgamation with the neighboring Apex gold mine which has so far developed ore of a higher grade than the Benoni.

The ore reserves of the mines of the Rand amount to between 80,000,000 and 100,000,000 tons. Recently I wrote that it appeared probable that the Witwatersrand had attained its maximum profit-earning capacity, but a closer study of recent annual reports convinces me that many of the larger mines are in a position (given an adequate supply of labor) to increase largely their outputs and profits and it will probably be three or more years before the field will suffer a serious setback owing to the exhaustion of well known outcrop producers.

In view of rumors that the development in extreme depth, 4500 vertical feet, in the Cinderella Consolidated mine was unsatisfactory, the remarks of the chairman at the annual meeting are encouraging. He stated that development at all levels disclosed ore of the average grade of the mine, 27s. 6d. per ton, and that during the year (despite labor shortage) the ore reserves had been increased to 740,000 tons fully developed ore of 6.73 dwt., with 190,000 partially exposed. During the first quarter of this year 141,000 tons were developed against 49,000 milled. At the end of the year the manager hopes to have 1,500,000 tons in reserve.

The February returns from the alluvial diamond fields in the neighborhood of Bloemhoff in southwestern Transvaal show 7000 carats won, valued at £32,800. The March return was 7760 carats valued at £36,700, the largest diamond won was 129½ carats, valued at £1050. These sums represent the earnings of several thousand diggers and success comes only to a small proportion of the workers.

Ore Separation by Decrepitation

By HENRY E. WOOD*

An examination of the various authorities on ore dressing discloses that the application of decrepitation is suggested only as of possible assistance in the crushing of ore, as such action renders it more friable and consequently requires less power. I recall the receipt two years ago of a shipment of several tons of massive corundum ore from Argentina. With great difficulty small portions of it could be broken with a hammer, but after a few blows the hammer was ruined. Samples were given to machinery companies to test their drills, but all had to abandon it as being practically undrillable.

It could not be placed in any of our crushers or mills without ruining them in a few minutes. As a last resort several stoves were fired up and then filled with the ore. After heating the ore it was suddenly plunged into water. This rendered it so friable that the entire lot was easily ground to 30 mesh and successfully concentrated, and without injury to the corundum. This in my opinion should not be classed as a decrepitation result, although it produced the same effect, as it enabled us to pulverize the ore.

Decrepitation is caused by the sudden conversion of hygroscopic water, or water of crystallization, into steam. As this water of crystallization is uniformly distributed, its expansion causes decrepitation. It is the application of this simple theory to a hitherto difficult ore problem that is described herewith.

BLENDE AND BARITE SEPARATED

In various mining sections lead and zinc ores are frequently associated with barite. The usual plan of separation is by means of jigs, which enables one to make a high extraction of the galena with its specific gravity of 7.4 from the barite and blende which have a specific gravity respectively of 4.3 and 4.0. As far as the removal of the galena is concerned, the method is satisfactory, but the blende and barite remain closely associated as a jig middling assaying about 45% barite and 25% to 30% zinc. As it is an unsalable product it must be discarded, although both minerals are of value when separated. An analysis showed that the particular barite under treatment contained 2.3% water. An exceedingly simple device was arranged for a test, consisting of an iron pipe 6 ft. long and 6 in. in diameter.

The pipe was placed over a blacksmith's forge at an angle of 30°. About two feet of the middle section of the pipe was brought to a dull red heat. At the lower end of the pipe a 30-mesh screen was attached as an extension of the pipe. While the pipe was being slowly revolved, the coarse jig middlings from a 10-mesh to ½-in. size or more, were fed into the upper end. During their passage across the heated portion of the pipe, the barite was instantly shattered finer than 30 mesh, while the blende remained at its original size, and was unaltered. The low temperature prevented oxidation of the blende and it passed over the 30-mesh screen on its way out, while the fine barite passed through the screen to a separate collector. A series of tests was made on jig middlings assaying 23.3% zinc and 44.6% $BaSO_4$. The concentrate varied from 56% to over 60% zinc, the recovery being over 90%, while the tailing ran 1% zinc and under. By this plan both blende and barite are placed in a marketable condition. A confirmation of this method by means of crude apparatus resulted in a carload of blende assaying 63% zinc.

It should be noted that this system could not have been successfully applied to these particular middlings had they contained fine galena or silicious material. It must be remembered also that all barite does not possess water of crystallization to produce the decrepitation effect. Other ores were benefited by similar treatment at our plant.

The reverse of the above result was noted recently in the treatment of blende-pyrite middlings from a Mexican mine. These assayed 30% zinc, with a high percentage of pyrite which was to be removed magnetically after roasting. On the first application of heat it was noticed that the zinc decrepitated without affecting the pyrite. Simple screen sizing then separated the fine blende from the pyrite, raising the grade to 54.5% with a high recovery.

Patents for this method of separation have been applied for by L. D. Emery. The Denver Engineering Works Co. has drawn plans and is constructing a furnace with attachments for this process. It is perfectly evident from its simplicity that it will be inexpensive to operate and have a large capacity.

[This article is interesting in connection with the article by F. C. Bryant, published in the JOURNAL of May 11. Of course, there is no novelty in separating blende and barytes by decrepitation, but there may be novelty in the method of doing it. Samples of mineral products sent to us by Mr. Wood exhibited a remarkable separation. We fancy that different ores will give materially different results in this respect.—EDITOR.]

---

*President, Henry E. Wood Ore Testing Co., 1734 Arapahoe St., Denver, Colo.

The Origin of Zinc Smelting

By W. Hommel*

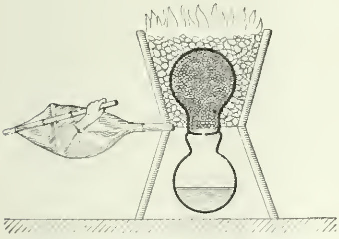
Although the art of zinc smelting originated in India, it was more extensively practiced in China, the latter being practically the sole producer of zinc until the middle of the eighteenth century.

In 1745 the ship "Gotheborg" was wrecked on a submerged rock near Gothenburg, Sweden. She belonged to the East Indian Co. of that town and had a full cargo of porcelain, silk, tea and zinc on board, which she had taken up in Canton, being on her return journey for fully 18 months.

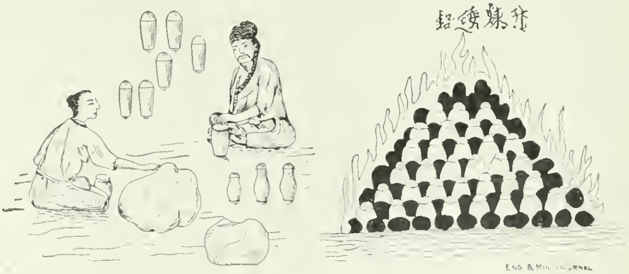
About 40 years ago one Captain Lamper had divers take up the porcelain and incidentally they also saved some of the zinc blocks. These were bought by Alexander Keiller of Gothenburg, who favored me with the above information and who was also kind enough to send me a piece of that zinc.

ANALYSIS OF CHINESE ZINC

This I had analyzed and found to my surprise that it was very pure and extraordinarily well preserved. Its surface was covered with a grayish crust, hard like enamel, which consisted of zinc oxychloride. This crust, being about 1/16 in. thick, successfully resisted the influence of the sea water for over 100 years and prevented the corrosion of the metal.



KOSCHI APPARATUS FOR SMELTING CALAMINE USED IN INDIA



EARLY CHINESE ZINC SMELTING

The analysis of the metal showed: zinc, 98.990%; iron, 0.765%; antimony, 0.245%. No copper, nickel, silver, arsenic or lead was present. The beautifully bright fracture and the purity of this zinc would certainly be the delight of more than one manager of our days, who has to resort to all kinds of impure ores with which to fill his retorts.

ZINC INTRODUCED INTO EUROPE FROM INDIA

This is the metal which in the 17th and 18th centuries was introduced into Europe by the men of India under such names as *calaëm*, *spiauter*, *tuttanego*, the same metal which the famous alchemist Andreas Libavius describes[1] and which he declares consists of silver, cadmia, mercury and arsenic.

A keen competition between the Portuguese and the Dutch was going on at that time in the Indian Seas and a Portuguese ship having been captured by the Dutch, her cargo of *calaëm* or "Indian tin" went to Holland where nobody knew what to do with the hitherto unknown metal. The piece which Libavius investigated had also been taken from this lot. For the first time then, in all probability, Oriental zinc had found its way into Europe, as otherwise the excitement which its arrival created among the alchemists of that time could not be explained.

EARLY ZINC TRADE BETWEEN INDIA AND CHINA

However mention is made of *calaëm* some time before by J. H. van Linschoten.[2] He describes it as a metal occurring on the coast of Malacca, where he was in 1579. The metal was not known in Europe at that time but it formed quite an important branch of the trade between India and China, which later on the Portuguese and the Dutch seem to have taken up. This we may conclude from several remarks in Meister's "Orientalisch - indianischer Kunst-und Lust-Gärttner" of the year 1692 where it is said that China delivers *spiauter* to the Dutch, whereas the coast *Cormandel* takes it from them. In India, Chinese zinc was very largely used in the production of brass and I presume that the Portuguese and Dutch took it up in China and exchanged it in India for tin, because in Europe nobody knew what to do with the zinc which the seamen probably took for an impure tin.

ZINC FIRST PRODUCED IN INDIA

Most of the zinc, if not all, was at that time manufactured in China but the art of its production originates undoubtedly from India. The first Chinese book which mentions zinc, calling it *ya-yuen*, is the Technical Encyclopedia "Tien-kong-gaï-ou," which appeared in the beginning of the 17th century. There it is said,[3] that "the metal *ya-yuen* is not mentioned in the old Chinese books and that only the modern authors speak of the same."

EARLY REDUCTION METHODS

On the other hand there exist quite a number of detailed prescriptions for the production of zinc by direct reduction as well as by distillation in Indian works of the 13th and 14th centuries. In the "Rasarnava," a work which appeared between 1100 and 1300 A.D., it is said that *rasaka* (calamine) mixed with wool, lac, the myrobalans and borax and roasted in a covered crucible, yields an essence of the appearance of tin. Of this, there is no doubt.[4]

Quite similar are the prescriptions in the "Rasaratnasamuchchaya," which was written in the 14th century. In one of them the advice is given to use a tubulated crucible. "When the flame issuing from the molten calamine changes from blue to white, the crucible is caught hold of by means of a pair of tongs and

---

*Metallurgist, Tudor House, Eltham Road, Lee, London, S. E.

[1] "Alchymia," 1606; in the first edition of 1597 this passage is not contained.

[2] "Travels to India," 1596.

[3] Geerts, "Les produits de la nature japonaise et chinoise," 1878-1883.

[4] Praphulla Chandra Ray, "A History of Hindu Chemistry," 1902, p. 39.

its mouth held downwards and it is thrown on the ground, care being taken, not to break its tubulure. The essence possessing the luster of tin which is dropped is collected for use." Alternatively the following method is mentioned: "A vessel filled with water is to be placed inside a Koschthi apparatus (see Fig. 1) and a perforated cup or saucer placed over it. A crucible charged as above is to be fixed in an inverted position over the saucer and strongly heated by means of the fire of jujube (*Zizyphus injuba*) charcoal. The essence which drops into the water should be applied (in medicine.)"[5]

Zinc Not Separately Classed At First

Until that time the "essence of the luster of the tin" was not classified as a separate metal probably on account of the deep reverence the Indians were inspired with before the old authors. Only six metals were then recognized, brass and bronze being distinctly mentioned as alloys. Zinc appears for the first time as a distinguished metal under the name of *jasada* in the medical lexicon of the King Madanapala, which is said to have been written about the year 1374.[6] It is also mentioned in the medical work "Bhávapraleása" (about 1550), with the advice to purify and to pulverize it in quite the same way as tin.[7]

First Technical Production in China

By all these methods, however, which are merely recipes from medical books, hardly more than small quantities of the metal could have been obtained and even those probably only as dust or *poussière*. The first technical production of zinc seems to have taken place in China, and certainly not before the 16th century.

The method of its technical production and its application is for the first time described in the "Tien-kong-kai-ou" (which appeared in 1637 for the second time) and in the great Chino-Japanese encyclopedia, the "Wa-kan-sai-dzu-ye" of the year 1713. In the "Pen-tsao-kang-mu," which was written in the second half of the 16th century, and which represents a compilation from the works of not less than 800 authors, zinc is not mentioned. However the making of brass by means of calamine is described. The "Pen-tsao" only mentions five metals, tin being considered to be a kind of lead. The "Wa-kan-san-sai-dzu-ye," however describes seven.

Zinc Had Various Names

The encyclopedia enumerates first of all the various names for zinc, as *ya-yuen*, which means "lead of inferior quality" and *totan*. The latter name is said to originate from a foreign language.[8] Next follows the description of the various forms in which the metal is put on the market, viz., in plates, rosettes, etc., and afterwards a number of prescriptions are given for the making of brass and bronze. The addition of zinc thereto is said to be very essential and the metal is therefore regarded to be a precious one. The best quality is said to come from Canton. Here also the metal is distinctly called a modern one, which was not known in former times.

In the "Tien-kong-kaï-ou" zinc making is described in the following way: The ore *lu-kan-shi* (calamine) is placed into crucibles, firmly pressed and the covers are securely sealed with loam. The crucibles intermixed with pieces of coal are built up in the form of a pyramid (see Fig. 2) and after having been brought to a red heat, they are cooled and broken up. The metal is found in the middle of the crucible as a round button.

Early Chinese Methods in Doubt

Nothing is said of reducing coal having to be mixed with the ore. Champion[9] therefore thought it necessary to propound the impossible hypothesis, that the ore was reduced by carbon monoxide, which entered the porous crucible from outside. Freise in citing this passage from the "Tien-kong-kaï-ou"[10] says that a second crucible, filled with powdered coal is to be put in an inverted position over the first one. He does not say, however, where he got his information and I believe that his citation is only a faulty translation of Biot's remark in *Journal Asiatique*, 1835, p. 141. In any case, even this method would not suffice to reduce the calamine.

Berthelot[11] doubts, whether the metal produced in this case is zinc at all and not rather an alloy of lead or copper. However taking into consideration the fact that zinc had at that time actually been produced, I am much more inclined to think, that the Chinese author did not describe the process correctly or that he did not perfectly know it. That the art of zinc making was kept rather secret may be concluded from several passages of the Chino-Japanese encyclopedia, where the author does not even know for certain, whether calamine is really the mineral, from which zinc is produced!

A much better description is given[12] by Sir George Staunton. He says: "*Tu-te-nag*, that is, zinc, is extracted from rich calamine. The ore is powdered and mixed with charcoal dust and placed in earthern jars over a slow fire, by means of which the metal rises in the form of vapor, in a common distilling apparatus, and afterwards is condensed in water. The calamine contains neither lead nor arsenic and only a little iron." Biot[13] thinks that this represents an improved method over the one described in the "Tien-kong-kaï-ou," but I believe that the latter method was in reality quite similar, probably based upon the prescriptions given in the "Rasaratnasamuchchaya." The difference in the shape of the crucibles in Fig. 2 should be noted. It is so distinct, that a mere mistake on the part of the artist cannot well be accepted as an explanation for this fact. It is quite possible, that some of the crucibles represent the condensers for the zinc vapors.

Other Names for Calamine and Zinc

Calamine is in Sanskrit designated with *rasaka, kharpara, kharpara-tuttha* and *tuttha*. When translated into Persian and Arabian the latter word became *tutia* and the "essence of the calamine" was consequently called *ruh-i-tutia*, which means "spirit of tutia." From the Sanskrit *jasada* (zinc) was derived the Persian *jast*.

In the "A'in i Akbari" (that is "mode of governing of the King Akbar"), which was edited by Abu al Fadhl ibn Mubarak in 1590, it is said that *jast*, which according to the opinion of some is *ruh-i-tutia* and resembles lead, is nowhere mentioned in philosophical books, but there is a mine of it in Hindustan, in the territory of Jalor, which is a dependency of the subah of Ajmir. Further a number of prescriptions for brass making are given. "Brass, which the Hindus call *pital*, is made in three ways, firstly: 2½ *sers* copper to 1 *ser ruh-i-tutia*, which is malleable, when cold; secondly: 2 *sers* of copper to 1 *ser* of *ruh-i-tutia*, which is malleable, when heated; thirdly: 2 *sers* of copper to 1 *ser of ruh-i-tutia*, not worked by the hammer, but by casting."[14]

Confusion in Early Nomenclature

Blochmann translates *ruh-i-tutia* as pewter, also in the new edition of Gladwin's translation it is designated as "a kind of native pewter." Praphulla Chandra Ray therefore accuses Blochmann of inaccuracy (*loc. cit.* p. 92) which, however, in my opinion is not quite justified. At least one may say with certainty that nobody knew then what this substance really was and that in Persia and Arabia at that time all kinds of metals and alloys were called *ruh-i-tutia*, just the same as in Germany during the 16th and 17th century *conterfey* designated zinc, pewter, bismuth, antimonial lead, white copper, etc.

---

[5] P. C. Ray, loc. cit.

[6] P. C. Ray, loc. cit.

[7] Udoy Chand Dutt "Materia medica of the Hindus," Calcutta, 1900.

[8] From the Sanskrit "tuttham," to which word also the Tamil "tatanagam" and the Persian "tutia" refer.

[9] "Industries de l'Empire Chinoise," 1869, p. 47.

[10] "Oesterr. Z. f. Berg. Hütten u. Salinen wesen." 1908.

[11] "Archéologie et Histoire des Sciences," 1906.

[12] "An Embassy to China," 1797, II, p. 540.

[13] "Journal asiatique," 1835, p. 141.

[14] Translated by Blochmann, Calcutta, 1873. The translation of Gladwin, London, 1800, of which a new edition appeared in Calcutta in 1897, is quite useless, because it is only an extract.

Already the above cited remark of Abu al Fadhl shows this clearly and it may further be concluded from the fact, that all sorts of substances were called *tutia*. Thus one finds in the lexicon of Ebn Baithar, who died in 1248, five kinds of *tutia* mentioned. One is said to be found in mines, another one is made in furnaces, "in which the ore is melted." (This is clearly zinc oxide.)

Then there are three fossil kinds, a white one, a greenish one and a yellowish one, the last mixed with red. They are found on the coasts of India and China. The best is the white one, which is covered with a saltlike substance; after this comes the yellow one. The green one is rough, porous and comes from China.[15] In Persia sulphate of zinc was called "white tutia," sulphate of copper "blue tutia," sulphate of iron "green tutia,[16] the word tutia—being apparently used in the sense of our "vitriol." Also Avicenna and Geber mention several kinds of it.

A little more consistent was the use of the terms *rasaka* and *lu-kau-shi* in India and in China. In the "Rasarnava" three kinds of *rasaka* are distinguished: one yellow, one of the appearance of treacle (molasses) and one of the color of stone, whereto the remark is added: "No wonder, that *rasaka* if . . . . . roasted with copper, changes the latter into gold." In the "Pen-tsao-kang-mu" calamine is called the "seed of gold and silver." It is clear, that in both these cases the making of brass is referred to. Ono Ranzan, however, the "Japanese Linné," in his work "Hon-zo-kei-mo-mei-so" (1804) distinguishes four kinds of *lu-kau-shi*, viz. of white, reddish, yellow and blue color."

MANY METALS CALLED ESSENCE OF CALAMINE

It can therefore not reasonably be doubted, that at that time all sorts of metals and alloys carried the name of "essence of calamine" or "spirit of tutia." It is indeed quite possible, that in many places even an especially pure *tutia*—or zinc oxide, perhaps one which was prepared in crucibles, may have been signified as *ruh-i-tutia*. Zinc oxide was in fact occasionally made or purified in this way, as may be seen from the following passage in the book "De medicatis aquis et de Fossilibus" by Fallopius (1564), which shows clearly, that the old metallurgists sometimes worked under conditions fairly appropriate for zinc reduction:

"Cadmia, quae Venetiis conficitur, fistularis est, quia conficiunt ipsam in fistulis aeneis, nam explent fistulas materia, deinde ponunt fistulas in fornacem: postmodum extrahunt, concutiuntque fistulas et concidit cadmia, quae nihil luti habet coloris." How easily could a Belgian zinc furnace have resulted from this, if somebody had been struck by the idea to use clay tubes instead of the copper ones!

It is interesting to note, that China—like Germany—seems to have had a metal called "counterfeit," provided, that Mély[18] translates the passage in question from the "Wa-kan-san-tsai-dzu-ye" correctly.

"WHITE TIN" PROBABLY ANTIMONY

There it is said, that in the year 700 A.D. a man brought "white tin" (pe-le)[19] from the province of Tamber, which was found to be just as resistible as tin. "This metal was introduced into China by smelters from the province of Yang. Everybody said, that this was *toen-yn* (a counterfeit). About that time it was used by false-coiners for the imitation of the *sapèques*." The metal in question is in all probability antimonial lead or antimony, which is actually found in that district. Quite a similar story is told by Michael Maier[20] of an alchemist who by means of zinc and methods known only to himself made copper white and induced a magnate to have base money coined from it.

Likewise it is antimony or antimonial lead, but by no means zinc, which as the metal *khar-sini*, Kazwini "the Persian Pliny," describes in his "Cosmographia," about 1200 A.D. To this metal, whose name literally translated means "stone" or "iron from China," the most extraordinary properties are ascribed. Its color is said to be of a reddish black. Spears made from it are tremendously powerful and with harpoons made from it the largest fishes may be caught. It may further be used to make mirrors which serve to cure convulsions of the face and nippers to tear the hair out, which, once removed by them will never grow again.

KHAR-SINI IS ANTIMONY, NOT ZINC

This passage has been cited by some authors[21] as evidence, that zinc was known in the Orient in olden times. This, however, is not so. First of all it must be noted, that Abu al Fadhl who also mentions the metal *khar-sini*, and this in words which show clearly that he takes his information from Kazwini, does not identify the same with *jast* or *ruh-i-tutia*. Still it is remarkable that he calls it in a sense "crude gold," adding that "some people regard it to be a kind of copper." This passage has a striking resemblance to the above quoted citations from "Rasarnava" and "Pen-tsao," where calamine is called the "seed of gold and silver," but one must not forget that Abu al Fadhl wrote fully 400 years after Kazwini.

That *khar-sini* was nothing else but antimony or antimonial lead follows clearly from its color (because zinc is silver white and not reddish black) and further from the mentioning of the mirror. Even nowadays cheap mirrors are made in Japan from mixtures of lead and antimony. To seek the origin of the mirror tale in the "well known healing power of zinc preparations for diseases of the eyes," as some authors have done, means nothing else than to go astray into fairy land.

SUMMARY

It may therefore be taken as beyond any question, that the art of zinc smelting originated in India. Thence it came to China, which country remained the sole producer of zinc until the middle of the 18th century, disregarding a minute quantity of that metal, which was occasionally obtained as a byproduct in the lead furnaces of Goslar in the Harz Mountains.

As a curiosity it may be mentioned, that the zinc of which I gave the analysis above, was produced in China about the same time (1743) when in Europe Swab and Marggraf were engaged upon their fundamental researches on the manufacturing of zinc from calamine.

---

[15] Translated by Sontheimer, 1840, I, p. 217.

[16] J. F. Royle, Essay on the Antiquity of Hindu Medicine, 1838.

[17] Geerts, loc. cit., II, p. 574.

[18] Les Lapidaires chinois, 1896, pp. 33 and XXXIV.

[19] Geerts (loc. cit.) translates: "A metal similar to tin."

[20] "Examen Fucorum Pseudo-chymicorum," 1617, p. 34.

[21] Sacy, Chrestomathie arabe, 1827, III, p. 430 f.; Schweiggers, Journal ür Chemie u. Physik, 31 (1821), p. 357; Neumann, Die Metalle, 1904, p. 293.

Tom Reed Mines

The report of the Tom Reed Gold Mines Co., Oatman, Ariz., for the year ended Mar. 31, 1912, states that the average value of the ore decreased from $42.46 per ton in 1910 to $19.35 in 1911. The treatment of 39,447 tons, a 200% increase over 1910, resulted in a total gross production of $802,599, which was $208,486 more than for the previous year. An average extraction of 98.85% was maintained at the mill. The total cost of mining and milling averaged $6.83 per ton, which is $2.08 per ton less than last year.

A total of 3365 ft. of mining and development work was done. A winze was sunk from the 350- to the 550-ft. level in the Tom Reed claim, most of the way in ore. In the Ben Harrison claim, the sinking and timbering of the main shaft to 860 ft. were completed. The Olla Oatman shaft reached a depth of 465 ft. New orebodies of larger dimensions, but of lower grade, were encountered and opened. Twelve dividends, totaling 40%, or $363,822, were paid during the year.

Iron-Ore Railroads at Lake Superior

SPECIAL CORRESPONDENCE

Actual and pending changes in the railroad situation with reference to the transporting of iron ore to Lake Superior ports and its distribution from them to the points of ultimate consumption may disturb the spheres of influence in the iron trade which have grown out of this vast transportation business and may create new conditions of interest in the iron business of the country. In the Minnesota iron region the two independent iron-ore roads serving the Vermilion and the Mesabi districts, respectively, in their early development, passed into the direct control of the U. S. Steel Corporation with the organization of that company. One other road, acquired by the Great Northern Ry., tapped the Mesabi and divided the important Mesabi traffic with the Steel Corporation roads.

This situation remained undisturbed until the threat of the federal suit against the Steel Corporation caused these roads to anticipate adverse rulings and to cut the rate of 80c. and 90c. to Lake Superior from the Mesabi and Vermilion, to 60c. and 70c. per ton respectively. This cut was met, of course, by the Great Northern, but in this case J. J. Hill had been wise enough to provide, in his lease contracts made on the Great Northern ore lands, that a reduction in the freight rate would act automatically to raise the royalty the same amount as the freight was reduced. This is the situation as to the Mesabi and Vermilion districts today.

CUYUNA RANGE TRAFFIC

The Cuyuna district development introduced a new factor in the transportation situation. The early promoters of the Cuyuna being unable to secure what they thought were satisfactory terms from the Northern Pacific R.R., which runs through the district to the head of Lake Superior, began negotiations with the Minneapolis, St. Paul & Sault Ste. Marie R.R., the "Soo," an American subsidiary of the Canadian Pacific system. The "Soo" was building new lines in the northwest and besides had an alleged grievance against the Hill roads because of "invasions" of the Canadian territory in the west. The business in itself was attractive, for a large tonnage was proved and, as an inducement, contracts for hauling half this tonnage at 65c. per ton, were given to the "Soo" to induce it to build into the district and to provide the necessary costly dock facilities on Lake Superior. The "Soo" road is now completed into the district and is hauling ore from the several mines now in operation.

But with the advent of the "Soo," the Northern Pacific became more amenable and entered into a traffic arrangement with a new road called the Cuyuna Northern, which is being built by Cuyler Adams, the pioneer in the Cuyuna district. This gives the district competitive transportation and gives to the Hill interests, represented in the Northern Pacific, control of a large tonnage of ore. The "Soo" road so far is confined to the Cuyuna district because the greater part of the ore in the other Minnesota districts is controlled or under contract to the interests already in the transportation saddle there. However, should an important extension of the Mesabi be opened, especially at the western end, or if there are discoveries in the prospective territory between the Cuyuna and the Mesabi, the "Soo" would undoubtedly extend into the Mesabi territory.

THE CANADIAN ROADS

The Vermilion district has been served solely by one road and that in the control of the Steel Corporation. A few years ago the Canadian Northern system, now centering at Port Arthur on the north shore of Lake Superior, built a line toward the Vermilion district as far as the international boundary. This line is projected to the Vermilion and to Duluth. It could and undoubtedly would seek to take the independent ore from the Vermilion district to the Canadian port. The late President Hays, of the Grand Trunk, had under consideration a project for an extension of the Grand Trunk system from Canada through the Mesabi and Cuyuna districts to the head of Lake Superior. This project is more remote than the other two noted, but it is entirely feasible and rather likely. An independent road is also projected from Grand Marais, a port north of Duluth, to the Vermilion and to the prospective magnetite deposits of Cook and Lake Counties.

The result of this rearrangement of the vast Minnesota iron transportation business would, of course, be directly felt by the Lake shipping which is more or less closely allied to the railroads and to the former interests that control them. The entrance of competition into the iron-transportation field and the fact that this competition represents strong Canadian railroad interests able to take care of themselves fully and seeking to expand to justify their government subsidized trunk lines, presents a situation of interest and affords a protective situation for the "independents" in the iron trade and in iron mining. This situation does not so far concern directly the Wisconsin and Michigan districts. The "Soo" line has always participated in this traffic and geographic conditions do not encourage any such readjustment as is possible in Minnesota.

ORE DOCKS

The actual status of the several railroad interests in this vast iron-ore carrying trade is approximately measured by the statistics of the ore-loading docks on the Lakes, recently compiled by W. A. Clark, chief engineer of the Duluth & Iron Range R.R. The total number of docks is 37. These are controlled as follows: Duluth & Iron Range at Two Harbors, 1070 pockets, storage capacity 196,100 tons; Duluth, Missabe & Northern, at Duluth, 1152 pockets, storage capacity 172,800 tons; total for the Steel Corporation roads, 2222 pockets, 368,900 tons storage capacity.

Great Northern Ry., at Superior, 1352 pockets, 420,700 tons storage capacity.

Canadian Pacific roads (subsidiaries), Duluth, South Shore & Atlantic, at Marquette, 400 pockets, 65,000 tons storage capacity; "Soo" road, at Ashland and Superior, 514 pockets, 91,400 tons storage capacity; total for Canadian Pacific roads, 914 pockets, 156,400 tons storage capacity.

Chicago & Northwestern Ry., at Escanaba and Ashland, 1634 pockets, 325,600 tons storage capacity.

Lake Superior & Ishpeming Ry., at Marquette, 400 pockets, 75,000 tons storage capacity.

Chicago, Milwaukee & St. Paul Ry., at Escanaba, 480 pockets, 90,000 tons storage capacity.

These docks are all at the American ports. In addition to these there are at Canadian ports docks as follows: Algoma Central Ry., at Michipicoten, 12 pockets, Canadian Northern at Key Harbor, 20 pockets.

Explorations in Quebec

SPECIAL CORRESPONDENCE

During the coming summer, the Canadian Geological Survey will devote a good deal of attention to the province of Quebec. Two exploring parties will be sent to northwestern Quebec, one of which will examine the country east of the Bell River, between Grand Lake Victoria and Lake Mattagami, while the other will work along the Nottaway River, from Lake Mattagami northward, that being regarded as a likely route for the projected railway from Montreal to James Bay. J. Keele, who has made a specialty of the investigation of clay deposits, has been assigned to make a special inventory of the clay and shale resources of the province. A party will continue the work of mapping, in detail, the geology of Brome and Missisquoi Counties.

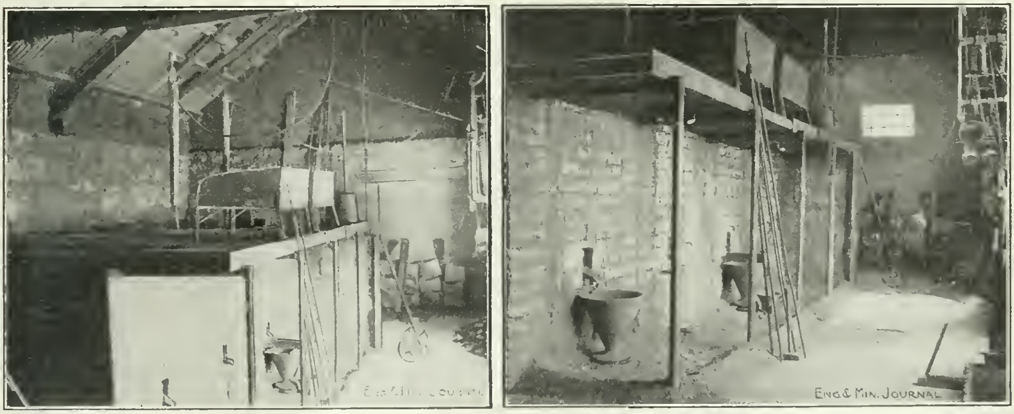
Electric Furnace at Lluvia de Oro

By H. R. Conklin*

The electric furnace at Lluvia de Oro cyanide mill is probably the first one to be used for melting precipitate or smelting gold-silver concentrate. Bullion is the only product shipped. The slag produced is used as flux or is treated in the mill as ore. The melting capacity is 400 kg. of precipitate in 24 hours.

In 1910 and previously, the Lluvia de Oro Gold Mining Co., at Lluvia de Oro in the state of Chihuahua, Mexico, was melting precipitate from its cyanide plant in crucibles, using charcoal as fuel, and forced draft to obtain sufficient heat. Oil furnaces were objectionable on account of high cost of fuel. Charcoal costs at the mine, $20 per ton, and oil about 50c. per gal., mainly on account of the distance from railroad. The company owns a hydro-electric power plant the operating cost of which is constant, whether the output is a maximum or a minimum, so that power to operate an electric furnace would actually cost nothing.

With the purpose in view of economy and a hope, in addition, of better work, I investigated in the fall of 1910 all the electric furnaces that I could hear of as being in anyway suitable. R. S. Wile was then operating two furnaces at Connellsville, Penn., smelting tin dross, and these furnaces seemed to be doing work more nearly like smelting precipitate than any other of which I could hear. The inside dimensions were 20-in. diameter at the top, tapering to 8 or 10-in. at the bottom, and $6\frac{1}{2}$-ft. deep, having a lining of chrome dust. They were plain resistance furnaces, no arc being used, except possibly when starting, and the charge was heated by its resistance to the passage of current. An outfit was ordered from Mr. Wile, and on its arrival at Lluvia de Oro early in 1911 the experiments began.



Battery of Electric Furnaces for Melting Precipitates and Smelting Concentrates at Lluvia de Oro Mill

Furnace Rectangular in Section

Our present furnace is rectangular in section, 16-in. square inside, and 4-ft. deep. Additional depth is of no value, as if a charge is more than 4 ft. deep the pressure of metal when tapping is too high for good control and the metal spatters out of the mold. The cross section increases as the furnace is used, and at the time of rebuilding is nearly circular and 24 to 26-in. in diameter. By making the cross section square instead of circular the brick lining is much more easily laid and the joints are tighter, making the construction as good as a circular cross section with special brick, and requiring no skilled labor.

In order to avoid all buckstays and to use the minimum amount of brick, we have built a battery of four furnaces, the side and back walls being solid adobe. All bricks, except one course in front, are liners. The bricks in the front course are used many times. In repairing, all bricks are removed and the entire brickwork relaid inside the cavity in the adobe. This design is shown in the accompanying engraving.

The adobe structure makes an excellent floor on top of the furnaces and is extended 4-ft. in front. This extension is supported on old tank sheets and posts of 2-in. pipe, as shown in the accompanying halftones. This gives a floor about 20x12-ft., unbroken except for the four furnace holes, each 16-in. square. In addition there is no woodwork of any kind, and no fire risk. Charges are mixed on top in sheet-iron boxes and all dust and sweepings are put into the furnace. Small boards are laid on this floor to stand on when handling the electrodes.

Firebrick Lining Used

The first furnace was lined with chrome dust, rammed in place with sodium silicate as a binder. It lasted about 30 hours, melting precipitate and all dissolved in the slag, which was dark green, exceedingly hard and pasty. After this experience we used good firebrick, laid with ends exposed to the charge. If laid otherwise they are liable to float out of sides or bottom when partly destroyed, but by laying endwise to the charge they will remain in place until more than half gone. All the firebrick next the charge have joints floated full of fireclay. Those not so exposed are laid in red clay. Any spaces between brick and adobe are filled solid with red clay and brick bats. The life of firebrick linings averages about 200 hours.

In the effort to improve on this, we tried one lining of carborundum fire sand, rammed 3-in. thick, with 5% of sodium silicate of 52° Bé. for binder. This lining did not work as well electrically as the firebrick, appearing to conduct the current much better and reducing the melting capacity of the furnace. It was also rapidly attacked by zinc in the charge. We did not try this lining for melting precipitate; for that work alone, it might do better. The carborundum lining was laid with circular cross section. It was patched once, and a thick syrup of *panoche* (brown sugar) used as binder, which apparently did fully as well as the sodium silicate. The life of this lining was about the same as that of firebrick, and its cost nearly twice as high.

---

*Manager, Lluvia de Oro Gold Mining Co., Lluvia de Oro, Chihuahua, Mex.

The first tap hole was made by drilling a hole through a firebrick. This was unsatisfactory and was improved by building a piece of ¼-in. iron plate into the front, having a ⅞-in. hole drilled through it for tapping. Afterward an iron arrangement was made from 3- and 4-in. angle iron, forming a sort of box with a tap hole and a spout for the metal. Iron castings have been ordered of this shape, but have not yet been tried, and there is a possibility that cast iron will not stand the work as well as wrought iron or steel.

At present the brick lining in front is being built with a tapered channel leading from the furnace proper, for three or four inches forward to an iron plate with a ⅞-in. hole. This plate protects the brick from injury by tools when tapping and the brick protects the plate from burning out. A spout of angle iron is laid in the brick work to guide the metal and slag from the tap hole to the mold. For bullion a hole of ¾-in. diameter is sufficient, but one of 1⅛-in. diameter is not too large for concentrate smelting.

CURRENT SUPPLY AND REGULATION

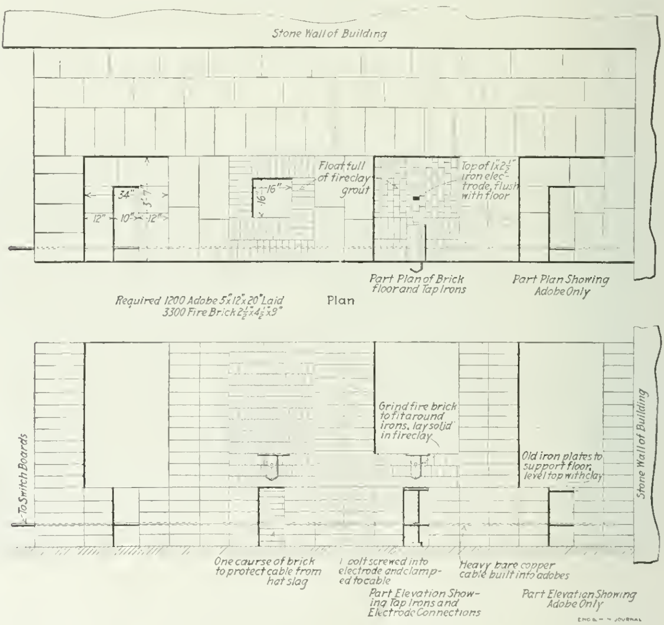
Alternating current of 60 cycles is used at 110 volts. Direct current would do exactly the same work. A switchboard, with resistance for regulation when starting, is necessary for each furnace in operation.

Diagrams of electrical connections are shown in the accompanying engravings; a halftone shows the two switchboards at Lluvia de Oro. One side of each furnace circuit is of course grounded through the bottom electrode, and to avoid danger to workmen an independent transformer is used for each furnace.

In order to balance the load of the three-phase generator as nearly as possible each furnace is on one phase. One side of each secondary, at 110 volts, is connected at the switchboard to a common cable leading to all the bottom electrodes, so that there is never more than 110 volts between any upper electrode and the ground. By using bare copper wire for the cable to the lower electrodes a good ground is obtained and no shock is felt when tapping the furnace with iron tools, although current is being used. When using insulated wire, carried directly to the lower electrode, a strong shock could be received when tapping the furnace, and workmen had to stand on boards, causing much annoyance. Three furnaces could be connected in the same way and balance the entire load on three phases.

GRAPHITE ELECTRODES USED

Graphite electrodes, 4-in. diameter by 40-in. long, made by the Acheson Graphite Co., of Niagara Falls, are used. The first furnaces were built with a graphite electrode in the bottom. Soon after beginning operations, we could obtain no more graphite on account of revolutionary troubles in 1911 and as an expedient used iron. Iron is just as satisfactory as graphite for the bottom electrode, when used for melting precipitate, and by making it of 1x2½-in. size it lays exactly right in the brick bottom, without any cutting. A long 1-in. bolt screwed into its side near the lower end makes a convenient attachment to the copper cable from the switchboard. This cable is built into the adobe where it is entirely out of the way and protected from any damage, and yet can be readily attached to the bottom electrode when rebuilding.


Stone Wall of Building
34"
3'-7"
12"
10"
12"
16"
16"
Float full of fireclay grout
Top of 1x2½" iron electrode, flush with floor
Part Plan of Brick floor and Tap Irons
Part Plan Showing Adobe Only
Required 1200 Adobe 5"x12"x20" Laid
3300 Fire Brick 2½"x4½"x9"
Plan
To Switch Boards
Grind fire brick to fit around irons, lay solid in fireclay
Old iron plates to support floor, level top with clay
Stone Wall of Building
One course of brick to protect cable from hot slag
1 bolt screwed into electrode and clamped to cable
Heavy bare copper cable built into adobes
Part Elevation Showing Tap Irons and Electrode Connections
Part Elevation Showing Adobe Only
ENG. & M. JOURNAL

BATTERY OF FOUR ELECTRIC FURNACES AT LLUVIA DE ORO. TWO ARE OPERATED WHILE THE OTHER TWO ARE BEING REPAIRED

Temporarily we used for upper electrodes some 2½-in. XX pipe which we happened to have. They were fairly satisfactory with the exception that the ends burned off considerably forming iron shot, ¼ to ⅜-in. in diameter, which collected in the bottom of the furnace and gave trouble when tapping. Most of them would run out with the bullion and had to be chipped from the tops of the bars. These pipes were unsatisfactory for electrodes when smelting concentrate, as the addition of metallic iron to that kind of a charge, where there was already an excess, made a pasty mass in the bottom of the furnace which could not be handled. It is better to use graphite for the lower electrode also when smelting concentrate on account of rapid destruction of iron.

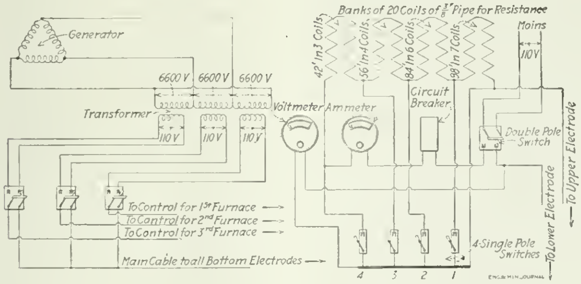
The graphite electrodes are threaded with male and female threads on the ends. By having a cast-iron block into which they can be screwed, they are completely consumed, a new one being added as required at the top. The cable from the switchboard is brought to this cast-iron block on glass insulators, and fastened to it by bolt and washers.

On each switchboard is mounted a small windlass carrying a flexible cable on which is hung the upper electrode by means of a strain insulator. This enables easy, quick and exact adjustment of the upper electrode in the charge. Current is easily regulated by varying the depth of immersion of the upper electrode, and is roughly regulated by the rate of charging and the temperature of the furnace. Any arc between the upper electrode and the charge consumes the electrode rapidly. For this reason the electrode should be kept sufficiently immersed to maintain good contact.

Melting Precipitate

Our precipitate is sometimes quite dirty from slimes, contains more or less zinc, and may be quite wet occasionally. We make no effort to prepare it specially, as it is melted just as well, even if very dirty. One batch was melted which only assayed about $2000 per ton. This is a great advantage, for nearly everyone sometimes gets a mess of stuff that is hard to handle in crucibles. Since there is no air blast, the loss by dusting is small. Reasonable amounts of zinc volatilize in white fumes and give no trouble.

We vary the fluxes depending upon the quality of the precipitate, but generally the charge is about as follows: Precipitate 100, lime 5, sand 15, borax 10, soda 10. Locally burned lime is used, the same as is used for producing alkalinity in the cyanide plant, and quartz sand from the mine, obtained from the coarse product of a Dorr classifier which feeds the tube mills. A rather large amount of slag is not objectionable, as it assays only about $60 per ton, and is all used as a flux in smelting concentrate. It is easily treated in the regular milling process, and any excess is put in the ore bin above the stamps.



Electrical Connections for Furnaces at Lluvia de Oro Mill

In starting the furnace, all resistance is cut into circuit by opening all the regulating switches; the upper electrode is lowered to the bottom of the furnace in one corner, five or six inches from the bottom electrode. A handful of powdered graphite is dropped on the bottom, making a line between the electrodes. Current is immediately started through the graphite. A pint or so of borax is added, which melts immediately. Then powdered slag is added until the bottom of the furnace is covered with melted slag which makes a good conductor. As the slag melts, more is dropped in and the upper electrode is raised as it accumulates. The switchboard resistance is reduced by closing one switch after another as rapidly as possible, without unduly increasing the current, and is generally all out in 30 to 50-min., with melted slag about a foot deep in the furnace.

Precipitate mixed with flux is then added until the furnace is full, or enough bullion is melted to pour one or two bars. If too much bullion accumulates before tapping, it is liable to chill and not pour well. This is caused by the bullion perfectly conducting the current and therefore receiving heat only from the melted slag above it. No precipitate is charged for half an hour or so before pouring, to allow all shot to settle through the slag, and if the bullion in the bottom is chilled, an iron bar is used for stirring it. In case of necessary shutting down, a ½-in iron rod is left in the charge, resting on top of the bottom electrode, in order to establish current when starting cold, but the furnace is always emptied if possible, when shutting down.

Bars not suitable for shipment, pieces of bullion, shot and chunks of metal produced from melting short zinc or smelting concentrate, floor sweepings and any rich slag, are all charged and melted with precipitate, so that a general cleanup of all odds and ends is accomplished. Bullion is re-melted if it runs less than 900 fine, but no effort is made to produce bullion of fineness exceeding 900, as the cost of marketing increases for lower fineness, but does not decrease for higher. The bullion from the Lluvia de Oro mine assays generally about 100 fine in gold, 800 fine in silver, and 100 base.

When tearing down a furnace, considerable metal is always found in the bottom and in cracks between the bricks, sometimes even impregnating the pieces of brick. All these pieces of metal are melted over, and all the refuse bricks go through the mill.

If the bullion product were less in bulk and higher in proportion of gold, it might be difficult to prevent loss. When melting precipitate, current is kept between 250 to 350-amp., and about 400 kg. are melted per 24 hours.

Melting Short Zinc

Short zinc is roasted in a small reverberatory furnace, the hearth of which is 5x7-ft., being the same furnace that is used for roasting concentrate. After a thorough roast it is melted without any difficulty, the zinc going into the slag. The charge is as follows: Short zinc 100, sand 30, borax 10, soda 10. Bars are not cast from this melt, but the entire content of the furnace is drawn into slag pots, all the metal collecting in the bottom of the slag pot and the slag overflowing. This button or chunk is remelted with precipitate. The slag assays about $40 per ton, and is run through the mill. Power consumption and capacity are about the same as when melting precipitate.

Whenever slag, brick bats, or other furnace waste is run through the mill, a separate stamp is used, (the mill is equipped with Nissen stamps) using a 30-mesh screen, and all shot and small buttons are caught in the mortar, panned clean and melted again with precipitate. All the fine product from the stamp takes the regular mill process and the extraction is satisfactory.

Smelting Concentrate

The concentrate from this mine constituted about 0.75% of the ore milled, and was dried, sampled and shipped in sacks, the value per ton being about $1500. Handling, sacking and sampling were troublesome. Dust loss, freight costs and taxes were excessive. The concentrate was readily amenable to a special cyanide treatment, but that required an additional plant, and the output of 15 to 20 tons per month hardly jusified the investment. The cost of marketing concentrate was about 5% higher than the cost of marketing the same value of bullion.

The present process is: (1) reconcentrate all the product on one table, bringing its value up to about $3000 per ton; (2), roast off nearly all the sulphur in the small reverberatory furnace, and partly oxidize the iron content; (3), smelt in the electric furnace with flux as follows: Concentrate 100, lime 15, sand 30, slag from precipitate melting 15. This concentrate consists of pyrite, but carries a high percentage of metallic iron, derived from wear of stamp shoes and tube-mill liners. The percentage of metallic iron is extra high on account of the extreme hardness of the ore causing much wear of iron, and because of the small percentage of concentrate contained in the ore.

By careful work a product is obtained from the furnace consisting of bullion, matte and a heavy iron slag. A larger tap hole is used, about 1⅛-in. diameter.

Current comsumption of 400 to 600-amp. smelts about 800-kg. of concentrare per 24-hr. Bullion product is remelted with precipitate. Matte product can be melted along with short zinc to a limited extent and produce all bullion. Some can also be added when melting precipitate, but great care must be exercised not to get silver sulphide in the bars of bullion.

A recent experiment is the addition of a small jet of compressed air to bubble up through the molten bullion and slag and burn off the excess of sulphur, producing also a higher grade of bullion, but the scheme has not yet been perfected and was only tried once. The first trial seemed very successful, however, and it should work out saticfactorily after devising the best means of introducing the air pipe. In case of success, all matte will be melted with precipitate.

Slag from concentrate smelting assays from $50 to $100 per ton, and the regular cyanide work in the mill extracts easily to $3 per ton. The simple expedient of running it along with ore from the mine, which was at first intended, does not suffice, however, for the reason that the slag is so heavy with iron that it all comes out with the concentrates on the tables, and would immediately lower their grade and also have to go through the furnaces again. The present intention is to stack it until a sufficient quantity has accumulated to run the mill a day or so on nothing else, at which time the tables would be receiving no concentrate from mine ore, and their entire product, consistng of slag only, would be returned to the tube mills until too fine to be caught, when it would go directly to the cyanide plant.

All slags should be rather high in silica, to prevent too rapid destruction of the firebrick lining. High-silica slags also have more resistance to the passage of current and the furnace can be kept at a higher temperature. This can easily be carried too far, however, and one charge required so high a temperature before becoming sufficiently liquid, that it melted all the tap-iron and part of a heavy cast-iron slag pot when running out.

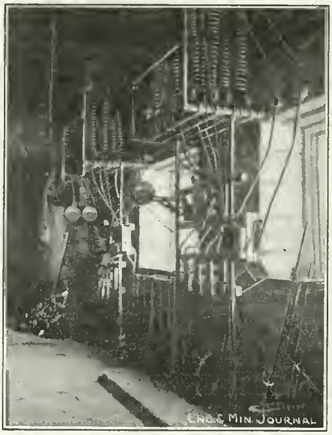
ONLY BULLION SHIPPED

To sum up, the disposal of all the furnace products is as follows: Bullion is shipped to market. Slag from precipitate is used as flux for concentrate, or sent to mill. Slag from short zinc is sent to mill. Slag from concentrate is stacked for future cyanide treatment, the regular mill treatment being satisfactory, but the quantity produced being so small that several months accumulation can be treated in a day. Furnace refuse, consisting of brick bats, clay and sweepings, is sent to mill.

This method leaves everything cleaned, no accumulation of anything valuable, and all products from the mine ore, either shipped as bullion or discharged as tailing from the mill, with no contents that can be recovered economically.

For larger operations, smelting concentrate, I would experiment with a furnace about 3-ft. wide, 4-ft. long and 4-ft. deep, having an electrode in the middle of the bottom, two electrodes hung above, and adjustable horizontally as well as vertically, using a three-phase current at 110 volts, with a switchboard and rheostat in each phase.

So far as I know, this is the first and only electric furnace to melt precipitate or smelt gold-silver concentrate. There is no patent applied for, or intended, on any of the processes or improvements which have been worked out here, and unless some basic patent covers the use of electric current to heat a substance by means of its resistance, which hardly seems reasonable, the furnace and its operation are free for use by anyone who may so desire. If any of the readers of this article know of a lining which would do better than firebrick, a letter to me with full particulars would be greatly appreciated.



SWITCHBOARDS FOR ELECTRIC FURNACES

Mica in 1911

According to figures published by the U. S. Geological Survey, there were 944 tons of rough-trimmed and cut, and 3512 tons of scrap mica produced in the United States in 1911. This came from North Carolina, South Dakota, New Hampshire, Alabama, New Mexico, Colorado and Virginia.

Two large crystals of mica were found during the year at Celo, N. C. One was 32½ in. thick, by 29 in. wide, by 33 in. long, the other 17½x29½x33½ in. These are said to have sold for about $125 and $100 respectively. The old Silley mica mine, near Burnesville, N. C., was reopened, and much development work done. Some mica was also obtained as a byproduct by the Carolina Mineral Co., which was mining for feldspar near Penland, North Carolina.

It is usually stated that mica containing inclusions of iron oxide is worthless for insulating purposes. In domestic mica this does not seem to be true, as the black specks are thin magnetite dendrites which occur between the laminæ, but do not penetrate them. In certain foreign micas the magnetic minerals penetrate the layers. These micas are, of course, spoiled for insulating purposes.

Alaska United Report

The net profit of the operations of the Alaska United Gold Mining Co., at Douglas Island, Alaska, for the year ended Dec. 31, 1911, was $321,415, according to the official report. Of this amount, $81,090 was disbursed as dividends and $195,000 charged off for depreciation.

At the Ready Bullion mine, the development work accomplished in the period was 3968 ft.; the ore reserves are estimated at 1,448,108 tons, averaging $2.94 per ton. At the 700-ft. Claim mine, the development work was 4786 ft.; the ore reserves, 1,387,076 tons, averaging $3.08 per ton.

The Ready Bullion mill treated 223,668 tons of ore, the average yield being $2.32 per ton with the tailing running 25c. The stamp duty is 5.13 tons per 24 hours. The costs were: Mining, $1.155; milling, $0.303 per ton. The 225,403 tons produced by the 700-ft. Claim mine were mined at a cost of $1.063 and milled for $0.26 per ton. The average yield was $2.34 per ton, 19c. being left in the tailing.

The cyanide mill for treating concentrates is owned jointly by the Alaska-Treadwell, Alaska United and Alaska-Mexican companies, on the basis of 60%, 20% and 20%, respectively. An extraction of 96.5% was obtained in treating 17,751 tons, the cost averaging $2.812 per ton.

Geology of Upper Wisconsin

The staff of the Wisconsin Geological Survey is working on new maps, covering the geology of the Northern Wisconsin country. These maps will be published soon, and are likely to be of importance in connection with the mineral development of that section. They corroborate in the main the earlier geological work done in that region, but will bring out certain accessory structural features and details, which are of present significance in the interpretation of the geological conditions of that section with relation to possible new iron and copper deposits.

New Publications

DREDGES AND DREDGING. By Charles Prelini. 6¼x9¼, pp. 305, illus.; $3. D. Van Nostrand Co., New York.

NOUVEAUTE EN METALLURGIE. 6½x9½, pp. 69, illus., paper; 3 francs. Mois Scientifique et Industriel, Paris, France.

EINFUHRUNG IN DIE PROBIERKUNDE. By C. Schiffner. 5¾x8½, pp. 171, illus.; 6 marks. Wilhelm Knapp, Halle a. S., Germany.

HISTORICAL PAPERS ON MODERN EXPLOSIVES. By George W. MacDonald. 6¼x10¼, pp. 192; $2.50. The MacMillan Co., New York.

COAL NEAR THE BLACK HILLS, WYOMING-SOUTH DAKOTA. By R. W. Stone. Pp. 73, illus. Bull. 499, U. S. Geological Survey, Washington, D. C.

BUILDING STONES AND CLAYS. Their Origin, Characters and Examination. By Edwin C. Eckel. 6x9¼, pp. 264, illus.; $3. John Wiley & Sons, New York.

I GIACIMENTI PETROLEIFERI DELL' EMILIA. By E. Camerana and B. Galdi. 7½x10½, pp. 334, illus.; paper. Studio Pubblicato to per Cura del R. Ufficio Geologico, Rome, Italy.

CENTRIFUGAL PUMPING MACHINERY. The Theory and Practice of Centrifugal and Turbine Pumps. By Carl George de Laval. 6x9, pp. 184, illus.; $3. McGraw-Hill Book Co., New York.

ZUSAMMENSETZUNG DER GEBRAUECHLICHEN METALLEGIERUNGEN. By Ed. Wilhelm Kaiser. 7½x11½, pp. 26, paper; 2.80 marks. Wilhelm Knapp, Halle a. S., Germany.

THEORIE UND PRAXIS DER STAUBVERDICHTUNG UND DER REINIGUNG UND ENSTAUBUNG VON GASEN. By C. Guillemain. 5¾x8½, pp. 54, paper; 2.84 marks. Wilhelm Knapp, Halle a. S., Germany.

INVESTIGATION OF THE COALS OF CANADA WITH REFERENCE TO THEIR ECONOMIC QUALITIES AS CONDUCTED AT McGILL UNIVERSITY, MONTREAL, UNDER THE AUTHORITY OF THE DOMINION GOVERNMENT. By J. B. Porter and R. J. Durley, assisted by T. C. Denis, Edgar Stansfield and assistants. Volume I. Pp. 236, illus., with numerous plates and maps. $1. Canada Department of Mines, Mines Branch, Ottawa, Ont.

A TEXT-BOOK OF RAND METALLURGICAL PRACTICE, Vol. I. By Ralph Stokes, Jas. E. Thomas, G. O. Smart, W. R. Dowling, H. A. White, E. H. Johnson, W. A. Caldecott, A. McA. Johnston and C. O. Schmitt. 6½x9, pp. 468, illus., half leather. Charles Griffin & Co., Ltd., London; J. B. Lippincott Co., Philadelphia.

As stated on the title page, this book is designed as a "working tool" and practical guide for metallurgists upon the Witwatersrand and similar fields. Much of the subject matter was first published in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa. The presentation of these valuable contributions to the knowledge of gold-ore milling in convenient and readily accessible shape alone would have been a boon to the profession, but the authors have gone farther; they have prepared the subject matter of these articles in logical sequence and have added thereto the minor data, often overlooked in similar publications. The book is a guide and catalog to Rand metallurgical practice; it should prove to be a veritable handbook to every gold metallurgist wherever he may be engaged, but, of course, does not embrace the phases of chlorination and concentration in the metallurgy of gold.

TYPES OF ORE DEPOSITS. Edited by H. Foster Bain. 6¼x9, pp. 378, illus.; $2. Mining and Scientific Press, San Francisco, Calif.

This is an important collection of papers by a distinguished list of geologists. The book cannot fail to be of interest and value to everyone who is in any way engaged with its subjects. The latter comprise contributions on "The Clinton Type of Iron Ore Deposits," by C. H. Smyth, Jr.; "The Lake Superior Type of Iron Ore Deposits," by C. K. Leith; "Flats and Pitches of the Wisconsin Lead and Zinc Districts," by H. Foster Bain; "Lead and Zinc Deposits of the Ozark Region," by E. R. Buckley; "Native Copper Deposits," by Alfred C. Lane; "The Cobalt District, Ontario," by S. F. Emmons; "Geology at Treadwell Mines," by Oscar H. Hershey; "The Saddle-Reef," by T. A. Rickard; "Contact Deposits," by James F. Kemp; "The Conglomerates of the Witwatersrand," by F. H. Hatch; "Replacement Orebodies and the Criteria by Means of which They May Be Recognized," by J. D. Irving; "Outcrop of Orebodies," by William H. Emmons; "Some Causes of Oreshoots," by R. A. F. Penrose, Jr.

THE METALLURGY OF STEEL. Vol. I, Metallurgy, by F. W. Harbord; Vol. II, Mechanical Treatment, by J. W. Hall. Fourth edition, enlarged and revised. Pp. 933. 51 folding plates, over 500 illustrations in the text and nearly 80 photomicrographs; $12. Charles Griffin & Co., Ltd., London; J. B. Lippincott Co., Philadelphia.

The first edition of this work appeared in 1904, and was the first treatise in English aiming to cover the subject exhaustively since the classical work of Howe in 1890. The new book therefore assumed at once the position of the standard modern authority and reference book for English practice, as well as the best recent publication in the language on American practice. As far as the mechanical treatment is concerned, the first edition was, and the second edition still is, as far as I know, the most thorough and exhaustive single book of reference extant. Both authors labor under the handicap of practising their profession most of the time in a country in which progress in the metallurgy and mechanical treatment of iron and steel has been relatively slow during the last 10 years at least, and which has dropped in 20 years from first to third place in industrial importance. Nevertheless, both have taken special care to acquaint themselves with practice in other countries, and the new edition may be described as sufficiently uptodate for all ordinary reference purposes, even as regards American practice, and especially as regards mechanical treatment. It has the further advantage over a book written in this country, of bringing an entirely new and conservative viewpoint to bear upon the innovations which we adopt so readily and at such great expense and loss of invested capital. Since the first edition is already so well known to all men to whom it is addressed, this review need only concern itself with the changes in the second edition:

The division of the work into two volumes is a distinct advantage, for the previous book of 800 pages in one cover was both inconvenient and perishable. The new scheme also necessitates a stricter differentiation between the metallurgical and mechanical sections of the book, which is more logical. Beyond this, the general scheme has not been altered, "but only such additions and modifications have been made as have been rendered necessary by the advancement in the theory and the practice of the art." Drawings of the latest types of open-hearth furnaces, charging machines and gas producers have been introduced, recent developments of the basic-open-hearth process described, and the discussion of electric smelting and purifying, upon which Mr. Harbord is now one of the world's greatest authorities, brought as far as possible up to date. Plans of representative modern installations in Europe and America have been added.

In the first section of the book, "The Manufacture of Steel," there have been slight changes or additions under: Small converters, gas producers and armor plate (the latter being the new cast armor), and more extensive changes under the basic Siemens process. In section 2, slight changes have been made in the chapter on heat treatment of steel, recent tests have been added under mechanical testing, many new data are given under special steels or steel alloys, under microscopical examination, and new plates in the chapter called "Typical Steel Plants."

In the mechanical volume, extensive changes have been made throughout: "The provision of power for use in steel works is treated much more fully. To the chapter on steam engines has been added a section on the use of steam in exhaust-steam turbines. Entirely new chapters have been added dealing with the generation of steam by solid fuel and waste gases, on the production of power by gas engines working with blast-furnace gases, and on electric driving of the mills."

In Volume II, the changes are so extensive as to make detailed discussion impracticable here, as will be evident from the observation that this subject, which occupied about 288 pages in the previous edition, now covers more than 400 pages. A useful practice in this volume is the addition of a bibliography at the end of each chapter. Those who aim to maintain a modern reference library on steel cannot afford to be without this second edition, even if they already possess a copy of the previous one.

Bradley Stoughton.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

J. R. Finlay has been in British Columbia on professional business.

T. Lane Carter, of Chicago, is examining properties in northern Michigan.

G. C. Bateman has been examining properties in the Swastika district, Ontario.

K. V. Gardiner has resigned his position as manager of the Success mine, Porcupine, Ontario.

Kirby Thomas, of New York, is spending some time in Ontario and Quebec, making mine examinations.

Robert S. Botsford has returned to London from a professional trip to the neighborhood of Vladivostok, in Siberia.

Dwight E. Woodbridge, of Duluth, Minn., has gone to Central America on professional business, to be absent a few weeks.

Edward J. Collins has returned to Duluth, Minn., from British Columbia, where he has been examining copper properties.

W. Parsons Todd has been elected vice-president of the Quincy Copper Co., in place of W. P. Bliss, resigned. Mr. Bliss remains a director.

C. Powell Karr has been appointed metallurgist of the Standard Chemical Co., Pittsburgh, manufacturer of vanadium and other alloys.

E. J. Carlyle left New York on June 6 for London, on his way to Argentina, to take charge of the smeltery of the Famatina Corporation, at Chilecito.

Ambrose Monell, president of the International Nickel Co., has been chosen president of the Canadian Mining & Exploration Co., Ltd., a new organization.

Herbert Johnson, recently with the Oliver Iron Mining Co., at Ishpeming, Mich., has been appointed assistant engineer with Pickands, Mather & Co., at Iron River.

George Wingfield, well known in connection with the Goldfield Consolidated Mines Co., has been appointed U. S. Senator from Nevada, in place of the late George S. Nixon.

S. L. G. Knox, for several months general manager of the Yuba Construction Co., has been elected vice-president and general manager of the Natomas Consolidated of California.

Norman T. Tracy has been appointed manager of the mines of the Compañia Minera Jesus Maria y Anexas, at San José de Gracia, Sinaloa, Mexico, in place of Mauricio A. Newman, resigned.

Frederick A. Pelter, recently assistant superintendent of construction for the Tennessee Coal, Iron & R.R. Co., has been made assistant engineer for the H. Koppers Co., in charge of new construction.

Richard Henry Thomas has returned to New York from Kyshtim, Russia, where he was engaged for two months in looking over the electrolytic copper refinery, with a view to securing greater efficiency in its work.

Austin H. Brown has closed his San Francisco office and has removed to Walnut Grove Ranch, Willets, Mendocino County, Calif., where he is still open for professional engagements as mining and metallurgical engineer.

N. H. Emmons, having severed his connection with the Tennessee Copper Co., announces that he has opened an office in the Union Oil Building, Los Angeles, Calif., where he will do consulting mining engineering.

John H. Kennedy, formerly general superintendent of the Punxsutawney Iron Co., Punxsutawney, Penn., is in charge of the blast-furnace department of the Rogers-Brown Iron Co., operating the Susquehanna furnaces as Buffalo.

W. R. Bassick, who was general sales manager of the Yuba Construction Co. during the incumbency of Mr. Knox as general manager, has succeeded to that position, and becomes vice-president of the company, with offices in San Francisco.

Waldemar Lindgren, of the U. S. Geological Survey, has been appointed head of the Geological Department of the Massachusetts Institute of Technology, in place of Prof. T. A. Jaggar, who is now director of the Hawaiian Volcanic Observatory.

Frank M. Chambers, for six years past superintendent of the Great Western Ore Purchasing Co., at Goldfield, Nev., has sold his interest in that company and will hereafter represent the International Smelting & Refining Co., in Nevada, with headquarters at Goldfield.

Newton Cleveland, who for a long time had been general manager of the Yuba Construction Co., and the several dredging companies of the Hammon interests in California, has been relieved of these various duties gradually and is now retained as consulting engineer.

J. W. Keffer, manager of the Shelby Iron Co., Shelby, Ala., has resigned to take charge of coal properties recently purchased by him, at Sebree, Ky. He is succeeded by L. W. Searles, of Birmingham, Ala., who has been consulting engineer for the Shelby Iron Co. for the past year and a half.

F. P. Schwindler has resigned his position as manager of the McIntyre Mining Co., at Porcupine, Ont. W. Cooper, who was superintendent of the mine, has also resigned. It is stated that the mine will be under the direct management of C. B. Flynn, who represents the majority of the stockholders of the company.

OBITUARY

Theodore Albert died at his home in Cincinnati, Ohio, May 27. He was president of the William Powell Co., of Cincinnati.

James Moffet died at Los Angeles, Calif., June 4. He was born in Ireland and came to America when a boy. He was 75 years old, and had been engaged in mining and mine development with his brothers for many years in California, Oregon and Montana. He is said to have made a fortune from the Orphan Girl mine near Butte. Two of his brothers survive him.

Senator George S. Nixon, of Nevada, died at Washington, June 5. He was 52 years old, was born in California, and went to Nevada when a young man. Making his home at Reno, he was extensively engaged for many years in mining operations in different parts of the state. He became especially prominent in connection with the development of Goldfield and Tonopah, where he is said to have made a fortune. He served several terms in the state legislature, and was chosen United States senator in 1905, succeeding William M. Stewart. He was reëlected in 1911. His death resulted from an operation for throat trouble.

Societies and Technical Schools

State College of Washington—The senior class of the mining department, with Prof. Francis A. Thomson, head of the department in charge, left the college at Pullman for Republic on May 19, and, after having spent three days in that camp, proceeded to Greenwood, Phœnix, Grand Forks, Trail and Rossland, all in British Columbia. Mines, copper and lead-smelting works, and the electrolytic lead refinery at Trail, were examined. The trip was the best the class has made to date.

American Institute of Mining Engineers—At the annual business meeting of the institute, Feb. 29, it was voted to postpone the consideration of the proposed amendments to the constitution until June 3, 1912, and the meeting adjourned to reconvene on that date, or on such subsequent date as should be fixed by the special committee of five, appointed on Feb. 20, and the board of directors of the institute, acting jointly. Owing to various causes, including absence of two members of the committee in Europe for two months, it has not been possible for the special committee of five to complete its report in time for preliminary distribution to members of the institute and consideration by them prior to June 3, and it has been mutually agreed by the special committee and the board of directors to postpone the date at which the adjourned meeting shall be reconvened from June 3 to Oct. 7 next.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

June 5—State Mineralogist Storms has appointed Charles C. Selby curator of the State Mining Bureau, and has directed that a complete rearrangement of the museum and a partial reclassification of the 20,000 specimens be made. These specimens are the accumulation of a great many years of collections and donations and they have been handled numerous times through necessary removals and unnecessary loans to expositions. The desire to have California properly and appropriately represented at fairs and expositions has prompted the loans, but the desire was never strong enough to induce the legislature to appropriate sufficient money to secure fresh specimens direct from the mines for this purpose. So the mining-bureau specimens have gone out and come back and have often been misplaced. The earthquake of 1906 shook up the museum, and, in addition, the frequent returns from exposition loans resulted in much improper arrangement and inaccurate classification.

The present classification, where incorrect, will be corrected, as far as possible. The new arrangement of the minerals contemplates a plan that will make the specimens from the various mines of greater value to the student, and not merely an exhibit that is attractive to the mass of visitors as a picture which they do not comprehend. While the present administration of the bureau has no desire nor intent to destroy the value of the bureau as a show place, the chief purpose is to make it of educational benefit to the student of mineralogy and mining geology.

The errors in classification, Mr. Storms states, include many of the rock specimens, which will also be corrected, and the rearrangement of this portion of the exhibit contemplates the placing of these specimens in such order as to illustrate the transition of rocks. The museum contains fine specimens of the wall rocks of the Mother Lode region, a section of the state that is always of interest in California. These and the wall rocks from other mining districts, and various mineral specimens, have been collected by the field assistants of the bureau and many by Mr. Storms, while employed in that capacity and as a mining superintendent. These specimens include the clay slates, micaceous slates, schists, greenstones and a variety of types of amphibolite schists. Besides the rearrangement of the museum to meet the requirement of students and mining men seeking knowledge of the rocks and minerals of the state, the state mineralogist and the curator will extend to all visitors every courtesy and lend assistance to all who desire information in the pursuit of their studies of any mine or district that is represented in the bureau museum, or in the investigation of the mineral resources of the state. The present curator is relieved of the duties of bookkeeper and treasurer imposed on his predecessors, and will be able to devote his entire time to the mineralogical and geological department of the bureau.

Denver

June 6—It is announced that the Argo Reduction & Ore Purchasing Co. has been organized by Boston men, headed by Frank A. Schirmer, of that city, who is also president of the company controlling the Newhouse tunnel, of which his son, R. F. Schirmer, is manager. It is also stated that plans for a mill are being prepared and that construction of the first 100-ton unit will be under way in July, the cost being estimated at $85,000. The mill is to be erected just below the portal of the Newhouse tunnel and will be under the superintendence of Arthur H. Roller.

The production of gold for the Cripple Creek district for May, as given by the mills and smelteries, is 76,704 tons, worth $1,203,325, as against 77,281 tons in April of a gross value of $1,216,693. The New Portland mill, at the mine at Victor, treated 14,000 tons last month; Stratton's Independence mill, 10,851 tons.

An incipient Cherry Creek gold excitement is with us again. It has cropped up about every 10 years since 1860, this time engineered by a placer company, capitalized for $5,000,000, which has been advertising its $1 shares for 2c. per share. However, the district should not be condemned. The region in question is Newlins Gulch, about six miles from Parker, on the Colorado & Southern Ry. and 25 miles south of Denver; that the sands and sandstone conglomerates of that region contain gold is well known, but until the area has been thoroughly drilled, and working tests of the ore made, it will not be known what the average grade is or whether it can be mined and treated at a profit. The conglomerates would have to be blasted and, of course, crushed for treatment, and water for a mill would have to be pumped.

The Smuggler mine, at Aspen, has been closed down, owing to a walkout of the timbermen, following a cut in the pay of the helpers, and over 300 men are out of employment in consequence. The matter is one of ordinary mine discipline, as Supt. John Champion decided that instead of two timbermen working together, the pairs should be composed of one timberman and one helper.

Butte

June 4—During May, gold worth $181,585 was deposited at the U. S. Assay Office, at Helena, from Montana counties. Madison County led with $83,410. The various counties ranged as follows: Broadwater, $439; Chouteau, $20,071; Deer Lodge, $472; Fergus, $39,483; Granite, $66; Jefferson, $88; Lewis & Clark, $35,242; Madison, $83,410; Missoula, $2000, and $309 for Powell County.

With both shafts of the Pennsylvania mine of the Anaconda hoisting ore, the output should be increased fully one-third. The third compartment of the air shaft will be used for the compressed-air pipe line and the electric cables. The south crosscut on the 1800-ft. level is advancing at the rate of nearly 100 ft. per month, and has now reached a point 1600 ft. south of the shaft. The fan-driven air system, recently installed, by which fresh air is constantly supplied through a 14-in. galvanized-iron pipe to the miners working in the breast of this crosscut, is accomplishing excellent results, the men working in the decreased humid heat with increased efficiency. While stoping on the 1000-ft. level, a connection was recently made to some old workings of the St. Lawrence mine, causing an inflow of gas from the latter. The opening was immediately closed.

Salt Lake City

June 6—The United States Smelting, Refining & Mining Co. interests secured control of the Consolidated Fuel Co.'s coal lands on June 1, after negotiations extending over about four months. Notice of the transaction was given out by the Deseret National Bank, of this city, which held the stock in escrow, acting as an intermediary. The holdings comprise about 5000 acres of bituminous coal land in Emery County, the town of Hiawatha and a half interest in the Southern R.R., which connects the mines with the Denver & Rio Grande, at Price; the Hiawatha mine, one of the largest and best coal mines in the state, the Blackhawk mine, the holdings of the Castle Valley Coal Co. and other properties. The output of the Consolidated Fuel Co.'s mines is at present 2700 tons per day, and when the lands are opened this will be largely increased. Surveys are now being made for what will be known as the Utah Coal R.R., which will extend from Mohrland through Huntington Cañon to Hilltop, and from there parallel to the Marysvale branch and main line of the Denver & Rio Grande to Provo or to Spanish Fork. This road, when completed, in connection with the Southern Utah line, will furnish a direct outlet for the coal fields. When the lands are opened, they will be the largest producers in the state.

The listing of local industrial securities on the Salt Lake Stock & Mining Exchange is being considered, and a meeting of the governing board will be called to take action on the matter. This proposed addition has met with approval on the part of brokers, who are members of the Exchange, and will give a market value to various industrial securities on which there are at present no regular quotations.

Globe, Ariz.

June 5—After a conference of the managers and superintendents of the principal mines of the Globe-Miami district, an increase of wages or reduction of hours has been granted to all employees, to take effect June 10. Nearly 3000 men will be affected. The 9-hour day has been abolished for surface men, and hereafter all employees on surface and underground will not work more than 8 hours per day. All surface men who have been working 8 hours per day will receive a 7% increase in wages. Surface men now working 9 hours will receive the same pay for 8 hours' work. All men working underground will receive the same pay as heretofore, but will spend a total of only eight hours underground, as provided in the eight-hour law recently passed by the legislature. The men will be hoisted and lowered and will eat their lunch in this eight-hour period, which will consume about an hour, so that they will hereafter receive the same pay for 7 hours' work that they have been getting for eight. The increase is in line with the policy of the large mining companies, adopted several years ago, of granting an increase in wages when copper shall have advanced in price beyond a certain point, with the understanding that they shall be lowered to the old rate when the price of copper falls below that point. This "critical point" was fixed at 18c. in Butte and seems to have be established at 16c. in Arizona. The companies state in the notices posted at the mines that they regret that the wages of underground men cannot be increased, but the 8-hour law, reducing the actual working time to about 7 hours, prevents this, as it is not possible to reduce working hours and increase wages at the same time.

A petition is being signed by prospectors, claim owners and business men of the district, addressed to the Arizona legislature, now in special session, asking that the miners' lien law, recently enacted, shall be amended. The law as enacted provides that persons furnishing labor, or material to be used in mines or on mining claims under contract with the owners or their agents, or with lessees, or with persons or corporations working the mine or mining claims under option to purchase, shall have a lien upon such mine or mining claims for such sums as are unpaid. In other words, prospectors and claimowners will have to stand for any debts contracted by individuals or corporations working their claims under option. It is generally believed that the enforcement of such a law would mean stagnation if not paralysis to the development of mines and prospects in Arizona. While it is admitted that the law affords admirable protection to miner and laborer, for which purpose it was intended, yet it is believed to be grossly unfair to the small claimowner and prospector.

Negaunee, Mich.

June 8—Indications are for a record year in the shipment of iron ore from the Lake Superior region. In spite of cuts in the selling prices of the ores and political unrest, most of the mining companies are shipping large quantities and cleaning up stockpiles of several years standing.

On the Marquette Range, the Lake Superior & Ishpeming Ry. has contracts for the transportation of 2,000,000 tons, as compared to last year's figure of 800,000 tons; this railroad is owned by the Cleveland-Cliffs Iron Co. and the Jones & Laughlin interests. At Negaunee, the Breitung-Kaufman companies have already sold 475,000 tons of ore; this does not yet equal last season's shipment of 575,000 tons, but last season was an exceptionally busy one for these companies.

At Iron River, a boom is on both in mining and general business; this district, where 15 independent companies are operating, expects to ship 2,000,000 tons in place of the 1,000,000 shipped last year; Pickands, Mather & Co. will be the heaviest shippers, with a total of 600,000 tons from its Caspian, Baltic and Fogarty mines.

The Cleveland-Cliffs Iron Co. recently gave an exhibition of first aid to the injured before Pres. W. G. Mather and other officials, at Ishpeming. Teams from the company's mines, on the Marquette and Swanzy Ranges, participated. The program was as follows: First, Treat condition of a man who is found insensible, with arm across an electric wire, clothing burning; Lake mine team. Second, Treat compound fracture of lower leg and lacerated wound of thigh; teams from North Lake, Morris and Lloyd shafts. Third, Treat man insensible from gas; Stephenson mine team. Fourth, Treat simple fracture of lower leg and wound on side of head; Cliffs shaft team. Fifth, Treat compound fracture of upper arm and bruised forearm and fingers; Salisbury mine team. Sixth, Treat man insensible from drowning, using pulmotor; Negaunee mine team. Seventh, Treat lacerated chest and side, and broken collar bone; Austin mine team. Two- and three-man teams and individual men were then picked at random from the different teams for exhibitions in treating broken bones in all parts of the body, burns, bandaging and carrying injured men.

Toronto

June 8—J. B. Tyrrell, who will report on the territory from the new Provincial boundary through to Port Nelson, which Ontario is to secure from the Dominion, has left Toronto for Winnipeg, from which point he will commence the second stage of his journey. He is accompanied by Ellis Thompson, geologist, and Professor Stewart, who will act as surveyor. Much of the time spent in the north will be devoted to securing data upon the harbor facilities at the mouth of the Nelson River, where Ontario is entitled to a frontage on the river and on Hudson Bay, of 10 miles. The party will then explore along the coast to the southeast, to gain an idea of the best 5-mile strip, to the border of the district of Patricia.

Hon. W. T. White, Canadian Finance Minister, was recently notified that owing to the scarcity of cement, paving and construction companies in western Canada are unable to obtain this material in sufficient quantities to fill their contracts, and that serious business loss and public inconvenience will result unless conditions are remedied. It is stated that Western contractors have been forced to place heavy orders in the United States and to pay the high duty involved. A suspension or reduction of the tariff is suggested as a remedy. F. P. Jones, general manager of the Canada Cement Co. was summoned from Montreal to confer with the government and took the ground that the difficulty was the shortage of transportation facilities. He stated that the company had 1,000,000 bbl. ready for shipment but was unable to get cars. The government is making a full investigation and the Finance Minister promises to announce the result in a few days.

The Mining News

The Current History of Mining

Alaska

Volcanic activity started June 6 in the Aleutian and Alaskan Ranges. Mt. Katmai was reported in eruption, covering villages on Kodiak and Woody Islands with a foot of ashes. Mt. Hayes, southeast of Fairbanks, is also believed to have been a center of disturbance.

Alaska-United—During April the mills crushed 37,464 tons of ore, yielding $85,287 gross and net $26,430. Operating expenses were $47,900; construction, $10,957; development, 617 ft. The ore averaged $2.57 per ton at the Ready Bullion mill and $2.04 at the 700 claim.

Alaska-Mexican—During April the mill crushed 19,152 tons of ore, yielding $57,058 gross and net $17,525. Operating expenses were $31,347; construction, $8.85; development, 176 ft. The ore averaged $3.01 per ton.

Cordova District

There is a larger number of "hard-rock" prospectors operating along the Copper River & Northwestern Ry. this season that ever before. Some good prospects in silver, gold and iron are being worked. Early this spring large shipments of hydraulic machinery were made, consigned to G. H. Birch, manager of the Dan Creek Mining Co., and George Max Esterly, who is operating on Chittitu Creek, 20 miles from the end of the railroad.

Yukon Territory

New Atlas Mining Co.—This company, which last March bonded a group including the principal mineral claims in the Whitehorse copper camp, southern Yukon, has been shipping ore by the White Pass & Yukon R.R. to Skagway, Alaska. W. D. Greenough is manager, and John Mocine superintendent. By May 15 more than 2000 tons of ore had been delivered into the dock bunkers at Skagway and 1000 tons shipped to the Tacoma smeltery. Machinery is being put in on the Valerie claim, but as yet production is from the Pueblo only. R. G. McConnell, of the Geological Survey of Canada has reported that the Pueblo orebody consists of an impure mass of hematite, 300 ft., long, with a maximum width of 170 ft. The surface section measures approximately 33,000 sq.ft. The orebody has been proved to a depth of 100 ft. The company claims 412,500 tons above the 100-ft. level, with a probable average copper content of 3%; the gold and silver value is small, probably about $1 per ton.

Arizona

Gila County

Activity is being displayed in the old silver camps in the Apache Mountains, about 12 miles northeast of Globe. The McNorris mine in Richmond basin, a producer of silver in the 70's and as late as 1882, is being reopened by W. D. Fisk of Globe, and associates. A new gasoline hoist has been installed and the 800-ft. shaft has been retimbered for 160 ft. George Wilson is superintendent. John Mitchell and Edward Casson are working Fred Hefty's group of 12 claims under bond and lease. These claims adjoin those of the McMillen-Stonewall company. The Rice brothers are developing the Buckeye group and Lee Ikenberry is taking high-grade silver ore from his claims in Richmond Basin. Edward Simonton is mining rich silver ore on the claims leased from P. W. Gallentine. Earnest efforts are being made to develop this district, with possibilities of success.

Miami—May production was about 2,700,000 lb. of copper, a slight increase over April. Development work for May totaled 5627 ft. Diamond-drill hole No. 1 disclosed commercial ore for over 200 ft. below the 570-ft. level, which is 150 ft. more than has ever been estimated. Work will start soon on a new machine shop near No. 4 shaft, and the foundation is in for a second 500,000-gal. mill-water supply tank. The mill is now using nearly 2,000,000 gal. per day. About 900 men are employed, 500 underground.

Inspiration Consolidated—The concrete work on the dam across Pinal Creek has been finished and grading will be started for the pumping station. Engineers are making the location survey for the spur from the Arizona Eastern R.R. to the mine and millsite, and contractors are figuring on the grading and construction. Grading on the site of the working shafts continues and three development shafts are being sunk to greater depth. About 2500 ft. of drifts and raises were driven in ore last month, the ore being hoisted through the Joe Bush shaft. About 400 men are employed.

Southwestern Miami—Considerable difficulty has been experienced in the churn-drilling for the last two weeks, but the work is now proceeding satisfactorily. Holes 4, 5, 6 and 7 are 585, 675, 520 and 230 ft. deep, respectively. No. 4 has been temporarily discontinued and the drill has been moved nearer to the Live Oak line, where Hole No. 8 has been started. None of the holes are in ore.

South Live Oak—There has been considerable trouble recently on account of caving ground and losing the tools in the hole; the latter is at about the same depth as last week, 640 feet.

Old Dominion—The May production of the smeltery amounted to 2,160,000 lb. of copper. Production of ore was at about the same rate as for the previous month, there being no attempt to meet the prevailing price of copper with increased production until after the capacity of the concentrator has been increased and other improvements made. An average of 2½ furnaces were in operation during the month. The foundations are in for the new flue and dust chamber at the converter plant and the steel has been shipped. Plans are now being worked out for equipping the shaft for hoisting the ore in skips instead of cages, the change to be made without interfering with hoisting or curtailing production. H. Kenyon Burch is working on the plans for doubling the capacity of the concentrator. An order is being placed with the Power & Mining Machinery Co. for a large converter stand and two shells that will take the place of the three small stands now in use. The shells will be of the Great Falls type, electrically operated; basic lining will be used. The concreting of the fourth section of the Kingdon shaft of the United Globe mine is finished, making a total of 710 ft. of completed concrete lining. The temporary timbering for the fifth and last section, of 290 ft., has been started. Paul Michaelson and C. H. Weideman are the contracting engineers.

Pima County

Pioneer—The blast furnace is being changed to use coke instead of oil, smelting with the latter fuel having proved too slow.

Santa Cruz County

Copper Queen—Engineers representing this company are reported recently to have examined and acquired copper claims near Patagonia.

Yuma County

Arizona-Nevada—This company operating in the Castle Dome district has recently received machinery for a 100-ton concentrator. Development of an old silver-lead mine has been going on steadily. Ore has been developed on the 200 level and work is being done on the 300.

California

AMADOR COUNTY

Kennedy—It is reported that the company has purchased the Barton ranch adjoining the Jackson cemetery and east of the Bright estate, which the company purchased in 1910. The Barton field is situated on the East belt and is believed to contain a continuation of the Zeila vein. Webb Smith, of Jackson, is superintendent.

Zeila—That part of the mine which extends under the surface of Pleming ranch is reported to have been abandoned as regards extraction and development and the machinery taken out. There are other orebodies developed. W. F. Detert, of Jackson, is manager.

Plymouth Consolidated—The unwatering of the Pacific shaft has extended to the 1600-ft. point. This shaft is 1650 ft. deep, and the unwatering has practically drained the drifts of the Empire and Pacific shafts. It is expected that exploration will soon be in progress. J. F. Parks, of Plymouth, is superintendent.

Bunker Hill—A new steel gallowsframe is contemplated. The present wooden frame has been in use for many years. E. Hampton, Amador City, is superintendent.

South Amador—The new compressor has arrived.

CALAVERAS COUNTY

The construction of an electric railway between San Andreas and Valley Springs is contemplated. The installation of automobiles for passenger and freight service is also being considered. Either the electric or the auto service will be equal to the demands, The present auto-stage service runs from Angels by way of San Andreas to Valley Springs. Auto-truck service connecting San Andreas and the surrounding mining sections with the railroad would aid largely in developing and reopening old mining claims that cannot be economically worked without reasonable hauling rates.

Calaveras Mining Co.—This company, operating copper mines at Copperopolis, is installing four Speedwell 6-ton auto trucks to haul ore to the railroad at Milton, and to haul fuel oil to the mine. The oil tank and ore compartment fitted on the body of the truck was designed by R. Harry Croninger, a San Francisco representative of the Speedwell Motor Car Co. A triangular-shaped steel tank rests on the floor of the truck, and the body forming the ore-carrying compartment is built around it. The body of the truck is 15 ft. long and 6 ft. wide.

INYO COUNTY

Bishop Creek Milling Co.—The company is erecting the first unit of 10 stamps. These will weigh 1250 lb. each. The El Oro mortars will weigh 9000 lb., and will be set on concrete foundations with interchangeable foundation bolts. The other equipment will depend upon experiments.

Southern Belle—This company near Laws is selling its 10 stamps and accessories.

Salt Valley Co.—A long aërial tramway is being installed to transport salt to the railroad.

KERN COUNTY

Rattlesnake—Ten tons of good ore have been mined on a lease on this property in the Stringer district, and are ready for milling. R. Roschl and James Burns are the leasers.

Gold & Platinum Extraction—This company, operating in the Stringer district near Randsburg, is reported to have finished a test run with satisfactory results. No definite information is given out. Improvements are being made in the machinery.

NEVADA COUNTY

Pennsylvania—Installation of a cyanide plant to treat the tailings is being considered. George W. Starr is manager.

Union Hill—Electric motors have been ordered for running the compressor and pump. Clifford Graham is superintendent and Arthur Doe manager.

Empire—Arrangements have been made to operate the hoist by electric instead of by water power. Frank R. Hull is superintendent.

Idaho-Maryland—Arrangements have been made to put in electric power to run the mill, compressor and pump, in place of water power. Robert Nye is superintendent.

Golden Gate—The addiiton of 10 stamps is contemplated. C. C. Haub is manager.

Montana—Arrangements have been made to change from water to electric power. Arthur W. Hoge is manager.

PLUMAS COUNTY

Alaska and Seattle men are said to have secured options on 800 acres of land in Indian Valley, near Greenville, which will be drilled as prospective dredging ground. The Altoona Mining Syndicate has bonded or taken options on similar lands known as the Hudson, the Lawrence and other ranches. The men concerned are Col. J. W. Bailey, Lincoln Davis, F. D. Wilson, P. H. Bailey, A. A. Taubeneck and J. M. Wiswold. Other prospective dredging lands are to be prospected with Keystone drills near Clio, on the middle fork of Feather River.

SHASTA COUNTY

Afterthought—A trust deed for $800,000 to the Security Trust Co., of Indianapolis, has been filed at Redding by this company. The money is to be used in the extension of the Anderson & Bella Vista R.R. from Bella Vista to Ingot, 13 miles, provided the negotiations for the road from Anderson to Bella Vista are consummated. The purpose of reopening the mine is to recover the zinc contents as the chief product.

Mt. Shasta Power Co.—The tunnel at the big bend of Pit River is being advanced from both ends. About one-half mile of this tunnel is reported completed. The full length will be approximately six miles. W. A. Cooper, of Montgomery Creek, is manager.

SIERRA COUNTY

Goodyear Bar—A vein of commercial asbestos has been opened on this serpentine belt by William Casserly.

Bear Creek—At this Forest mine, the recent cleanup yielded $150 per ton of ore crushed. The vein at the 150-ft. level is over 3 ft. wide. John Andrews and associates are the owners and operators.

Oxford—This Downieville mine, on the same serpentine belt as the Tightner, York and Sierra Standard, has been bonded to Charles W. Morse, who is connected with the Tightner mine, at Alleghany, and the North Star mine, at Grass Valley.

TUOLUMNE COUNTY

Eagle-Shawmut—Fifty stamps are operating on ore from below the 2000-ft. level. An additional roasting furnace for the chlorination plant has been received and will be installed.

Dutch—The mill contains 40 stamps, eight Johnston concentrators and 10 Frue vanners, and is operated by electric power. A 7-drill Leyner compressor has been installed and an electric hoist is contemplated. A new Ward drill sharpener and forge have also been installed. Charles H. Segerstrom is superintendent.

Colorado

BOULDER COUNTY

The Prussian 75-ton mill at Roena has been remodeled and is in commission again. Monell concentrating tables and slimers were added.

Lee S.—This mine at Sunset has developed some smelting ore. The erection of a small mill is contemplated to treat low-grade ore.

Reppie—This mine at Sugarloaf, is preparing to resume operations. Equipment includes a steam plant, compressor and air drills. The mine is developed by a 220-ft. inclined shaft which will be sunk 200 ft. deeper.

Colorado Metals & Chemical Co.—The company has remodeled the Bailey mill at Eldora from a chlorination to a cyanide plant of 50 tons capacity.

Clear Creek County

Golden Empire—This company operating at Empire is driving the Denver City Tunnel on Cordove Mountain. E. D. Payne is manager.

Old Town—This company performed 120 ft. of development in May. G. K. Kimball is manager.

Bride—J. J. Hoban and E. D Payne are reported to have leased this mine with the intention of operating it through the Idaho tunnel. Hoisting equipment will be required.

Stanley—The fifth level south was advanced 114 ft. in May. It may be opened an additional 1500 ft. to prospect the Stanley vein. The Road adit is being placed in working order. The Salisbury 50-ton mill is treating ore from development. The mines are unwatered to the sixth level. All pumping is done with compressed air, obtained with hydraulic power. This equipment may be used eventually for drilling purposes and electric pumping facilities provided.

Lake County-Leadville

The Lake County placer diggings are all busy again, and gold in pay quantities is being recovered. In California Gulch the old Tom Star placer worked since 1860, seems to get a new store of gold every winter and is again paying good wages. At the head of Cranes Park, the placers on Tennessee Creek are said to be paying, and at Tennessee Pass Maupin Brothers are taking out coarse gold from their placer diggings; all this work is being done with the old-fashioned flume and riffles.

Dinero Tunnel—Thirty men are employed and the ore being sent to the smeltery is said to yield about 84 oz. silver per ton.

New Dome—One hundred tons of good grade carbonate-of-zinc ore have been shipped.

Yak Tunnel—Seventy-five tons per day of iron-sulphide ore are being shipped from the lower levels of the Louisville shaft, sunk below the Yak Tunnel level by the owners, Hanifen & Reynolds.

Ouray County

Tomboy—During May the mill crushed 8400 tons of ore, yielding a total of $81,500. Expenses were $41,000; profit, 40,500 and $14,361 were spent on permanent improvement.

San Juan District

Mineral Farm—This mine on the outskirts of Ouray, owned by Mr. Lucas of St. Louis, has been closed down for a long time, but it is now to be reopened and this, as in many other cases in the state, is due to improved methods of ore treatment. Though noted for its rich silver ore, the trouble was that it was chiefly an argentiferous gray copper in a baryta gangue, the medium and lower grades of which could not be concentrated. It is reported that the gray copper has been successfully separated from the gangue by the H. E. Wood & Co. flotation process, at their testing works, and that better results have been attained than by any wet process hitherto tried. Mr. Lucas has men at work at the mine.

Doyle Consolidated—This company, near Mancos, is at work again under W. M. Mauat, superintendent, and the mill, under the superintendence of J. H. Bills, will soon be treating 25 tons of ore per day. Two burro trains are packing supplies, coal and wood over three miles of snow to the mines and this spirit seems to pervade the mining camps of the entire San Juan region.

Mickey Breen—This mine up Poughkeepsie Creek, near Ouray, has commenced shipping concentrates to the smeltery. It is stated that the mill is turning out a product yielding 75% lead and 40% zinc with good gold and silver contents. This mine is being operated by the Haagsma-Hall Mining Company.

Teller County—Cripple Creek

Press reports state that the El Paso, Mary McKinney and Henry Adney mines are to be combined under one management. It is further said that ground for a reduction plant to treat the low-grade ores has been purchased and that plans for the mill are under consideration.

Gold Dollar—In the annual report of H. L. Shepherd, president, it is stated that 30 sets of lessees are at work on this Beacon Hill mine and that the net amount of cash paid into the treasury since the last report is $39,847 with $29,064 cash on hand. In driving the 10th and 11th levels most of the work has been in ore and about half of it is of smelting grade. Since the completion of the deep drainage tunnel, it will be possible to sink the main shaft another 100 ft. without reaching water.

El Paso—It is announced by Charles M. Heberton, vice-president, that 400,000 shares of stock have been sold to German and Swiss men, this block representing the holdings of the Bernard-Beaty faction, who fought so hard for the control at the last election and lost to Allan Burris, now president. The deal was made by Joseph Walker & Sons, of New York.

Mary McKinney—The output for May was 45 cars or about 1400 tons of ore averaging about 2 oz. gold per ton. The main shaft, now 820 ft. deep, will be sunk 130 ft. deeper on the Republic claim. Lessees on the Howard shaft on the Grace Greenwood and other blocks are making a good production.

Mountain Beauty—Hatcher brothers, of Goldfield, have installed a 15-hp. electric hoist at this mine, to hoist ore from a depth of 250 feet.

Idaho

Blaine County

Croesus—A 200-ft. winze has been sunk from the 800 level and good lead-silver ore opened. W. D. Mouck is in charge. The property is equipped with stamps, tables and vanners.

Elkhorn—These mines, near Ketchum, are being prospected by a syndicate, headed by Colonel Hardess, formerly superintendent of the Ketchum smeltery. Work has been in progress for two years with 25 men. Equipment includes a 50-hp. Diesel oil engine and a compressor.

Idaho Consolidated—This company, owning the Minnie Moore mine, once owned by Charles M. Schwab, is in the hands of J. J. Donovan, receiver. Equipment includes an 800-hp. steel and concrete hydro-electric plant.

Michigan

Copper

Old Colony—Reports state that hole No. 14 is 1453 ft. deep and that the drill has passed through several alternate beds, showing some copper. No. 15 is in trap at 1140 feet.

Hancock—At 3650-ft. depth, the vertical shaft has disclosed some copper on the foot-wall side.

Adventure—The crosscut from No. 2 to No. 3 lode disclosed copper at 850 ft. from the shaft, close to No. 3 lode, but it is reported that it is still insufficient to identify it as No. 3 lode.

Algonquin—This company has been organized by R. C. Pryor, of Houghton, and Hayden, Stone & Co. and Payne Webber & Co. of Boston. Capitalization is $3,750,000, par $25. A tract of about 11,000 acres of land has been acquired in Matchwood township, Ontonagon County.

Iron

Chatham — At this Oglebay-Norton mine at Iron River, a balanced-hoisting system, using two skips, has been installed in the shaft where a single skip was used before. The same drum will serve, but a new cable is required. It is planned to equip the boilers with a Tilden automatic damper for regulating the draught; also a new 30x60-ft. machine shop is planned. Frank Smith, formerly at the Buckeye mine, Commonwealth, is superintendent.

Colby—Corrigan-McKinney & Co. have added 130 men to the force at this mine at Bessemer.

Newport Mining Co.—This Gogebic range company is establishing logging camps at Newport Siding, for cutting mining timber.

Imperial—Shipping from stockpile has been started from this Cleveland-Cliffs mine at Michigamme, although underground operations are at a standstill.

Rolling Mill—At this mine of Jones & Laughlin, in the Negaunee basin, a new wooden headframe is being constructed over the No. 2 shaft. The material used is Washington fir.

Jones & Laughlin—The machinery from the Gogebic range properties of this company has been transferred to Iron River, as the operations on the Gogebic range have ceased. The Iron River mine has a 10x12-ft. shaft down 200 ft. and a drift on the first level at 175 ft. depth has reached the ore. About 50 men are employed.

Volunteer Ore Co.—Shipping is being done from the Maitland shaft and 200 tons per day of soft bessemer ore are being forwarded. No stockpile shipments have been made yet.

Zimmerman—This mine expects to hoist ore from the new No. 2 shaft soon. This shaft is 240 ft. deep and drifting to the orebody has been in progress for several months.

Minnesota

Great Northern—The company has awarded the contract for stripping Section 27 to Winston & Dear. It is reported one of the largest contracts awarded on the Mesabi Range for several years, amounting to about 7,000,000 cu.yd. of overburden. The property is also known as the Adams mine and adjoins the Monroe-Tenner, near Chisholm.

Montana

Butte District

Anaconda—At the Pennsylvania mine, 750 ft. of advance work on the levels were done during May. Of this raising constituted 80 ft., crosscutting 175 ft. and drifting 495 ft. The enlarging of the air shaft from the 1600-ft. level to surface, by cutting out a third compartment on the east side, has advanced from the 1600- to the 800-ft. level. When this is completed, a large compressed-air hoist will be installed, and two compartments will be used in hoisting ore in addition to the main shaft. No skips will be used at present in the air shaft, but the ore will be hoisted in mine cars on double-deck cages.

Butte-Balaklava—The company recently held its annual meeting in Duluth, and elected George C. Swallow, of Milwaukee, president, in place of P. H. Nelson, who resigned. Mr. Nelson has been at the head of the company for a number of years, and has given much time to its affairs. At the meeting the directors were authorized to raise $100,000 by debenture notes, for further development, and to defend the Anaconda suit. Development is now being done on one of the veins not involved in the suit.

Butte Copper—A special meeting of stockholders will be held, June 8, to elect a new board of five directors. The company owns 35 acres, comprising the Trifle, Anselmo Nos. 1 and 2, and a part interest in the Robert Emmet claims, Nos. 1 and 2, situated directly west of the Anaconda's Gagnon mine. On the Trifle claim, a shaft was sunk to a depth of 700 ft. and there is a shaft 300 ft. deep on the Robert Emmet. Since July, 1907, nothing has been done.

Pilot-Butte—For further developing the property, subscriptions for $100,000 additional stock have just been made by Edward Hickey, president of the Tuolumne company, N. J. Bienlenberg and others, of Butte. The funds will be used in sinking the shaft to the 2000-ft. level, from which point crosscutting will be started.

Jefferson County

Butte-Corbin—It is reported that officers of the company have been conferring with officials of the Great Northern R.R., relative to the laying of sidetracks on the property, at Corbin. Good ore was found in the mine some time ago, and H. Burnson, of Salt Lake City, consulting engineer for the company, has just finished an inspection of the property.

Madison County

Bell—A lease has been taken on the Grant 15-stamp mill, by S. J. Bukvich, who recently purchased the Bell mine, near Virginia City. Mr. Bukvich will keep the mill running steadily on his ore, and men are now preparing it for operation, and repairing the road from the mine to the mill. By the end of June the owner expects to have about 40 men at work in the mine and mill. Nine men are now getting out ore for the stockpile.

Nevada

Comstock Lode

Consolidated Virginia—A cleanup has been made of the ore accumulated from development work on the 2400-ft. level, and the bullion and concentrate were shipped last week from the Kinkead mill. The bullion was valued at $2300 and the 22 tons of concentrates at about $12,000. On the 2300-ft. level, the south drift, a short distance east of the foot wall of the main Comstock vein, is now in about 3 ft. of quartz, with occasional bunches of ore. This drift is 100 ft. west of the main south drift leading to Best & Belcher ground, and will develop virgin territory under the bonanza stopes.

Mexican—The cash return from the smeltery, on 12 bars of bullion shipped May 24, netted the company slightly over $39,000. The new clarifiers for the 100-ton mill are being set up and connections made. This addition is expected to bring the capacity up to 100 tons per day and give a higher percentage of extraction, which has averaged 90%, according to the weekly mill reports.

Union Consolidated—North and south drifts have been started in the east vein at a point where it was cut by the main crosscut from the 2500 station of the joint Union and Sierra Nevada winze. Going in a northerly direction the vein is 8 ft. wide, and face samples at a point 10 ft. in, give average assays of from [illegible] to $10 per ton.

Belcher—A north drift has been started in east crosscut No. 4, on the 1400-ft. level, on the 15-in. stringer of milling ore, and the vein continues to give the same width, dip and strike as found in the crosscut. This stringer is 90 ft. east of some of the early-day stopes that yielded a large quantity of high-grade ore.

Ophir—Complete returns have been received on the last run of ore at the Kinkead mill, and the net cash yield from the smeltery, from bullion and concentrates, was $48,697. The south drift on the 2100-ft. level is advancing in the West vein formation and is opening ground south of the famous Hardy-vein stopes.

Elko County

Bluster—The orebody on the south drift of No. 1 tunnel has been crosscut for 23 ft., the average grade being about $15 per ton. The new ore on No. 2 level has been found to be 6 ft. wide, yielding about $40 per ton.

Success—Nothing has been done in this mine since George Wingfield released it. He opened it with over 1200 ft. of underground workings, exposing three oreshoots, carrying $12 ore. Tonopah men have a bond on the mine and are now investigating it.

Alpha—The Chicago company, now in charge of this property, is doing development with satisfactory results. A gasolene hoist is being placed at the shaft. The latter is 85 ft. deep.

Log Cabin—The development and drainage tunnel being run through the mountain from this claim, is in 80 ft., and has cut the first indications of vein matter.

Jarbidge-Nevada—The tunnel is in about 500 ft.; a gasolene engine has been ordered to run a blower for ventilation.

Esmeralda County

Goldfield Merger—With the new hoisting equipment, shaft sinking is nearing the 1100-ft. point. It was originally planned to cut a station to accommodate stationary pumps, etc., at the 1000-ft. point, but as the volume of water encountered thus far is not a serious hindrance, it has been decided to defer this work.

Atlanta—The reorganization of the company having recently been effected, the new officials are considering the future operation of the property. It is probable that the mine will be explored at depth by a long crosscut from the bottom of the Grizzly Bear shaft of the Consolidated.

Lone Star—The shaft is nearing the 200-ft. point. It is the intention to sink to a depth of 250 ft., from which point drifting and crosscutting will be done.

Florence—The rich strike made in virgin ground on the 250 level, has improved with exploration. The vein has a total width of 11½ ft. Samples from across 3½ ft. next to the hanging wall, gave an assay of more than $1000 per ton, while the remaining 8 ft. against the foot wall averaged more than $20 per ton. A raise on the orebody from the 250 level and a crosscut to get under it on the 350 level will be started soon.

Pittsburgh-Silver Peak—The miners at Blair, struck June 1, when a reduction in pay to practically that of Goldfield became effective. The company officials were prepared and operations have not been seriously hampered.

EUREKA COUNTY

Mount Hope Mines Co.—This company has been organized to develop the Good Hope mines in the Mount Hope district. The ore contains lead and zinc sulphides. Walter Whitmore is superintendent.

Nevada Central Copper Co.—This company, operating in the Antelope district, has developed a quantity of oxides and carbonates. Electric drills and alternator have been received and are in operation. Extensive exploration and development are planned. H. A. Linke, Cedar, *via* Palisade, is superintendent.

Credo-Eureka—The company has taken an option on 30 claims at Adams Hill and is retimbering the old 400-ft. shaft. Drifting and crosscutting will be done to explore for lead-silver ore.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended May 30, are as follows:

Mines	Week	Year to Date
Tonopah Mining...	3,600	72,569
Tonopah Belmont..	1,850	44,826
Montana-Tonopah	1,094	22,440
Tonopah Extension	1,030	21,132
West End	667	15,601
Midway		180
MacNamara ..	455	7,725
North Star....		80
Totals	8,696	184,553
Estimated value	$217,409	

WHITE PINE COUNTY

Nevada Consolidated—During May, 314,137 tons of ore were milled at the Steptoe plant, the record tonnage for one month. The 250-ft. smokestack serving the McDougall roasters is cracked and will be replaced. The old one may be dynamited after the new one has been constructed.

New Jersey

American Smelting & Refining Co. A strike is in progress at the company's refinery, at Perth Amboy. E. M. Faircloth, assistant cashier, and two foremen are said to have been injured in attempting to leave the plant.

New Mexico

SANTA FÈ COUNTY

Santa Fè—A traction engine outfit was purchased recently and is expected to reduce transportation costs materially. It is expected to smelt 3600 tons of ore per month, for six months starting July 15.

SOCORRO COUNTY

Case Resmelting Co.—This company, formed in El Paso recently, has purchased the old Federal smeltery, near Highland Park, on the El Paso & Southwestern R.R., and has shipped the entire lot of machinery to Socorro, where it will be erected. The old slag dumps, purchased by the company, will be resmelted. The smeltery was purchased from the National Dry Kiln Co., which received it from the holdings of the late Col. W. C. Greene.

Amador—A shipment of high-grade ore is being taken out for treatment in the custom mill.

Deep Down—Leasers on this property sent 85 tons of ore to the Deadwood mill during the last week.

Oregon

Rainbow—Construction has started on a new mill that will contain 15 stamps and one tube mill. Simple amalgamation and cyanidation will be the process. Kelly filter presses and Merril zinc-dust precipitation will be used. The mill will be electrically operated with power from the Idaho-Oregon Light & Power Co.'s substation, at Gypsum. The machinery should be on the ground within two months. H. S. Lee, Rye Valley, is superintendent, and A. P. Anderson is mining engineer.

Utah

BEAVER COUNTY

The South Utah, Horn Silver, Moscow, Majestic and Red Warrior mines are making regular shipments. New copper discoveries are reported about 30 miles northeast of Newhouse.

Majestic—Returns on ore from the Old Hickory mine recently showed 3.8% copper, 2 oz. silver and 42.5% iron. During May seven cars were shipped. A compressor will be moved from the Harrington-Hickory and installed, and an electric power line brought in soon.

Horn Silver—From seven to ten cars per week are being shipped, mostly from the stope filling formerly considered waste. The 10-drill compressor is being overhauled.

GRAND COUNTY

Eastern oil men, who have been operating at Bakersfield, Calif., have arranged to drive three wells on claims seven miles east of Green River. Drilling rigs will be brought from Bakersfield, with a capacity for deep drilling. Several drilling rigs are reported to be on the way to the San Rafael Swell oil field near Green River.

Moab Oil—A well sunk by this company in the Klondike field is down 400 ft. The ground is caving, and work has been suspended awaiting the arrival of casing. Some gas has been encountered.

JUAB COUNTY

Tintic shipments for the week ended May 24 were 161 cars. This is a gain of about 350 tons over the preceding week. For the week ended May 31, 165 cars were shipped.

Iron Blossom—Connections have been completed on the 200-ft. level of the No. 1 shaft, around the portion damaged by the cave-in. Most of the machinery for the new hoist at the No. 1 workings has been delivered. One piece weighs 13 tons and may require a special outfit to haul it. On June 1, the company had $175,000 cash on hand.

May Day—The ore recently encountered on the 1000-ft. level is considered of much importance by the company. A new smelting contract has been made by which ore carrying zinc can be marketed. This is to be shipped to Bartelsville, Oklahoma.

Dragon Consolidated—Gold-copper ore has been opened in the northern part of the property, next to the Iron Blossom ground. Diamond drilling is to be done.

Eagle & Blue Bell—The new orebody, first found on the 700, is being developed and appears to be independent of the deposit, which has been mined to the 1200-ft. level and lower.

Uncle Sam—At the annual meeting held May 20, the former board of directors was reëlected. Ore sales during the year brought in $53,103. Cash on hand, June 3, 1912, was $16,664. There were shipped 3114 dry tons of ore, bringing average net smeltery returns of $17.05 per ton. Some zinc ore was developed.

Utah Consolidated—Forces have been increased, and two shifts are to be worked. Mineralized ground has been entered by the drift from the main level.

Black Jack—About 100 tons of ore were shipped as the result of a cleanup of the orebins.

SALT LAKE COUNTY

Columbus Consolidated—Ore was cut, May 23, by raising from the west side of the 400-ft. level, and has been opened for 16 ft. It is understood that the mill will be overhauled and brought up to a daily capacity of 100 tons. Some new equipment will probably be added. A large body of concentrating ore is available back of the old upper stopes. Development is under way to reach the Holland oreshoot on the 400 level.

Flagstaff—Work will be resumed soon at this Alta property.

Alta Consolidated—Carbonate shipping ore has been opened by a raise from the 125-ft. point above the tunnel. The tunnel is being driven for the contact, on which the ore was found. When the roads are opened, it is hoped to be able to maintain shipments.

Utah Mines Coalition—Notice has been sent to stockholders that this company's property has been sold and transferred to the Michigan-Utah Mining Co. The Coalition company's stock is transferrable into Michigan-Utah stock on the basis of two shares of Coalition for one of Michigan-Utah.

Maxfield—Leasers have about eight tons of carefully sorted ore, which it is expected will bring $65 per ton. This came from raises above the main tunnel level.

Virginia

A new pyrite mine is being opened, about 2½ miles northeast of the Arminius mine. It is partly owned and operated by Capt. B. F. Hand, Washington, D. C. The mine is about five miles northeast of Mineral, on the Chesapeake & Ohio Railroad.

Washington

Crescent Mining Co.—This company, at Twisp, Okanogan County, has 42 claims. Of these, 38 contain copper showings and four gold. On the copper property, a tunnel has been driving for two years and an electric plant is now being installed to run heavy drills. Development meanwhile is concentrated on the gold claims. Frank R. Creighton, Twisp, is manager, and D. C. McFee, president, is at the company's offices, in Winnipeg, Manitoba.

Wisconsin

Frontier Mining Co.—The company is developing the Hird and Sedgewick properties and has proved a run of zinc ore on the Samuel Birbeck land, at Days Siding.

Wisconsin Zinc Co.—The company has leased the Grey land, embracing the "Big Tom" workings and is drilling the tract. It has also struck good zinc-lead ore in the new Wicklow shaft, at 108 feet.

Scrabble Creek—The Vinegar Hill Zinc Co. has finished drilling this land and has commenced underground work in the old shaft.

Canada

British Columbia

Tyee Copper Co.—The Red Cliff Mining Co., of Vancouver, has secured an option on a controlling interest in the shares of this company. The Red Cliff mine is in the Portland Canal division and its ore gold-copper of good grade. The Tyee smeltery has two modern water-jacketed blast furnaces, together about 600 tons capacity.

Slocan Star—The deep-level crosscut being driven was in 1200 ft. on June 1; about 800 ft. more must be driven to reach the orebody.

Kootenay Gold—At the annual meeting of this company, owning the Granite-Poorman gold mines, near Nelson, West Kootenay, it was reported that in the last fiscal year 1900 ft. of development work had been done and more than 10,000 tons of ore crushed. The year's operations showed a loss, but in each month of this year a profit has been made.

Ontario

J. D. Grant, who claims to have found diamonds on the east shore of Hudson Bay, has gone north with a party to Cochrane, where they will outfit for an expedition to prospect the Hudson Bay region.

Ontario—Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended June 7, and for the year to date, are:

La Rose	32 29	1,491.55
Coniagas	76 32	889 82
O'Brien		263.24
Right of Way		148 60
Chambers-Ferland	32 00	225 60
McKinley-Darragh	68 64	1,209 00
Nipissing	76 10	901 28
Hudson Bay		312 62
Buffalo	32 80	472 87
Crown Reserve		210.26
Cobalt Townsite		536.78
City of Cobalt		145.84
Trethewey	33 65	241 04
Colonial		41 60
Kerr Lake		319 66
Cobalt Lake		207 41
Drummond		318.77
Temiskaming	32 90	416 87
Beaver		187 89
Wettlaufer		111 21
Provincial		22 22
Casey Cobalt		24.50
Totals	389 71	8,575.23

Bullion shipments in ounces

Nipissing	73,378 00	1,661,141 75
Temiskaming	2,331 00	2,331.00

Fire is reported on June 5 to have destroyed a portion of the town of Cobalt.

Coniagas—This company has decided to prospect that portion of the property which lies underneath the town of Cobalt. A crosscut is being driven from the 225-ft. level toward the southern boundary, from which a drift will be run toward an old shaft put down to 60 ft., which will be reached by a raise.

La Rose—It is stated that this company is considering the purchase of the Chambers-Ferland property. Work on the Fischer-Eplett is progressing satisfactorily with good results. Sinking is to be carried to the 600-ft. level.

Ontario—Porcupine

Pearl Lake—The syndicate of American men who have secured control has resumed operations on this property. The shaft is to be put down to the 800-ft. level and the crosscut started at the 400-ft. level is to be continued until the ore zone is reached.

Porcupine Lake—Satisfactory results having been obtained by diamond drilling, a power plant will be installed and preparations made to sink a shaft.

Hughes—The compressor plant is being installed and the underground working force has been considerably reduced until power is available.

Swastika—A crosscut is being driven from the 400-ft. level, which should intercept the vein in about 30 feet.

Lucky Cross—A few men are working on this property, at Swastika. The grade of the ore is erratic and it is stated that funds are low.

Tough—Good discoveries have been made recently on this Swastika property, which is under option to Haileybury men.

Benson—Good ore has been discovered on this property, in Turnbull Township.

Dane—Considerable work is to be done on this copper property, a few miles from Swastika. Two shafts are being sunk to the 100-ft. level, from which point drifts and crosscuts will be run

Mexico

Hidalgo

Cortez—Olaf Wenstrom, manager and consulting engineer, has returned to Boston from a five months' stay at the properties and reports that work has not been interrupted by the revolution. During 1911, an average of 700 ft. of development per month was done and 259 men, exclusive of staff, were employed. Some additional properties at Zimapan, Bonanza and Pechuga have been acquired and the company now has claims in four districts, aggregating 4200 acres. Actual mining is being confined to the Jacala property; the new acquisitions are being surveyed and examined by a staff, the headquarters being in Zimapan.

Mexico

El Oro—During May the mill treated 20,860 tons of ore and 15,350 tons of tailings, yielding bullion worth $168,820. Working expenses were $94,150; development, $21,180 and $62,910, total profit.

Sonora

Greene-Cananea—During 1911, net earnings were $1,307,131, compared with $1,184,750 for 1910. Net profit was $1,026,951. Total production was 44,897,466 lb. of fine copper, compared with 45,680,145 lb. for 1910. The company purchased a four-fifths interest in the Superior-Bonanza mine, near Imuris.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Revie

New York, June 12—The coal trade in the West continues rather slow. Demand for steam coal is good but buyers are reluctant to pay the advances asked by the mines. The making of contracts by large consumers is slow and many of them intimate that they will take the chances of the open market rather than make contracts at the higher prices which, consumers claim, are necessary owing to the advance in mine wages.

The Seaboard bituminous trade is slow and the markets are still weighted down by the large supply of coal at tidewater. Prices are consequently heavy and business is anything but active. Coastwise trade is slow. New England buyers are not yet scraping the bottom of their bins, but it is hoped that they will begin to sit up and take notice before the present month ends.

The anthracite trade is in rather a peculiar position. The collieries as a rule are running to 75 or 80% of their capacity, but complain that many laborers left during the suspension and have not yet returned. The demand for demestic coal is light. Dealers and large consumers do not seem inclined to lay in stocks. There is quite a rush for steam sizes, however, and the companies seem hardly able to deal with this. The advance in prices has called out a good deal of comment but there is little doubt that it will be held, in spite of threatened investigations in Philadelphia and elsewhere.

Anthracite shipments in May were 1,429,357 long tons, against 6,317,352 in May, 1911. For the five months ended May 31 the total shipments were 29,094,226 tons in 1911, and 19,905,333 in 1912; a decrease of 9,188,893 tons, or 31.6% this year.

Iron Trade Review

New York, June 12—No material change can be reported in the iron and steel markets, and the slackening up, usual as midsummer approaches, is not yet in evidence. In fact, an active business is rather expected between now and July 1, owing to the expiration on that date of many contracts.

Specifications are still reported heavy and the mills generally continue busy. The Steel Corporation and the leading independents are working up to something like 95% of capacity, which means practically full. The heaviest business at present is in structural steel, but plates are also in demand and the business in sheets continue heavy. Jobbers report an excellent business in bars and in smaller material. Prices are well held to the recent levels, but there is no apparent effort to advance them. It is thought that new contracts will be closed at about present rates.

Pig iron is rather quiet. Basic is in fair demand, both in the East and in the West. In Seaboard territory there is still a call for low-grade pig for the pipe foundries. Foundry iron has sold a little better, especially in New England and New Jersey, and the stove makers seem to be laying in stocks. Prices show little or no change, although furnaces are inclined to insist upon 25 or 50c. advance for fourth-quarter deliveries.

The coke market has settled down a little, and prices are steadier. The coke people are complaining of a shortage of labor.

The U. S. Steel Corporation reports unfilled orders on its books, May 31, of 5,750,983 tons, which is an increase of 86,098 tons over Apr. 30. This is the highest report since December, 1909. The small increase over April shows that May shipments were pretty heavy.

The taking of testimony in the Steel Corporation suits was resumed before the master on June 10. The evidence now being given relates to the panic of 1907 and the circumstances which led up to the transfer of the Tennessee Coal, Iron & R.R. Co. to the Steel Corporation. Some of this promises to be of considerable interest in bringing out the inside workings of that operation.

Steel Corporation Extensions—It is stated that the Steel Corporation has appropriated from the proceeds of bonds lately sold about $19,000,000 for new construction. Of this $3,000,000 is for additions to the Gary mills; $6,000,000 for completion of the Minnesota Steel Co. plant at Duluth; $10,000,000 for remodeling the Edgar Thomson works, including new machinery and the substitution of openhearth furnaces for bessemer converters.

Pig Iron Production—The statements of the blast furnaces, as collected and published by the *Iron Age* show that on June 1 there were 247 coke and anthracite stacks in blast, having an aggregate daily capacity of 81,500 tons, an increase of 1800 tons over May 1. Making allowance for the charcoal furnaces, the estimated production of pig iron in the United States in May was 2,537,100 long tons; for the five months ended May 31 it was 11,562,800 tons.

Baltimore

June 10—Exports for the week included 3,137,760 lb. steel billets and 254,582 lb. nails to Liverpool. Imports included 500 tons ferromanganese from Rotterdam; 12,870 tons iron ore from Cuba.

Birmingham

June 10—The pig-iron market in Southern territory continues strong, though selling is not as active as it might be. Some of the furnace companies report they are disposing of their iron about as quickly as they are manufacturing it, while others claim they are not yet ready to sell in any quantity for the reason that orders booked for delivery during the third quarter of the year are so large as to make it profitable to hold off for a while. The quotations for pig iron are nearer a $11.50 per ton basis, No. 2 foundry, than any other figure. The manufacturers of pig iron are confident this price will be the minimum for the fourth quarter and are not willing to enter the market with their probable make for the last three months of the year even at $11.50 per ton. The production in the Southern territory is about holding steady. For instance, in Alabama the make in May was less than 100 tons under what it was in April, when something over 151,000 tons of iron were produced. There has been an appreciable reduction of accumulated stocks of pig iron in the South, something near 20,000 tons having been moved off the yards during May.

The steel trade is looking up a little; the principal business that is being received is in small lots and mostly from points in the South.

There is slight improvement noted in scrap iron. Charcoal iron holds its own.

Chicago

June 10—General conditions in the iron and steel market continue unchanged. Pig iron is in light and finished products in heavy demand.

The pig-iron market is firm, despite the slack demand. Furnace agents have sold the output well up into the last half and on last-half business continue to demand more than the average melter is willing to pay. No. 2 Southern foundry brings $11 Birmingham, or $15.35 Chicago, and No. 2 Northern $14.50 at furnace on most sales; in some cases 50c. more is paid. The buyers are cautious; they prefer small lots of pig iron, bought often, to large lots bought the usual four to six months ahead.

In finished products there is general activity. Structural material is in good and increasing demand for bridge and building purposes locally and throughout the West; material up to 15 in. remains 1.43c. Railroad supplies, chiefly track fastenings, continue to sell well and standard rails will keep the local mills busy for several months. Bars are active with the mills crowded to make deliveries on time and new business coming in constantly; soft-steel bars sell for 1.38c. and iron bars for 1.25c., with higher prices on some orders. Sheets and plates show the same general conditions, with little need of new business, but with a large demand from consumers. Billets are still scarce and a larger demand.

Cleveland

June 10—Iron ore movement continues very active. Some small sales of ore are reported.

Pig Iron—There is a fair tonnage going, chiefly in small lots. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.50 for No. 2 foundry and $13 for forge.

Finished Material—The same story is heard everywhere, heavy specifications on contracts, but new orders rather light. More new business is expected, as many contracts expire with June.

Philadelphia

June 12—Indifference characterizes the pig-iron market because of the previous activity of several weeks which covered the requirements of consumers from two to four months. Quite a number of the smaller requirements were left unfilled and these are now coming forward without inquiry and small lots are being daily ordered to cover the immediate wants. Large consumers in New England who two or three weeks ago closed contracts for all the iron they thought they would want are now in the market again making inquiries which the makers think will result in new business. The fact that so many large furnace concerns are well sold ahead is the basis of the belief that higher prices are assured for the mid summer months. Large dealings in basic pig have been recently closed and foundry irons are now engaging attention. Forge irons are again under inquiry after a week or two of dullness. Quotations are at $15.50 for best No. 2 foundry, $14.75 for gray forge and basic $15.25 with offers at 25c. less.

Steel Billets—Steel billets are quiet after two or three weeks of unusual activity and local production has found ready markets outside of this territory.

Bars—Heavy orders have been placed within a few days for bars, and others are under negotiation. Quotations on common iron have been marked up a trifle.

Sheets—Sheets are active and orders are filling the mills, with excellent prospects for an unusual summer.

Pipes and Tubes—Merchant pipe has moved up and good sales have been made for early autumn delivery. Tubes are strong and show an advancing tendency.

Plates—The rush of orders for plates continues. Capacity is well sold up. Advances are threatened but prospective buyers of large quantities indulge in the belief that the mills will accept spring quotations for late fall deliveries.

Structural Material—Large orders for bridge work has been booked this week and inquiries for railroads and other large buyers have unexpectedly appeared.

Scrap—The only activity in scrap worth mentioning is in No. 1 railroad which has been sold at practically yard terms. There is also a better movement in car wheels and steel axles. Prices for all kinds of scrap have moved up in sympathy with other products.

Pittsburgh

June 11—The tone of the steel market is further improved this week, all the indications being that the present activity will last longer than was at first expected. The mills are well sold up and no large amount of new buying could be expected at this time, nevertheless the fact is that there is considerable strictly new business coming in, and this without any material diminution in the volume of specifications against old contracts. Prices are as firm as they were, and in some quarters there is a little greater strength. The advance in merchant pipe and oil-country goods has brought out heavier specifications, and while buying at the new price is exceptional, yet there is some buying of this sort, by consumers who did not have contracts. There is possibility of another advance in pipe July 1. In bars, plates and shapes there is a distinct possibility of an advance within 30 days, presumably of $1 a ton, which would make bars 1.25c., with 1.30c. for plates and shapes.

The bar, plate and structural mills have actual specifications for 60 to 90 days ahead, and with even quiet conditions are thus assured of full operations for perhaps five months. In tinplates the situation is fully as good, and in sheets nearly as good. In pipe there is actual business on books for nearly 60 days and specifications are certain to be ahead of shipments during the remainder of this month. In wire the market is slow, but has shown no loss in the past week, which is a good showing for this season.

Pig Iron—The market continues quiet with the operating furnaces well sold up and prices practically stationary, though showing a tendency to firm up. Sales are noted of 500 tons of bessemer, for early shipment, and 1200 tons of malleable for delivery over second half, the latter at $13.25, Valley, a trifle higher than could be done on prompt shipment. The Standard Sanitary Manufacturing Co. has just closed for a total of 12,500 tons of foundry grades for third-quarter delivery, this comprising the only activity in foundry iron in the week, and the largest transaction for several weeks. It took a total of 10,000 tons of No. 2, 2000 tons of No. 3 and 500 tons of gray forge from several furnaces in western Pennsylvania and the Valleys, the uniform price at furnace being $13.25 for the No. 2 and $13 for the other two grades. These transactions dispel the claims lately made by several furnaces that foundry iron had advanced. Furnaces are not seeking to make sales now, on account of the coke situation. The great majority of operators are trying to get $2.50 on second-half contracts, but their efforts are not meeting with much success, and their position has been greatly weakened by a decline in prompt coke to $2. In such circumstances furnaces will hold off from contracting for coke, filling their requirements from time to time by prompt purchases. We quote: Bessemer, $14.25; basic and malleable, $13@13.25; No. 2 foundry, $13.25; forge, $13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—Ferromanganese continues scarce, imports being light and sellers behind in deliveries on contract. Consumers are occasionally forced to buy prompt material, at a premium, but are taking the smallest quantities possible. We quote contract at $48.50 and prompt at about $55, f.o.b. Baltimore.

Steel—Sales of relatively small lots of billets and sheet bars have been made at advances of about 50c. The market is strong, with only a limited tonnage available, and small billets particularly scarce. The leading sheet interest last week bought about 10,000 tons of sheet bars from a Youngstown mill. We now quote: Billets, $21.50; sheet bars, $22, f.o.b. maker's mill, Pittsburgh; billets, $21; sheet bars, $22, f.o.b. maker's mill, Youngstown. Rods are $24.50@25, and are showing a slight stiffening tendency.

Sheets—Mills have canceled considerable tonnage which was due to be specified in May and was not, while they are preparing to make similar cancelations of June tonnage. This is of low-priced material, which could not be duplicated. The price situation is curious, in that the lowest prices are being made on small lots, sometimes single carloads, and by a few mills. On the other hand, some large contracts are being made, for extended delivery, at full prices—1.95c. for black and 3.00c. for galvanized—and in some cases even at slight premiums. It is distinctly the case that consumers are paying the mills for good service. Operations are as heavy as at any time, representing an average of fully 90% of the available capacity. We quote: Black, 1.90@1.95c.; galvanized, 2.90@3.00c.; blue annealed, 1.40c.; painted corrugated, 2.15c. per lb. and $1.35 per square; galvanized corrugated, 3.05c. per lb. and $2.55 per square.

St. Louis

June 10—The market for the past week has shown very little change. The demand is not as heavy as it was and is mostly for small lots. It is natural to have a lull during this part of the season and no desperate efforts are being made to sell as the furnaces have their output pretty well taken care of for the next couple of months. No. 2 Southern foundry is still firm at $11@11.50 Birmingham, or $14.75@15.25 per ton St. Louis. Northern No. 2 is quoted around $15 per ton.

Iron Ore Trade

Shipments of iron ore from the Lake Superior region in May were 5,919,074 tons. For the season to June 1 the shipments were, in long tons:

Port	1911	1912	Changes	
Escanaba.........	529,540	792 889	I.	263,349
Marquette........	218,931	356,914	I.	137,983
Ashland..........	267,337	521,772	I.	253,907
Superior.........	1,315,892	1,995,723	I.	679,831
Duluth...........	947,155	1,294,264	I.	347,109
Two Harbors.....	737,081	1,161,554	I.	424,473
Total...........	4,016,464	6,123,116	I.	2,106,652

Of the shipments this year 4,186,997 tons went to Lake Erie ports.

Imports of iron ore in Great Britain, four months ended Apr. 30, were 2,485,363 tons in 1911 and 1,865,447 in 1912; decrease, 619,916 tons. Imports of manganese ore were 138,528 tons in 1911, and 106,632 in 1912; decrease, 31,896 tons.

METAL MARKETS

New York, June 12—The metal markets have been a little quieter, but the upward tendency is still strong.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January....	110	111	July........	112	......
February ..	115	109	August.....	117	......
March......	112	111	September.	111	......
April......	114	120	October....	112	......
May........	118	123	November.	111	......
June.......	115	......	December..	110	......

Year 1909, 115; 1910, 115; 1911, 112.

Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Apr. 1912..	$ 1,816,816	$ 3,892,599	Imp.	$2,075,783
" 1911..	1,505,634	4,524,835	Imp.	3,019,201
Year 1912..	21,774,902	16,306,794	Exp.	5,468,108
" 1911..	3,364,658	23,990,572	Imp.	20,625,914
Silver				
Apr. 1912..	4,941,259	4,189,512	Exp.	751,747
" 1911..	7,610,154	4,251,532	Exp.	3,358,622
Year 1912..	21,897,247	16,039,732	Exp.	5,857,515
" 1911..	23,611,196	14,898,313	Exp.	8,712,883

Exports from the port of New York, week ended June 8: Gold, $37,750; silver, $1,249,815, mainly to London and Paris. Imports: Gold, $228,803; silver, $187,557, chiefly from Mexico and South America.

Gold—The price of gold on the open market in London continued at the usual bank rate, 77s. 9d. per oz. for bars and 77s. 4d. per oz. for American coin. Nearly all the supplies arriving for the week were taken by the Bank of England. In New York there was no unusual movement.

Sales of gold bars for industrial use from the U. S. Assay Office in New York in May, amounted to $2,382,798. For the five months ended May 30, the sales were $11,433,086 in 1911 and $11,596,023 in 1912; an increase of $162,937 this year.

Gold in the United States, June 1, is estimated by the Treasury Department as follows: Held against gold certificates outstanding, $1,034,895,369; in Treasury current balances, $169,601,010; in banks and circulation, $608,540,016; total, $1,813,036,395. Gold held against certificates includes bullion as well as coin.

Platinum—The market is still rather quiet, but prices are held without change. Dealers ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal. The foreign market seems to be a little uncertain, but without any definite change.

Iridium—There has been no change in this metal and the current price is $64 per oz., New York.

Silver—The market continues very steady and is quiet to firm, with a good undertone. Tendency depends much on the rain prospects in India, as the beginning of the monsoon period is about due.

SILVER AND STERLING EXCHANGE

June	6	7	8	10	11	12
New York....	60⅞	60¾	60¾	61⅛	61⅛	61⅜
London	28	28	28	28⅛	28⅛	28⅛
Sterling Ex..	4.8710	4.8700	4.8710	4.8720	4.8715	4.8720

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

Copper—A large business has been done, both for domestic delivery and for export, the bulk of it having been for August and September shipment. Buyers seem to have well covered their requirements for earlier deliveries. The price advanced sharply from June 6 to June 11, but at the top business became dull and a tendency on the part of sellers to make concessions became apparent. The recurrence of labor troubles at the refineries has not created a favorable impression and there begins to be more apprehension that the upward movement has been overdone. Consequently, at the close the market is somewhat easier, with Lake copper at 17¾@17⅝c., and electrolytic in cakes, wirebars and ingots at 17.20@17.30c. Casting copper is quoted nominally at 17@17.10 as the average for the week.

The London market has been sensitive

NEW YORK

June	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
6	17⅛ @17⅜	17.05 @17.15	46	4.20	4.15 @4.17½	6.75 @6.90	6.60 @6.75
7	17¼ @17½	17.15 @17.20	47¼	4.20	4.17½ @4.20	6.75 @6.90	6.60 @6.75
8	17⅜ @17½	17.20 @17.30	47¼	4.20	4.17½ @4.20	6.75 @6.90	6.60 @6.75
10	17⅜ @17⅝	17.25 @17.35	47¾	4.20	4.17½ @4.20	6.75 @6.90	6.60 @6.75
11	17⅜ @17⅝	17.25 @17.30	47⅜	4.20	4.17½ @4.20	6.75 @6.90	6.60 @6.75
12	17⅜ @17⅝	17.20 @17.30	47½	4.50	4.40 @4.42½	6.75 @6.90	6.60 @6.75

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

June	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
6	78⅝	79 1/16	83¾	203	195¼	17⅛	26
7	78⅝	79⅛	83¾	207½	196½	17⅜	25¾
8	......	......	......	......	......	......	......
10	78¼	78⅞	83½	206½	196½	17⅝	25¾
11	77 15/16	78 9/16	83¼	206	195¾	17½	25¾
12	78⅛	78¾	83¼	206½	196	17 1/16	25½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, ± £1 = ± 21¾c.

upward, due to realization on part of speculative holders. On June 6, spot was £78 12s. 6d., and three months, £79 1s. 3d. On June 11, spot was £77 18s. 9d., and three months, £78 11s. 3d., and the market closes at £78 2s. 6d. for spot, and £78 15s. for three months.

Copper sheets this week are unchanged at 22@23c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 18½c. base, carload lots at mill.

Brass Prices—The American Brass Co. announces prices as follows on June 10: Sheets, high brass, 16¾c. net, per lb.; low brass, 18⅝c. Rods, high brass 16½c.; low brass, 19⅜c. Brass angles and channels, 20⅝c. Brass tubing, brazed, 21¾c.; open seam, 20¼c. Scrap allowances, 12½c. net, per lb. for high brass; 13⅞c. for low brass.

Tin—The feature of this week's market has been the premium for spot tin, both in London and here, due to the scarcity resulting from the London dock strike. Supplies are dwindling down and unless the strike is soon raised, the premium for early deliveries is likely to be still greater.

The London market, which closed on June 5 at £200 for spot and £194 for three months, advanced on June 6 to £203 for spot and £195 5s. for three months. On June 10, it reached £206 10s. for spot and £196 10s. for three months, and closes at £206 10s. for spot and £196 for three months, a difference of £10 10s. between these positions.

The New York market has also been strong and advancing, and closes at 47½c. for spot.

Lead—A heavy demand has made itself felt, and on June 12 the A. S. & R. Co. raised its price to 4.50c. Consumption is excellent, and it is reported that the market is strong and looks as if it might advance still further. Missouri lead has been selling above the New York parity at about 4.17½@4.20c. It closes nominally at 4.40@4.42½c. and New York at 4.50 cents.

The scarcity of lead for early delivery in London continues, and the market is firmer, Spanish lead being quoted at £17 8s. 9d. and English 2s. 6d. higher.

Spelter—Considerable business has been done for both early and distant deliveries. The market is slightly firmer at 6.60@6.75c., East St. Louis, according to the time of shipment.

The London market is somewhat easier, good ordinaries being quoted at £25 10s. and specials at £25 15s.

Base price of zinc sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7¼c. per lb., New York, in carload lots.

Other Metals

Aluminum—The market has been quiet, with little business forward. We continue to quote 22½@23c. per lb. for No. 1 ingots, New York. Negotiations are reported pending for about 3,000,000 lb. of aluminum wire for an electrical transmission plant.

Antimony—Business is quiet for the present. Cookson's has been advanced a shade, to 8.10c. per lb.; Hallett's is unchanged at 7.75c.; while 7.10@7.25c. per lb. is quoted for Chinese, Hungarian and other outside brands.

Quicksilver—Business remains fair. New York quotations are $41 per flask of 75 lb., with 60c. per lb. charged for retail lots. San Francisco, $41 for domestic orders and $38.50 for export. The London price is £8 5s. per flask, with £8 2s. 6d. quoted from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

German Metal Trade

Imports and exports of metals other than iron and steel in the German Empire, three months ended Mar. 31, were, in metric tons:

	Imports	Exports	Excess	
Copper..........	59,548	21,817	Imp.	37,731
Copper, 1911....	46,400	20,016	Imp.	26,384
Tin...............	3,755	2,481	Imp.	1,275
Tin, 1911.......	3,495	2,579	Imp.	817
Lead.............	16,272	12,322	Imp.	3,950
Lead, 1911......	17,467	10,024	Imp.	7,443
Zinc..............	10,585	24,643	Exp.	14,058
Zinc, 1911......	12,569	35,512	Exp.	22,843
Nickel...........	470	632	Exp.	52
Nickel, 1911....	820	580	Imp	240
Aluminum.......	3,781	1,174	Imp.	2,607
Aluminum, '11.	1,920	796	Imp.	1,125
Minor metals....	460	4,137	Exp.	3,677
Minor, 1911....	449	3,482	Exp.	3,038

The figures include alloys and manufactures of the different metals. The imports and exports of ores for the three months were, in metric tons:

Ores:	Imports	Exports	Excess	
Gold ore.........	51	....	Imp.	61
Gold ore, 1911 .	19	....	Imp.	19
Silver ore........	296	....	Imp.	296
Silver ore, '11..	737	....	Imp.	737
Copper ore.......	9,990	5,219	Imp.	4,771
Copper ore, '11.	4,431	3,748	Imp.	683
Tin ore...	3,689	......	Imp.	3,689
Tin ore, 1911...	3,960	....	Imp.	3,960
Lead ore..........	42,382	691	Imp.	41,691
Lead ore, 1911 .	30,884	1,146	Imp.	29,738
Zinc ore..........	54,328	9,482	Imp.	44,846
Zinc ore, 1911 .	52,134	9,626	Imp.	42,508
Nickel ore.......	3,678	....	Imp.	3,678
Nickel ore, '11.	2,843	....	Imp.	2,843
Miscellaneous..	7,546	2,085	Imp.	5,460
Miscellan's, '11	1,720	262	Imp.	1,458
Chrome ore.... ..	4,262	220	Imp.	4,042
Chrome ore, '11	1,761	162	Imp.	1,599
Pyrites	211,220	11,223	Imp.	199,997
Pyrites, 1911. .	144,629	2,483	Imp.	142,146

Miscellaneous includes ores of tungsten, molybdenum and other rare metals.

Zinc and Lead Ore Markets

Platteville, Wis., June 8—The highest price paid this week for zinc ores was $57; the base price, 60% zinc., was $56 per ton. The base price paid for 80% lead ore was $52@53 per ton.

SHIPMENTS, WEEK ENDED JUNE 8

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton...................	855,000	62,000	644,200
Shullsburg...............	802,600	....	....
Mineral Point..........	748,910	....	....
Galena....................	576,200	66,400	....
Highland................	389,000	....	....
Platteville..............	362,000	....	60,000
Cuba City...............	299,150	....	133,220
Hazel Green...........	270,000	....	....
Harker..................	220,050	....	....
Rewey..................	82,000	....	....
Montfort................	60,000	....	....
Linden..................	......	63,300	....
Total...................	4,664,910	181,700	827,420
Year to date..........	90,410,140	3,754,110	12,384,870

Joplin, Mo., June 8—The high price of zinc sulphide ore this week was $61, the base per ton of 60% zinc is $54@58.50. Zinc silicate sold from $27 to $30 per ton of 40% zinc. The average price, all grades, was $54. The high price of lead ore is $55 and the average price, all grades, is $53.54 per ton.

The zinc-ore market remained the same as the previous week.

SHIPMENTS, WEEK ENDED JUNE 8

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville.	4,637,690	......	1,485,630	$169,965
Joplin........	2,111,800	......	226,550	65,133
Galena........	1,006,640	......	61,470	29,782
Duenweg.....	820,020	60,000	38,910	24,870
Alba-Neck....	600,300	......	49,130	18,733
Oronogo......	455,760	......	4,440	10,225
Granby	205,250	272,260	9,470	9,810
Miami........	163,450	......	187,000	8,784
Spurgeon	130,570	247,490	......	7,235
Springfield ..	171,000	......	86,000	7,100
Carl Junction	228,680	.....	......	6,860
Jackson......	209,300	......	8,560	5,861
Carthage	173,650	......	......	4,688
Cave Springs.	119,380	......	......	3,461
Wentworth...	129,590	......	......	3,240
Aurora.......	56,020	63,000	......	2,595
Sarcoxie......	62,440	......	......	1,685
Totals......	11,291,540	642,740	2,157,150	$380,028
23 weeks...	233,313,340	13,867,950	39,693,130	$7,079,379

Blende val., the week, $312,162; 23 weeks, $5,795,905
Calamine, the week, 10,106; 23 weeks, 203,618
Lead value, the week, 56,760; 23 weeks, 1,079,856

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January.....	$41 85	$44.90	$40.55	$43.64	$55 68	$58.92
February....	40 21	45.75	39.16	43 31	54 46	52.39
March.......	39 85	51.56	38.45	49.25	54.57	54.64
April.......	38 88	52.00	37 47	50.36	56 37	54 18
May.........	38 25	55.30	36 79	63.27	55 21	52.45
June........	40.50	......	38.18	......	56 49	......
July........	40 75	......	38 36	......	58 81	......
August	42 50	......	41 28	.....	60 74	......
September .	42 63	......	41 29	......	59 33	......
October.....	42.38	......	40.89	......	54.72	......
November...	45 40	......	43.27	......	57 19	......
December...	44.13	......	40.76	......	62 03	......
Year......	$41.45	......	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, June 12—The general market is still in good condition, but is beginning to feel something of the midsummer dullness, which is becoming a regular feature of the season.

Arsenic—Demand has visibly slackened and supplies have improved a little, but not much. White arsenic is held still at $3.87½ per 100 lb. for spot. Futures are nominally $3.50 per 100 lb., but there is very little interest in them.

Copper Sulphate—As was expected, an advance in this article has followed the advance in copper metal. Current quotations are up 25c. and are now $5.50 per 100 lb. for carload lots, and $5.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is rather quiet, as is to be expected at this season, but the market continues firm. Quotations are $2.40@2.42½c. per lb. for spot and futures up to Oct. 1; while for all positions after that date, 2.45c. is asked.

Potash Salts—Exports of potash salts from Germany three months ended Mar. 31 were, in metric tons:

	Total	To U.S
Crude salts, kainit, etc.	361,934	169,839
Potassium chloride	95,603	60,885
Potassium sulphate	25,474	6,870
Potassium-magnesium sulphate	30,999	2,619
Totals	514,010	240,213

Comparisons with 1911 cannot be made as the German authorities have this year changed the classification of the different varieties.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, four months ended Apr. 30:

	Imports	Exports		Excess
Copper sulph. lb.	....	7,118,825	E.	7,118,825
Copper sul., '11	....	6,488,357	E.	6,488,357
Bleach, lb.	26,670,268	400	I.	26,669,868
Bleach, 1911	33,094,400	17,368	I.	33,077,032
Potash salts, lb.	234,877,645	1,377,817	I.	232,499,828
Potash salts, '11	310,908,547	1,445,736	I.	309,462,811
Soda salts, lb.	3,982,409	169,281	I.	3,813,128
Soda salts, 1911	13,228,260	191,430	I.	13,036,830
Acetate lime, lb.	....	22,309,463	E.	22,309,463
Acetate, 1911	....	27,504,701	E.	27,504,701
Nit. of soda, tons	142,784	3,315	I.	139,469
Nitrate, 1911	226,309	2,759	I.	223,550
Phosphates, tons	....	334,500	E.	334,500
Phosphates, '11	....	354,738	E.	354,738
Sulphur, tons	6,764	14,553	E.	7,789
Sulphur, 1911	7,303	647	I.	6,656
Pyrites, tons	291,009	....	I.	291,009
Pyrites, 1911	310,041	....	I.	310,041
Magnesite, lb.	69,150,213	552,150	I.	68,598,063
Magnesite, 1911	93,658,540	933,550	I.	92,724,990
Sul. ammonia, lb.	48,506,690	134,715	I.	48,371,975
Sul. am'nia, '11	88,110,626	....	I.	88,110,626
Arsenic, lb.	1,352,988	....	I.	1,352,988
Arsenic, 1911	1,613,143	....	I.	1,613,143

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 123,168 tons.

MINING STOCKS

New York, June 12—On June 6 the Exchange showed some weakness, but recovered before the close. The Curb was fairly active and strong. Copper shares sold up generally; there was good trading in Motherlode and Yukon Gold, and a small advance in Cobalts.

June 7. The Exchange was rather reactionary, with small declines in nearly all the active stocks. The Curb showed small dealings in copper stocks; a recession in nearly all the Cobalts, and heavy sales, at a decline, of El Paso Consolidated and Tri-Bullion.

June 8, the Exchange was more active and the general position at the close was stronger. On the Curb interest was mainly in the industrials and mining stocks were rather dull, El Paso Consolidated was the exception, selling largely at a small advance.

June 10, the Exchange was dull and price changes insignificant. On the Curb copper shares were quiet with fair sales of Braden and Mason Valley. El Paso Consolidated made good sales at a slight advance, as did Yukon Gold also. Cobalts were quiet but steady.

June 11, the Exchange turned weaker again and prices declined on moderate trading. Curb prices were also off, copper stocks losing fractionally. Other mining stocks were fairly steady, on light trading.

June 12, the market recovered a little, but business was not especially heavy.

Sales at auction in New York, June 5, included: Naica Mining Co. note for $250 and 2500 shares stock, $1 par, $10 for the lot; also note for $500 and 5000 shares stock, $15 for the lot; Federal Mining & Smelting Co., 80 shares preferred stock, $100 par, $40.25 per share.

Boston, June 11—Copper shares fairly boiled at one time during the week; although at present they are simmering, yet the market is in a strong and healthy position. The heaviest advances have been recorded in some specialties and the greater part of the gains have been maintained. Ahmeek and Calumet & Hecla are notable examples. The former rose $45 per share to $360, which is its record price, and the latter $36 per share to $530, the highest for a long time. The key to the advance in Ahmeek is the raising of the dividend rate to $5 per share. The company instituted these payments last November with a $2 disbursement. Thus far in 1912 the company has divided $12 per share in addition to the $2 paid last year.

Butte & Superior and Island Creek common stocks have also had notable advances during the week. The former rose $12.37½ to $49, and the latter $11.75 to $65.75. Butte & Superior developed from a copper to a zinc mine and the new mill is saving over 90% of the ore contents. Island Creek's advance was due to the placing of the stock on a dividend basis. The directors have declared a quarterly dividend of 50c. and $3 a share payable in common stock. This latter will be financed through an issue of 6000 additional shares of common.

Curb trading received inspiration from

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	March	April	May
Alaska shipments	4,987,916	1,243,911	1,720,391
Anaconda	25,900,000	25,480,000	25,800,000
Arizona, Ltd.	3,150,000	3,400,000	3,500,000
Copper Queen	7,197,121	6,806,425	7,024,187
Calumet & Ariz.	4,652,000	4,104,000	4,424,000
Chino	1,108,381	....	....
Detroit	2,246,238	2,506,718	2,092,478
East Butte	1,480,000	....	....
Mammoth	1,939,310	1,718,450	....
Mason Valley	1,140,000	....	....
Nevada Con.	6,380,000	6,115,095	....
Old Dominion	2,432,000	2,167,000	....
Ray	2,300,000	2,611,920	....
Shannon	1,388,000	1,544,000	1,161,000
South Utah	299,000	284,215	236,884
United Verde*	2,250,000	....	....
Utah Copper Co.	8,160,000	8,615,775	....
Lake Superior*	19,750,000	18,250,000	21,250,000
Non-rep. mines*	7,291,619	8,250,000	....
Total production	104,051,585	....	....
Imports, bars, etc.	23,519,215	26,842,014	....
Total blister	127,570,800	....	....
Imp. in ore & matte	8,736,874	9,350,972	....
Total	136,307,674	....	....
Miami	2,755,000	2,554,352	2,565,000
Brit. Col. Cos.:			
British Col. Copper	....	....	....
Granby	1,882,073	1,941,797	1,914,460
Mexican Cos.:			
Boleo	2,424,800	2,149,280	2,260,160
Cananea	2,834,000	4,654,000	....
Moctezuma	2,446,731	2,797,718	2,892,521
Other Foreign:			
Cape Cop., S. Africa	725,760	954,240	....
Kyshtim, Russia	....	1,545,000	....
Spassky, Russia	638,400	649,600	....
Famatina, Argen.	....	....	....
Tilt Cove, Newf'd.	104,992	119,869	....
Exports from:			
Chile	3,584,000	6,496,000	....
Australia	8,064,000	9,408,000	....
Arrivals in Europe†	12,559,680	12,064,640	....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
V, 1911	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326
V	126,737,836	72,702,277	69,485,945

VISIBLE STOCKS

	United States	Europe	Total
VI, 1911	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757
V	65,066,029	134,176,000	199,242,029
VI	49,615,643	117,801,600	167,417,243

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

the activity on the board and prices generally hardened. The sequel to the recent decline in Boswyocolo, is the placing of the Laramie, Hahns Peak & Pacific Ry. in receiver's hands. These two companies are closely allied, being under the same management.

Assessments

Company	Delinq	Sale	Amt
Alpha Con., Nev	May 29	June 19	$0.05
Andes, Nev	May 28	June 18	0.05
Best & Belcher, Nev	June 3	June 27	0.10
Bingham Copper, Utah	June 1	....	0.05
Black Horse, Ida	.. ..	....	0.02
Caledonia, Nev	May 21	June 11	0.10
Challange, Nev	June 8	July 2	0.10
Crown Point, Nev	June 24	July 17	0.10
East Tintic, Utah	May 30	June 25	0.005
Ely Con., Nev	....	....	0.05
Exchequer, Nev	May 23	June 13	0.06
Federal Ely, Utah	May 8	June 8	0.01
Glen Dale, Utah	May 25	June 25	0.00
Great Falls, Utah	June 26	July 27	0.002½
Hale & Norcross, Nev	July 2	July 29	0.05
Houghton Copper, Mich	May 17	....	1.00
Julia, Nev	May 15	June 5	0.05
Lower Mammoth, Utah	Mar. 16	....	0.01
New York Bonanza, Utah	May 8	....	0.02
Ojibway, Mich	Jan. 10	....	1 00
Overman, Nev	June 29	July 23	0.10
Raven, Mont	Feb. 1	....	0.10½
Savage, Nev	June 4	June 26	0 10
Segregated Belcher, Nev	June 1	June 28	0.05
Seven Troughs, Nev	June 15	July 2	0.002½
South Lake, Mich	June 3	....	2 00
Tintic Central, Utah	June 14	July 6	0.005
Utah Antimony, Utah	June 1	....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60 880	24.797	24.583	28 038
June	53.462	53.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24.428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53.486	53.304	......	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12 295	14 094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14 329	54 974	62 893
March	12 139	14.698	12.447	14.868	54.704	65.884
April	12 019	15 741	12 275	15.930	54.034	70.294
May	11 989	16.031	12 214	16 245	54 313	72 352
June	12 385	......	12.611	......	56.365	......
July	12 463	......	12.720	.. .	56.673	......
August	12 405	......	12 634	.....	56.266	......
September	12.201	......	12 508	.....	55.253	......
October	12 189	......	12 370	... .	55.170	......
November	12.616	......	12 769	.... .	57.253	......
December	13 552	..	13.768	...	62 068	. .
Year	12.376	....	12.634	.....	55.973	....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK.

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	.... .
February	41 614	42 962	August	43 319	. ....
March	40 157	42.577	September	39 755	.... ..
April	42 185	43 923	October	41 185	.... .
May	43.115	46.053	November	43 125	......
June	44 606	......	December	44.655	......
			Av. Year	42 281	.. ..

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4 483	4.435	4 334	4.327	13 009	15.619
February	4 440	4.026	4 266	3 946	13 043	15 738
March	4 394	4.073	4 238	4.046	13 122	15.997
April	4 412	4 200	4 262	4 118	12.889	16 331
May	4 373	4 194	4.223	4 072	12 984	16 509
June	4 435	.....	4 292	.. ...	13.260	... .
July	4.499	......	4 397	......	13 530	.....
August	4 500	......	4 406	......	14.260	......
September	4 485	.....	4 356	......	14 744	......
October	4 265	......	4 139	......	15.332	......
November	4 298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	15.648	.....
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	6.499	5 368	6.349	23 276	26 661
March	6.563	6.626	5.413	6.476	23 016	26.048
April	5 399	6.633	5.249	6 483	23 743	25 644
May	5 348	6.679	5.198	6.529	24.375	25.790
June	5 520	......	5 370	.....	24 612	......
July	5 695	......	5 545	......	25 006	.....
August	5 953	......	5 803	......	26 801	.....
September	5 869	......	5 719	......	27 750	.....
October	6.102	......	5 951	......	27.256	... .
November	6.380	......	6.223	......	26.795	... .
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15 90	$15.12	$14 40	$13.32	$14.75	$14.00
February	15 90	15.03	14 50	13.28	14 81	14.01
March	15.90	14.95	14 65	13.66	14.96	14.10
April	15 90	15.13	14 65	13.90	15 00	14 15
May	15 90	15.14	14 30	13.90	14.72	14.12
June	15 90	......	14 06	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14 92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS June 11

Name of Comp.	Bid.
Acacia	.06
Cripple Cr'k Con.	01½
C. K. & N.	17½
Doctor Jack Pot	.05½
Elkton Con	.66½
El Paso	.99½
Findlay	.04½
Gold Dollar	16¾
Gold Sovereign	‡ 01⅝
Isabella	.14
Jack Pot	.04
Jennie Sample	.05
Lexington	‡ 02
Moon Anchor	01
Old Gold	.03⅜
Mary McKinney	.71⅝
Pharmacist	.01⅝
Portland	.92
Vindicator	.82
Work	.01

SALT LAKE June 11

Name of Comp.	Bid.
Beck Tunnel	10
Black Jack	‡ 15½
Cedar Talisman	02
Colorado Mining	.18
Columbus Con	29
Crown Point	02
Daly-Judge	5.95
Grand Central	65
Iron Blossom	1 26
Little Bell	42
Lower Mammoth	01½
Mason Valley	‡11.50
May Day	10
Nevada Hills	‡1 95
New York	‡ 04¼
Prince Con	1 60
Silver King Coal'n	2.85
Sioux Con	.05½
Uncle Sam	.19
Yankee	‡.10

TORONTO June 11

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7 10	Hollinger	9 75
Hudson Bay	‡70 00	Imperial	02
Temiskaming	.41	Pearl Lake	17
Wettlaufer-Lor.	.54	Porcu. Gold	35
Apex	03	Porcu. Tisdale	.03
Central	‡5 56	Preston E. D.	04
Crown Chartered	12	Rea	25
Doble	30	Standard	02½
Dome Exten.	.39	Swastika	11
Foley O'Brien	17	West Dome	15

SAN FRANCISCO June 11

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.07	Belmont	10.05
Belcher	.58	Jim Butler	.62
Best & Belcher	.13	MacNamara	.26
Caledonia	1 40	Midway	.44
Challenge Con	.14	Mont.-Tonopah	2.65
Chollar	.03	North Star	.18
Confidence	.55	West End Con	1.90
Con. Virginia	55	Atlanta	.27
Crown Point	.38	Booth	.09
Gould & Curry	04	C.O.D. Con	.10
Hale & Norcross	14	Comb. Frac	.16
Mexican	7 70	Jumbo Extension	.38
Occidental	55	Pitts.-Silver Peak	1.25
Ophir	1.10	Silver Pick	.12
Overman	.80	St. Ives	.35
Potosi	.03	Tramp Con	‡.01
Savage	14	Argonaut	‡2.00
Sierra Nevada	.15	Bunker Hill	‡4 50
Union Con	.70	Cent. Eureka	.59
Yellow Jacket	.48	So. Eureka	3.50

N. Y. EXCH. June 11

Name of Comp.	Clg.
Amalgamated	85⅛
Am. Agri. Chem	61
Am.Sm.&Ref.,com	85⅛
Am.Sm. & Ref., pf.	107¾
Am. Sm. Sec., pf. B	89¼
Anaconda	43⅞
Batopilas Min	1⅝
BethlehemSteelpf	70½
Chino	33
Comstock Tunnel	‡ 10
Federal M. & S., pf.	41⅛
Goldfield Con	4⅛
GreatNor.,ore.,ctf.	40⅞
Homestake	93
Inspiration Con	19½
Miami Copper	28
Nat'nalLead,com.	56⅞
National Lead, pf.	109½
Nev. Consol	22⅛
Pittsburg Coal, pf.	89
Ray Con	20¾
RepublicI&S,com.	23¼
Republic I & S. pf.	78½
SlossSheffi'd,com.	51
Sloss Sheffield, pf.	90
Tennessee Copper	43½
Utah Copper	63
U. S. Steel, com	68¾
U. S. Steel, pf.	110¾
Va. Car. Chem	50⅜

N. Y. CURB June 11

Name of Comp.	Clg.
Barnes King	‡ 30
Beaver Con	.44
Braden Copper	6⅞
B. C. Copper	6
Buffalo Mines	‡1¼
Caledonia	.68
Con. Ariz. Sm.	⅝
Davis-Daly	2⅛
Diam'field-Daisy	10
Ely Con	5/16
Florence	.90
Giroux	5⅝
Gold Hill Con	.
Greene Cananea	10⅛
Greenwater	‡ 06
Guggen. Exp.	223
Internat S. & R.	124
Kerr Lake	2¾
Keystone	2¾
La Rose	3½
McKinley-Dar-Sa	1 13/16
Min. Co. of A. new	3
Motherlode Gold	..
Nev. Utah M. & S	03½
Nipissing Mines	7¾
Ohio Copper	1 9/16
Pacific Sm. & M	3/16
Ray Central	‡2⅜
South Live Oak	3⅝
South Utah M. & S.	¾
Standard Oil (Old)	865
Stand'd Oil of N.J.	382
Stand'd Oil Subs.	490
Stewart	1¼
Tonopah	7 1/16
Tonopah Ex	1 13/16
Tri-Bullion	½
Tularosa	‡
Union Mines	3/16
United Cop., pfd.	10
Yukon Gold	3 11/16

LONDON June 12

Name of Com.	Clg.
Camp Bird	£1 8s 0d
Dolores	1 10 0
El Oro	0 16 9
Esperanza	1 10 0
Mexico Mines	7 5 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 5 0

BOSTON EXCH. June 11

Name of Comp.	Clg.
Adventure	10⅛
Ahmeek	350
Algomah	7
Allouez	47
Am. Zinc	31
Ariz. Com., ctfs.	6¾
Bonanza	‡ 40
Boston & Corbin	7¾
Butte & Balak	‡4¼
Calumet & Ariz	75⅞
Calumet & Hecla	615
Centennial	24½
Con. Mercur	‡ 05
Copper Range	59¾
Daly West	5⅞
East Butte	13¾
Franklin	13
Granby	55
Hancock	34⅝
Hedley Gold	17
Helvetia	1½
Indiana	19¼
Island Cr'k, com.	63
Island Cr'k, pfd.	90½
Isle Royale	30½
Keweenaw	1⅞
Lake	40
La Salle	7¼
Mass	7¼
Michigan	3
Mohawk	66
New Arcadian	4¼
New Idria Quick.	‡6⅞
North Butte	30¾
North Lake	7
Ojibway	‡4½
Old Dominion	58½
Osceola	123
Quincy	91½
Shannon	15
Shattuck-Ariz	22½
Superior	37
Superior & Bost.	2⅜
Tamarack	44
Trinity	7¾
Tuolumne	4¼
U. S. Smelting	39
U. S. Smelt'g, pf.	49
Utah Apex	‡2½
Utah Con	13
Victoria	4⅛
Winona	6⅞
Wolverine	110⅞
Wyandot	2½

BOSTON CURB June 11

Name of Comp.	Last
Bingham Mines	2½
Boston Ely	1½
Boswyocolo	.03
Butte Central	6⅛
Cactus	10
Calaveras	2⅞
Chief Cons	1 5/16
Corbin	2
Cortez	1¼
Crown Reserve	3 1/16
First Nat. Cop.	2⅝
Majestic	55
Mazatan	50
Moneta Porc	‡ 11
Nevada-Douglas	3½
New Baltic	3
Oneco	2¾
Raven Copper	.31
Rhode IslandCoal	.29
San Antonio	‡3
S. W. Miami	7¾
South Lake	9
Trethewey	.45
United Verde Ext.	37
Vulture	‡5.00

‡Last quotation

The Engineering and Mining Journal

Vol. 93. JUNE 22, 1912. No. 25

Issued Weekly by the
Hill Publishing Company
John A. Hill, Pres. Rob't McKean, Secy.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N. W. 7.

Walter Renton Ingalls, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page
Editorials:
Some Aspects of the Copper Situation ... 1209
The Situation in Cuba ... 1209
The Telluride Case ... 1210
A Long Raise ... 1210
Mine Inspection ... 1210
By the Way ... 1211
Competition in Aluminum Production ... 1212
Iron Mines Assessments Lowered ... 1212
Powder Trust Dissolved ... 1212
Newlin's Gulch Gold District ... 1212
Correspondence and Discussion:
Fighting at the Cobre Mines.... The Mathematics of Copper Sampling....What is Stratified Rock? ....Reduction of Zinc Oxide.... New Kink in Iodide Copper Assay 1213
*Mining on Forest Reserves. Merritt Booth 1215
Round Mountain Mining Co. ... 1216
Oil Pipe Lines Are Common Carriers 1216
Greene Consolidated ... 1217
A Piece of Practical Forestry. R. W. Raymond 1218
Metal Schedule Hung Up ... 1218
Details of Practical Mining:
*Mining Dangerous Ground on the Mesabi Range....A Home-made Tuyere....*Water Blast for Allaying Dust....*Correcting the Meandering of Boreholes.... Cleaning Air Compressor Cylinders ....*Skip and Dump Plate for Vertical Shaft....Concrete Stations in Shafts ... 1219
Details of Metallurgical Practice:
*Adjustable Amalgamation Table ....Strength of Crane Chains.... *Joplin Ore Bin Construction.... *Home-made Belt Feeder ... 1220
The Cost of Doing Things:
Hand Sorting and Developing at Ferreira Deep....Mass Consolidated....Ivanhoe....Pig Iron in 1909....Minas del Tajo Milling ....Allouez ... 1224
*Methods of Teaching Rock Drilling ... L. E. Young 1227
Damage by Electrolysis. E. W. Stevenson 1229
*Copper Smelting at Kyshtim, Russia ... Ernest J. Carlyle 1231
South African Power Supply Project ... Owen Letchers 1235
Mines of the Vladivostok District, Siberia ... Albert Bordeaux 1236
*Rolling Mill No. 2 Shaft, Michigan. P. B. McDonald 1237
Transvaal Mining Notes ... 1238
Mine Valuation ... J. R. Finlay 1238
Globe and Phoenix Report ... 1239
Personal, Obituary and Societies ... 1240
Editorial Correspondence ... 1241
Mining News ... 1243
Markets ... 1249
*Illustrated

Some Aspects of the Copper Situation

An extravagant advance in the rise of any commodity is never an unmitigated blessing. It may be, and often is, an evil. The producers of copper have many times experienced the truth of these principles and are not unlikely to become aware of them once again. One of the evils is the creation of a spirit of unrest among the men who are paid in wages. If an advance is economically justified, and if the producers are enabled to earn more money thereby, their employees ought to, can and will share the increased profit. If, however, the advance be but ephemeral, or be greatly overdone, the producers are likely to be led to make increases that subsequently will be difficult to cancel.

The recent strikes at the refineries in Baltimore, Brooklyn and Perth Amboy seem to have been stirred up by the malevolent hands of the Industrial Workers of the World, the anarchistic organization led by Hayward, with whom western mine operators are familiar. The avowed purpose of the I. W. W. is to wage war upon the employers of labor. Probably its leaders read in the newspapers of the scarcity of copper and the urgent demands upon the refineries and determined that the refineries would be a good place in which to put a spoke in the wheel. Perhaps this would not have occurred if so much had not been said of the stress upon the refineries and their being the key to the copper situation, etc.

A feature of the recent advance in copper that has been unsatisfactory to many persons, but otherwise to well-wishers for the industry, has been the nondevelopment of an old-fashioned copper stock boom. It is true that most of the standard copper shares have risen in about the same ratio as the metal, but there has been no public excitement carrying prices up to a basis of 5% yield on 17c. copper, and those who have stocks to sell are disappointed. No doubt the public will save money, because there is no probability that copper will average 17c. over a series of years, and besides the best of the copper stocks ought to yield more than 5% on the purchase price.

The absence of public excitement is possibly due to an increase in wisdom, but anyway it may be attributed to suspicion respecting the present situation. Most people are convinced that the last six months have witnessed a substantial improvement in general business, but while that has been slow and orderly, as reflected in the iron and steel markets, the copper market has been crazy, which discrepancy has not easily been reconciled; and, moreover, the mysterious disappearance of the new production of copper has had the effect of creating doubt rather than of inspiring confidence.

The Situation in Cuba

The communications from Mr. Lawrence and Mr. Emerson, published elsewhere in this issue, are illuminative of the situation actually existing in Cuba, and it will, we think, be a revelation to most people that American property has been so greatly in danger. The Cuban government seems to be unable to cope with the situation and Washington has been ignorant, or timid or both. It is high time that the chronic disturbances in this island be quelled permanently and a bold hand should be exerted if necessary. Otherwise there will be no further investment of American capital there for the simple reason that it will be unsafe.

Washington should moreover see to it that an exceptional class of men be appointed to the consular positions not only in this, but in the other South American countries where turbulence endangering Americans is likely to occur. The American consuls in those places should be strong, sane men, who will be leaders in time of trouble and safe advisers to their countrymen who happen to be around them. The ordinary American political consul is far from being such, and not infrequently is simply a joke. During the recent disturbances at Santiago, the place would have been panic-stricken had it not been for the coolness and bravery of Mr. Emerson and Mr. Combs, two officers of the Cuba Copper Co. The American consul did not seem to figure prominently.

The Telluride Case

An important recent piece of news from Colorado has been the award of $403,000 to the Smuggler-Union Mining Co. in its suit against the Liberty Bell Mining Co. for trespass. The suit was nominally for $600,000.

The Liberty Bell company made an underground discovery of a vein and figuring that its apex came in a narrow gap between the Carruthers and Waters claims of the Smuggler-Union made a location (the Winner claim) covering that gap. The hypothesis being confirmed, as it was supposed, by raises following the vein to the surface, the Liberty Bell proceeded to extract ore from the vein.

Later it developed that there were errors in the surveys of one of these raises and also in the lines of the Carruthers claim, and that the apex fell within the Waters claim; and moreover that the outcrop known there was in fact merely a branch of the vein, which had split, the other branch being just within the Carruthers lines.

Under these circumstances the Liberty Bell company became a trespasser, which we understand was recognized by its management. The Smuggler-Union company was the injured party and was entitled to redress, which has now been given to it. As to the extent and some other phases of the matter we are not going to comment. The point of general concern is that the verdict as it stands is a reflection upon the Liberty Bell management, which, in our opinion, is unfair. We are sure that Mr. Winslow and Mr. Chase would not steal ore from their neighbor, or from anybody else, and most people will believe with us that their trespass was unintentional. If any criticism is to be directed toward them it is for lack of care in surveys with respect to an apex supposed to lie within a width of only 28 ft. of free ground, but even as to this there were extenuating circumstances. It is a pity that this case, which is another troublesome manifestation of our absurd law of the apex, could not have been settled out of court.

A Long Raise

There has been some talk recently of records made in shaft sinking, particularly on the Rand, mention of which was made in the Journal of June 1. The Rolling Mill No. 2 iron mine, in Michigan, is now engaged in some shaft work, which, while it does not constitute a record as far as time and speed are concerned, is, nevertheless, interesting. While good time was made in the initial work, the chief interest lies in the method followed.

It was decided, for various reasons, to drive a vertical shaft by raising from the 620-ft. level to surface. Other considerations aside, this in itself is a long raise. The completed shaft will be 12x14 ft. in size, but the raise was driven 8x8 ft. Nine miners did the work in five months, working three 8-hr. shifts per day. In addition to the actual work of drilling, these men also did the timbering and trammed the rock a distance of 750 ft. To facilitate the work, under these conditions, the raise was driven as a three-compartment opening, one long, narrow compartment and two smaller, square ones being used. Holes were drilled and blasted in such a manner that the greater part of the broken rock was thrown, by the force of the blast, into the same compartment, at each firing round. Last, but not least, a light type of drill was employed, known as the butterfly-valve, air-hammer, stoper drill. In that district, at least, the use of such a drill for shaft work is a departure. There is reason to believe, however, that its successful use was largely responsible for the satisfactory outcome of the work to date. With them the 8x8-ft. raise was successfully holed through to surface, and the same drills are now being used to strip the shaft to 12x14 ft. size from surface down. At present, this work has progressed about half the total distance.

It will be recalled that the Alpha shaft of the Giroux Consolidated, in Nevada, was opened by a raise 948 ft. long, thus exceeding in length that at the Rolling Mill mine. At the Giroux a light, stoper drill was also used with satisfactory results. In timbering and other details, however, the operations at the two mines were different. The method followed at the Rolling Mill mine, described by P. B. McDonald in this issue of the Journal, will undoubtedly interest many operators, as an example of what can be done with a machine drill of light construction.

Mine Inspection

State mine inspection has never been efficient in the United States. It is not now, and there is only slender hope to believe that it will become efficient in the future. Municipal and state inefficiency is a chronic ailment in our domestic affairs. The federal government does better, wherefore eyes are more and more turned toward Washington. Secretary Root, in his impressive speech, called attention to this and pointed out that if centralization is to be avoided, the states must better attend to their own business. If they don't, Washington will.

On these lines, Dr. John Randolph Haynes, special commissioner on mining accidents, in the State of California, argues for a federal mining commission. He advocates:

> The etablishment, by congressional enactment, of a permanent commission of, say, five members, analogous in character to the Interstate Commercal Commission; this commission to have complete power to prescribe the conditions under which coal entering into interstate commerce shall be mined, just as the federal government at present passes upon the character and conditions under which meat products enter into interstate commerce. This commission should have power to appoint federal mining inspectors and to enact regulations for all coal entering into interstate commerce. The members, to be appointed by the President, should consist of three scientific men, selected for their special eminence in the subject of coal mining; one practical coal miner; and one business man of experience in the mining and marketing of coal. This commission should be empowered: First, to appoint its own inspectors; second, to pass and enforce regulations protecting the lives of the miners; and, third, to prevent the waste of coal in mining (now nearly one-half) for the benefit of future generations.

We suppose that such legislation under the cloak of the interstate commerce provision, which covers such a multitude of federal actions, would be constitutional, but to any sincere believer of state rights the idea must be abhorrent.

By the Way

In a contemporary we note that trouble was experienced with some foundations because "a worked-out coal mine existed practically over the whole site." Almost equal to Mark Twain's tunnel on the trestle.

The Pennsylvania courts, it appears, are to be asked to pass upon the sentimental—or other—value of a hole in the ground. The William Miles estate, which leases certain coal lands to the Pennsylvania Coal Co., has brought suit to enjoin that company from flushing the old workings at No. 1 shaft of the Old Forge colliery. The reasons given by William Repp, agent of the estate are: "By filling up the old workings they block our access to the mines to make measurements and ascertain by our engineers what amount of coal has been taken out. That's one reason. They have no right to fill up the space. Their rights consist in taking out the coal, not filling up the space. The hole in the ground is ours to do with as we please. If we had no other reason than a sentimental one to preserve our property interests in that hole in the ground, we should consider that sufficient to bring an action against the Pennsylvania Coal Co. to stop them."

Harris Merton Lyon describes in June *McClure's* the adventures of one Antonio Zachariah Podd, an "honest promoter" of the J. Rufus Wallingford type. A "practical miner" induced Podd to apply his genius to a copper showing in Canada. Kick Kaw Copper was accordingly organized; when the stock-selling campaign was only fairly under way, Podd received a telegram from the "mine," stating that the copper had pinched out, but that the showing now looked like silver. The prospectus writer was accordingly put at work on Singletree Silver, which was as great in proportion as the price of silver was to that of copper. But the silver showing went the way of the copper. The promoter wired the mine to learn what sort of a layer was underneath the silver and the reply read: "Looks like gold, but indications uncertain." Uncertainty at such a stage was merely a matter of temperament, however, and a lack of enthusiasm should not prevent the "progressive stockholders" in Kick Kaw Copper and Singletree Silver from having an opportunity to participate in a further exchange of shares, accompanied by a small amount of cash. The Gulliver Gold Mining Co. was accordingly organized. But Podd had guessed wrong again, for his "practical miner" stalked into the office one day and announced that they could not dig for anything any longer, as they had been drowned out by "fizz-water." Nothing easier in the world, however, for Antonio Z. A mineral-water company was formed to sell Vi-Joy, which did everything by way of restoring one to health, except operating for appendicitis. This is only fiction. We have read, however, of real pousse-café mines in Minnesota which are reported to contain layers of brick and pottery clay, gold and silver ore, iron ore, etc., the last representing any layers that may have been inadvertently omitted.

"In 1850, each person in the United States used 1028 lb. of coal and about 75 lb. of iron; in 1910, each person used 11,000 lb. of coal and 600 lb. of iron." In his recent commencement address on "Mining and Civilization," before the Missouri School of Mines, James R. Finlay reviewed the march of civilization as expressed today in our various industries, in our increased comforts, and in the ways of communication, such as railroads, automobiles, the great ocean steamships, and many other less striking phases of modern civilization. Continuing, he said: "I wish to draw your attention to the fact that practically all the means for these accomplishments are supplied by our mines. We dig out of the earth not only our materials but our energy. The modern ship is as good an example as any. She is wholly built of and propelled by the products of mines. The energy which makes possible the very process of building is supplied by mines, for almost every lathe is the world is driven by steam, which is furnished by coal. How shallow then is the idea so often entertained, and so casually expressed that the business of mining is a kind of gambling, from which the prudent businessman should carefully shy away! On the contrary, mining is the mainspring of our whole industrial system! This, I think, must be so plain to every thinking man, that I shall not dwell on it further."

It was the engineer-in-chief of a great modern undertaking requiring the combined efforts of civil, mechanical and electrical engineers, and of a big labor army with many officers graduated only in the school of experience, who expressed his desire for and belief in the ultimate supremacy of the college man as an executive. At the same time he frankly stated that where one college graduate had failed him for lack of technical attainments, nine had disappointed his expectations for other reasons. Some failed owing to inability to discipline themselves, and many others did not properly supervise, use and coöperate with those under their control. Some did not realize that the engineer is no longer any man who can merely subdue or adapt natural forces and materials to the needs of civilization. Not a few can now solve satisfactorily the purely mechanical side of problems; but the successful engineer is the man who, in addition to this, can make the dollar go farthest and draw out the best efforts of his workmen. There are, remarks John Calder, in the *General Electric Review*, several educational causes of failure which might be removed. The first of these is neglect of general culture prior to the college course. This is a marked defect in our present high-school system, and also in all the "get-wise-quick" schemes of a semi-scholastic nature for "framing up" an engineer. This neglect is followed too often—and even encouraged at some colleges—by options and by too early specifications, which frequently remove the last chance of the young engineer for an all-round mentality. No graduate should leave college in ignorance of the extent to which knowledge of the human factor bulks in executive success.

The "New American Rand" has again been discovered in Denver's backyard. An engineer "who has enjoyed an extended experience in Australia, South Africa, California and in the Nevada and Georgia gold camps," has reported that Newlin's Gulch has "the qualifications of one of the greatest camps ever discovered in the State of Colorado." However, a Colorado geologist, who has examined the "new Rand," is not so sure. In his "conclusions," he says that: "The only questions to be settled are the amount of the metal and the best methods of mining and extraction."

R. H. Titherington, in the New York *Sun*, presents the following rhyme of "The Get-Rich-Quick" man:

Dear friends, I venture to bespeak your serious attention;
I want you all to buy some shares in this unique invention.
You know how many millions have been reaped by Edison and Bell;
Friends, this new patent scheme of mine will pay at least as well!

Why buy those watered railroad stocks that Wall Street sharpers sell?
The Stock Exchange is nothing but a wicked gambling hell;
Now I'm a man of principle; I've nothing to conceal;
Trust me, dear friends; you'll always get the squarest kind of deal.

Next let me tell you of this tract of rich oil bearing land;
We've got fifteen producing wells—at least, we've got them planned.
To-day the stock's ten cents a share, but that price won't last long;
Next week 'twill rise; buy now and get a fortune for a song.

And then I have a wondrous mine, a glittering vein of gold;
To say there's billions in the thing would scarcely be too bold.
When once we get it opened up, its yield will be immense;
Invest a hundred dollars and you'll have a competence.

Why sell such stocks, you ask? Why don't I keep them for myself,
And rake in all the profits till I'm simply gorged with pelf?
Dear friends, I'm not that kind of man! I scorn such selfishness;
I want to give you all a chance to share in my success.

What's that I hear you say? An ugly rumor is abroad?
I'm charged with having used the mails for purposes of fraud?
This is a trick—an outrage! I decline to make reply!
I start at once for Canada—good-by, dear friends, good-by!

Competition in Aluminum Production

We have repeatedly pointed out the opportunity for competition in the production of aluminum in the United States since the expiration of the Bradley patents, leaving the metallurgical process free to everybody. While in Europe aluminum has been produced by a long list of rival concerns and the metal has become as free in the market as spelter, copper, tin and other competitive metals, in the United States the Aluminum Company of America has continued to exercise a monopoly, which has been tempered only by importations from Europe. It is especially interesting, therefore, to be able to report that there is soon to be competition by another American producer.

The Southern Aluminum Co., with a capital of $8,000,000, has been organized by L'Aluminium Francaise, in conjunction with some large French and Swiss banks, and the American Metal Co., Ltd., of New York. L'Aluminium Francaise is an amalgamation of the aluminum producers of France, including the works at Froges, Salandres and all the others in France.

The Southern Aluminum Co. has acquired, at Whitney, N. C., a water power which is partially developed. This water power has an estimated capacity of 50,000 hp., and the company is now engaged in completing the development for the purpose of making aluminum. The company is planning to erect an aluminum plant with a capacity of about 5000 tons of aluminum per annum.

The construction of this plant is to be under the direction of Dr. Paul Heroult, one of the leading metallurgists of this art, who is now on the ground executing the preliminary engineering work. It is expected that construction will be begun soon and that the production of aluminum will begin about 18 months hence. The company has entered into contracts for an ample supply of bauxite. While this new production of aluminum may mean the creation of a redundant output of aluminum at the beginning, we are of the opinion that the increasing consumption of this metal in the United States will soon take care of all that will be supplied.

Lucky Tiger Report

The net profit of the Tigre Mining Co. for the year ended Dec. 31, 1911, was $328,846, after deducting $88,675 for depreciation, according to the official report of the Lucky Tiger-Combination Gold Mining Co., the United States holding company for the Mexican corporation. The sum of $357,601 was paid as dividends.

Development work to the extent of 4099 ft. was done at the Sonora property; the ore exposed on three or more sides at the end of 1911 was 218,315 tons, averaging $19.20 per ton. The 46,945 tons mined and milled assayed $27.75 per ton, the total cost being $14.37 per ton. The total recovery is now being maintained at about 90 per cent.

The new 20-stamp mill, 250-ton cyanide plant and electric power plant were started July 1, 1911, and are being worked to full capacity. The old mill was in operation all the year.

Newlin's Gulch Gold District

DENVER CORRESPONDENCE

The stock in a company controlling property in the Newlin's Gulch district, near Denver, is being extensively advertised in a flamboyant fashion, and others will no doubt follow suit. From the standpoint of real mining the claims that are made are, of course, premature, to put it most kindly.

An engineer, who spent several days in the district, informs me that the placers are in the form of a horseshoe basin, surrounded by conglomerates to the height of about 100 ft., the strata of the latter being about as follows: On the surface about 4 ft. of trap rock, which covers a large area; then 6 ft. of coarse sandstone conglomerate, gold bearing; then about 1 ft. of greenish, clayey rock, described as disintegrated serpentine, barren of gold; then 1 to 2 ft. of sandstone conglomerate with large waterworn boulders. The gold in the conglomerates is not rounded and did not travel far. It is fairly coarse.

Powder Trust Dissolved

On June 13, 1912, the U. S. Supreme Court entered a final decree at Wilmington, Del., whereby three companies are to take the place of the one big powder combination which, in June, 1911, was declared by the same court to be in violation of the Sherman Anti-Trust Law. Under this decree the E. I. du Pont de Nemours Co. (1902, Delaware corporation), the Hazard Powder Co., the Delaware Securities Co., the Delaware Investment Co. and the Judson Dynamite & Powder Co. are dissolved and the property distributed among the stockholders, provision being made for the organization of two corporations in addition to the E. I. du Pont de Nemours Powder Co. (1903, New Jersey corporation). A fair proportion of the business controlled by the Dupont company must be distributed as far as practicable between the new companies. After Dec. 15, 1912, the companies will not be permitted to occupy the same offices, to have the same office force and organization or to have the same persons serve as officers or directors. If the conditions of the decree are not complied with by the above date, an injunction will be issued, restraining the defendants from placing their products in interstate commerce.

The petition concerning the International Smokeless Powder & Chemical Co. was dismissed because it was shown that this company is coöperating with the Government in a manner beneficial to the army and navy.

Iron Mines Assessments Lowered

NEGAUNEE CORRESPONDENCE

At a special session of the Michigan Tax Commission, held recently in Houghton, the assessments of two iron mines at Crystal Falls were lowered. The valuation of the Bristol mine, of Oglebay, Norton & Co., was reduced from $865,000 to $666,000, and the Great Western Extension, of Corrigan, McKinney & Co., was lowered from $50,000 to $18,000. In addition, credit was given the Bristol for ore mined, making a further reduction of $107,000. Doctor Leith, of the University of Wisconsin, the Tax Commission's iron expert, was present.

The reasons given for the reduction, amounting to about 25%, of the Bristol mine assessment, has to do with the figure for "expected average profit per ton" on Crystal Falls ore, which was given in J. R. Finlay's appraisal as $1.16, and which is rather high, especially in consideration of the prevailing low prices for iron ore. The Bristol mine ships two grades of ore, Bristol and Manganate. The former averages 54.86% iron and 0.633% P; the latter, 50.36% iron and 0.593% P. Both of these would be classed as rather low-grade ore, especially as before being dried the moisture content is 8 per cent.

The Great Western Extension figure was lowered because of the discrepancy in valuation between it and the assessment of the Neely exploration, to the east. The Great Western Extension, with less ore proven than the Neely property, had been assessed at a higher figure.

Using Boreholes in Shaft Sinking

In sinking a recent airshaft in the Königshutte district, Germany, a borehole was first put down to meet the workings below. At the surface the borehole was 79 cm. in diameter, and at 190 m. depth, where it met the underground workings, it was 53 cm. The ground removed in sinking was shot down this hole and then used as filling, says the *Mining Journal*, June 1, 1912, thereby saving about 20% in sinking cost, and fully 33% in the time required. The total cost of sinking, including the bore-hole tubing, lining the shaft with masonry, and expense of cleaning out the borehole once after it became blocked, was about 500 marks per meter.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Fighting at the Cobre Mines

I send the JOURNAL a letter just received from our manager, Mr. Emerson, at El Cobre, near Santiago, Cuba.

BENJ. B. LAWRENCE,
President, Cuba Copper Co.

New York, June 18, 1912.

Dear Sir:

As you will have understood by my cables, the situation grew rapidly worse until we were attacked. I had guards out and men sleeping with their arms until the night of June 5. We had seen more and more men each night, and our sentinels were shooting every night and shots began to come in from outside, so on June 5, I put out every man I had a gun for, and a large force with dynamite. The insurgents had evidently gathered in considerable numbers and had planned a serious attack on the mine. Shooting started from outside at about 10 o'clock and we had to stop the Hardy hoist and put out all lights. One shot passed between the legs of the Hardy winchman. At 2 a.m. a concerted attack was made at Hardy, Mina Blanca, and by the stables. The insurgents began firing, and we used guns and dynamite and held them, except at the stables where they drove back our men on to my house, but retreated under cross-fire from Mina Blanca, the engineers' house and the house. We had no one wounded, but the shots hit the house in many places. It was pitch dark, and we do not know if we inflicted any damage or not, as it was easy for any wounded to get away.

The men had been up for many nights with constant shooting, and for a layman a few black nights with shooting is bad for the nerves, as I will testify. It became evident to me that we were not going to be able to stand very many more such nights, and I was very glad when Lieut. Belknap came over and told me I could have marines. Our actual request for marines I made to Lieut. Belknap at about 4 p.m. on June 6, and at about 7 p.m. they were landing in Punta Sal. Capt. Gulick in charge left a squad at Punta Sal and another at Hermitano bridge and then came on to Cobre. He has 108 men here now, and still keeps 12 of our armed Spaniards for duty at night.

Night before last a force of insurgents attacked Cuero, defended by 100 marines. They repulsed two attacks and sustained a fire from about 1 a.m. until daylight.

The situation does not improve. Hundreds of families have flocked into El Cobre, and we expect a famine and all kinds of such trouble. No supplies can come by road, and we are transporting everything over the railroad. Even the government made formal request for the mails over our lines as their roads were not safe. We paid yesterday under a strong American guard, and had no trouble. No one could be more vigilant than Capt. Gulick, and his men are on duty night and day.

E. H. EMERSON,
Manager.

Santiago, June 11, 1912.

The Mathematics of Copper Sampling

On reading the discussion on copper-bullion sampling, by D. M. Liddell and Dr. Edward Keller, in the JOURNAL of Dec. 16, 1911, and Apr. 6 and 13, 1912, it seems to me that there are points which require further explanation.

Thus: Mr. Liddell speaks of the difficulty of devising a template, so that the size-weight ratio of the corner-section holes shall be correct, as being insurmountable. It would be practically impossible, as Mr. Liddell says, to calculate a template for bars having a heavy bevel, such that the size-weight ratio of the corner holes would be correct for every individual bar. But sampling by the template system is based on the blessed law of averages, and it would not be impossible to calculate a template which would be correct for the average bars in any given lot. Thus bars in the same lot having a heavy bevel will not all be of the same thickness and, therefore, the top areas will be different, some will be slightly smaller than the template; nevertheless the average area will be nearly the same as that of the template. It is, therefore, possible to calculate an average position for the corner hole which, although it will not be correct for each bar, will be correct for the average. Such a result may be obtained by swinging the corner holes on the template inward from the normal position toward the center. Even if this is not an absolute solution it will closely approximate the truth.

THEORY CERTAINLY FAVORS SLABS

It seems to me that Doctor Keller's able paper is the strongest possible argument in favor of casting all crude argentiferous copper in the form of slabs. Many smelters recognize the superiority of this form and the larger part of crude argentiferous copper is now shipped in this shape. Unfortunately for the sampler, a number of smelters still cling to the old form of "pig," and a more irrational shape from the sampler's viewpoint would be difficult to devise. As Dr. Keller says, "a copper bar with a square cross-section or one approaching it, is composed of two edge zones of a slab symmetrically joined together; the most irrational form for the purpose of sampling by drilling." The ordinary copper pig has not a square cross-section, but one approaching a square—it would be quite impossible to sample such a shape by any one-hole method or even by a template containing a number of holes closely grouped in a given section. In such shapes we must perforce take cognizance of the bevel because, so far as segregation of the metal is concerned, the whole thing is bevel.

Sampling by sawing, in a large way, is practically impossible, although it may be done in an experimental way effectively. We must, therefore, rely on drilling by the template system as the only practical method for obtaining samples from pigs and other heavily beveled shapes of small cross-section.

It might be inferred from Doctor Keller's mathematical demonstration that it is not possible to take correctly representative samples from beveled shapes by drilling. This would, indeed, be impossible if the copper segregated in even layers, each differing in silver and gold contents from all the other layers. But, fortunately, this is not the case. Segregation occurs always toward or away from the cooling surfaces, not in mathematical lines, but in devious ways which are only regular on the whole, that is, which have a tendency in one direction but not an absolutely fixed progression in one direction. The metal in every parallelepiped is a mass of mixed crystals interfering with one another in all sorts of broken lines. Owing to slight differences in the surface measurements of pigs, a template can never be placed with mathematical precision, consequently the actual drill holes are sometimes in one section of a given parallelepiped, sometimes in another. The heterogeneity of the metal and the slight displacement of the drill holes save the situation, provided only that the sections of the parallelepipeds be small and the drill holes large. To insure accuracy, it is only necessary to drill enough holes in the whole, the half or the quarter of the pig. But care should be taken that those holes which are drilled in the actual bevel should be spaced so that the weight of borings taken from the bevel bears a proper relation to the weight of borings taken from the body of the pig.

Surface Errors in One-hole Method

Considering the one-hole method—if that name may be given to the scheme for boring slabs in a circumscribed area of the inner zone, to the exclusion of the wedge: It occurs to me that there might be a serious source of error with some kinds of copper. It sometimes happens that cakes exhibit a smooth top at the outside edges, covering an area an inch or an inch and a half wide. The inner portion of the surface, however, is very rough, containing many interstices and blow holes. The outside border consists of solid copper, while the inner portion is covered with an uneven crust of cuprous oxide. In this rough crust, particles of converter lining, matte, etc., are held, but they do not occur on the smooth solid metal constituting the border. The copper-oxide crust is usually much richer in silver than the solid metal beneath it. In boring such cakes by the restricted-template method, the tendency might be to get too much silver, due to the highly argentiferous oxide crust, which does not occur, or at least is much thinner, on the outer border. On the other hand, matte or converter lining would cause a compensating error, but both errors would be at the expense of the copper contents of the sample.

It would appear that the one-hole or restricted template method would be applicable to anodes and all slabs which have a reasonably even surface, but in slabs such as I have described and in all thick bars with bevels, the older template methods would appear better. I hope this is not the case and that someone will prove it.

A. M. Smoot.

New York, June 13, 1912.

What Is a Stratified Rock?

There is a question which the geologists might answer through the columns of the Journal: What is a stratified rock? I am prompted to ask this question after reading some of the papers presented at the several geological societies in this country, by which I am led to understand that the distinction between stratified and eruptive rocks is not sharply drawn.

For example: Assume that a volcano is in eruption ejecting rock in the form of fine dust or "volcanic ash." This dust, being transported by the wind, falls into a lake, say at an altitude several thousand feet lower than the volcano; the dust settles to the bottom, and, the quantity being great, a thick bed of mud is formed. Assume that this mud consolidates rapidly into one coherent bed.

Assume that lower down in the crater of the same volcano, a mass of plastic rock is forced into an open fissure in the surrounding rock, which, solidifying, becomes a sill, say at a distance of a few hundred feet from the surface. After many ages, let us assume that this sill has been exposed on the surface by denudation and itself has been eroded, the fine débris having been carried by a river into the same lake as has been mentioned. Suppose that a fairly thick bed of this débris accumulates on the bed of the lake and ultimately consolidates into one coherent mass as did the wind-borne dust. Should that lake dry up and all the solidified sediments be exposed, would the geologists call the first an eruptive and the second a stratified rock?

C. C. S.

New York, June 12, 1912.

Reduction of Zinc Oxide

The articles of Prof. Harry C. Jones, which have been appearing in the Engineering and Mining Journal, have been very instructive, and especially well adapted to give the average technologist or engineer new and valuable ideas on physical chemistry and its applications to industrial, chemical and metallurgical processes.

It is just because of the wide influence of those articles that I venture to criticize a statement made by Professor Jones, in the Journal of June 1, p. 1087.

> "While zinc oxide is not reduced by carbon at 1100° C., it is apparently reduced at 1125° by carbon, showing that its energy of formation at this temperature is equal to that of carbon monoxide when formed from carbon and oxygen = 29,650 calories."

This statement gives an entirely erroneous idea of the nature of the reaction and of the heat relations involved. The reaction $ZnO + C = Zn + CO$, taking place at 1125°, is not a thermally balanced one, in which the heat of formation of the CO just equals the heat of decomposition of ZnO; on the contrary, the reaction at this temperature is *more* endothermic, that is, absorbs more heat, than it would if it took place at ordinary temperatures. It is not necessary here to explain in detail how the heat absorbed in this reaction at 1125° can be calculated (it is discussed in my "Metallurgical Calculations," Part I. p. 53), but suffice it to say that about 82,140 calories are absorbed at 1125° when this reaction of reduction takes place, and the supplying of just this large quantity of heat, at this high temperature, is the principal thermal work done in the zinc furnace.

Professor Jones' statement would leave one to infer that the chief thermal work of producing zinc consisted in heating the charge to 1125°, at which temperature the energy of oxidation of the carbon was equal to the work of deoxidizing the zinc; but this view is so far erroneous, as stated above, that it leaves out of the count the main work done in the reduction, viz., the supplying of the energy absorbed at this temperature.

A satisfactory viewpoint for this reaction, and one which I think Professor Jones will himself agree to, upon reflection, is that the immense amount of heat which is, undoubtedly, absorbed in the reduction in question, at 1125°, may be regarded as latent heat of reaction, quite analogous to absorption of latent heat of fusion or vaporization. We are all familiar with the boiling of water at 100° C.; the vaporization only takes place at 100° *in measure as* the latent heat of vaporization of the water is supplied from outside sources at the temperature 100°. In an exactly parallel way, heat $ZnO + C$ to 1125° and the mixture is at the proper temperature to react; now supply the required heat energy from outside, at this temperature, and *in measure as* you supply it, the reaction takes place. The kernel of the whole matter is, that it is not sufficient merely to keep the mixture at 1125°, to have the reaction take place, but heat must be supplied, and in large amount, at 1125°, and the reaction then proceeds, at that temperature, in proportion to the amount of heat thus supplied. If anyone asks how the heat thus absorbed is supplied, the answer is: by trying to heat the mixture to a higher temperature, just as you boil water by trying to heat it to a higher temperature than 100 degrees.

My apology for this rather long protest is the great importance to the chemist and metallurgist of understanding rightly the *modus operandi* of reactions taking place at high temperatures with absorption of heat. Such reactions are numerous in chemistry and metallurgy, and if properly understood and comprehended can be handled and practiced much more intelligently.

Joseph W. Richards.

South Bethlehem, Penn., June 15, 1912.

New Kink in Iodide Copper Assay

While I appreciate the practical utility of Messrs. Popper and Hall's contributions on the above subject (Eng. and Min. Journ., May 25, 1912, June 15, 1912), are they not dismissing the theory too summarily.

Instead of unvarying reactions such as are indicated, especially by Mr. Hall's paper, I am under the impression that mass action, temperature, and concentration, all have a great effect, and that although the end product is chiefly cupric sulphide, I think it is not entirely so. As a matter of interest, it has been shown recently by Firth and Meyers, if the copper salt be in excess, a condition not compatible with quantitative work, metallic copper itself may be precipitated.

C. C.

Newark, N. J., June 17, 1912.

Mining on Forest Reserves

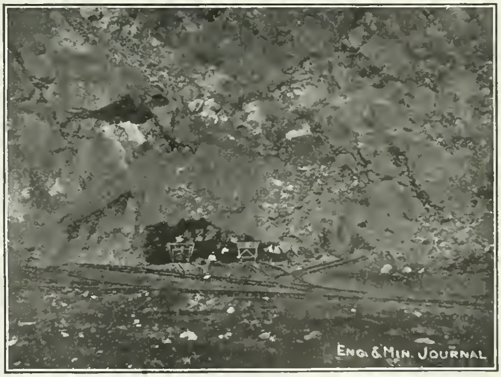
By Merritt Booth*

The National forests are open for prospecting and mining under the same regulations that apply to such operations outside the reserves. In Colorado, mining is being done on National forests; and the author maintains that legitimate prospecting is fostered by the Forest Service.

"To be interested in faraway objects, like the moon," and to slight what is apparently within reach, is characteristic of human nature. During the last few years mining camps in distant countries have diverted attention from the great possibilities of the virgin mineral areas in Colorado. The fact that Colorado is an old mining state should not operate to drive the prospector and the money behind him to new and remote fields. The opportunities are as good at home as abroad, and in many cases a great deal better.

In boom times everything possible was said and done to increase the excitement and bring outside capital into the state; in fact, too much was said, and when reaction came people who had invested at random, without investigating the merits of the stocks offered for sale, found themselves in many instances victims of an inflated stock market. The result was a general slump in mining which lasted for several years. Those who invested right have something to show for their money. Many of the prospects that were handled legitimately during the Cripple Creek excitement are now producing mines and have been for a number of years. The same can be said of Leadville, the San Juan region, and other camps of note throughout the state.

Hydraulicking Near Hahn's Peak, Routt National Forest, Colo.



Limestone Quarry in a National Forest in Colorado

Colorado Wants New Mines

The old mines are holding their own, but the state wants new mines opened up; and prospecting is the first step toward effecting that end. During the recent period of inactivity in prospecting operations, new fields were talked of. Prospectors who could land a grubstake were off to Alaska, Mexico, Canada and other faraway places. The farther away the better the chances, so it seemed, and for a while Colorado was not thought of as offering inducements in the prospecting field.

Only recently have the people awakened to a full realization of the situation in Colorado and have started in anew to overcome the prejudices brought about by a long string of circumstances that naturally put a quietus on the prospecting business. Now, things appear to be on the move again. Through the efforts of the Denver Chamber of Commerce, the press, and enterprising citizens, prospecting has taken on new life, and it is probable that during the coming year many new finds will be reported within the state's virgin mineral areas. It is gratifying, to say the least, to observe the optimistic feeling that prevails throughout the state. The perfecting of processes to treat the extremely low-grade ores enters into the rejuvenation of mining, as a strong factor, and thousands of tons of gold ores that in years past were consigned to the dumps are now being handled at a profit.

National Forests Open to Prospecting

For a long time the fact that the greater portion of the mineral areas were within National forests caused considerable comment. The local mining people did not have a clear idea of what "Forest Service" meant and what the attitude of the Service was toward the prospector and the locating of mineral claims within the forests. Even at this late date people are met with who are not aware of the fact that the mineral areas within the forests are open to prospectors. The policy of the Forest Service is to encourage prospecting and the Service has no desire to antagonize the locating of valid mining claims, no matter how heavily timbered they may be; but the claim must be a valid one in order to pass to patent.

Under authority of the Federal laws, an examination is made of all mining claims for which patent is sought. No claims are protested unless they have been examined by practical mining men, men whose experience and association with the obstacles met with in mining, and with the prospectors and miners themselves, have rendered them capable of passing intelligently on the many intricate and unusual situations bearing upon the mineral possibilities of the areas staked out; and the claimant is given the benefit of the doubt, if any exists.

Must Comply with Mining Laws

The laws governing the locating of mining claims within and outside the National forests are precisely the same. The statutes provide that mining claims may be located only upon a discovery of valuable deposits, whether in lode or placer claims, and that no location of a lode claim shall be made until there has been a discovery of the vein or lode within the limits of the claim located. The object of the latter provision is evidently to prevent the appropriation of presumed mineral ground for speculative purposes to the exclusion of *bona fide* prospectors, before sufficient work has been done to determine whether a vein or lode really exists.

---

*Mining expert, U. S. Forest Service, 1321 Bannock St., Denver, Colo.

The claimant, therefore, prior to locating his claim, unless the vein can be traced on the surface, must sink a shaft or run a tunnel or drift to a sufficient depth therein to discover and develop a mineral-bearing vein, lode, or crevice, and should determine if possible the general course of such vein in either direction from the point of discovery, by which direction he will be governed in marking the boundaries of his claim on the surface. The law also provides that five acres of nonmineral land noncontiguous to the lode may be patented when actually used for mining and milling purposes, and that patent shall not issue in any case until $500 worth of labor shall have been performed in the development of the particular claim located.

These are not rules invented by the Forest Service. They are the statutes of the United States. State and local regulations, so far as they do not conflict with the United States statutes, are recognized by these statutes and by the officers who enforce them. So the prospector is protected in the possession of his claim while he is working to discover valuable mineral thereon; but to preserve his possessory title, or, in other words, to protect himself against individuals who would jump his claim, he must comply with local mining regulations and do the annual assessment work required by law.

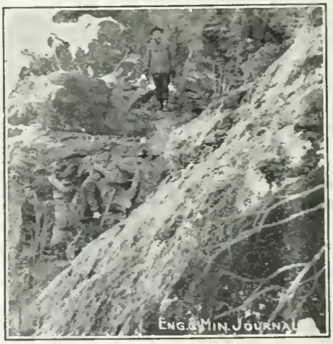
The enforcement of the United States mining laws with particular reference to the patenting of mining claims has eliminated the possibility of mining claims being located where there are no minerals, presumably for the purpose of obtaining title to large areas containing valuable timber, and of locating a number of claims around a new discovery merely to have additional territory. The law provides that a discovery of mineral must be made on each claim. In this the prospector is protected. He knows the mining laws were made for his benefit, and if large tracts of mineral and timber lands were allowed to pass in this way, there would be no ground left to prospect and no timber for the real miner to develop his mine with.

How the Forest Service Aids Prospectors

The Forest Service has placed no restrictions of any kind upon the prospector and locator of mineral claims; in fact, many have been aided in their search for the precious metals, through the advantages offered by the Forest Service. The efficient field force, with its carefully prepared maps and a general knowledge of local conditions, is available to the prospector for information as to the best routes and the accessibility of remote sections. By means of a developing system of telephone lines, constructed by the Service at considerable expense, these remote places are being brought into communication with the outside world.

A large amount of money is also expended in making trails over rough mountain passes which heretofore were inaccessible with pack outfits or even a saddle horse. These trails are a wonderful advantage and convenience in mountain travel. They obviate the necessity of making long detours in order to arrive at a point that is now reached by a short cut. The methods in practice for prevention and control of the much dreaded and destructive forest fires are being perfected in every detail. This in itself is something of more than ordinary value to the mining operator in heavily timbered sections.

The Forest Service has done more toward the advancement of mining than the public has given it credit for. All mineral lands are open to the prospector, and cases where adverse report has been made are few as compared with the number of claims that have been reported upon favorably. It is simply a matter of compliance with the United States mining laws on the part of the claimant, and, as it has become generally known that the Service is exacting nothing more, a change of feeling, I believe, has taken place from antagonism to a better realization of the benefits and protection accorded to the prospectors and miners whose fortunes lie within the National forests.



Excavating for Thistledown Mill, Uncompahgre National Forest, Colorado

Round Mountain Mining Co.

During the year ended Mar. 31, 1912, the Round Mountain Mining Co., operating at Round Mountain, Nev., milled 54,915 tons, of a gross value of $7.09 per ton, recovered $6.24 per ton, had miscellaneous earnings of $0.08, and costs of $4.96, including depreciation of $0.31 and litigation charges of $0.20 per ton. The ore reserves were increased from 111,928 to 145,820 tons. Cash on hand increased from $60,658 to $115,491, and the company has no debts.

Litigation has been expensive during the year. The Commissioner of the Land Office rendered a decision in favor of the Round Mountain company in regard to the protest of the Sphinx company against the issuing of a patent to Great Western No. 1 claim, but the case has been appealed to the Secretary of the Interior. The company also has two other cases before the Supreme Court of the State of Nevada.

Developments in the mine continue to be encouraging, and placer work by the Round Mountain Power & Water Co. has shown a new 20-ft. vein running from $3 to $12 per ton which should be accessible from the 200-ft. level of the No. 2 shaft.

Oil Pipe Lines are Common Carriers

An order filed by the Interstate Commerce Commission on June 13 lays down the rule that interstate pipe lines are common carriers and are subject to the provisions of the Interstate Commerce Law. The Commission holds that the provisions of the law are clear, that the intent of Congress is plain, and that the validity of the sections affecting pipe lines has never been questioned before any court. It is therefore ordered that 13 of the larger pipe lines are to file by Sept. 1 schedules of rates and to comply otherwise with the provisions of the law. The companies affected are the Oklahoma Pipe Line Co., Prairie Oil & Gas Co., Standard Oil Co. of Louisiana, Ohio Oil Co., Standard Oil Co. of New Jersey, Tidewater Pipe Co., Ltd., Producers & Refiners' Oil Co., Ltd., United States Pipe Line Co., Pure Oil Co., Pure Oil Pipe Line Co., National Pipe Line Co., Uncle Sam Oil Co. and Uncle Sam Oil Co. of Kansas.

This decision was based on an investigation by the commission begun on its own initiative. The decision is in substance as follows:

The Decision

The act to regulate commerce impresses the obligations of a common carrier upon a pipe line engaged in the transportation of oil in interstate commerce, even though such pipe line was built over its privately acquired right of way, and transports only its own oil Such traffic is not divested of its interstate character by placing the ownership of the pipe line in a different corporation in each state through which the transportation passes, and by transferring title to the oil to each of such corporations contemporaneously with the entrance of the oil into the pipes of that corporation at the state line.

The effect of a Kansas statute making pipe lines common carriers was not considered, as Federal jurisdiction depends upon Federal acts. If the Federal act is ineffective, a similar statute of an individual state is of no avail.

The utilization by a pipe line of the right-of-way of a common carrier railroad does not impress upon that pipe line the obligations of a common carrier. A pipe line is not impressed with the obligations of a common carrier merely because, by arrangement with the abutting owner, it uses a public highway for right-of-way purposes.

The transportation by the New York Transit Co. in New Jersey and by the National Transit Co. in New Jersey and Maryland, prior to Nov. 1, 1905, was transportation by these corporations as common carriers.

The transfer by a common carrier pipe line to a private corporation of a portion of its property theretofore used in its common carrier operations, but not located in the state wherein it was incorporated as a common carrier, does not release that property from the obligations of a common carrier.

Stora Kopparbergs Bergslags Aktiebolag

The latest report of this Swedish company covers the year 1911. It is the oldest mining and metallurgical company in the world, its records dating back to the fourteenth century. Its present activities are varied, including mines of copper pyrites and iron; copper, iron and steel works; timber and paper-pulp works. For the year 1911, the income was $1,714,385; expenses, $841,665; net earnings, $872,720. The dividends paid were $666,665. Of the total profits, 16.1% were from copper; 20.2% from iron and steel; 22.1% from timber; 41.6% from pulp and paper. The production report for two years past is as follows, in metric tons:

	1910	1911	Changes
Pyrites mined	19,867	21.592	I 1,725
Copper sulphate	320	326	I. 6
Sulphuric acid	3,685	6,159	I. 2,474
Iron and steel	66,946	67,311	I. 365

The company is actively interested in the use of the electric furnace. It is the owner of the Domnarfvets iron works, where the electrical production of pig iron was rather small during 1911, owing partly to the lack of water in consequence of the drought during the summer, and partly to many alterations to the furnace. The total working time amounted to 44 days and the operations, in fact, were conducted mainly with the view of experimenting and gaining experience. The results obtained are stated to have been very satisfactory. A new electrical furnace of a capacity of 12,000 hp., is now under construction and will probably be completed in October. The company is also having another electrical furnace built for the manufacture of ferromanganese and ferrosilicon, which will be completed in July.

Greene Consolidated

The report of the Greene Consolidated Copper Co., covering the operations of the Cananea Consolidated Copper Co., S. A., Cananea, Sonora, Mex., shows that the gross profit for the year ended Dec. 31, 1911, was $1,307,131, from which $280,180 was deducted for depreciation. The total production was as follows: Copper, 44,897,466 lb.; silver, 1,295,297 oz.; gold, 5892 oz. The production from its own ores was 37,101,119 lb. of copper, 795,160 oz. of silver and 3610 oz. of gold.

The average cost of the 51,874 ft. of development work accomplished was $8 per ft. The company mines produced 751,462 tons of ore at a cost of $2.46 per ton. The important developments of new ore have all been in the limestone areas. These ores are reported to contain from 3 to 5% copper, from 1 to 4 oz. of silver and from 10 to 30c. in gold per ton. They are direct smelting ores, highly basic in character. General Manager Ricketts states that the physical condition of the mines is good and that he looks for a satisfactory year ahead and a notable increase in the output of both copper and silver.

No attempt was made to press production during the year, but, on the contrary, the aim was to curtail. However, on account of the development of basic high-sulphur ores, more silica was needed; consequently operations were resumed at the Henrietta mine, which was closed in 1910, and the Cobre Grande mine was reopened. Toward the end of the year, work was also started at Puertecitos, with a view to increasing the output when necessary.

At Puertecitos, a new quarry for oxidized ore was started, and the porphyry contacts on each side of the limestone core of this hill are being developed. By the middle of the year it is expected that over 200 tons of smelting ore per day will be obtained from this mine. Dead work only was done in 1911, resulting in high costs at this mine.

The Henrietta mine proper, while profitable, is a small mine, and no large orebody has been found in its workings. This mine, however, is being used as a base for broader work in the development of this district.

The face of the Combination tunnel at the close of the year was 5200 ft. from the portal and is being slowly driven ahead. The tunnel has passed entirely beyond the Elisa zone and has entered the Cananea claim.

In the Elisa mine, the main oreshoot was opened on the sixth level, and was crosscut by extraction tunnels on the level of the Combination tunnel. The main shaft will be sunk during the coming year to develop the ore below. The ore was of satisfactory grade and the outlook is considered better than in several years past.

The limestone area of the Sierra de Cobre mine, over the Combination tunnel, has shown the most encouraging developments. Important orebodies were opened in the limestone adjacent to the Eureka fault at three points, and in a number of other places in the limestone ore was crosscut, which probably will yield important tonnages. The ore in this area is exceedingly irregular in its occurrence.

Developments on the tenth level of the Capote mine, under the old orebody, were disappointing, although some ore was encountered between the eighth and tenth levels. During the year ore was opened on the second, third, fourth and fifth levels, and it is believed that this ore will continue as far as the ninth level. A great deal of the ore is an exceedingly lean pyrite, which cannot be beneficiated at present, but noteworthy quantities of ore of profitable smelting grade occur on the lower levels. The mass of pyrite on the fifth level is about 220 ft. long, with a maximum width of 100 ft., and the indications are that a large tonnage of profitable ore can be obtained, even though no way of beneficiating the leaner material is available at present. A fairly large amount of this ore averages about 4% copper and some silver; so long as it contains at least 2½% copper, it should be profitable for smelting.

The Oversight mine maintained a steady production and a satisfactory amount of first-class smelting ore was opened. Development work is to be prosecuted vigorously during this year. The old Esperanza orebody is also to be opened. It contains a low-grade concentrating ore, which should be profitable under existing conditions.

The Vete Grande mine was idle in 1911, but operations will be resumed the latter part of this year. The Kirk mine produced 95,000 tons of ore, most of which was of smelting grade. The Cobre Grande mine produced a good quantity of ore for converter lining and for smelting. The old orebody is not adapted to concentration. A new body of concentrating ore was found to the west. It is of good grade, but apparently not of large extent.

The tendency is toward lower-grade mattes, and the company is endeavoring to develop ores low in sulphur, to help to raise the grade of the mattes. With this aim in view, the company bought a four-fifths interest in the Superior Bonanza mine, situated near Imuris, Sonora. This mine gives a siliceous ore containing small quantities of copper and larger quantities of gold.

The amount of money involved in the purchase of this mine is not large. It is probable that no ore will be produced until some time in 1913. Development work is being done and it is hoped that before that time a sufficient tonnage of ore will be opened to justify building a railroad for the 5½ miles between the mine and the Sonora Railroad. The company has obtained a reasonable rate on this ore from the railway company, so that it can be brought to Cananea and smelted at a profit.

During the year, 528,412 wet tons of ore were milled. Of this, 415,199 wet tons were company ore; the concentration ratio was 2.40: 1. The total cost for concentration was 72.2c. per wet ton. An average of 77.69% of the copper in the ore was saved in concentrates. In the reduction works, 580,060 dry tons of new copper-bearing material were treated at a cost of $2.57 per ton. The total cost of mining and beneficiating, including every cost until the refined copper was sold, was $5.257 per ton of ore.

A Piece of Practical Forestry

By R. W. Raymond*

The greatest waste of our forests has always been, and continues to be, their destruction by fire. The U. S. Forestry Bureau has laid the blame upon the failure of Congress to make adequate appropriations; and leading members of Congress retort that they have striven in vain to have this department of forestry work more thoroughly covered, and that the Forestry Bureau had defeated such increased specific appropriations, while receiving immense sums for other and less vitally important operations. Whatever be the merits of this controversy, the fact remains, that conflagration annually destroys more than "conservation," in its widest and wildest aspect, can save.

Under these circumstances, it is a pleasure to note a piece of practical forestry, in a circular issued by the Pennsylvania Forestry Association, the Philadelphia Commercial Museum and Lehigh University, "for general circulation among the boys and girls of Pennsylvania." A million copies of this circular are to be distributed, with the aid and approval of the State Superintendent of Public Instruction, the State Commission of Forestry and the Governor of Pennsylvania, all of whom have affixed their signatures to the document, which will be placed in the hands of every boy or girl in the public schools of the state.

The circular, printed in red and black, with effective illustrations, is well calculated to make an impression upon youthful readers. The headings in red ink state such general propositions as: "We must have woods and forests, and those who follow us will need them more than we do!" "When fire runs through the woods, practically all the young trees are killed," "Forest fires are preventable." "What can you do to help?"— not to quote many other similar statements, each explained and enforced in subordinate black type—and the whole is summed up in the appeal. *"Therefore*, Never toss away burning matches, cigars, cigarettes or pipe ashes. Never start a fire in the woods among leaves, dry wood, or against a log, or against any tree, whether it be dead or alive. Never start a fire in the moss or peat of a dry bog—it may smolder for days, and at last break out in open flame. Never leave a fire until it is *surely out.* Never start to burn brush or stumps in a clearing in a dry time, or on a windy day, and never leave a fire burning in a clearing—stay with it until the fire is *completely* out. A locomotive which throws out sparks, or drops live coals along the track, may start a bad fire. Take the number of the locomotive which does these things, and send it to the division superintendent. He will probably thank you for the information."

This will suffice to indicate the character, though not the impressive typography, of the circular. The most noteworthy feature of it, however, is the effect which it has already produced among the boys and girls of Pennsylvania, who have taken up with enthusiasm the cause of forest protection, and who constitute already a vast corps of innumerable vigilant guardians and observers, more effective than any official body could be. This simple yet powerful agency might well be invoked in other states.

Metal Schedule Hung Up

Washington Correspondence

The action of both House and Senate in declining to come to an agreement on the metal-schedule bill is regarded here as practically closing that subject for this session of Congress. During the week ended June 15, conferences were in progress for the purpose of securing if possible an adjustment of some kind that would permit something to be agreed upon between the two houses. On Monday, June 10, the House declined to accept the reciprocity and the print-paper amendments to the metal-schedule bill, inserted by the Senate, although it assented to the amendment relating to the ferroalloys and pig iron. Subsequently the Senate formally refused to recede from its amendments and thus the measure is hung up.

There is an interesting situation with reference to this matter, however, as both sides freely admit that if the election in November goes in favor of the Democrats unreservedly, an adjustment will probably be arrived at that will result in sending the bill in some form to President Taft. Senate Republicans put in these amendments, in order if possible, to save President Taft the necessity of vetoing the measure. They will not feel it incumbent upon them to stick to this policy after the elections are over. Democrats will, it is expected, have little trouble in making concessions to the Senate Republicans that will result in putting through this metal-schedule bill if they desire to do so. The discussion has developed the fact that the opponents of the proposed reductions in iron, steel, lead zinc, and other metals have lost greatly in numbers.

International Smelting & Refining Report

According to the 1911 report of the International Smelting & Refining Co., the Tooele copper furnaces did not run at capacity at any time, because of insufficient ore supply, although matters were much better toward the end of the year. The lead furnaces were not blown in until Feb. 29, 1912.

At the Raritan Copper Works the capacity had to be increased by about 30%. The idea of building a lead plant at Perth Amboy was abandoned and work has been commenced at East Chicago, Indiana.

After allowing $175,229 for depreciation, profits were $1,219,037, out of which $800,000 in dividends were paid. Surplus now stands at $1,556,941 on a $10,000,000 capitalization.

Maryland and Pennsylvania Copper

The production of copper in Maryland and Pennsylvania for 1911 amounted to 665,110 lb. of copper, chiefly from the Cornwall mine, Lebanon County, Penn., says the U. S. Geological Survey. The mine is worked by an opencut, the ore going to a 1000-ton magnetic concentrator, where the iron is taken out, and the tailings concentrated for copper. The copper concentrates are briquetted by the Gröndal process.

The New London mine, Frederick County, Md., has an inclined shaft 300 ft. deep, and a 100-ton concentrating mill. It made a small production of concentrates during the year.

Alaska-Mexican

The 19th annual report of the Alaska-Mexican Gold Mining Co. covers the period from Dec. 16, 1910, to Dec. 31, 1911. In future, the fiscal year will conform to the calendar year. The net profit was $257,881, of which $126,000 was disbursed as dividends and $100,000 written off for depreciation.

Development work to the extent of 3613 ft. was done; the ore reserves are given as 980,025 tons, averaging $3.14 per ton. The amount of ore mined was 227,081 tons at a cost of $1.253 per ton. The stamp mill crushed 236,383 tons, at a cost of 27c. per ton. With heads averaging $3.26, an extraction of $2.97 per ton was obtained.

---

*Secretary emeritus, A. I. M. E., 29 West Thirty-ninth St., New York.

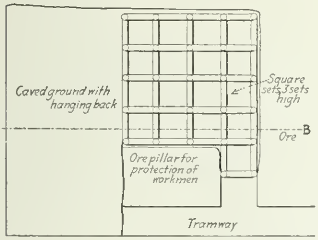
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

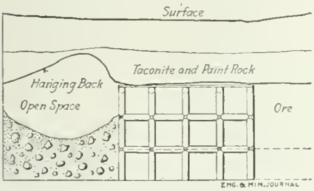
Mining Dangerous Ground on the Mesabi Range*

By B. M. Concklin†

Some of the simplest and most useful practices in mining are occasionally overlooked for no other reason than their simplicity. It may, therefore, be interesting to note a method of mining practiced on the iron ranges of the Lake Superior region, which is simple in itself and also affords protection to the miners. In this case the ore is capped by tough taconite and paint rock, both of which are more or less disintegrated, while the bottom of the orebody is solid taconite. The orebody is from 18 to 24 ft. thick. The square-set method is usually used in the extraction of this ore, the orebody being too thick to be adaptable to the slicing method operated from one level and too thin to develop more than one level.


Caved ground with hanging back
Square sets 3 sets high
A
B
Ore
Ore pillar for protection of workmen
Tramway

Plan



Section A-B

System of Mining on Mesabi Range

In the extraction of ore at the start of operations the back refuses to cave entirely, but arches for considerable distances, making it extremely dangerous to the miners working along the semi-caved area. To protect the workmen and also to extend and weaken the arch which holds the ground from caving properly, square-setting is started two or three sets back from the semi-caved ground. The work is then carried on just as if a new pillar were to be worked out. The slice or drift is first driven the full width of the pillar; then square-setting is started toward the open room. When the room is reached, square-setting is carried on from the slice drift or crosscut to the open room until the tramway is reached, when the timbers supporting the square-set room are shot down and the ground allowed to cave.

This process is repeated until the ground caves satisfactorily, when the square-setting is again resumed, this time immediately along the caved ground. The accompanying sketches show the process.

There seems to be one serious objection to this method, the probable loss of ore in the last pillar between the square-set room and the tramway, due to the fact that the extension and resultant weakening of the arch has a tendency to crush this pillar as the timbers and pillar take weight. This disadvantage, and the additional cost of mining due to driving the crosscut through solid ore across the pillar, is offset by the greater protection afforded the miners.

---

[*] From the "Wisconsin Engineer," April, 1912.

[†] Mining engineer, Great Northern Ore Properties, Bovey, Minn.

A Homemade Tuyere

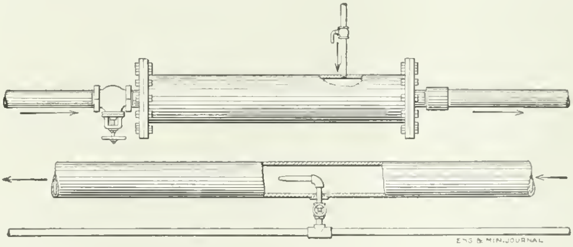
To make a tuyere for forges take a piece of heavy gas pipe about 1½ in. diameter, long enough to reach from one side of the forge to the other, states the *Engineer and Fireman*. Enlarge one end so as to receive the point of the bellows well. Bring the other end even with the opposite side of the forge. Drill a ⅝-in. hole at the point where the fire is wanted. Imbed the whole tube at the usual depth in the forge, covering all parts, except fireplace, with brick or clay, or both, leaving a sufficient space for the fireplace. Insert a wooden plug at end of tube. After using for two or three weeks, some cinders will get in the tube; then remove the wooden plug, and using a rod with a small hook at the end, scrape it out clean. When good coal is used, such a tuyere will last for many years and stand heavy heats. The joints between bellows and tube are made air-tight with putty.

Water Blast for Allaying Dust

The James water blast, illustrated in the accompanying drawing, was developed in South Africa and now is used in many of the mines on the Rand. In a recent report by the Royal Commission on Mines of New Zealand, this type of dust allayer was recommended for adoption in the mines of that country. The blast is intended especially for allaying dust and absorbing noxious powder fumes immediately after blasting.

As shown in the figure the appliance is simple, consisting of a short piece of 6-in. pipe about 10 ft. long closed at each end by a flange which has been tapped and threaded so that the 6-in. pipe can be installed in any part of the 2-in. compressed-air mains. When placed in position the side of the 6-in. pipe is tapped and threaded for a small pipe by which connection is made with a supply of water under low pressure. This may be obtained conveniently by providing a tank or cistern for water storage in some part of the mine above the level in which the water blast is used.

A valve in the 2-in. service pipe and in the small water supply pipe are used to control the flow of air and water. While drilling is going on the air valve is left wide open, but the water valve is closed. When ready to blast the miners close the air valve and open the water valve; the 6-in. cylinder is quickly filled with wa-



Water Blast and Draft Inducer for Allaying Dust in Drifts ter. As soon as the blast has been fired the air valve is opened suddenly causing the water contained in the 6-in. pipe to be ejected into the face of the drift in the form of a fine spray.

The spray of water is effective for a distance of 30 or 40 ft. back from the face. To promote further ventilation an induction draft pipe as shown in the sketch may be used to deliver air at the face or to withdraw air from it. The water blast not only allays the dust made while blasting, but wets the broken material so thoroughly that little or no dust is raised by shoveling.

Correcting the Meandering of Boreholes[*]

BY JOHN I. HOFFMAN[†]

Another interesting application of the deflecting wedges described in the JOURNAL of June 15, 1912, under the caption "Two Cores from One Borehole," is their use for cutting several cores from one hole or bringing back into line a hole that has meandered from the intended course. An example of such practice is afforded in the work done at the Lace Proprietary Mines' Vlakfontein borehole in South Africa. This hole was commenced in November, 1908, and was finished in November, 1909. In April, 1910, it was decided to try to obtain another core from the vein, commencing the deflection about 800 ft. above the bottom of the hole. This work was successfully done. As the hole had been standing for five months, sediment had settled in the bottom and had to be cleared out, which was done by drilling with a blank crown attached to the rods of a diamond drill to loosen the sediment, the pump forcing it with the water to the surface.

Then 150 ft. of old drill rods were dropped in the hole. The main rods were next lowered by the machine and it was found that the bottom of the old rods had stuck in the hole 10 ft. from the bottom. The main rods were then raised and 425 ft. of old rods were screwed together, on top of which 200 ft. of 1¼-in. black pipe was screwed and the whole length of 625 ft. dropped in the hole. The reason for screwing this pipe to the top of the old rods instead of using the whole 775 ft. of old rods was because the old drill rods were magnetic to a certain extent and would affect the needle of the survey instrument used, whereas it was found that the ordinary black pipe had no appreciable magnetism. To the top length of the 1¼-in. pipe a pilot wedge,[1] was attached. The position of this wedge was surveyed and the main guide wedge set so that the deflecting cut would be immediately opposite the direction in which the borehole was dipping. The position of the wedges then was as illustrated in Fig. 1. Drilling was then restarted with a "C" bit and rods 1⅝ in. diameter, the deflection from the old hole commencing at a depth of 5872 ft., was continued down to a depth of 6160 ft., where the foot wall of the vein was again cut.

From the above it will be seen what great advantage is gained by the use of a deflecting wedge, as in this case the second complete core of the vein was obtained at a distance of 60 ft. horizontally from the point where the vein was cut in the original borehole, for the cost of drilling only 288 ft., as against 6160 ft. had a second hole been sunk from the surface.

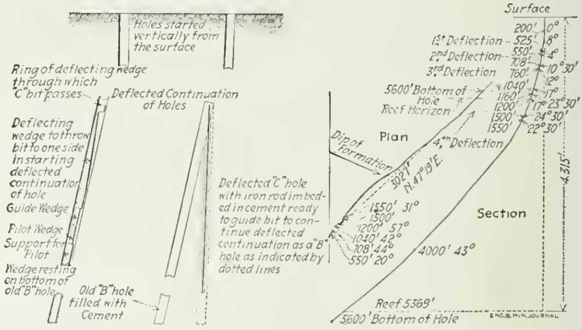

Holes started vertically from the surface
Ring of deflecting wedge through which "C" bit passes
Deflected Continuation of Holes
Deflecting wedge to throw bit to one side in starting deflected continuation of hole
Guide Wedge
Pilot Wedge
Support for Pilot
Wedge resting on bottom of old "B" hole
Old "B" hole filled with Cement
Deflected "C" hole with iron rod imbedded in cement ready to guide bit to continue deflected continuation as a "B" hole as indicated by dotted lines
Surface
200'
0°
1st Deflection
525'
8°
2nd Deflection
550'
4°
708'
3rd Deflection
760'
10°30'
12°
1040'
17°
1160'
1200'
17°
23°30'
1500'
24°30'
1550'
22°30'
5600' Bottom of Hole
Reef Horizon
Plan
Dip of Formation
4th Deflection
3027'
N. 47°19' E.
1550' 31°
1500'
1200' 57°
1040' 42°
708' 44°
550' 20°
Section
4000' 43°
4315'
Reef 5369'
5600' Bottom of Hole
ENG.& MIN. JOURNAL

Fig. 1 Fig. 2 Fig. 3

READY FOR STARTING DEFLECTION, DEFLECTION STARTED, AND PLAN SHOWING DEFLECTIONS IN WITPOORT BOREHOLE

The necessity of reducing the diameter for the deflected portion of the hole has now been overcome by an ingenious process devised by William Gallagher, who for many years has been one of the leading diamond-drill contractors on the Rand. By Mr. Gallagher's invention a succession of deflections can be made in a borehole and each deflected portion kept the same diameter as the original hole. This was successfully done in the case of the Witpoort borehole, illustrated in Fig. 3, under my immediate supervision, where four successful deflections were made down to a depth of 1500 ft. in order to change the direction of the hole which had deviated from the vertical. The procedure is as follows:

When the deflecting wedge has been set, the "C" hole is only drilled to a depth of about 12 ft. below the top of the deflecting wedge, after which the rods are withdrawn and the taper tap is then lowered and screwed into the guide ring at the top of the main deflecting wedge which is pulled out of the hole, after doing which the pilot wedge, together with the bottom pipe connected to it, is also raised. A piece of round iron 1 in. in diameter and in this case about 13 ft. long, the bottom end of which has been bent about ¼ in. out of straight is fastened to the end of the main rods with two copper rivets, and lowered down the hole until the bottom end of the round iron is level with the top of the new hole which has been drilled by the "C" bit. The rods are then lowered very gently and twisted round at the same time so as to bring the bent end of the round iron into the new hole. Once the operator thinks this has been done the rods are further lowered until the bottom end of the round iron rests on the bottom of the new hole. When this has been effected the copper rivets are sheared and the main rods withdrawn, leaving the iron rod at the bottom of the new hole.

A thoroughly liquid mixture of Portland cement is then made and put into a piece of pipe of a length sufficient to carry the required amount of cement to fill up both the old and new holes to about one foot above the top of the iron rod. The bottom end of the pipe is burred on the inside so as to hold a blank flange made of thin insertion the same diameter as the inside of the pipe. The pipe is then filled with liquid cement and a similar insertion flange fixed on the top, but having a flap valve cut in it. The pipe is then fastened to the end of the main rods and lowered in the hole until the bottom is one foot from the top of the iron rod. Water is then pumped down the center of the drill rod, the pressure opening the insertion flap valve downward and forcing the cement together with the bottom insertion flange out of the pipe, and thus filling both old and new holes with cement up to the requisite height as shown in Fig. 2. This cement is allowed to harden for two or three days, after which, drilling with a "B" bit, the same size with which the original hole was drilled, is commenced, and the cement is drilled away until the top of the iron rod enters the hole in the bit and acts as a guide, pulling the bits and rods over from the old hole into the new. Drilling is continued below the bottom of the iron rod; when once the core breaks, the iron rod together with the core, which has broken off underneath it, is drawn out of the hole into the core barrel in the usual manner. Difficulty was experienced in drilling the Witpoort borehole, owing to the broken nature of the strata encountered.

---

[*] Excerpt from a paper entitled "Recent Practice in Diamond Drilling and Borehole Surveying," Bull. 91, I. M. M. Figs. 1 and 2, accompanying the following excerpt, were not published in the article, but have been drawn from the description in the text

[†] Mining engineer, 216 Moorgate Station Chambers London, England.

[1] Described in Eng. and Min. Journ., June 1, 1912.

While in the case of the Witpoort borehole the deflections were made to bring a deviated borehole around to the direction desired the same procedure can be followed to obtain a number of cores from a vein by deflecting in the direction of the vein at intervals along the lower part of the first borehole sunk.

Cleaning Air Compressor Cylinders

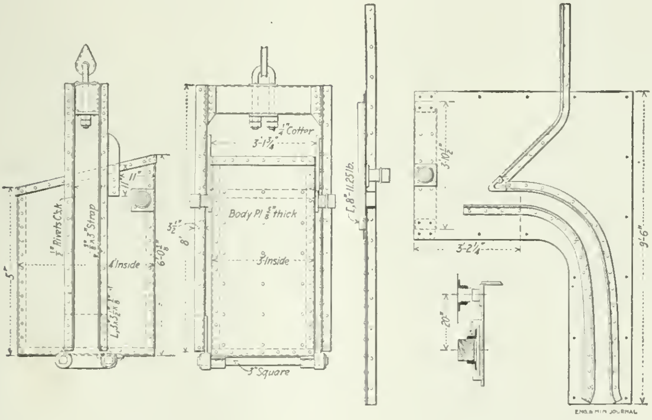
A method of cleaning air-compressor cylinders is described by A. P. Shaw, in *Power*, as follows:

A ½-in. hole is tapped in the suction line near the cylinder, into which a ½-in. pipe is screwed. From the ½-in. pipe a 2-in. vertical raiser, 18 in. long, is put in, the top closed by a screw cap; a globe valve is used on the ½-in. pipe. Once each week a cake of soap is dissolved in 2 gal. of hot water. When dissolved, the solution is poured into the raiser, a cupful at a time, through a screened funnel. When about three-fourths of the solution has been used, a half cup of oil is poured into the pipe, then it is washed out with the rest of the suds. Oil is then put in at the suction inlet to lubricate both the upper and lower parts of the cylinder, as when oiling with lubricators the oil does not reach to the bottom of the cylinders.

Skip and Dump Plate for Vertical Shaft

By Lee L. Wilcox*

A modification of the De Beer's type of skip for a vertical shaft, which is an improvement over the old type, is shown in the accompanying illustration. The top of the old type of De Beer's skip was square and trouble was experienced from ore falling back into the shaft. This not only gave the shaft an untidy appearance, but in a few instances the men working near the shaft were seriously injured by falling pieces of ore.



Skip and Dump Plate used in a Minnesota Iron Mine

Attempts were made to improve the skip: in one instance a lip was riveted to the bottom plate; in another a filling piece was attached to the dump plate, thus throwing the lip up farther from the edge of the shaft. These changes proved to be only partially successful in stopping the ore from falling back down the shaft, but they introduced other faults which were nearly as bad. The lip would spread the discharge of ore so that it would lie on the dump angles, causing the skip to stick as it descended; and the filling piece decreased the inclination of the skip when dumped so that it did not clear itself readily.

When the new Pettit headframe was built it was decided to make some changes in the design of the skip. It was made longer in proportion to the base than is customary; the dimensions being, base 3x4 ft. and length 6 ft. on one side and 5 ft. on the other. The base dimensions are unusual, because of local conditions. Under ordinary conditions it would have been made nearly square. The additional length, however, throws the lip considerably farther away from the shaft and all the ore is discharged well back from the edge of the shaft. By incorporating the extended lip in the body of the skip itself, as shown in the illustration, the trouble caused by the ore gathering on the dump plates was entirely overcome. The new skip was satisfactory from the start.

A few changes were made in the dump plates which are worthy of mention. The dump angles were shod with a ⅜-in. strap; as this strap is worn it can readily be replaced without removing the dump angle itself, thus making the repairs much easier and simpler. The plate was reinforced behind the dump roller by a channel. This prevented the bending of the plate at this point which on the larger skips is troublesome.

Concrete Stations in Shafts*

Concrete plats or stations, have been in use at both the Ahmeek and the Mohawk mines in the Lake Superior copper country for some time. They differ from the timber station in outward design only in the cross-section of the members, which are 9x12 in., and are reinforced with old rails and wire rope and replaced the 12x12-in. and 14x14-in. timbers formerly used. Holes are cored to accommodate gates for skip and dump doors and tram rails are imbedded in the concrete, making the use of spikes unnecessary. When turntables are used at the back of the stations, the rigidness furnished by the concrete insures the trammers against derailment of cars resulting from a tilted table.

At the present time, the Ahmeek company is installing reinforced concrete dividings to replace the practice of putting in 10-in. flat timber. In cross-section they are 9x12 in., and are reinforced by old rails. On the ladder road, they are placed six feet from center to center and between the skip compartments are put in as often as the hanging requires. Since the casing along the ladder road performs no other function than the protection of the men while on the ladder, or in case of a fall, plank is used for the purpose and a 3-in. hemlock strip is molded into the dividings to facilitate the fastening of this casing.

---

*Chief Engineer, Republic Iron & Steel Co., Gilbert, Minn.

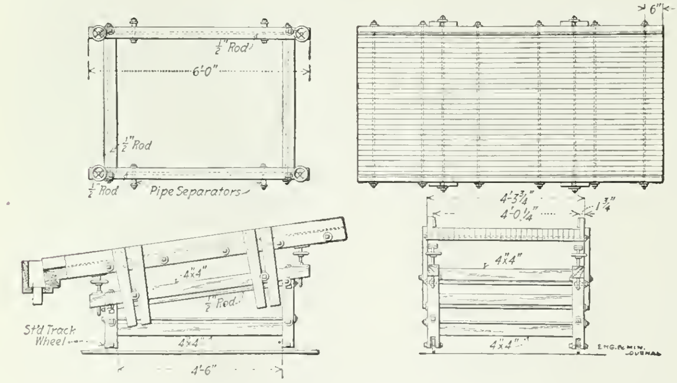
*Excerpt from a paper entitled "Reinforced Concrete as Applied to Mine Shafts," read by E. R. Jones before the Michigan College of Mines Club, Houghton, Mich., Feb. 25, 1912.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Adjustable Amalgamation Table

The amalgamation table shown in the accompanying illustration differs from those that have been described heretofore in these columns in that it is made in two parts, a table or platform for the copper plate, and a truck with wheels upon which the table proper is adjustably mounted. This construction is particularly desirable when the table is to be used directly in front of tube, chilean, Huntington mills, or grinding pans, as the plate table may be lowered to clear the discharge lip of these machines and the entire structure be moved forward on the tracks so as to make the front of the mill accessible while repairs are being made; the grade adjustment permits drawing the head end of the table tightly up under the discharge lip of the crushing machine and setting the table at any desired slope. Not the least important advantage of a movable table is that it may be so placed that no grease or oil will fall upon it while overhauling of the mill is in progress. These advantages also appertain to the use of the table in front of stamps, although perhaps not to the same degree as when it follows other crushers.



An Adjustable and Movable Amalgamation Table

The plate table is strongly made of a number of longitudinal 1¾x4-in. battens running the entire length of the table and held tightly together by tie-rods that also hold the 1¾x8-in. sides in place. The single copper plate is bound to the upper surface of the table by a cleat on each side. The plate table is supported upon the truck frame as is clearly shown in the illustration. The adjustment of the slope is made by manipulation of the four hand-wheel screws on the truck.

Tables of this type made by the Allis-Chalmers Co., were installed in a mill in Eastern Nicaragua. The plate table proper may be supported upon stationary framing as in the more common practice.

Strength of Crane Chains

In the accompanying table the safe working load for crane chains is given with 4 as a factor of safety; in some cases a factor of safety of 6 is used.

Diameter of link, in.	Safe working load, lb.
¼	840
5/16	1,260
⅜	1,820
7/16	2,520
½	3,360
⅝	5,180
1	13,440
1¼	21,000
1½	30,240

Chains, according to *The Foundry*, should be examined frequently, and occasionally annealed to prevent crystallization. As the links wear, the strength of the chain is correspondingly reduced.

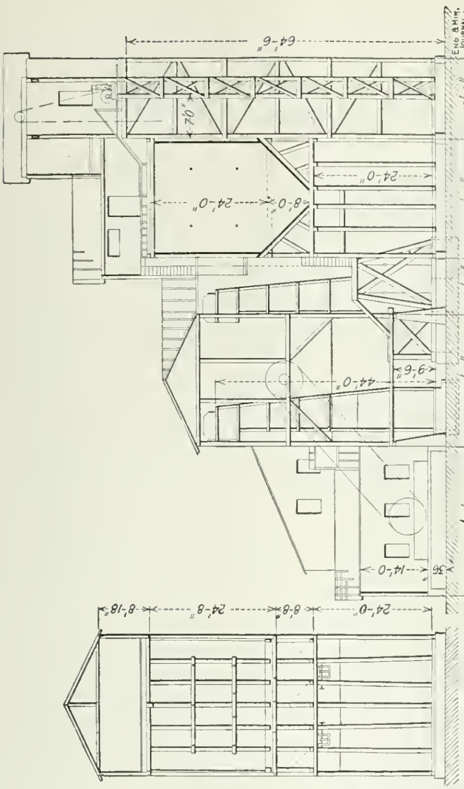
At the Benoni mill in the Transvaal, slime treatment in Way-Arbuckle cones has been discontinued, but the sand-treatment process seems to be satisfactory.

Joplin Ore Bin Construction

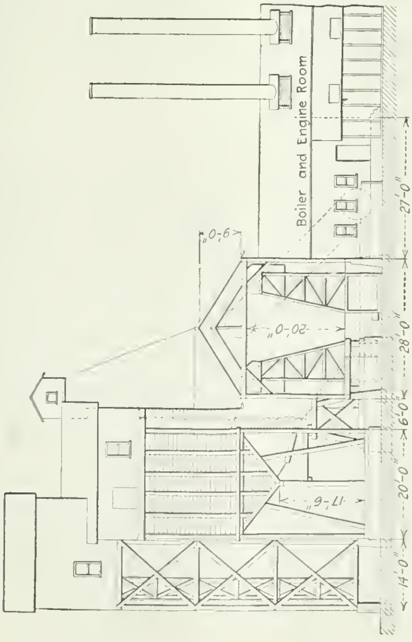
In the Joplin type of surface plant, the mill is built close to the mine bin at the collar of the main shaft. This makes a compact type of plant with the ore from the bucket going directly to the jaws of the crusher without rehandling. Until within the last few years, during which time the Freeman type of one-reduction electric hoist was perfected, the quantity of ore that could be handled through one of the shafts with one hoist was limited to about 250 tons in eight hours. Now it is possible to hoist twice as much with one engine of the improved steam or the Freeman electric type.

The shafts are rarely more than 200 ft. deep and usually are 5x7 ft. in section. The tramming was, until the last two or three years, done by hand and no mules were used or other forms of traction like endless rope haulage or gasoline locomotives which are now to be tested in the district. It was, therefore, cheaper to sink another shaft when it was desirable to send a larger tonnage to the mill so as to enable running it two shifts, and to transfer the ore by a skip car, rather than tram it underground by hand.

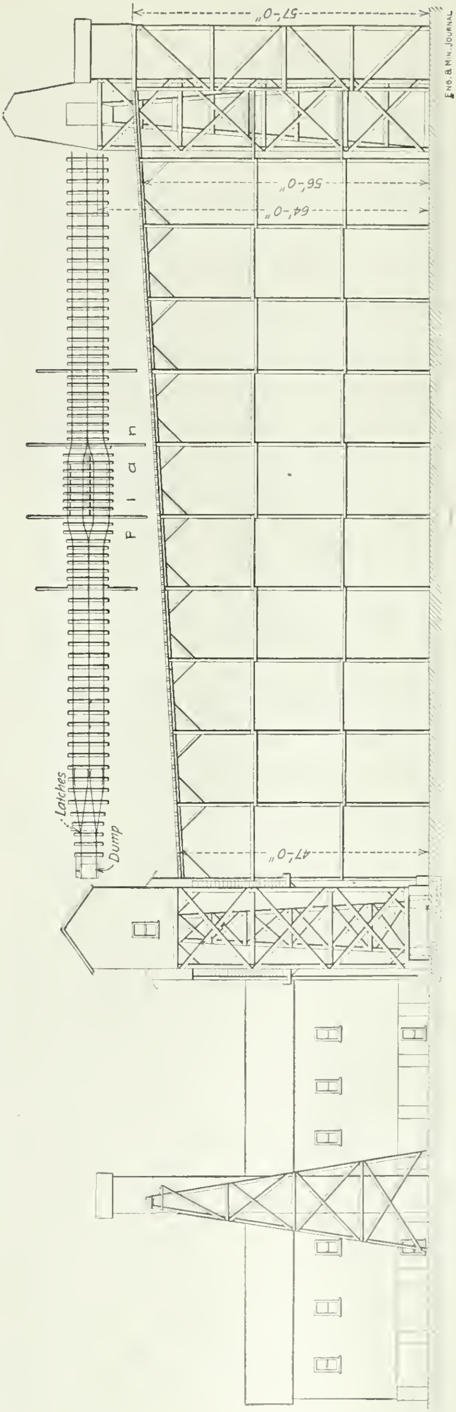
The bins at these auxiliary shafts are of the ordinary type with the bottom sloping in one direction and are built at the side of the derrick frame. A headframe is known as a derrick frame at Joplin. But in a few instances where the auxiliary shaft is quite close to the mill shaft, the ore instead of being culled and broken down on a grizzly at the auxiliary shaft and sent to a bin then to be transferred in a car, is dumped directly into a car and lowered by gravity down an incline trestle to the mill grizzly where it undergoes the ordinary treatment. This requires a higher auxiliary derrick and an expensive trestle so that it is more usual to use a bin with a grizzly over it and cull down the ore in the ordinary manner, then draw it from the bin into a skip car and take it up a short incline trestle near the mill, much of the track when the shafts are 300 ft. apart being on the ground. The auxiliary hoist serving this transfer car is sometimes placed in the mill-shaft derrick. Sometimes when a small amount of transferring is to be done it is placed on the ground where the engineer tending the mill engine can do the transferring of the ore if the work at the main shaft keeps the hoistman busy all the time. When both shafts are hoisting at capacity the engine serving



FRONT OF ORE BIN AND ELEVATION OF P. L. & M. MILL



AVE MARIA MILL AND ORE BIN



WEST ELEVATION OF AVE MARIA MILL AT JOPLIN, SHOWING ORE BIN the transfer skip is placed at the auxiliary shaft where the man running it can also tend the loading of the car.

Some of the mill hoppers, as the bins are called in the district, are also made with the bottom sloping in only one direction, but it is difficult to keep this type of bin from pushing over to the heavy side because of the cheap construction that the temporary nature of the mining makes necessary, as these mines rarely have a life of more than four years and often only one or two in the case of other than sheet-ground mines.

On that account it is becoming more and more the custom to make the bottom of the bin with a double slope, as shown in the accompanying drawings. There are two ways of bracing the bottom; the cap sill may be placed on top of the bottom pinning of the bin with short struts extending up to support the bottom sills of the bin between end supports, or the supports for the sills of the bin bottom may spring from the cap of the mud sill. The advantage of the latter construction is that the weight is thrown evenly upon the foundations, for the loading of the posts, although it is somewhat unequal, is not greatly unbalanced in regard to the center line of the bin. The importance of this, when the temporary nature of the mining is borne in mind and the consequent reluctance to put in as costly foundations as would otherwise be considered necessary, becomes apparent when it is considered that the mill building abuts against the bin on one side while the derrick frame is against it on the other. In the mill the line shaft is carried by an auxiliary truss where the mill is wide. The crusher and the first rolls are placed immediately in front of the bin gate so that the ore from the crusher drops into the feed hopper of the rolls without rehandling.

On the opposite side of the bin is the derrick frame which is generally built square. The four posts are 8x8-in. timbers with 8x8-in. cross timbers placed about 20 ft. apart vertically to give stability. Intermediate cross braces and diagonal braces of 2x8-in. planks are used as shown in the drawings of the derrick frame, which is built up to a height of about 60 ft. These intermediate braces, it will be noticed, are arranged so as to brace the derrick frame against side pressure from the bin structure. In the more common type of derrick the cross braces which are either the same size as the posts, 8x8-in. or 10x10-in., are placed 15 ft. apart vertically and tied together by cross timbers of 2x8-in. planks.

It will be noticed that in the interior of the derrick there is a four-post structure tied together much more strongly and better than the derrick itself. These are the Sampson posts that support the hoisting engine, which is driven by vertical engines so as to give little side vibration to the structure. This manner of carrying the hoist and the use of an engine with vertical reciprocation are characteristic features of the Joplin derrick, and it is because of these two features that the derrick type of headframe is so efficient. Indeed the derrick frame really supports only the floor surrounding the hoist, the sheave wheel, the tail or dump rope used in dumping the hoisting bucket, and part of the weight of the grizzlies, the rest of the burden of the grizzlies being on the bin timbers. The resultant of all these forces falls well within the derrick structure, for the hoisting engine is on top of the Sampson posts that are carried up within the derrick frame and close against the side of the shaft.

The Sampson posts sometimes are four vertical posts, as shown in one of the accompanying drawings, but in the majority of the derricks, especially the low ones, all four posts of the Sampson frame are put up with a considerable batter, as shown in all the other drawings of headframes accompanying this article. In the case of the lower derrick frames, the Sampson posts are reinforced against vertical vibration by four bolts equipped with turnbuckles. In the higher frames old pieces of hoisting rope are used instead of bolts. In still other cases a box loaded with rock is suspended in the center of the Sampson posts to resist the upward component of the vertical vibration. To the top timbers of the Sampson frame the bedplate of the hoist is bolted.

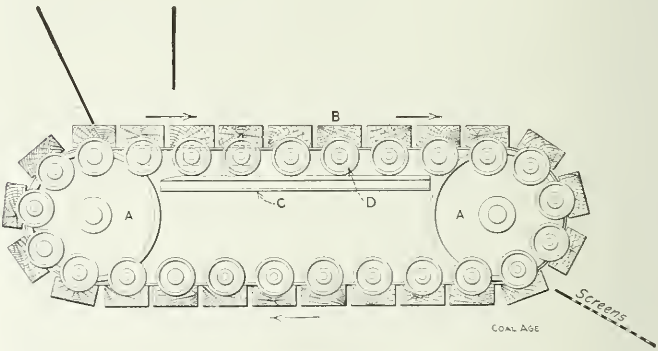
The boulders of waste are culled on a flat grizzly over the bin. The top of this bin comes about 4 or 5 ft. below the derrick floor and generally the ore in dumping from the bucket slides down a set of inclined grizzly bars on to the flat grizzly where the boulders of mixed ore and waste are sledged. The culls from the grizzly sorting are almost always loaded into a car which runs on a trestle extending out from the bin structure.

Homemade Belt Feeder

The belt feeder illustrated in the accompanying sketch was designed by Mr. Carr, of the Carr Wood & Coal Co., near Lytle, Texas, states *Coal Age*. It is used to supply coal screens with a uniform feed, from a hopper-bottom bin. The belt feeder here described may be built cheaply and an excellent device be obtained at little expense.

The apparatus has proved wholly satisfactory and is constructed as follows: The drums *A* may be made of any convenient material, and connected, preferably by sprocket and chain to the motive power. They should be 3 ft. long, or extend at least 3 in. each side of the hopper bottom, and be placed not less than 4 or 5 ft. center to center, parallel and horizontal.

The belt consists of an endless strip of heavy canvas, brattice cloth or other available material, whose width equals the length of the rollers. To this cloth belt are attached, on the outside, wooden strips *B*, 2x4 in. by 3 ft. long, placed side by side to form a continuous circuit around both drums. The whole is made sufficiently tight to revolve when the drums are placed in motion.



Traveling Band Feeder for Screens or Crushers

Between the drums, on the upper path of the belt, should be placed a short section *C* of mine rail to provide a track for the small wheels *D*, placed on the ends of each strip *B* and thus prevent sagging of the belt from the weight of material in the hopper. It is obvious that after passing over the forward roller *A* on the return run these wheels need no support until again reaching the upper portion of the circuit. The strips *B* may be placed loosely, side by side, forming a transversely rigid, but longitudinally flexible support for the belt.

A simple slot and screw adjustment of the axle of one of the rollers *A*, is provided for loosening and tightening the belt. The whole apparatus may readily be constructed at any mining plant.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Hand Sorting and Developing at the Ferreira Deep

At the Ferreira Deep Ltd., Transvaal, South Africa, all ore is hand sorted before it is sent to the mill, the discarded ore averaging about 0.7 dwt. fine gold. The following is a record of the amount of ore discarded by sorting for the last six years:

1906	17.40%	1909	10.60%
1907	18.14%	1910	19.95%
1908	12.56%	1911	19.70%

Average discarded for the last six years is 16.3% of the ore sent from the mine.

The following gives the number of tons of ore produced per foot of development work in the mine:

	Unsorted Ore, Tons	Sorted Ore, Tons
1906	30.8	25.5
1907	45.4	37.2
1908	40.7	35.6
1909	46.0	41.2
1910	64.0	51.2
1911	43.0	34.4
Average	41.3	36.6

Based upon the total tons mined and the additions to ore reserves 64 tons of unsorted ore are developed per foot of development work; allowing 16.3% of the additions to ore reserve, for ore that will be discarded by hand sorting, gives approximately 53 tons of sorted ore developed per foot.

Mass Consolidated Costs

The 1908 annual report of the Mass Consolidated Copper Co. in the Lake Superior district, Michigan, states that the average number of machine drills operated during the year was 11.04, that 200,808 tons of rock were broken, and that 175 men were employed. This gives an average of 18,188 tons per year per drill and 1147 annual tons per man employed. This is practically 67% increase in drill efficiency and 22.7% increase in tons per man over 1907, when 309,132 tons of rock were broken with an average of 28.3 drills and 330 men; or an average of about 10,900 annual tons per drill and 935 tons per man per year. The increased efficiency in 1908 over 1907 was credited by the management to the increased efficiency of the men employed. Based upon the tons of rock stamped the total expense has averaged: $2.05 per ton in 1907; $1.68 in 1908; $2.07 in 1909; $2.60 in 1910 and $6.33 per ton in 1911. The increase in the costs in 1911 is due to an excessive amount of construction and development as well as a reduction in tons stamped. "C" shaft was sunk 152 ft. during the year for $222 per ft., 6410 ft. of drifting was performed at $5.75 per ft. and 466 ft. of crosscutting at about $4.40 per ft. These costs do not include any proportion of surface expenses. Based upon the total tons of rock hoisted, development expense amounted to 49c. per ton; mining, 88c.; surface, rockhouse and office expense, 34.4c. per ton and stamping 47.4c. per ton stamped. In addition to these charges other expenses such as construction, treatment and selling charges, etc., bring the cost per ton stamped to $6.33 as stated. Owing to the low yield of the ore, which averaged only 11.3 lb. from 1906-1910 inclusive, the cost per pound of copper has been 18.3c. The yield per ton stamped in 1911 was 17.58 lb. per ton and the operating charges apparently about $3.45 including development.

Ivanhoe Costs

At the Ivanhoe Gold Corporation, Ltd., property, Boulder, W. A., the total cost of producing 238,965 tons (2240 lb.) of ore was $5.13 per ton, which included $2.02 for mining; $2.01 for ore treatment; 33c. for general expenses; 10c. for charges on bullion; 58c. for mine development; and 9c. for improvement to buildings, mine ,plant, machinery and equipment. Of the ore-extraction cost, $1.29 per ton was charged for breaking ore; 25c. for filling stopes and 48c. for trucking and raising ore to surface. The ore-treatment expense was made up as follows: Rock breaking, 8c.; transportation to mill, 3c.; milling, 41c.; concentration, 15c.; roasting, 12c.; fine grinding of concentrates, 3c.; fine grinding of sands, 16c.; cyaniding of concentrates, 3c.; leaching of sands, 18c.; agitation of slimes and treatment, 39c.; filter pressing, 14c.; precipitation and smelting, 9c.; and disposal of residues 12c. per ton milled.

The net yield in gold was 113,691 fine ounces, or an average of 0.474 oz. of gold and 0.094 oz. of silver per ton of ore. The total extraction at the mill was 88.61%, of which 25.75% was obtained by amalgamation; 12.60% by leaching; 30.37% by agitation and 19.89% by concentration. An average of 6.92 tons was crushed per stamp per day. At the end of 1907, the ore reserves were reported as 926,737 tons (2000 lb.), and at Dec. 31, 1911, 1,088,421 tons, making an increase of 161,684 tons; during this period, 930,768 tons were mined and treated and 21,335 ft. of development work performed, which would indicate that about 51 tons of ore were secured per foot of development work. During 1908, the total power cost was 38c. per hp. per day, made up as follows: Labor and salaries, 6c.; fuel, 22c.; water, 5c.; oil, grease and waste, 1.4c.; and repairs and maintenance, 3.6c. per hp. From 1908 to 1911, inclusive, expenditures on buildings and equipment averaged 18.3c. per ton of ore produced. Reference to a schedule of these expenditures, since the beginning of operations, shows that this is about the average charge required to meet the necessary charges of this nature.

Pig Iron in 1909

According to the 13th census of the United States there were 208 iron and steel blast-furnace establishments in 1909, comprising 388 stacks of which 370 were active; 195 were operated by corporations producing 98.7% of the total production as compared with 97.7% in 1904. In 1909, 86% of the establishments reported products valued at over $1,000,000 against 49 in 1904 and the production of these concerns amounted to 85.8% of the total production, an increase of 11% over 1904. Of the total cost of production as reported 1.8% was for salaries, 6.8% for wages, 88.4% for materials and 3% for miscellaneous expenses. The total horsepower used in connection with blast-furnace operations amounted to 1,173,422 of which 198,040 hp. were generated by 85 gas engines operated by blast-furnace gas. A total of 43,061 men was engaged in the industry; 48 were proprietors and firm members, 262 salaried officers of corporations, 809 superintendents and managers, 3513 clerks, and 38,429 wage earners. Of the total: Firm members, officials, managers and superintendents amounted to 2.6%; clerks 8.2%; and wage earners 89.2% of whom 99.8% were males, less than 0.1% females, and 0.2% under 16 years of age.

Total pig-iron production was 25,651,798 tons (2240 lb.), consisting of approximately 10,000,000 tons of bessemer pig ranging from 0.04 to 0.10% in phosphorus, and 250,000 tons below 0.04%; basic pig, 7,750,000 tons; foundry

5,550,000 tons and the remainder in miscellaneous castings, alloys, etc. About 62% of the total production was consumed in the works of the various companies in manufacturing steel and iron products and 38% sold as pig iron. In the production of this tonnage, 48,353,077 tons of iron ore at an average cost of $3.88 per ton were consumed; 96.5% of which was domestic ore costing $3.80 per ton and 35% foreign ore at $5.54 per ton. Other iron-bearing material consisting of mill cinder, scraps, etc., to the amount of 1,982,530 tons and costing about $2.79 per ton was also used, making a total of 50,336,207 tons of iron-bearing material treated. Flux used amounted to 13,570,845 tons at an average cost of 90c. per ton. Heretofore the fuel consumption reported included fuel for steam raising but for 1909 the following figures represent only fuel consumed in smelting: Coke, 28,068,335 tons @ $3.64 per ton; charcoal, 38,032,618 bu. @ 7.4c. per bu.; anthracite coal, 265,401 tons @ $3.41 per ton; and 102,833 tons of bituminous coal @ $1.64 per ton. All other materials used in the process of producing pig-iron amounted to about 20c. per ton.

SUMMARY

The figures reported in the census are not intended to furnish the total cost of manufacture so that the exact profits may be determined but the following interesting facts may be deduced from the figures stated: Based upon the total men engaged in the iron and steel furnace industry, 595 tons of pig iron are produced per year per man; 610 tons per clerk and wage earner employed or 667 tons per year per wage earner. Based upon the tons of iron-bearing material treated, approximately 1310 tons are treated per year for every wage earner employed, and including tons of iron-bearing material, flux and fuel handled in smelting, about 2400 tons are handled per year per wage earner. Of materials used apparently it required 1.89 tons of iron-bearing material to produce one ton of pig iron, 96% of which was iron ore; and 0.37 tons of flux per ton of iron ore, cinder, scraps, etc., treated. The amount of fuel of course varied according to the nature of the fuel used but by using the figures as reported they would indicate that it required 0.43 tons of coke, 0.585 bu. of charcoal, 0.004 tons of anthracite and 0.0015 tons of bituminous coal to smelt one ton of material consisting of ore and flux in the ratio stated.

At the Greene Consolidated, in Sonora, Mexico, it was estimated that three barrels of oil as furnished them by the Texas Oil Co. was equivalent to one ton of run of mine coal.

Minas del Tajo Milling Costs

The following costs were extracted from a paper by George A. Tweedy and Roger L. Beals, published in Vol. XLI, *Trans.*, A. I. M. E. The Minas del Tajo is in Rosario, Sinaloa, Mexico, and treats approximately 70,000 tons per year by cyanidation.

Stamping—The gross weight of falling stamps with new shoe is 1100 lb., made up as follows: Stem, 450 lb.; boss, 350 lb.; tappet, 120 lb.; shoe, 180 lb. The weight of the die when new is 140 lb. The stamps drop 6.5 in., 104 times per minute. Crushing is done in solution, using a double-discharge mortar, from 10 to 12 tons of solution were required per ton of ore stamped; with a single-discharge mortar only six tons were required.

The ore is divided into two classes: Oxidized, which is soft and friable, consisting largely of decomposed andesite with feldspar changed to clay; and unoxidized, much of which is flint-like quartz. Using punched-tin screens with holes 0.6 mm. in diameter, the stamp duty is about 3.5 tons of unoxidized ore, and with a mixture of 20 to 30% of oxidized ore, four tons per stamp. Cast-iron dies were found to cost more per ton crushed than steel dies. The consumption of steel in shoes per ton crushed was 0.52 lb. The total cost of stamping is reported at 48.8c. per ton, with power constituting 71% of the cost, wood fuel being $5.50 per cord of 180 cubic feet.

Leaching—The leaching tanks are charged by tram cars filled from the bottom-discharge doors of the collecting tanks and trammed over traveling bridges and dumped into the leaching tanks; this is done by contract at 5c. per ton. There are 14 leaching tanks, 35x4.5 ft., with canvas-filter bottoms and bottom-discharge doors. Before charging, the sand increases about 20% in volume from the collecting tanks, and will occupy from 20 to 22 cu.ft. per ton; after soaking for six hours in solution, it subsides to about 24 cu.ft. per ton. The total time of treatment is approximately 18 days. It takes one man from eight to 10 hours to discharge the sand, using a 2-in. hose under a 40-ft. head and through launders having a 3% grade. The total cost of leaching is 59.88c. per ton.

Slime Plant—In the slime plant, two collecting and 10 treatment tanks are used: the latter are 24 ft. in diameter and 9 ft. 6 in. deep. A two cross-arm mechanical agitator is used on each tank and revolving six times per minute requires one horsepower. Connected to each tank is a 4-in. centrifugal pump driven from a line shaft; running at 800 r.p.m. they handle the contents of a tank in one hour, and requires 1.5 hp. Four agitations are given the pulp; the first, eight hours, and the three following four hours each. The total cost of slime treatment is 74.9c. per ton.

Filtering—Two 60-ton capacity Oliver filters are used for filtering; the drums are 11 ft. 6 in. in diameter and 8 ft. wide and revolve once every four minutes. By using a wet vacuum and maintaining it at 26 in., the capacity of the two filters was increased to 125 tons per day.

A small compressor, furnishing from 5 to 10 lb. per min., is used to discharge the slime and agitate the pulp in the filter boxes. To operate the filters, pump and compressor, it requires 13 hp. To clean off lime, which settles on the filter cloth of the drum, requires 7 lb. of dilute hydrochloric acid and an hour's washing; this is necessary about every two weeks. There are 290 sq.ft. of surface on each drum, and the canvas lasts from three to five months; the cost of recovering a drum is given as follows: 13 yd. of No. 12 duck, 104 in. wide; 25 yd. of 8-oz. burlap; 77 lb. of No. 17 spring-steel wire and one mechanic and three helpers, 16 hours. The direct cost of filtering, not including supervision, is reported at 12.23c. per ton.

Allouez Production Costs

During 1911, the Allouez Mining Co., in Michigan, mined and treated 288,610 tons of rock, yielding 16.56 lb. of refined copper per ton, at a cost of 13.3c. per lb., according to the annual report. The cost of mining, transportation and stamping was $1.668 per ton, compared with $1.769 in 1910, when the yield was 18.84 lb. of copper per ton, resulting in an increase of 0.68c. per lb. of copper during 1911 for these items. No construction was charged during 1910, but in 1911 the charge for this account amounted to 0.90c. per lb. copper. These two charges account for nearly all the increase of 1.83c. per lb. during 1911 over the 1910 costs. Smelting, freights, commissions, etc., was 1.95c. in 1911, compared with 1.81c. in 1910; 1.51c. in 1909; and 1.4c. in 1908. Slightly over 2% of the rock broken during the last two years has been discarded by hand sorting.

During a five-year period, 1906-1910, the Allouez produced 17,355,301 lb. of copper from 1,114,085 tons having an average yield of 15.6 lb. per ton. The average cost of production was 17c. per lb., made up of 13c. for mining, transportation to mill, milling, smelting, refining and selling, and 4c. for construction and other expenses. The average cost during two-year period 1909-1910 was 12.3c., and for 1910, 11.6c. per lb. Not including a payment on stamp mill, the cost during the five years was about 15c. per pound.

Methods of Teaching Rock Drilling

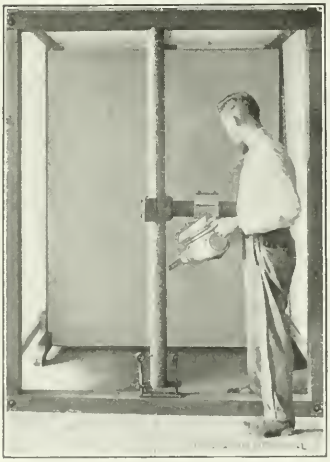
By L. E. Young*

A unique method of demonstrating the principles of rock drilling is used at the University of Missouri. A frame covered with chicken-coop wire represents the face, behind which is a second frame covered with finer wire; a piece of canvas thrown over these frames represents a tunnel. Tin tubes with hooked ends are pointed by a dummy rock drill through the front and hooked to the back screen. Removal of the canvas shows the tubes in the position of drill holes in a face.

The mining department of the University of Missouri has developed methods and equipment for demonstrating in the class room and in the laboratory a number of important points in the practice of rock drilling and blasting, particularly as applied to drifting and tunneling.

Almost everyone who has attempted to teach rock drilling and blasting has been handicapped by the difficulty of instructing a large class of students in drifts and tunnels where only a few students can hear and see the instructor; by the difficulty underground of making students realize just where the holes are bottomed; by the difficulty of getting the student to realize exactly where the charge of powder goes; and by the impossibility of actually showing underground anything more than the drilled face of the drift before the charge is ignited, and the broken rock or the missed hole after the blast. Instructors have wished that they could show the bottom of each hole. It has seemed impossible to illustrate graphically the actual position of the several charges of dynamite and to demonstrate the distribution of the powder through the rock to be broken in tunneling and drifting.

The equipment described in this article was designed primarily with the idea of inducing the student to think (in this exercise at least) of the bottom of the drill hole, of the actual volume of the rock to be broken by the powder, and of the new face of the drift rather than—as the student generally thinks—of the face of rock exposed, of certain customary set-ups of the drill, and of holes drilled according to custom. The idea has been to make the student think for himself and to give him an opportunity to see what can be done from certain set-ups of the rock drill.



Student Pointing to a Hole with Dummy Drill

Holes Represented by Tin Tubes

The equipment consists essentially of the following: (1) Light-weight, full-size columns, bars, arms, and rock drills made of wood. Light-weight apparatus is used in order to save time and to make it possible for one man to demonstrate rapidly the various points under discussion. The rock drill is used only to show the position of the drill steel relative to the arm and the columns and the length of the feed. (2) Telescopic tin tubes are used to represent the holes drilled. The tubes are made in 2-ft. lengths of various diameters, as 1¼, 1¾, 1½, 1⅝ in., etc., to represent the portion of the holes drilled with steel of a given gage. (3) Colored oilcloth is wrapped about the tin tubes, to indicate the position of the dynamite in the hole. Rubber bands are used to hold the oilcloth in place on the tin tubes. (4) A portable, light-weight, 4-piece timber set, 5x7-ft. in the clear is used to support the column or the bar. This is not intended to represent mine timber. (5) Portable screens are placed parallel to the 4-piece set. The purpose of the screens is to support the tin tubes when placed in position to represent the holes drilled. A sheet of paper is stretched over the screen near the 4-piece set and indicates the position of the face of the drift. The other screen is placed in position to indicate the face to which the drift will be advanced after the round of holes has been fired. The hook on the bottom of each tin tube representing a drill hole is hooked on the screen representing the face to be won, and the other end of the tube is supported by the rear screen. (6) Five 1x3-in. wooden strips are used as braces for the screens and the 4-piece set, and to support the canvas covering. (7) A canvas covering represents the walls and back of the drift. There are suitable eyelets for attaching the canvas to the wooden strips. This canvas covering is generally not required as most of the students conceive the position of the walls and back without this actual inclosure. (8) Cardboard letters and numbers are used for labeling drill holes. These indicate the order of drilling, the set-up from which the hole is drilled, and the order of firing. (9) Wires are used to support the tin tubes which may be required to indicate the position of short cut-holes.

Use of Equipment

The use of this equipment may be illustrated as follows: A student is asked to demonstrate a set-up of a rock drill in a 5x7-ft. tunnel, and to show how the holes are placed. The equipment is placed at the beginning of the demonstration as shown in Fig. 1. Having explained where he expects to bottom each hole of the round necessary to break ground, the student shows the first set-up and indicates where the second set-up will be, if more than one set-up is necessary.

The front screen is then covered with paper in order that the student may not have an opportunity to see more than he would if actually drilling into a face of rock. He then points each hole from the set-up, placing and hanging on the wire screens the several tin tubes necessary to show each hole drilled. He must show actually the size of hole he would drill, the necessary changes of gage of the drill bits, the angle of the hole, and the amount of powder charged. As designated by the student, one tin tube is put in place for each hole of the round. The student is not permitted to change any hole after it is bottomed. If more than one set-up is necessary, the work is carried on for the remaining set-ups in the same manner as for the first until each hole of the round is shown.

After the round has been placed, the paper is taken down showing the tubes as illustrated in Figs. 2 and 3, then the

---

*Director, School of Mines and Metallurgy, University of Missouri, Rolla, Mo.

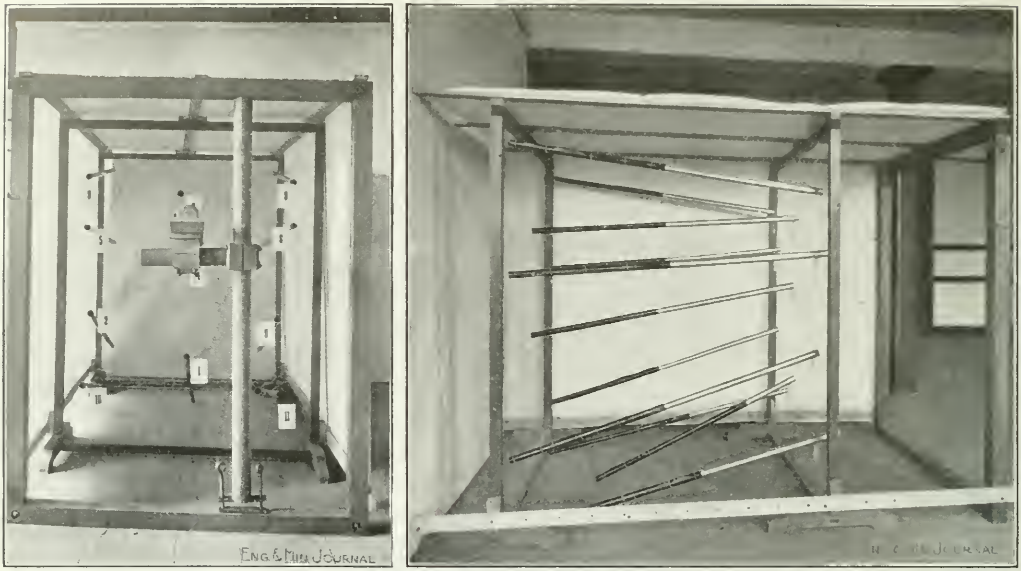


FIG. 2. ROUND OF HOLES AS DRILLED AND LOADED IN THE PORTLAND MINE, VICTOR, COLO.

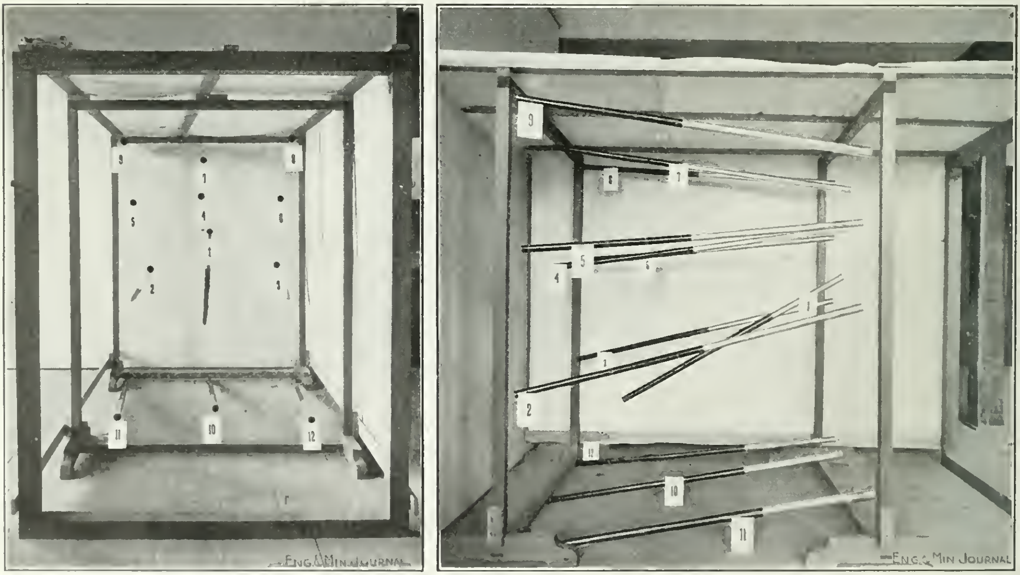


FIG. 3. ROUND OF HOLES AS DRILLED AND LOADED IN THE LEONARD MINE, BUTTE, MONT.

student can examine and criticize his work. The instructor points out, among other things, the following: (a) The total footage of holes the student has used for the round. (b) The holes that are unnecessarily long. (c) The danger of shooting the collar and primer off certain holes, providing the primer is put in last. (d) Any improvement possible in the angle of the holes, that is, where uppers might have been drilled to advantage instead of down holes or *vice versa*. (e) The position that would have made a more effective set-up. (f) Any improvement possible in the proportioning of the burden on each hole.

The student is reminded in each demonstration of the desirability of breaking the rock to a suitable size for shoveling; of the importance of having the "muck" thrown back from the face; of the importance of having the holes square the drift for the next round; and of the importance of placing the dynamite so that there may be no undue shattering of the walls and of the back.

It is not intended that this should in any way reduce the necessity for or the importance of demonstration and work with rock drills in a mine, but it has been found that many points may be made clearer by the use of this supplementary equipment. Moreover, the fact that there are "slips" and joints in rock has not been forgotten and that a set-up will depend largely on the way the last round broke. If the equipment and method described does nothing more than train the student to think of the burden he is putting on each hole, it will have accomplished much. These demonstrations have been of benefit to many who have had large experience in tunneling and drifting in hard rock.

Larger screens and other equipment are now being prepared in order to demonstrate graphically the pointing and loading of holes, and order of firing in tunnels of large cross section, such as the Roosevelt and the Laramie.

The Caspar, Wyo., Oil Field

Special Correspondence

The importance of Caspar oil field in Wyoming has, in my opinion, been underestimated. The field has been worked in a desultory manner since early times. A number of people have been working in and about the field on a prospector's and promoter's basis, but no real development work was done until last year.

The early history of the French and Dutch companies operating here would be extremely interesting reading. Some men, I understand, have been living at the rate of $40,000 to $50,000 per year on subscriptions collected from gullible French and Dutch investors, for work to be done on the oil locations north of Caspar; instead of work being done, paper locations were filed and the money used by the gentlemen "where it would do the most good." This was the history of the field for nearly 20 years. The resulting titles have, of course, become what might be termed "mixed."

The state of title frightened off a number of people with capital, but finally V. Z. Reed of Colorado Springs, now of France, had the necessary nerve to go ahead and is now being duly rewarded. In the short space of one year he has opened up a number of new wells, two of them being gushers. A 40-mile pipe line has been laid and a refinery built at Caspar, the capacity of which at present is about 2500 bbl. per day. Orders have been placed, however, for increasing it so that by autumn it is the expectation that the refinery capacity will be 8000 bbl. per day. There is not a dry well in the field and others are now going in. This summer will see a great deal of drilling and I doubt not that this development will be profitable.

Damage by Electrolysis

By E. W. Stevenson*

The rapid development of the use of electricity in mining, particularly for tramming, has already led to serious results due to the ignorance of some mining engineers of the damage done to piping, metal beams and sheathing of supply cables by stray return currents where a grounded return is used, and which of course must be used when the rails are a part of the circuit.

The subject of electrolysis by stray currents has been amply covered in the voluminous reports and books published in the electrical and railroad journals from time to time in the last 15 years. The street-railroad journals are perhaps the best source of information, for it is the current from the trolley systems that has been doing the most damage all over the country, there being hardly a town in the United States which has not at some time had its steam, water, gas pipes or lead sheathing of electric cables partly or totally destroyed by these stray currents. The trouble is not exactly caused by the current getting into these pipes or cables but in getting out of them, for wherever one ampere of current leaves a pipe on its return to its source, it takes with it 20 lb. of metal per year and deposits it upon the adjacent medium which may be a puddle of water or a network of other pipes or anything which is of low electrical resistance, and a convenient jumping-off spot for the current.

Electrolysis of a Power Cable in a Shaft.

I was called upon recently to investigate a case in which a cable had failed due to several breakdowns of the insulating cover. The cable was of considerable length, over 1000 ft., and had been built with a view to sustain itself for the entire length, should it be found necessary. It was built for 600-volts service, but only 250 volts were used on it and its size was sufficient to carry over 50 kw. at less than 5% drop. The rubber cover was protected by 5/64 in. of lead, a bedding of jute over the lead, and eight galvanized armor wires of steel at regular intervals with sufficient jute in the interstices was put on to take the weight should it have to be suspended as mentioned before. As the shaft is called a "wet" one it was thought advisable to apply a final layer of two tarred-jute coverings over these armor wires. The total weight of the cable was about 3500 lb. This final layer was thought to be a protection from the sulphurous water of the mine.

The cable was installed one year ago and it was a surprise to the factory where it was made when they were told that it had failed. Upon examination several faults were discovered and in every case these faults were found to be in a similar position as regards the timbering of the shaft. The cable instead of hanging free, had been attached to the shaft timbering; the wall plates of which were spaced three feet apart.

As a protection a light board had been placed over the entire length of the cable. The mine water ran out of the vein about 500 ft. from the collar of the shaft and for about 300 ft. the cable was soaked through with this water. It was reported that this water was the cause of all the trouble, but a cursory examination was enough to show the cause, for in all instances where the lagging was wet the cable was eaten away at a point just below. Where this action had taken place, the cable under the outer jute cover had swollen to a diameter of 2 in., while its normal diameter was not more than 1¾ in. This swelled spot extended from about three inches below the lagging to the same distance above, and on reaching out from the cage, and grasping the swelled spot firmly in the hand it was quite possible to pull away a mass of disintegrated material containing jute, salts of iron and zinc, and parts of thoroughly pitted lead covering; a clear case of electrolysis. Besides, there was a decided crater in the metal coverings where the damage had not gone too far. In extreme cases the armor wires were worn off to a point, and the current going to ground had been so strong as to raise the temperature sufficiently to warm the rubber insulation and finally burn it off, making the grounds on the circuit which first called attention to the trouble.

Bare Copper Cable on Opposite Side of Shaft.

The engineer in charge could not understand why electrolysis had caused the trouble for he said he had ample returns in his circuit and showed me a bare copper cable suspended on the other side of the shaft of a similar capacity to the damaged cable. But on examination, it was found that the bare strand merely went to the botom of the shaft and was there bonded to the rails. While all the rails through the different tunnels were supposed to be adequately bonded, no tests had ever been made by a sensitive voltmeter to show if there was any current escaping into the ground at any point. Such a condition was likely at any time to result in serious disaster, for alongside of the tracks at certain spots was a line of piping for distributing compressed-air. Stray currents will take advantage of any path and is quite likely that this pipe is thin at spots and may give trouble in the future.

---

*Electrical engineer, Hazard Manufacturing Co., Wilkes-Barre, Penn.

The above is merely cited as an example of what may occur if conditions are not carefully investigated before construction of transmission lines is begun. There is this fundamental difference between a traction system in a town or city and in a mine. The traction company sends out current along its lines to the farthest end, relying on the rails to bring back the current to the power house, some companies are careful about bonding, and some run out returns to centers where the current can be taken care of, for they find it to their interest to do so. But in any case they are not doing any damage to themselves, except possibly digging into their coal pile a little more than is necessary. The sufferers are mostly the individual house owners for their service pipes are destroyed. Occasionally though some of the water company's mains blow up and then there is trouble, or perhaps large multiple lead-incased paper cables belonging to the telephone companies are troubled from the same cause. But with the mines, it is an entirely different matter. There, the damage is done to the property of the mine and it is necessary to take adequate precautions to prevent it.

Necessity for Well-Bonded Rails.

For mine work generally, when lead-incased cables or armored or both types are used, where it is impossible to prevent current from getting astray, the other sheathing should be carefully and solidly bonded to the return grounds. For instance in the example given, if the simple plan of joining a bare copper wire across from the outer sheathing of the cable which had been damaged, to the return, had been followed all the current would have been deflected away from the sheath and no possible damage could have been done. This should have been repeated at intervals of not less than 50-ft. Then enough copper should be used along the tracks to which the rails should be bonded at intervals, especially in the vicinity of spurs, cross overs, and switches, for there is always more or less trouble at these points and bonds will work loose. The return conductors should really be slightly in excess of the outgoing feeders, but some reliance can be placed on the metal rails to take care of this excess.

There are many good types of bonds on the market, and also good bond testers, and both should be thoroughly investigated and used. A special crew should look after this work, making surveys at definite and frequent intervals. For ordinary use, the center-reading milli voltmeter is a handy instrument; it can be carried by one man and armed with a metal pointed stick he can reach any convenient spot where he wishes to test for a stray current and its direction.

Most electrolysis is supposed to be caused only by a direct current, but there have been several instances recently described in the electrical journals where damage was caused by an alternating current. Several cities have made ordinances controlling trolley systems, and it is generally agreed that a difference of potential of not more than ¼ volt should exist between the rails and any adjacent pipe or conduit which is not supposed to have anything to do with the circuit.

Engineers should remember that however well they have been able to get rid of stray currents at one time, these currents are like the mine rats, always looking for a chance to come back again, so they must be on the lookout for these currents, and surveys should be made at regular intervals. Changing the polarity of a current has been suggested as a remedy; it may be a remedy temporarily but it merely changes the place of the electrolysis and the best thing to do is to stamp it out entirely, or as far as possible, and then keep it out.

Old Dominion Company

The Old Dominion Company is a holding company, owning 155,245 shares of the 162,000 of the Old Dominion Copper Mining & Smelting Co., and all of the United Globe Mines stock. Its receipts for 1911 were $493,211, its expenses $7,222 and its dividend disbursements $439,867, or at the rate of $1.50 (6%) per share.

The Old Dominion Copper Mining & Smelting Co., operating in the Globe district, Ariz., produced 26,482,019 lb. of fine copper, 132,722 oz. silver, and 2831 oz. of gold, of which 19,195,181 lb. of copper, 42,051 oz. of silver, and 936 oz. of gold came from its own ores. The copper sold for an average of 12.39c. per lb., and cost 7.65c. per lb. at Globe, after deducting gold and silver receipts, or 9.15c. per lb. at New York.

Development work in 1911 consisted of 7600 ft. of drifts, 2568 ft. of raises, 199 ft. of shaft, and 80 ft. of winzes in the Old Dominion vein. The average grade mined was 5.84% cu. (7.75% for the smelting ore; and 3.50% for the concentrating), at an average cost of $4.18 per ton, as against $5.17 in 1910.

Lessees mined 5378 tons of iron flux from the upper levels and 258 tons of smelting ore, and 2219 tons of siliceous converter lining from the Keystone, while about 19,000 tons of smelting ore were obtained by working over the old stopes from the second to the eleventh levels. From the orebodies west of the west fault about 48,000 tons of oxidized smelting ore were extracted. The remainder of the year's production came from the ground east of the west fault, with the exception of a small amount from the Kirkey vein.

The average flow of water has been about 500,000 gal. per day higher than in 1910. During the year 1,000,000 gal. of water per day were sold to the Miami Copper Co., and now 2,000,000 gal. daily are being delivered.

During the year 140,230 dry tons of ore were concentrated at a cost of $1.012 per ton, and 231,603 tons of charge smelted at a cost of $2.568 per ton. There were no great changes in these departments.

In the concentrator a set of 30x16-in. rolls and an Evans-Wardell chilean mill, and in the smeltery an ore-mixing system were installed. In 1912 it is purposed to increase the concentrator capacity by 650 to 750 tons per day, and to build a separate converter dust chamber. The cost of converting was $8.26 per ton of fine copper, as against $9.68 in 1910. The power costs for 1911 were $83.77 per horsepower-year, against $96.18 in 1910. A new contract for fuel oil should cut present figures by 20 per cent.

From the United Globe mines there were 110,579 tons extracted in 1911, of which 84,877 tons went to the Old Dominion smeltery; 21,851 tons to the Copper Queen; 2843 to the Calumet & Arizona; and 1008 to the El Paso smeltery. There were 11,669 ft. of development and extraction work done, on the Old Dominion, Buckeye, Buffalo and Gray No. 3 veins.

The ores of the United Globe mines consist chiefly of two classes: Ores so high in silica that they cannot be profitably smelted locally, but are used elsewhere in the Southwest as converter linings, or for an acid flux; and granular sulphides, most of which must be concentrated before use. While the quantity of sulphides developed on the United Globe property would be sufficient to supply local demands, it is better to secure favorable freights on outbound siliceous tonnage by hauling sulphides from Bisbee as return freight. However, the probable preponderance of siliceous ores in the unexplored eastern sections of the United Globe property suggests the advisability of considering some leaching method, in which case the sulphide ores already exposed will meet all demands of the furnace plant.

There was no domestic monazite marketed in 1911, although 13,132 lb. of crude sand was mined in the Carolinas, according to the U. S. Geological Survey. There were 3208 lb. of zircon produced. The oxides of the rare-earth metals contained in these substances are used in gas-mantles and the glower of the Nernst lamp.

Copper Smelting at Kyshtim

By Ernest J. Carlyle*

A modern copper smeltery is now in operation on the Kyshtim estates in the Urals. Pyrite smelting is practiced in the two furnaces, blast for which is supplied by turbo-blowers. The matte containing 30 to 40% copper is blown to blister copper in Peirce-Smith converters. Gas-fired regenerative furnaces of the Siemens type are used for smelting fines and flue dust.

One of the most interesting of recent Russian mining enterprises is that of the Kyshtim estates in the Urals, which are being exploited by an English company, the Kyshtim Corporation, through a subsidiary local organization, the Kyshtim Mining Works Co., with headquarters in St. Petersburg. The estates comprise about 1,500,000 acres of land from which, for over a century, timber, iron and gold have been produced. As the eastern part of the estates is traversed by the Trans-Siberian Ry. and the western portion connected with the Volga by the Ufa River, the facilities for marketing the various products are excellent. Moreover the government is making a survey for a railway line which will pass through the western part of the property.

The headquarters of the estates are at the town of Kyshtim on the railway. Twenty-five miles to the south lies what is known as the Soimonovsk Valley. The existence of copper ores in this district attracted the attention of English capitalists, in 1907, who proceeded to prove the deposits and to arrange for the beneficiation of the ores. Their efforts have culminated in the development and equipment of four important mines, the construction of a 36-in. gage railway connecting the mines with the government line at Kyshtim, the erection of a large electrolytic refinery in that town, and finally the completion of the Karabash smeltery in the Soimonovsk Valley.

General View of the Karabash Smeltery, in the Soimonovsk Valley, Kyshtim Estates in the Urals

Large Tonnage of Ore Explored.

The cupriferous ore reserves proved by diamond drilling and underground development are, as stated in the last annual report, 1,817,000 long tons and the indications of large additions being made to this reserve as exploration continues are excellent. One of the four mines yields barren pyrites which because of the large proportion of sulphur it contains, commands a ready market in Russia. The copper ore in the proportions supplied by the various mines, is of the following composition: gold, 0.1 oz. and silver, 1.0 oz. per long ton; copper, 3 to 4%; sulphur, 40.8%; silica, 12%; iron, 34.1%; lime, and other earths, 3 to 6%. Numerous deposits of quartz containing from 88 to 95% silica and small quantities of gold, occur within easy reach of the plant and railway, and limerock is quarried about two miles from the smeltery. Obviously the conditions favor pyrite smelting.

Two Experimental Plants Operated.

As early as 1907, the company was producing copper at a small plant at Kyshtim, and early in 1908 a second plant was blown in near the principal mine. The first of these plants consisted of two circular water-jacket blast furnaces, each of a daily capacity of about 70 long tons of charge, one stand of converters, and a small refining furnace. The second consisted of three furnaces identical with those at Kyshtim.

Eventually one of the Kyshtim furnaces was transferred to the Soimonovsk plant, thereby increasing the capacity to about 200 tons of ore per day. The resulting matte, ranging from 15 to 25% copper was carted to Kyshtim, raised to converting grade in the remaining furnace, and blown to blister. This was refined, at first in the original poling furnace, but ultimately in the anode furnace which was built at the new electrolytic refinery. Both these smelteries were regarded merely as experimental plants. Small and unsatisfactory to operate as they were, these plants served to develop the process of smelting the ore and to train workmen, and they yielded substantial profits to the company.

The Karabash Plant

The present plant was completed early in 1911, at Karabash Lake in the Soimonovsk Valley. The site chosen was a hillside adjoining the lake at a point midway between the principal orebodies. At the foot of the hill an old river bed provided ample space for a slag dump, and beyond this depression lay an expanse of well-drained, level ground on which were erected the office, laboratory, and dwellings of the staff and workmen. One spur from the railway connecting the plant with the mines was carried around the hill by comparatively easy curves and gradients up to the ore bins, a second spur at an intermediate level to handle sample-mill rejects and fuel for the power plant, and a third on the ground level of the plant was carried to the main smeltery building to handle the finished products and to serve the machine shop and warehouse.

---

*Metallurgist, Woodstock, Ontario.

The ore is brought from the mines in bottom-dump steel cars of 10 tons capacity. It is weighed at the plant junction on a standard Fairbanks scales of 3000 poods (50 long tons) capacity; the platform will take easily three ore cars. Every tenth car in rotation from each mine is dumped into a receiving bin at the sampling mill, which stands at the approach end of the main ore bins.

The sample mill is equipped with a 9x15-in. Blake crusher, the product of which is raised by a bucket elevator to the top floor and discharged into a sampler of the Vezin type which cuts out one-tenth and delivers it to 30x10-in. Allis-Chalmers rolls. One-tenth of the product is then cut out by a second and smaller sampler, and passed through 24x10-in. rolls into the final sampler which cuts out one-fifth or a final sample of 0.2% of the original car sample. The rest of the ore, and ultimately the rejects from the sampler, are dumped into flat-bottom bins of approximately 6000 tons capacity.

In the floors of these bins are series of longitudinal slots 30 in. wide that may be covered by close-fitting but easily removable 4-in. planks. Movable chutes, equipped with inverted-arc gates, are suspended below the slots from rails.

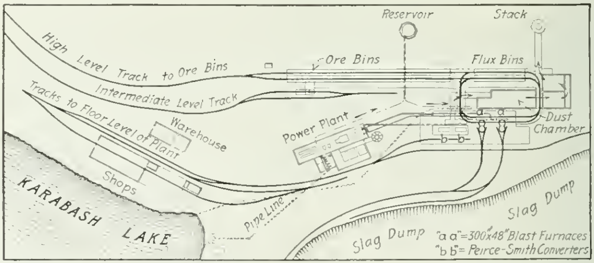
The procedure in withdrawing ore from the bin is to place a chute beneath the toe of the slope of the ore above, then to remove two or three of the planks at that place. As the ore is removed, more boards are taken up as the toe of the slope recedes toward the back of the bin. With a steady supply of ore to the bins, it is seldom necessary to move the chutes, which then serve as stationary gates. When occasion demands, the slots provide a convenient opening for cleaning out a section of ore. The chutes discharge into the cars, in which the ore is taken to the furnace feed-floor.

Beneath the chutes from the ore bins on the blast-furnace charge-floor level are laid 24-in. gage tracks made of 54-lb. rails, which lead to the blast furnaces. The charge trains, three in number, consist of four side-dump steel cars, each of 4000-lb. capacity. They are hauled by Westinghouse electric traction motors weighing three tons, and equipped with 18-hp., 220-volt, direct-current motors.

The blast-furnace charges, made up of ore, quartz, limerock, plant cleanup, converter slag skulls, etc.) and low-grade matte from the Siemens furnaces mentioned below, are delivered to the furnaces as follows: First flux train consisting of four cars, each containing a weighed mixture of quartz, limerock, cleanup, etc., is brought, say, to the east side of a furnace and dumped through the four charge doors on that side. Then two 4-car trains of ore are brought in, one on each side, and dumped. This constitutes one charge. On the succeeding trip the flux comes in on the west side and so on. A charge thus consists of three train-loads, and weighs about 50,000 lb. The coke is shoveled in through the end doors just before the flux train is dumped. The ratio of coke to total material charged during any given month is a little under 1.25 per cent.

The Blast Furnaces

There are two blast furnaces each measuring 300x48-in. at the tuyeres, and 22 ft. 8 in. from the bottom plates to the charge floor. They are jacketed with three tiers of water-jackets on the ends and two on the sides; but side jackets are being made which will extend from the bottom to the apron plates. There are two bronze tap jackets on each furnace, one in the center of each side.



ENG & MIN. JOURNAL

Ground Plan of the Karabash Works

The spout used at the front of the furnace is shown in an accompanying sketch. It is a plain, water-jacketed, slag spout that is lined with magnesite brick before being used. The blast is trapped by a water-cooled nose piece or dam of blister copper. As shown in the sketch, this dam does not cover the entire front opening of the spout proper, but leaves a fairly large open space below its bottom edge and the upper face of the spout. This opening is filled with clay and is provided for the purpose of affording a convenient means in case of emergency for quickly emptying the hearth of the furnace of all molten material—a strong thrust with a bar being sufficient to break through the clay stopping.

The tap jacket at the rear serves a useful purpose when a furnace is being blown in, inasmuch as the slag produced during the first 20 or 30 min. is discharged from the back rather than into the settler. Besides this, of course the back taphole is useful if through any cause the front tap is lost, as the blast can be kept on and the matte and slag run through the back till the breast can be drilled.

The air is delivered through a 24-in. bustle pipe to 52 tuyeres, 26 on each side of the furnace. Of these, however, the four tuyeres above the bronze jackets are seldom used so that the working complement is normally 48 tuyeres.

Originally the slag and matte flowed into two 15-ft. settlers arranged in cascade, but eventually these were thrown into one because, owing to the frequent tapping for the converter, the supply of matte entering the lower settler was insufficient to keep it hot and open. With a common settler there is a uniform depth of matte, and as the four tap holes are used in rotation the settler bottom and the tapholes themselves are easily kept in good condition.

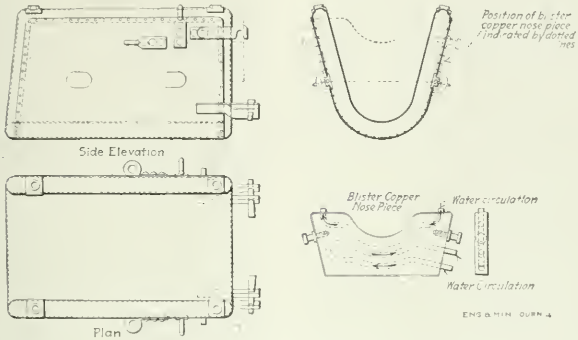
At first all settlers were lined with refractory brick in order to resist the corrosive action of the low-grade matte. Recently, however, following the practice at the old plants, a settler has been lined with soapstone quarried on the estates and cut into shapes of the required dimensions. This is satisfactory and cheap.

Slag Disposal

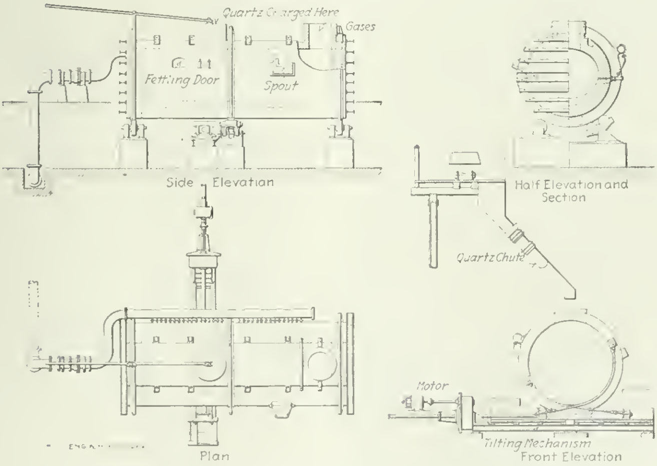
Each settler is provided with two slag spouts on opposite sides of the forward end, through which the slag is led into 4-ton cars consisting of cast iron, elliptical bowls, mounted on substantial trucks. Two such cars are placed on each side of the settler. When they are full the slag stream is diverted into the pair of cars on the other side of the settler and the full pair hauled to the dump by a small locomotive. In addition to this haulage system, there is installed beside each settler a launder through which in case of accident to the locomotive or other trouble, the slag is granulated and carried to waste by turning in the overflow water from the jackets.

The matte produced at present contains from 30 to 40% copper. With this concentration each furnace smelts from

500 to 600 long tons of charge per day. During a recent month the average charge was made up as follows: Ore, 28,800 lb.; quartz, 6350 lb.; lime rock, 1900 lb.; cleanup, 1300 lb.; matte, 2250-lb.; a total of 40,600 lb. of ore and fluxes to which was added 500 lb. of coke, or 1.23% of the total charge. The resulting matte contained 31.2% copper and the slag for the month averaged 31.9% silica, 41.2% iron, 4.4% lime, 1.5% sulphur and 2% alumina. The copper in the slag varies from 0.3% to 0.5. Other things being equal, cleaner slags are obtained when the matte fall is high.


Side Elevation
Plan
Position of blister copper nose piece indicated by dotted lines
Blister Copper Nose Piece
Water circulation
Water Circulation
ENG & MIN JOURN

Slag Spout Used on Karabash Blast Furnaces



Basic Lined Converters as Used at the Karabash Smeltery

Review of the Smelting Practice

Using large charges simplifies transportation, and since in pyrite smelting the sulphides, fused in the upper part of the furnace, are fluxed at the smelting zone by the quartz which has preceded them thither in previous charges, there appears to be no object in employing smaller charges, to obtain the intimate mixture at the furnace top which is desirable in ordinary smelting. The usual characteristics of pyrite smelting, basic slags, dark tuyeres, and a porous accumulation slightly above the tuyere line, are in evidence. With adequate supervision any tendency of the smelting focus to mount in the furnace is easily defeated, and the length of furnace campaigns is affected more by outside influences than by difficulties arising from the process. At the time of writing a furnace was shut down after 118 days vigorous running, and the shut down was directly due to a leaking jacket. The half of the furnace not affected by the water was running normally up to the time of blowing out. With the ferruginous slags produced there is, it is true, a tendency for the settlers to chill and build up more rapidly than in ordinary practice, but this difficulty is overcome by shutting off the water spray on the settler shell, and by occasionally making low-grade matte for a few hours. It is safe to say that in the absence of accidents, furnace campaigns of six months or longer should be the rule rather than the exception.

Much Flue Dust Produced

Being pyrite the ore decrepitates vigorously in the furnaces, and as the sulphides from the upper levels of the various mines are soft and friable, there is a large production of flue dust, and although the ore is now screened and only the coarse ore sent to the blast furnaces, the dust recovered never falls below 10% of the ore charged. This dust is collected in a masonry chamber which the gases from each furnace enter through two downtakes 6-ft. in diameter. The chamber is so constructed that the gases travel for a distance of about 100 ft. through a compartment with a cross section of 945-sq.ft., and then through two compartments each 60-ft. long and of 1610 sq.ft. cross-sectional area. After leaving the first compartment the gases pass through four walls in which, midway between roof and floor, are openings so spaced as to produce a maximum diffusion and hence a minimum velocity of the gases.

The chamber floors are made of flat cast-iron arches, perforated with 6-in. openings in which rest conical castings These are fitted beneath with spindles and handles by means of which the trammers on the track floor below force the cones upward, and so permit the dust to flow into cars. From the chamber the gases are led through a flue 12x12½-ft. inside up a slope of 31°. to a stack 16-ft. in diameter and 185-ft. high, the top of which is 241-ft. above the blast-furnace charge floor.

Fines Treated in Gas-Fired Regenerative Furnace

Even in the original small plants the smelting of the ores was accompanied by a large production of dust. For a time part of this was briquetted with tar and pitch from the producers in the iron works, but this method was inadequate to cope with the rapid accumulation of dust. K. D. Koliasnikof, then superintendent of the Kyshtim works, and my successor as manager of the Karabash plant, solved the problem by treating the dust in a gas-fired, regenerative furnace of the Siemens type, which had formerly been used for the production of openhearth steel. With cheap wood available for the producers, he rapidly developed a satisfactory and economical process. Upon the completion of the new plant at Karabash he was authorized to build a second and larger Siemens furnace at Kyshtim, and these two units are now treating not only flue dust, but also fine sulphides screened at the mines from the ore hoisted for the smeltery. The product, a low-grade matte, is shipped to the Karabash plant and is a welcome constituent of the blast-furnace charge.

Peirce-Smith Converters Used

While it has been proved to be feasible, especially with the above-mentioned matte on the charge, to produce in one operation matte containing 30 to 40% copper, experience at the old plant indicated that easier running and better furnace performances generally, would accompany the production of lower-grade matte, and the original program was to produce a matte containing 20 or 25% copper and convert it direct in basic-lined converters; accordingly two Peirce-Smith converters were installed. Converters of this type were described in the Journal of Mar. 12, 1910. The shells at the Karabash works are cylindrical, 25 ft. 10 in. long by 10 ft. diameter, lined with magnesite brick. For feeding quartz, a special opening was cut in the top of the converters close to the central riding ring. When the blast is on, this opening is kept closed by a heavy cover. After the converter has been skimmed and the matte poured in, the quartz is fed through a chute from cars on the furnace charge floor level. This saves much time as the quartz can be charged while the crane is still busy with the matte ladle. Another alteration was to cut a second opening in the front side of the shell in order to facilitate fettling.

The converters are served by a traveling crane of 45-ft. span, equipped with a main hoist of 25-tons capacity, and two 5-ton auxiliary hoists. Because of the frequency with which matte must be delivered to, and slag removed from the converter, this crane is kept very busy, and a new crane is being put in, equipped with two 25-ton hoists.

Converter slag is carried by the crane and poured through launders into the blast-furnace settlers which it enters at the same point as the furnace slag and matte. As the converter slag which has cooled somewhat during transit, is heavier than the blast-furnace slag it settles rapidly and seems to act as a collector, for a long series of samples has shown that the slag emerging from the settlers for some moments after the converter slag has been poured generally carries less, and seldom more copper than the normal furnace slag.

Trouble Experienced in Converting Low-Grade Matte

The Peirce-Smith converters are easy to operate and the men soon became adept in their use. At first the original plan of converting matte containing 20% copper was followed, but it soon became apparent that this procedure resulted in rapid deterioration of the lining. Despite all efforts to keep the temperature down by the addition of scrap and excess quartz the slags would frequently fall to 18 or 20% silica, and at the temperature of formation of such slags the bricks at the tuyere line were rapidly destroyed by the abrasive action of the bath. In a few days these bricks would be worn back almost to the shell and the tuyere pipes burned away. The campaign could then be prolonged by tamping in fettling of ground magnesite and sodium-silicate solution, but this was a mere palliative and relining soon became necessary.

Eventually arrangements were made to treat only screened ore in the blast furnaces. This ended so many difficulties and so improved the smelting, that it became possible to keep the furnaces up to full capacity and make matte containing not less than 30% copper. From the time that this was done the rapid corrosion of the converter linings ceased. The use of the Siemens-furnace matte naturally makes it still easier to produce matte of satisfactory grade, and altogether, with the conditions now existing there is no difficulty in keeping the amount of silica in the converter slag up to 25% or higher.

Besides the life of the linings there is, in my opinion, another reason for serving as high-grade matte as possible even to basic-lined converters. Since weight for weight, air at 15-lb. pressure is more expensive than air at 40 of 50-oz. pressure, it should be in most cases cheaper to oxidize and slag iron in the blast furnace than in the converter. Our cost sheets indicate that the air required to convert matte containing 20% copper costs about half as much as that required for matte containing 16%, whereas the difference in the cost of blast to the furnaces when producing these mattes was insignificant. The difference in favor of oxidizing the iron in the blast furnace is, of course, all the more pronounced when pyrite smelting is practiced.

When the copper of a previous "blow" has been poured, the converter is fettled if necessary, with the magnesite mixture; from four to six ladles of matte are then charged and sufficient quartz to raise a good slag. When this is formed it is poured, another ladle of matte, and more quartz added, and so on, the matte being gradually concentrated until there is a sufficiently large bath of white metal to finish. When a "blow" is finished the copper is transferred by the crane in 5-ton ladles to a casting machine of the endless-conveyor type. By tilting the ladle with the auxiliary hook the copper is poured into the moving molds and chills rapidly enough to fall out easily as they pass over the sprocket wheels at the delivery end of the machine. The bars are then trimmed, weighed, and shipped to the refinery at Kyshtim.

Furnace Blast Supplied by Turbo-Blowers

The equipment of the power plant need hardly be described in detail because with one exception the machines are typical of any modern smeltery of the same size. That exception is the blowers serving the blast furnaces. These are turbo-blowers, installed by Parsons & Co. of Newcastle-on-Tyne, under guarantee of the following capacity:—

Air Pressure oz	Free air cu.ft.	Steam lb. per hr.	R.P.M.
60	30,000	10,700	3,400
50	24,709	7,770	3,000
40	22,700	6,100	2,700

Because of the arrangement of steam mains it was difficult to make a test to ascertain the steam consumption of these blowers under actual working conditions, but they have been satisfactory so far as operation and maintenance are concerned.

We soon found that with the deep charge employed it was not possible to force 30,000-cu.ft. of air per min. through a furnace even under 60-oz. pressure, and to keep the pressure down to 40-oz. as we preferred, the blower had to be run much below full speed. This led us to try running both furnaces with one blower, keeping the other as a stand-by, and this became regular practice save when both furnaces were very loose, or when one furnace appeared to be taking air at the expense of the other. Two requisites for efficient turbine performance are, of course, superheated steam and a high vacuum in condensation.

The above notes may serve to give a general idea of the equipment and process at the Karabash smeltery. In conclusion it may be stated that while the difficulties incidental to the erection of a modern plant in a district so remote as the Urals and to the bringing of such a plant up to satisfactory production, have not been trifling. The Karabash smeltery is now in operation with gratifying results; the copper produced during 1911 exceeded the amount predicted by the company's consulting engineers, and a steady increase in the future is assured.

U. S. Quicksilver Production

The total production of quicksilver in 1911 in the United States was 21,256 flasks of 75 lb. each, the greatest output since 1907, says the U. S. Geological Survey. California produced 18,860 flasks of this total, Nevada and Texas the remainder. Although this is an increased production over 1910, it is below the decennial average ending with 1911, of 26,610 flasks. Imports were 6293 flasks (471,944 lb.), and exports were 291 flasks (21,825 lb.) in 1911. The exports were the smallest and imports the largest for many years.

South African Power Supply Projects

By Owen Letcher*

A history of the power-supply companies that were finally consolidated as the Victoria Falls & Transvaal Power Co., which had the ambitious object of harnessing Victoria Falls, on the Zambesi River. The company is now operating steam-driven plants in a most unsatisfactory manner, the greater project of using water power not having been carried out.

Of the many important projects that have been launched in South Africa in recent years, none has been more ambitious than the undertaking of the Victoria Falls & Transvaal Power Co., Ltd. As the title implies the company was originally floated to supply the great Witwatersrand gold-mining industry with electric power generated at the Victoria Falls of the Zambesi River, which are about 600 miles from Johannesburg. These falls were discovered in 1855 by David Livingstone. They represent one of the greatest natural storehouses of energy on the earth. The company which conceived this ambitious project was registered in Rhodesia in 1906. It was promoted by the African Concession Syndicate and it acquired the preferential right to develop 250,000 h.p. at the falls and the exclusive right to sell such power in the Transvaal.

Early Opponents of the Victoria Falls Project

At the time of the flotation of the Victoria Falls Power Co. much criticism was directed against the scheme by responsible engineers. It was contended that while generation of electrical energy at the falls and transmission of such energy to the Rand was scientifically practicable, the project was predoomed to commercial failure. It was argued that the loss over such a great length of transmission line would strangle the undertaking in its infancy, that the cost of such transmission lines would be excessive and the expenditure invested in effectively controlling them would be enormous. Moreover it was pointed out that there were no large industrial plants on the route to the gold field nearer than Johannesburg to which power could be supplied and so relieve the financial strain on the company. It was also contended that it would be an unwise policy on the part of the miners to place the whole gold-mining industry at the mercy of one company whose source of energy was hundreds of miles away and whose transmission line would be subject to risks unknown in more civilized and more temperate countries, risks for instance in connection with elephants (these animals have pulled down more than one telegraph line in South Africa) and violent sub-tropical thunderstorms.

A Change in Policy

With a view to investigating the commercial possibilities of the undertaking the promotors of the Victoria Falls Power Co. enlisted the services of some of the prominent consulting electrical engineers of the day, among them eminent Continental professors and Ralph E. Mershon, of New York. Soon after the formation of the company the directors announced their intention of erecting a steam-driven plant on the Witwatersrand at the outset of the company's career, the greater project of obtaining power from the Zambesi being indefinitely postponed.

Previous to the visit of the British Association to South Africa in 1904, no electric power distribution schemes of magnitude had been carried into effect in South Africa, and some of the learned and technical members of this association remarked that it was surprising to find no large electric-power company in such a concentrated zone of industrial activity as the Witwatersrand. Shortly afterwards, however, details of the Victoria Falls power scheme were announced and simultaneously other projects were commenced. The firm of H. Eckstein & Co. began to work out the details for a large central power company, at the same time Lewis & Marks engaged in a full consideration of the advantages of Vereeniging on the Vaal River and close to important coal fields, as a site for a large power distribution station. Vereeniging lies about 40 miles distant from Johannesburg as the crow flies. For some time much rivalry existed between these companies and the relative disadvantages of each were assiduously advanced at meetings of technical societies and in the columns of the press.

Harnessing of Victoria Falls Abandoned.

After much negotiation, however, the Victoria Falls Power Co. absorbed the other undertakings, and proceeded to enlarge greatly the scope of the project and with a commendable honesty changed the name of the concern to the Victoria Falls & Transvaal Power Co. Of the Victoria Falls project it is not proposed to say anything further in the course of this article. The project of obtaining power from the Zambesi River has been shelved for an indefinite period and the present-day power-supply problems of the Transvaal are concerned with local steam-driven stations only.

The Victoria Falls & Transvaal Power Co. retains preferential right to develop a quarter of a million horsepower at the Zambesi but it will probably be a long time before that right is exercised. At the commencement of its career, the Victoria Electric Power Co. acquired the plant and property of the General Electric Power Co. at Driehoek close to the famous Simmer & Jack Proprietary mine and about eight miles from Johannesburg, and also the Rand Central Electric Co. at Brakpan, 19 miles from Johannesburg in an easterly direction. Previous to the acquisition of the power company the former concern was owned by the Consolidated Gold Fields of South Africa, Ltd., and the latter by A. Goerz & Co. Subsequently the building of a large electric and compressed air station was commenced at Rosherville, (about six miles east of Johannesburg) and the Vereeniging power site was acquired from the African and European Investment Co. Some idea of the magnitude of the undertaking of the Victoria Falls & Transvaal Power Co. may be gained from the fact that the authorized debenture and share capital is £6,000,000. The transmission lines are in operation from the West Rand Consolidated to Brakpan and Modderfontein, a distance of between 50 and 60 miles. The compressed-air transmission lines have been completed from one end of Central Rand to the other and the Victoria Falls & Transvaal Power Co. and the Rand Mines Power Supply Co. have jointly secured licenses from the Union of South Africa government permitting the supply of power up to 11,000,000 units annually.

General Use of Electricity on the Rand.

Electricity is now being supplied throughout the Witwatersrand for mining and metallurgical practice. Above ground electric current is employed for main winding engines, air compressors, electric locomotives, stamp batteries, tube mills and crushers. Below the surface it has been applied to electric winding engines for hauling ore on the incline of the reef and to pumps; it is also extensively used for lighting. It might be said that European practice in regard to the application of electricity to mining has been eclipsed in South Africa. The enlargement of the scope of operation of the Victoria Falls & Transvaal Power Co. has been rapid and remarkable. The company is now in possession of four erected stations and one in course of erection which is practically completed. The stations and their capacities are as follows: Electricity, Rosherville station, five sets of 10,000 kw. each; Vereeniging, four sets of 10,000 kw. each; Simmer Pan (Driehoek), six sets of 3000 kw.; Brakpan, two sets of 3000 kw. The compressed-air plant at Rosherville consists of four sets of steam-driven air compressors of 4000 hp. each. Of these the Rosherville, Simmer Pan and Brakpan stations are completed and that at Vereeniging is nearly completed.

---

*Mining engineer, Box 418, Johannesburg, S. A.

Results not up to Anticipations

There can be no doubt of the fact that so far the operations of this vast power project have resulted far from satisfactorily. Hundreds of thousands of pounds have been spent on machinery, buildings and transmission lines and further large sums have been sunk for power-station sites, technical advice, salaries, etc. The position today is that the power company is heavily mulcted for fines imposed on account of its inability to fulfill contracts while many of the mines have had to recommission their steam plants.

In recent months there has been a marked tendency for Rand working costs to rise rather than decline and a decline of at least 9d. or 10d. per ton in working expenditure was confidently anticipated as a result of purchasing power from large central power-supply companies. Scarcity of native labor has contributed in some degree to the augmentation of running expenditures, but it is held that the inability of the power company to supply sufficient power by stipulated dates has been mainly responsible for the increase in the cost of operation. Great inconvenience and expense have, of course, resulted to the mines and it is a matter for congratulation that the old steam plants have been maintained in good running order as standbys.

The truth of the matter seems to be that the power company has engaged to carry out larger contracts on specified dates than the power stations were in reality capable of; that the company has seemingly abandoned the policy of maintaining a reserve of power in case of emergencies and has, in fact, taken unwise and impolitic risks. The position has been further aggravated by climatic influences. During the rainy season, September to April, the Rand is subject to violent thunderstorms and it is held that these have adversely affected the operations of the company. Much, it appears, remains to be learned about the climatic conditions in regard to transmission of power. It may safely be remarked that the conditions prevailing in the southern Transvaal and at this altitude, taken altogether have not fallen within the experience of electrical engineers in other parts of the world. It has been argued that the company committed errors in erecting overhead wires. These have been practically unavoidable as underground cables are not yet reliable at 40,000 volts pressure.

Many companies having contracts with the Victoria Falls & Transvaal Power Co. have recently changed over to their old steam plants because of the inability of the power company to supply sufficient current. Of course this has meant considerable expense and inconvenience to the mine and has at the same time seriously reduced the earnings of the power company. The whole question of future working is now being carefully gone into. The Marquis of Winchester, chairman of the company, has been visiting Johannesburg and has been in almost continual consultation with the heads of the industry. The East Rand Proprietary Mines setback has rather tended to overshadow all other matters relating to the Witswatersrand, but the position with regard to the electric power company is recognized as serious and everything possible will be done to relieve the situation. It is reported locally that an understanding has been arrived at between the mines and the power company, and that the whole question of penalties incurred by the power company in the past and the better supply of electricity in the future has been amicably settled.

Mines of the Vladivostok District, Siberia

By Albert Bordeaux*

The Vladivostok district has the advantage over the other districts of Siberia in being near the sea, permitting the shipment of products that otherwise could not be profitably produced.

The alluvial gold belt extends northward only to the Tumnine River. The production for 1909 was 126 kg. and for 1910, 34 kg., produced from about 77,000 tons of gravel. The smallness of the production is due to the fact that the gravels of most of the rivers along the coast have been exhausted, but since 1910 gold has been found in the tributaries of the Ussuri River, such as the Iman and Bikin, and there are good prospects of a revival of the industry of gravel washing. Moreover dredging is possible along the shore of the Okhotsk Sea and Americans are said to be interested in such an enterprise.

Small Production from Quartz Mines

There is a quartz vein on Askold Island, a short distance from Vladivostok. This vein has been mined for 30 years and the total production is said to amount to about 850 kg.; in 1909 it produced 16 kg., and in 1910, 6 kg. Gold-bearing pyrite associated with arsenic and antimony minerals is found at Sedimi and Odimi in the vicinity of Vladivostok. These ores are refractory but are amenable to treatment by the chlorination process after roasting.

The principal discovery of rich zinc ore, calamine, was made by me in 1903, at Tetinhe, 250 miles north of Vladivostok and 22 miles from the seashore, but it was only after the Russo-Japanese war that the mine could be put on a working basis. The production from 1907 to 1911 was 55,000 tons; the ore contained 43 to 44% zinc and was worth $20 per ton at the mouth of the Tetinhe River.

Lead Mines Worked for 200 Years

The most important deposit of lead and silver ore is one that adjoins the calamine deposit at Tetinhe. It is a contact deposit between limestone and porphyry. Tests are being made with the view of erecting a concentrator and, perhaps, a small smeltery. A premium is paid by the government of $20 per ton of lead produced. There are a dozen similar but smaller deposits that outcrop in the neighboring valleys and if all are mined together a large lead industry may be built up in the future as was the case at Nertchinsk where several hundred mines were worked for 200 years.

The principal deposit of copper ore is in the Djighit Valley; it is a quartz-chalcopyrite vein in andesite. A premium of $60 per ton is paid by the government for all the copper produced. There are two deposits of magnetite between Olga and Vladimir Bays. Chromium and manganese deposits are known, but have not been exploited; platinum is found in the beds of certain rivers.

Coal and Lignite Deposits Are Worked

Lignite deposits are mined at a distance of 25 miles from Vladivostok; 200,000 tons being produced annually. Coal seams are also worked on Sakhalin Island, the mines extending in a line 80 miles long. The coal contains 70 to 85% carbon and in heating power is considered to be equal to Cardiff coal, but unfortunately there is no good harbor on the Sakhalin coast. Petroleum is also found on this island, but not enough work has been done to determine its value. Several other deposits of coal are known and mined, one of which is mined by the government, the production being from 120,000 to 200,000 tons per year.

---

*Mining engineer, Thonon-les-Bains, France.

Rolling Mill No. 2 Shaft, Michigan

By P. B. McDonald[*]

An 8x8-ft. raise was driven from the 630-ft. level to surface in five months by nine miners, three on each 8-hr. shift. They did their own timbering and trammed the rock 750 ft. Stoping, air-feed, hammer drills were used in raising and are now being used to enlarge the shaft to 12x14 ft. The latter work is proceeding downward from the surface.

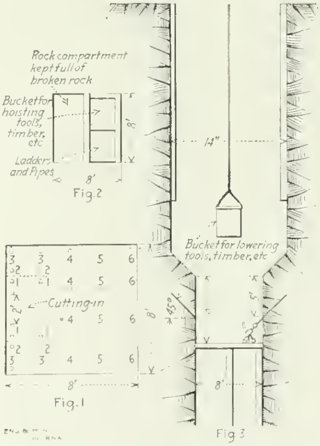
Considerable interest is manifested by Michigan iron men in the No. 2 shaft of the Rolling Mill mine at Negaunee. The shaft was started from the 620-ft. level last autumn and was raised to surface in five months by nine miners, three working on each 8-hour shift; they did their own timbering and trammed all the rock 750 ft. to shaft No. 1. The difficulties of raising so great a distance were successfully overcome, and no accidents or long delays were encountered.

ENLARGING RAISE FROM SURFACE DOWNWARD

The raise driven to surface was 8x8 ft., and this is now being enlarged to 12x14 ft., by working down from the surface, permanent timbering being put in at the same time. In this work of enlarging, the same rock drills which were used in raising are employed; this application of stoping, air-feed, hammer drills to the work usually done by heavy reciprocating drills, is uncommon and is accomplished by using 45° holes from below, to lift a 5-ft. cut, with the length of holes so gaged as to make the shaft of the required dimensions. On May 1, enlarging had been in progress for about two months, and the finished shaft was down 260 ft.; it was planned to take five months for raising and five months for finishing the shaft, and this schedule will probably be beaten. The work is under the direction of Capt. E. N. Cory, who has charge of underground operations at the mine for the Jones & Laughlin Company.

ARRANGEMENT OF HOLES

Fig. 1 shows the arrangement of holes for blasting, in driving the 8x8-ft. raise. The four holes numbered 1 are the cutting-in holes and the lengths of fuse were cut so that these would go first, and as nearly together as possible; the distance between the bottoms of the cutting-in holes was generally about 2 ft. The four holes, numbered 2, would go next, and these were given a small angle toward the cutting-in holes in order that their bottoms would not have too much to break. Holes No. 3 went next, and these completed a clean opening across the raise. In succession holes 4, 5 and 6 were fired, breaking easily into the opening made by the cutting-in holes and holes Nos. 2 and 3. All the fuses were lighted at once, the succession of explosions being regulated by comparative lengths of fuse, as it was not convenient for the men to fire the cutting-in holes and then to return to insure that these had broken before firing the others, as is sometimes done in drifting. The rock for the most part was jasper, with occasional streaks of schist, dipping at rather a steep angle to the vertical; the ground, however, usually broke evenly, and little allowance was necessary for the dip. The arrangement of holes in the sketch shows 24 holes, for the usual cut; sometimes in hard ground more holes were needed to help the cutting-in holes, while in soft ground it was possible to break the cut, using three holes each in sets Nos. 4, 5 and 6, instead of four holes.


Rock compartment kept full of broken rock
Bucket for hoisting tools, timber, etc
Ladders and Pipes
8'
8'
Fig. 2
14"
Bucket for lowering tools, timber, etc
3
3
4
5
6
2
2
1
1
4
5
6
Cutting-in
2'
4
5
6
2
2
3
3
4
5
6
8'
8'
Fig. 1
45°
5'
8'
Fig. 3
ENG. & M. JOURNAL

RAISE AT ROLLING MILL MINE, MICHIGAN

DRIVING THE RAISE

Sketch No. 2 shows the method of cribbing the 8x8-ft. raise, which was done by the miners. One 4x4-ft. compartment was used for a bucket for hoisting tools, timber, etc., for which purpose there was a small hoist at the bottom of the raise in a station cut for that purpose. The other 4x4-ft. compartment was used for ladders and pipes. The ventilating current came up one 4x4-ft. compartment and went down the other, the fan for this purpose being stationed at the foot of shaft No. 1, 750 ft. away; the reason for placing it so far away was to insure getting pure air. The 4x8-ft. compartment was used for broken rock and was kept full, thus holding the cribbing firm. After blasting a cut, the miners trammed about 30 cars of rock from the rock compartment, drawing it off through a chute on the 620-ft. level. This took about three hours, by which time the powder smoke would be gone and the men could go up to the face for timbering.

Just before blasting, a platform of 10-in. timber, squared on two sides, was laid across the two 4x4-ft. compartments, at an angle to deflect the falling rock into the rock compartment. A small opening was left in the 10-in. platform to permit the man who lit the fuses to escape through the raise. About four-fifths of the broken rock from the explosion fell into the rock compartment, because the cutting-in was placed over the rock compartment and the material shot directly downward, and the ground broken by holes Nos. 4, 5 and 6 was thrown sidewise toward the cutting-in.

The surface soil was but a few feet thick over the shaft site; this was cleared away, but practically no sinking was done to meet the raise. When about 15 ft. below the rock surface, a smaller size raise was driven up a short distance, and drill holes put up and loaded heavily with powder, which, when fired, broke the raise through.

ENLARGING THE SHAFT

Fig. 3 shows the unique method of enlarging the shaft, by which the same stoping air-feed hammer drills that were employed for raising, were utilized. These drills are butterfly valve, 2-in. cylinder, Ingersoll-Rand, B C 21 machines. The holes are put in at an angle of 45°, which is enough slope to allow the rock chippings to fall out. The length of the holes is so gaged as to make the enlarged shaft of the proper dimensions, and the rock usually breaks satisfactorily; only occasionally is it necessary to put in a pop shot, after a blast, to even up the walls. In such a case, the ordinary practice of placing holes is to use down holes, drilled vertically, perhaps 3 ft. apart. These holes could be drilled by reciprocating machines, mounted on tripods or long bars, or could be drilled by small plug drills, with hollow steel for blowing or washing out the rock cuttings. The objection to using reciprocating machines and tripods or bars is that they are heavy to handle in getting out of the way for blasting; also down holes often cause trouble in getting the rock chippings out. The last argument applies to the use of plug drills as well. It is probably faster drilling, per foot, with air-feed hammer drills at a 45° angle, with the rock chippings falling back out of the way, than to drill down holes with their liability to give trouble from drill steel getting stuck.

---

[*] Mining engineer, 102 West Main St., Negaunee, Mich.

The footage to be drilled, using 45° holes to enlarge an 8x8-ft. opening to 12x14 ft., is probably less than with vertical holes. The platform made by putting timbers across the top of the cribbing gives a convenient place for the men to stand. Furthermore, the air-feed hammer drills were at hand, ready to use, and the same nine men that drove the raise are now enlarging the shaft with the same drills. The broken rock is trammed to shaft No. 1 by trammers. There is a little trouble in the shaft at present, due to an unusual flow of water, much of which comes from the spring break-up on surface. Carbide lamps are found to be more reliable than candles. Washington fir is used for the permanent timbering.

Transvaal Mining Notes

Johannesburg Correspondence

At six of the Rand mines the residues from 2.5-dwt. sand average 0.40 dwt., and at six mines the total extraction is 96%. Slime residues from decantation run from 0.2 to 0.37 dwt. The sand residues at the Knights Central assay only 0.28 dwt., and at the Village Deep, 0.3 dwt. The Butters filter residues at the Robinson assay only 0.12 dwt. Owing to a bad season, the native-labor supply is improving this year.

The wages and salaries paid to white employees on the Witwatersrand during 1911, totaled £8,226,499, made up as follows: £764,153 to technical staff and medical officers; £382,167 to clerical staff; and £7,080,179 to employees as wages.

The Messina Copper Mine, in which Camp Bird, Ltd., acquired a large interest, is working on a small scale at present, and last quarter exported 461 tons of concentrates, assaying 34.5% copper.

Benoni Mill Treating Sand Only

It is definitely announced that the slime-treatment portion of the Way-Arbuckle plant, at the Benoni mill, is a failure. The 32 agitators were designed to treat a mixture of sand and slime, but owing to the failure of the screw conveyors of the slime-settling cones, all the slime is now being stacked untreated and the agitators are treating sand only with an extraction described as fair. No provision was, however, made for any interruption in the power supply, which is a bugbear of most continuous treatments. Consequently when any stoppage of electrical or air supply takes place, the pulp in the agitators settles, and has to be dug out and the solution and half-treated sands dumped out before operations can be continued. Mr. Bosqui has been commissioned to report and will doubtless recommend the installation of a Butters filter plant. The mine ore reserves equal 522,671 tons of 6.8 dwt. ore with 446,675 tons of 3.5 dwt. at present unpayable.

The Van Ryn Deep ore reserves total 600,000 tons, assaying 7.17 dwt. A Butters slime filter is on order for the reduction plant to be erected on this mine. The ore reserves on the Witwatersrand mine, one of the first to start milling on the Rand, total 1,225,084 tons, assaying 5.65 dwt. The once rich Glencairn mine is now making small profits by mining the remaining reserves of 925,000 tons of ore, having a recoverable value of 3.5 dwt. per ton. A little development remains to be done.

The alluvial diamond fields, near Klerksdorp, produce about $30,000 worth of diamonds per month from the labor of 6000 to 7000 diggers. The occurrence of diamonds is exceedingly erratic; some diggers make fortunes and many recover no stones at all. The diamonds are found in widely scattered surface gravels, which are probably the remains of deposits made by the Vaal River.

Tin-mining Situation

The Groenfontein tin mine has ceased milling, owing to the failure of the pipe ore deposits at present exposed. The total profits were £132,000, and capital expenditure £60,000. A 350-b.hp. gas engine is installed here, burning bituminous coal successfully, with a consumption of only 1¼ lb. per b.hp.-hr. The surface detritus is now being hydraulicked to win tin and to search for pipes. The ore reserves in the Zaaiplaats tin mine are 30,500 tons of 4.5% metallic tin. This mine produces 150 to 160 tons of concentrates per month.

The reserves in the Rooiberg tin mine are 21,000 tons of 4.5% tin. A new 20-stamp mill and dressing plant have just been completed. The adjoining mine, Leeuwpoort, has just been floated, after development work showed 67,325 tons of 2.27% tin, valued at £235,000, allowing for 80% extraction. The reefs are proved on the incline to 600 and 400 ft. in depth. It is estimated that the Swaziland alluvial tin deposit can still produce 30 tons of concentrate per month for 10 years.

Chrome Ore Production

The production of chrome iron ore for actual delivery in the United States during 1911 was 120 long tons, according to the U. S. Geological Survey, coming from Tehama, Siskiyou and Shasta counties, California. It is stated much more was mined than delivered, including some from Converse County, Wyoming. There were importations amounting to 37,540 tons of the ore, beside some chromic acid, and potassium bichromate. The chief uses are for refractory brick, pigments, tanning and in alloys.

The most important producers are New Caledonia and Rhodesia. Other important deposits are in Asia Minor, Russia, Greece, Canada, India and Japan. Chrome-iron ore is widely distributed through areas of serpentine and associated rocks, in the Appalachians, Rockies, Sierra Nevada, Coast and Cascade Ranges, but only occurs locally as workable deposits.

Mine Valuation*

By J. R. Finlay†

The central ideas, which I suppose are generally adopted by mining engineers in their conception of the value of mines, are due to H. C. Hoover. One of Hoover's main propositions is that a mine is a limited deposit of valuable ore, and that to make the greatest profit from it requires that the deposit be worked out rapidly. The main factor in this proposition is the time value of money; not only the money tied up in the investment, but of the money to be returned by the investment.

Hoover's Theory is to Mine Quickly

It follows that the true interest of a mine owner is not to perpetuate an income, but to complete a job; not to prolong the life of his mine, but to shorten it by exhausting all profitable ore and getting the money into something else just as soon as economy will permit. Good economy, by Hoover's theory, demands that the ore reserves be ruthlessly slashed by getting out the best ore first, in preference to poorer ore, there being no logical reason why any absolute profit should be sacrificed in order to make a showing of stability.

These conceptions are rather shocking to the average investor, with whom stability of earning power is a kind of fetish. Such a man will understand the proposition easily enough, but he is bound to realize the technical character of the mining business and is pretty sure to distrust his limited knowledge of its details. Hoover's style of reasoning is strictly for mining men, or at least for men in a position to appreciate the real facts about a mine. Moreover it was proposed in the first instance to apply only to gold mining—a form of enterprise from which some of the ordinary commercial factors have been eliminated because gold can always be marketed without limit at a fixed price.

---

*A paper read at the meeting of the New York section of the Mining and Metallurgical Society of America, May 16, 1912, as an introduction to the discussion of the valuation of mining properties.

†Consulting mining engineer, 52 William St., New York.

Commercial Data Important

Those of us who have inbibed these principles, of course understand that the mere annual income of a mine may mean very little in the problem of estimating its total value. We want to know the facts about the ore. We want to know how much profit is already assured and how much is the ultimate possibility. It then seems reasonable to believe that the real value of a mine lies between a certain minimum and a certain maximum. I fully believe that mines can be reasonably valued in this way. I am not able to see any reason why a mining engineer should not expect to understand commercial facts, and it occurs to me to point out the great importance of strictly commercial data.

Certain dopesters, whom we mining engineers may hastily call commercial quacks, often assure us that the valuation of mines by mining engineers is a cold, pale, and spiritless calculation, which is like poisonous gas to vital enthusiasm and will surely kill any enterprise that breathes it. We are perhaps disposed to grow indignant at these sneers, but I think we are forced to admit that the valuation of a mine, or the valuation of anything, depends on a number of factors in regard to which opinions of equally competent men are pretty sure to differ. There are plenty of cases in which strictly commercial questions, such as the price of a commodity or the value of money, or perhaps the mere demand for securities, or the value of some commercial strategic point, may outweigh the importance of the ore reserves.

A mining engineer may be at quite a loss as to how to weigh some of these facts, and his idea of value may be inferior to that of men who consider only commercial conditions. Furthermore, people attach enormous value to things which any hard-and-fast scheme of appraisal must leave quite out of the reckoning. Look at city real estate, for instance. Nearly all of it, unless built upon and utilized, is held at a great annual loss instead of a profit. Much of this land never will be utilized for any profitable purpose, but one would be foolish indeed to call it worthless. The fact is that it can be sold and it is always possible to borrow money on it. It seems to me that undeveloped mineral lands must be valued exactly as unused real estate is valued—at so much an acre, according to the prices fixed by mere trading. There is apparently no other basis.

Many Factors Involved

When we come to going concerns, I have always assumed that we have a series of factors as follows: (1) The average cost of the product. (2) The average price of the product. (3) Variations introduced by temporary fluctuations in prices. (4) The general tendency of prices in the long run. (5) The expected life of the mine. (6) The interest rate on invested money. It goes without saying that scarcely any of these factors is capable of being fixed with exactness. Of the whole list, the one factor which we generally consider to be the hardest to determine is the very one which is capable of being determined with the greatest exactness: I mean the amount of ore in a mine. While this is often exceedingly uncertain, we all know of instances in which it is absolutely measurable.

The average cost is not easily determined, and of this fact there are some capital examples in sight right now. The other factors are so uncertain that no two men will agree upon them. Take the question of probable prices for a given staple. All you have to go on are the facts of the past, and upon these it is almost always possible to put contradictory interpretations. Even past averages of prices apply only to a given term of years, and for each separate term you will get a different average. To project calculations into the future from this unstable base line is dangerously near pure guess-work.

Price of Product Important

What I think we sometimes forget is the enormous importance of the guess. In innumerable cases a difference of 10% in the price of the product will make more difference to the value than any possible uncertainty about the life of the mine. This applies to every kind of a mine except a gold mine. I have a case in hand now, a very important mine earning well over a million dollars a year. It is surely good for 10 years' life, and I believe that it is good for 20 years. If it lasts 20 years this mine will be worth say, $12,000,000; if it lasts only 10 years it will be worth $7,500,000. If, however, the price of its ore falls 11% it will be worth only $7,500,000 if it lasts the full 20 years. If, on the other hand, the price rises 11% it will be worth well over $10,000,000 with 10 years' life. You will observe that the differences in the price are no more than two men might readily disagree about. For instance, it is a difference about equal to that between 13½c. copper and 15c. copper.

How often do we stop to consider these most evident facts? Here is a little difference, well within the possibilities, which is more important than six or seven million tons of mighty good ore. There are a number of other variables, one of which is the value of money, but I shall not attempt to discuss them. My point is that in trying to place values upon mines we should be very cautious not to overestimate the importance of purely technical information.

Globe and Phoenix Report

Johannesburg Correspondence

The annual report of the Globe & Phœnix Gold Mining Co., Sebakwe, South Rhodesia, for 1911, shows that 71,802 tons were milled for a yield of 114,576 oz. of fine gold. The working cost was 33s. 6d. per ton, and profit 102s. 4d. per ton. Working costs were adversely affected by a shortage of native labor and the refractory character of the ore. The net profit for the year amounted to £321,293, and dividends, totaling £290,000 were declared. The capital of the mine is £200,000 in 5s. shares, and it has produced £2,611,907 since its inception, and the main shaft has reached a depth of 2672 ft. on the incline. A fine-grinding plant, equipped with grinding pans, a roasting plant of Edwards furnaces and a cyanide plant are being erected to deal with the large accumulation of refractory residues.

The ore reserves are estimated at 178,582 tons, of a gross value of £1,372,581, approximately a similar tonnage and value to that estimated in 1911. A disturbed area has encroached 80 ft. on the richest portion of the oreshoot in the 19th level, and shares fell heavily in value during the year. The total length of pay oreshoots in the mine is about 1000 feet.

Chinese Tin and Antimony

Neither tin nor antimony is found in North China, writes Consul-General Knabenshue, of Tientsin (*Daily Cons. and Trade Reports*, May 28, 1912). Antimony is found in western Central China, and tin there and in the extreme southeast. The trade routes for their export are by the Yangtze and the West Rivers. The total exports of antimony regulus in 1910 were 152,077 piculs of 133½ lb. each, divided as follows among the various ports: Changsha, 133,550; Yochow, 15,624; Hankow, 2418; all others, 485. There were 108,716 piculs of pig tin exported in 1910, divided as follows among the exporting points: Mengtsz, 102,465; Wuchow, 4276; Canton, 1176; Hankow, 625; all others, 181. Although Consul Julean H. Arnold, of Amoy, believes that there is a bright outlook for opening large antimony mines near there in the future, neither antimony nor tin is mined near there at present.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Herbert K. Scott has left London for Newfoundland on professional business.

George E. Farish, after a brief trip to New York, has returned to South Porcupine, Ontario.

Prof. J. C. Gwillim, of the School of Mines, Kingston, Ont., is on the British Columbia coast.

Willis Lawrence is general superintendent for the Chosen Mining Co. at Yeng Byen, Chosen.

J. Parke Channing made an address at Houghton, Mich., June 5, before the Copper Country Club.

Charles Camsell, of the Geological Survey of Canada, is in the Similkameen district, of British Columbia.

D. F. King, formerly manager for the Vane syndicate, has been appointed manager of the Achilles mine, Porcupine, Ontario.

J. I. Hoffman, of Hoffman & Johnson, London, England, is at present in Servia in connection with several mining propositions.

Victor G. Hills, of Hills & Willis, Denver, Colo., left last week for professional work in the Yukon Territory, Canada.

Hon. Richard McBride, premier and minister of mines for British Columbia, has returned to Victoria from a visit to England.

Prof. James M. Macoun, of the Canadian Department of Mines, has been created a companion of the Order of St. Michael and St. George.

J. M. Ruffner, of Cincinnati, has commenced the season's hydraulicking on the North Columbia Gold Mining Co.'s placer gold leases, in Atlin camp, B. C.

William Leckie has been chosen president of the Lathrop Coal Co. and the West Virginia-Pocahontas Coal Co., to succeed W. A. Lathrop, deceased.

Howard Poillon has just returned to New York from a two months inspection of the vanadium bearing deposits of New Mexico, Arizona, Colorado and Utah, in the interest of clients.

J. W. Bryant lately returned to Victoria, B. C., after having spent the winter in Windy Arm district, southern Yukon. On June 1 he left for Toronto, Ont., on his way to London.

Sidney Lang has been appointed engineer of the Naumkeag Copper Co., near Houghton, Mich. He is engineer of the General Development Co. and had charge of the geological survey of the mine.

George Watkin Evans, of Seattle, Wash., left June 5 for the Ground Hog coal field in the northern part of British Columbia. He will spend the summer making a thorough examination of the field.

Charles E. Mills, now general superintendent of the Detroit Copper Co. and in charge of the Phelps-Dodge interests at Morenci, Arizona, has been appointed general manager of the Inspiration Consolidated Copper Co., and will take charge early in July.

Howard W. DuBois, of Philadelphia, on May 25, left Prince Rupert, B. C., for Hazelton, Skeena River, to go thence along the line of the Grand Trunk Pacific Ry. to Tete Jaune Cache, and from there south to the Quesnelle Hydraulic Gold Mining Co.'s placers, in Cariboo district.

Frederick M. Chase, recently general superintendent of the Lehigh Valley Coal Co., has been elected vice-president and general manager of the company, to succeed Samuel D. Warriner, who resigned to become president of the Lehigh Coal & Navigation Co. Mr. Chase has a longer record in the service of the company than any other officer. He came to it as an office boy, 30 years ago.

OBITUARY

Dexter B. Chambers, secretary of the Stewart Iron Co., Cleveland, O., and a pioneer steel man, died June 10, at Cleveland. He was 83 years old. Mr. Chambers was born in New York, and went to Ohio when a young man. He was connected with Brown, Bonnell & Co., at Youngstown, O., for a number of years before going to Cleveland.

John C. Searight, 40 years old, drowned in the Niagara river at Buffalo, on June 8. He had retired a few months ago from the superintendency of the Northern furnaces of the Republic Iron & Steel Co., Youngstown. Mr. Searight began as a chemist and blast-furnace superintendent in the Pittsburgh district and after several years was transferred to New Castle as superintendent of the Carnegie furnaces, which position he held for 14 years. About three years ago he resigned to accept the position with the Republic Iron & Steel Co., retiring from active business eight months ago.

Alexander Hill died in London, April 24, aged 55 years. He was born in Scotland and educated at St. Andrews and Glasgow universities. He served successively with the Tharsis Sulphur & Copper Co. and the Rio Tinto Co. in Spain; at El Chico in Mexico; in Portugal and in California. He was for some years in partnership with G. D. Delprat, now well known in Australia. In 1905 he formed, with C. H. Stewart, the firm of Alexander Hill & Stewart, in London. The firm were consulting engineers for Le Roi No. 2 Ltd., at Rossland and for the Van Roi Mining Co. in the Slocan district, B. C. As consulting engineer Mr. Hill visited British Columbia several times.

Samuel P. Lewis, superintendent in charge of the railmaking, structural steel and sheet-steel piling mills of the Lackawanna Steel Co., Buffalo, died at his home in that city June 10, aged 56 years. He had been engaged in making iron and steel all his adult life and was regarded as one of the best authorities on railmaking in this country. He was born at Aberdare, Wales. His father was one of the first ironmakers to come to America from Wales, and the son followed his calling and was employed with the Illinois Steel Co. or its predecessors for 30 years, advancing through the different mill departments until 1905, when he accepted a position with the Lackawanna.

Societies and Technical Schools

American Institute of Mining Engineers—The Spokane local section will hold a meeting at Republic, Wash., during the last week in July. From Republic the party will proceed to the Boundary district of British Columbia, to visit the respective mines and smelteries of the Granby and British Columbia Copper companies.

Kentucky State University—A practical mining course has been added to the College of Mines and Metallurgy. It began June 10 and will continue until Aug. 2, and is intended especially to give practical instruction to miners, mine foremen and managers. The course is under the direction of C. J. Norwood, dean of the college, assisted by professors H. D. Easton and T. J. Barr. The subjects included are coal mining; mine gasses and testing; explosions and fires; mine surveying and map drawing; use of mine rescue apparatus.

Lake Superior Mining Institute—The seventeenth annual meeting of the Institute, will be held in the Copper Country, with headquarters at Houghton, Mich., Aug. 28, 29 and 30. Arrangements are now under way and an interesting meeting is assured. Members are invited to prepare papers for this meeting, and forward the same to the secretary as soon as possible, so that copies can be printed and mailed in advance. This will give an opportunity for more thorough discussion. The subject of "Mining Methods" on the various ranges presented at the last meeting should be further taken up, so that in time all the ranges in the Lake Superior district will be covered. Attention has been called to the subjects of "Uniform Mining Laws," "Workmen's Compensation Law" and "Safety Appliances," which should be taken up in special papers. Further circulars will be issued later, giving list of papers, and other information. A. J. Yungbluth, Ishpeming, Mich., is secretary.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

June 12—The South Eureka Mining Co. has initiated at the South Eureka and Oneida mines, in Amador County, the undertaking to solve the problem of disposing of the tailings from the mills in a manner to prevent damage to the farm lands in the vicinity, and in the hope that it will preclude any further complaint from the farmers. The South Eureka is well situated topographically for this purpose, as there is a natural depression where the tailings can be safely impounded. It is perhaps better situated in this respect than is any other mine in the county. There is evidence of disposition on the part of other mining companies to follow the example of the South Eureka, and to make such provision as is possible for disposing of or controlling the tailings. There is a diversity of opinion, expressed by the farmers, as to the effect of the detritus from the quartz mines. While it is known that crops have been successfully grown on land made of the tailings when a little scientific knowledge has been exercised, there are still farmers who declare that the detritus is not a fertilizer. The flooding, of course is not damaging to the land, and it is quite certain that quartz tailings, after disintegration and mixing with the natural wash of the soil, are a valuable aid to the productiveness of farm land. But the farmers complain. So the easiest way to remedy the supposed evil is to take care of the tailings, until the farmers progress to the point of knowing how to make advantageous use of them.

A tour covering the Real, San Diego, Sierra and Capital highways was started from San Francisco on June 10, in four touring cars. This tour was undertaken to demonstrate to the state engineer, the highway commission and others interested in the highways project the advantages of a continuous highway encircling the lower half of the state. An ultimate result of such a route will be to aid several mining districts that without it would likely remain unnoticed by investors for a long time. The passenger automobile is the forerunner of the auto truck. Both require much better roads than are demanded by horse teams. The mining districts that would be especially benefited by the adoption of the proposed route by the state highway commission, lie along the Sierra in Inyo, Alpine and Mono Counties. Eldorado would also be largely benefited, though that county is not in such need as Inyo and Mono, which are cut off by mountains on the west and by the desert on the south. The tour is conducted by W. G. Scott, a mining engineer of Bishop, and superintendent of the Treasure Hill mine in Mono County, will occupy about three weeks and cover about 1500 miles.

Denver

June 13—Dr. Victor C. Alderson, president of the Colorado School of Mines, announces that the new experimental ore-dressing and metallurgical plant, built for the school at Golden at a cost of $125,000, will be opened July 1. The plant, when fully equipped, will consist of four units, sampling, concentration, cyanidation and a fourth devoted to roasting and special apparatus, such as magnetic and electrostatic separators, dry tables and flotation schemes. Its facilities will also be available to experts who desire to make their own investigations. Floor space has been reserved for testing new devices. An inventor who wishes to perfect his invention can have the facilities of power, water, floor space, and ore supply at slight expense. While intended primarily for the use of the school, its advantages will be extended to those engaged in the solution of problems connected with ore dressing and extraction.

Plans for the building were drawn by Frank E. Shepard, president of the Denver Engineering Works. They were passed on by D. W. Brunton and Philip Argall, and mining engineers in all parts of the country gave suggestions. Finally, a reward of $50 was offered to the graduate who would make the best suggestion for improvement. This prize was won by Wallace A. Stephens of the class of 1898. The plant is in charge of Prof. F. W. Traphagen, director, and William G. Haldane, manager. Since the work done for individuals and companies will be charged for at reasonable rates, the plant will not interfere with private enterprises of a similar nature.

The largest amount ever awarded by the Federal Court has been given to the Smuggler-Union company in the Telluride district, in its suit against the Liberty Bell mine for removing ore from the claims of the former company. The amount claimed was $600,000 and the amount given by the court was $400,000. The basis of the suit was disregard of the apex law. Bulkeley Wells is president and general manager of the Smuggler-Union.

In the Paradox Valley region the uranium-vanadium interests are busy. The American Vanadium Co., owner of a mine in Peru, the Standard Chemical Co., and the General Vanadium Co., have bought claims and have been shipping test lots of ore. The Crucible Steel Co. has also purchased claims there. The Primos Chemical Co. is operating its mill at Newmire, Colo., and is turning out a good product. A large body of vanadium ore has been opened in new ground.

The *Herald-Democrat* gives the following Leadville production for May: From the Waterloo shaft, Carbonate Hill, the lessees sent out a little more than 1000 tons. From the Star properties 4000 tons of ore were shipped during the month. The Iron-Silver Mines Co. shipped 4000 tons, not including the tonnage shipped by leasers from the different properties of the company. The tonnage from the Yak tunnel was about 11,000. From the South Evans section fully 3000 tons were shipped from the different properties. From the Penn mines, Breece Hill, 4500 tons were sent out; from the Ibex, 7000 tons of all classes of ore were shipped. With these figures as a basis, fully 60,000 tons of ore are being hoisted per month throughout the district. Ore shipments from the Leadville station of the Denver & Rio Grande R.R. to valley smelteries and various zinc plants show a gain of 16,400 tons for the first five months of 1912 compared with the same period in 1911. It is asserted that the average gain for the Leadville district in ore output, of 1912 over 1911, is 25 per cent.

Butte

June 12—In the last 10 years, the Georgetown district has produced about $5,000,000, and this was done with poor transportation facilities, rough wagon roads with long hauls having been the only means of getting the ore out. The fact that construction of the extension of the Butte, Anaconda & Pacific R.R. into the district is actually in progress will bring the district into the foremost ranks of producing camps, as there are many low-grade prospects there, requiring only cheap transportation to make them mines. The effect of the new conditions is already being noticed by the inquiries being received from outside men, and some important transactions in mining property are being negotiated at present.

W. H. Sheets, a farmer, living near Silesia, in Carbon County, in drilling for water on his farm has found natural gas, which burned to a height of 15 ft. The drill had attained a depth of 107 ft. when the gas began to flow in such quantities as to stop operations. A number of years ago, two wells were sunk in this district, to a depth of about 750 ft., and a small amount of gas has been flowing from them ever since, although in nothing like the quantities noted this time.

The 1600-ft. level of the Mountain View mine of the Anaconda, has been opened from the airshaft only, but some excellent orebodies have been encountered and are being drifted on with such good results, that it has been determined to make it one of the principal working levels; a crosscut is now being driven from the workings to connect with the main hoisting shaft, after which electric motors for hauling ore will be installed. The machine shop on the surface, which is of brick, is being torn down and will be replaced with a steel-frame building.

The development of the Butte & Superior from a copper mine to a producer of zinc has been of absorbing interest to many mining men, and may mean much for some other mines in the district and for the camp as a whole. Underground operations have been extended to the 16th level and zinc ore continues to be opened. The new mill is said to be operating satisfactorily, and to be producing unusually clean tailings.

Salt Lake City

June 13—Improvements recently made at the Utah Copper Co.'s Arthur mill include coarse-crushing equipment, coarse rolls and gyratory crushers, new conveyor belts, Garfield roughing tables, classifiers, etc. The Nissen stamps have been replaced by rolls and Garfield chilean mills. These are larger and have higher sides than the ordinary chileans. The product from the roughing tables is classified in Janney-Richards classifiers, and the coarse product sent to the chilean mills. The new Janney-Richards classifiers have been running about two months. Additional transformers have been installed. Ten of the remodeled sections are running and the 11th and 12th are practically completed, the latter being over half finished. Work has not been started on the 13th section and it is not known when this will be changed. Between 5000 and 6000 tons per day are being treated. The reservoir of the Arthur mill has been cleaned out to free it from the accumulated slimes, etc. There is an experimental plant in which a new 12-deck Wilfley slime table is being tried out. New feed tanks have been added in the Magna mill, which is treating between 10,000 and 12,000 tons per day.

A number of improvements are being made at the Garfield townsite for the employees of the mills and smelteries. Five or six new brick terraces are being built, and ground is being broken for 18 bungalows. There are no frame houses, the buildings all being of concrete and brick. Two new switch engines have been received by the Bingham & Garfield R.R. to be used about the mills, for switching concentrates, etc. Grading on the branch line of the Bingham & Garfield R.R. to the American Smelting & Refining Co.'s sand pits near Saltair, has been practically finished and track is being laid. This sand will be used in banking up some of the reverberatory furnaces. There are five reverberatory and two blast furnaces in operation at present. Two of the reverberatories have been equipped for burning California crude oil as fuel, and are giving satisfactory results.

During May, the U. S. Assay Office at Salt Lake received gold and silver bullion worth $126,339. This is approximately 10% greater than usual. In April, bullion worth $65,771 was received. The total business for the first five months of the year amounted to $550,643, or over $110,000 per month. The total receipts in gold and silver bullion, since the opening of the office three years ago, have amounted to $3,792,115, making over $100,000, average monthly receipts.

Negaunee, Mich.

June 15—Drilling still continues in the region west of Republic. The Oliver Iron Mining Co. has a drill in the Fence Lake country, in Sec. 5, T. 46-R. 31, and one on Sec. 1, T. 46-R. 31, but the latter drill will probably be moved to the vicinity of Fence Lake soon; the Oliver camps have been moved westward to be nearer to the drills. The Jones & Laughlin Co. is still operating two drills on Sec. 30, T. 47-R. 30, south of the old Magnetic mine; this property, owned by the Norman Iron Co., was platted for a townsite a number of years ago, and a series of legal entanglements arose when the Jones & Laughlin Co. took the option to drill. In the Cascade district, the E. J. Longyear drills on the Kirkpatrick lands, near the village of Palmer, are still at work with three crews, while drilling continues on the Heidelbach lands, at the eastern end of the range.

The valuation of the Brotherton iron mine, on the Gogebic Range, in Michigan, was recently reduced from the high figure given it as a result of the appraisal by J. R. Finlay. The reduction is from $954,000 in 1911 to $400,000 in 1912, the reasons for the change being arguments presented by Pickands, Mather & Co.'s representatives, as to quality and amount of ore in the mine. At the same hearing, the mining company asked for reductions in valuation of their Sunday Lake and Mikado mines, but were refused. All three mines are situated at Wakefield, Gogebic County.

Toronto

June 15—The action of the Canadian Government in temporarily remitting one-half of the duty on imported cement is strongly opposed by the Canadian cement manufacturers. In the JOURNAL of June 15, the cement situation in western Canada was outlined in these columns. Some of the smaller independent companies state that they will have to close down, as they cannot compete successfully with the American plants, under the reduced duty. The effect of the remission was apparent immediately in the sending of large orders from the principal western cities for supplies of American cement. It is understood that the government's action is not necessarily final, as Hon. W. T. White, Finance Minister, is still engaged in an investigation of the whole question, including the matter of freight rates and car shortage; also that the future policy of the government as regards the tariff on cement will be determined by the result of his inquiries.

Cobalt

June 15—Several Cobalt mining companies are again agitating for a reduction of the heavy royalties which they have to pay. The City of Cobalt pays 25% of the net profits to the Temiskaming & Northern Ontario Ry. Commission. The Chambers-Ferland pays the same royalty to the Ontario Government, and the O'Brien pays 25% on the gross output. It has always been felt by the companies that such royalties were excessive and it is now believed that relief may be granted. The Chambers-Ferland company has never paid a dividend and the City of Cobalt has not paid one for two years.

The decrease in production of Cobalt mines is evidenced by the falling off in shipments of the Kerr Lake and Crown Reserve. For the first six months of the present year, the Kerr Lake has shipped 310 tons of ore, as against 733 tons for the corresponding period of 1911. Over the same periods the Crown Reserve has shipped 210 tons, as against 492 for last year. While a considerable part of this decrease may be attributed to the larger amounts of bullion produced and the smaller shipments of low-grade ore, the fact remains that both of these companies are producing less silver than they did last year.

Recent discoveries in Gowganda seem to have given that district a new lease of life. There are now three producing mines. the Mann, Millerett and the Miller Lake-O'Brien. These companies are in better shape than they ever were before, and all have larger ore reserves than at any time in their history. The construction of the railroad into Elk Lake has caused some revival of interest among the owners of mining properties. Mining in this section, however, offers small chance of any return.

The Mining News

The Current History of Mining

Alaska

Prospectors are beginning to outfit for the Port Wells region; the snow is going rapidly as the amount of snow is less than usual and the weather fine.

W. A. Dickey, of Landlocked Bay, is working a crew of about 15 men. His ore reserves are increasing constantly. He has lately built a wharf and will probably soon be one of the regular shippers of copper ore from this district.

The principal activity is in the Shoup Bay district, where the Cameron & Johnson, Bence & McDonald and the Rambler mines are being developed with crews of from 5 to 20 men each. The tunnel on the Bunker Hill property shows a vein from 6 to 24 in. wide for about 150 ft. The ore runs from $5 to $100 per ton.

Midas—E. F. Gray is examining this copper property, across the bay from Valdez, with a view to acquiring it.

Yukon Gold—It is reported that the company has acquired extensive interests in the Iditarod district.

Schlosser—Ore has lately been struck on this property, on Fidalgo Bay. The conditions had been rather unpromising there for a time, previous to the late discovery.

Blakenev—It was reported recently that the managers of this property, on Fidalgo Bay, will soon install an aërial tram. and begin shipping ore.

Three-in-one—C. E. Campbell, representing English men, is making an examination of this property, near the Cliff mine, with a view to purchasing. The mine is a low-grade property, with a large vein, and is now under lease to the Heckey brothers, one of whom is an owner.

Arizona

Gila County

Superior & Boston—The company is shipping to the Old Dominion smeltery about three cars per week of ore reported to average about 8% copper. The ore is coming from the stope below the sixth level on the Great Eastern vein. A crosscut has been started south toward the Limestone vein, opened through the Limestone shaft to the third level. About 55 men are employed.

Arizona Commercial—At the Copper Hill shaft the west drift on the fourth level has reached the boundary and connections made with a drift from the Gray shaft of the United Globe mine of the Old Dominion. Work is concentrated on the enlarging of the shaft to three compartments, working upward from the fourth level.

Black Warrior—The lease of P. S. Tate and the Lyle brothers on the first level has expired and the mine is being worked by the owner, the Warrior Copper Co. Development is in progress on the fifth, or lowest level. E. M. White is manager.

South Live Oak—Churn-drill hole No. 1 is still at about the 640-ft. mark, no progress having been made for two weeks because of serious caving and the loss of the tools in the hole. The tools have been recovered and casing will be put in; it is expected that drilling will be resumed within two or three days. The last 40 ft. have been in soft, altered granite, carrying considerable copper carbonates, and some chalcocite is reported.

Southwestern Miami—Churn-drill hole No 5 is 680 ft. deep in schist formation. Hole No. 6 is 545 ft. deep and is in schist. A string of tools is lost in the hole, which is being enlarged with a 10-in. under-reamer, preparatory to driving the casing before attempting to recover the tools. Hole No. 7 is in conglomerate and is 305 ft. deep. Hole No. 8 is 100 ft. deep in schist. None of the holes is yet in ore.

Inspiration Consolidated—The sinking of one of the new three-compartment working shafts has been started, and a headframe and hoisting equipment will soon be erected. The spur from the Arizona Eastern R.R. to the millsite and mine has been located. Grading for the concentrator is expected to start in about a month. Three of the development shafts are being sunk to greater depth and the ore is being blocked out for mining. Additional boiler and compressor capacity are being provided at the portal of the main tunnel, after which the underground force will be increased. W. H. Aldridge is at the mine.

Gibson—This mine, nine miles west of Miami, is shipping about three cars of ore per month to the Old Dominion smeltery. The ore is reported to average about 16% copper. Ten cars of ore have been shipped since the Gibson Copper Co. resumed the working of the mine in February. About 20 men are employed.

Keystone—Hole No. 52 is being drilled. Henry Krumb is making an examination of the mine for the Inspiration Consolidated Copper Co.

Santa Cruz County

Chief—This mine next to the World's Fair has been bonded for $60,000 to the Calumet & Arizona company.

Texas—M. M. Trickey is shipping from this property of the Duquesne company, on a lease with a royalty of 50 per cent.

Lafayette—McCarthy & Sheehy have optioned this group to the Copper Queen company.

Sonora—Pollock & Sheuat, representing Bisbee men, are shipping carbonate copper ore.

Volcano—Richard Farrel has bonded this group and some other claims to the Calumet & Arizona company. A great deal of work has been done upon this property and a good showing of ore made. The price is $100,000 distributed over two years.

Red Hill—The Copper Queen company is doing work on this property, on a speculative basis. The showing is attractive and deep work is expected to show ore.

Morning Glory—This property is shipping two cars of ore per week to the Pioneer smeltery. The owners of the smeltery have a bond on the group.

Pluto—Chapman & Crisman have taken over this property from A. C. Freeman and will work it. There is hematite cropping, that it is hoped may cover a copper deposit. This was worked and a smeltery built on the ground by Colonel Bean, some years ago.

Ivanhoe—The Copper Queen company has completed a thorough examination of this property with view to purchasing it.

California

Amador County

Following an address recently made by a representative of the Western Federation of Miners, several new members were added to the local union at Sutter Creek. There have been several attempts recently to revive the miners' union at Jackson. The Western Federation is not strong in the Mother Lode region. The skilled workmen are fairly paid and are generally contented. The unskilled labor in most districts is usually done by foreigners who do not seem to be in any special need of protection.

Butte County

A vein has been uncovered on the Crane ranch, near Oroville, which carries gold and copper ore. The occurrence of copper in this section is probable, as it is in line with the southeast strike of the west side copper belt of Shasta County, that is also exposed in Nevada County. Whether copper may be found in Butte County, in commercial quantity, remains for the prospector to learn.

The organization of the Oroville Exposition Association has been completed for the purpose of erecting an exposition building. The exposition held several months ago served to attract unusual attention to the mineral resources of the county. S. N. Feldhein is president and George P. Morse is secretary.

CALAVERAS COUNTY

Gold Cliff—The caving of the rim of the open cut in which the hoist and the gallows frame are situated, is reported to have damaged the engine and to have carried several tons of rock and soil into the shaft. Definite information is not available, but it is not likely that a great amount of débris reached the shaft if the caving was on the hoist-house side. The mine was formerly worked by an open cut, 500 ft. long and 200 ft. wide at the top, and from 25 to 75 ft. wide at the bottom, at a depth of more than 150 ft. The engineer had stepped out of the house just before the caving occurred. No one was injured.

INYO COUNTY

Cerro Gordo—This property is reported to have been purchased by Utah men and will be operated by modern methods. The ore is a lead carbonate, containing zinc and silver. Shipments are being made regularly and are carried by an aërial tram to Keeler, for transportation by rail.

Independent Lead-Silver Mining Co.—The property is situated on the Inyo Range, 25 miles east of Keeler, and contains 400 acres. The ore is argentiferous lead, carrying some copper. Prospecting has been done with shallow shafts and several cars have been shipped for test runs. Two auto trucks have been purchased for hauling ore to Keeler. The auto road will be shortened to about 12 miles. S. H. Brady, of the West End Consolidated, has been appointed general manager and consulting engineer.

KERN COUNTY

The Pacific Crude gusher, which caught fire on June 2 and burned constantly for six days, has been brought under control and the fire extinguished. A strong wind lifted the column of burning oil away from the well and carried it 100 ft. high. All the steam from the temporary boilers was immediately directed against the mouth of the well, thus preventing further ignition. The wind drove the burning oil across the sumps and away from the well, and the flames were soon controlled and extinguished. The well continues to flow, and is pronounced one of the best prospective producers in the northern part of the field. It is 3252 ft. deep.

California Trona—The receiver is having a mineral survey made, and is putting the old plant in shape for experimental work.

LOS ANGELES COUNTY

Little Rock Power & Water Co.—A survey was made recently for this company's reservoir and pipe line, for the power plant. The dam will be 100 ft. high, with an upper length of about 400 ft. The pipeline and penstock will have a diameter of 22 in. under a head of 800 ft. in seven miles' distance. Power will be carried 60 miles over the Mohave desert to Randsburg, for use in milling ore at the Yellow Aster mine.

MODOC COUNTY

The snow is reported to be going off rapidly and the prospects are that the rush into the Highgrade district will increase. It is also reported that the Ft. Bidwell and the Sunshine mines will resume work on a larger scale.

NEVADA COUNTY

Champion—The 20 stamps began dropping on June 6, for the first time since the property was taken over by the North Star. Thorough and extensive development has been in progress for 1½ years. The mill is being fed from development ore in the 1600-ft. drift of the Merrifield shaft.

SAN BERNARDINO COUNTY

Horn—This property in the south end of the Turtle Mountains, has been examined by William Neagle, engineer, representing the United Verde. No definite information is given out as to the result of the examination.

SHASTA COUNTY

Heroult—Four cars of products of the new electric plant were recently shipped to San Francisco, one each of pig iron, tar, pitch and lime. This is the last car of pig iron from the first continuous run of the smeltery. New electrodes are being installed, and the horsepower will be increased from 1200 to 2000. Two more furnaces will be installed.

TUOLUMNE COUNTY

App—This mine has not been sold, as previously reported. The mine and 60-stamp mill have been closed indefinitely. There have been examinations made by prospective purchasers, the last of whom was the Tonopah-Belmont. Whether the negotiations are closed has not been definitely stated but there is no immediate prospect of a sale.

Black Oak—This mine is being operated by C. E. Knox, of the Montana-Tonopah company. The 20-stamp cyanide mill is said to be securing a 96% extraction. It was erected by the Trent Engineering Co., which is also installing a 100-hp. electric motor to run the hoist.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

Newhouse—The 100-ton mill will be designed to treat ores by amalgamation, concentration and cyanidation.

Little Richard—The shafthouse, ore-sorting house and machinery of this company, in Soda Creek, were destroyed by fire recently.

Cully—It is reported that development work will be resumed at this tunnel and at the Alco mine. The company contemplates the installation of a new hoist and compressor. James J. Cully is manager.

Gem—A new steel and masonry shafthouse is to be built to replace the buildings recently destroyed by fire.

Mackey—It is reported that a rich strike has been made in this mine in the Apex district, on the 250-ft. level. The orebody is 6 ft. wide. George Pyle is superintendent and J. L. Mountz general manager.

LAKE COUNTY-LEADVILLE

Garbutt—The shaft is 950 ft. deep. The ore is found in a fissure vein and is a gold-bearing copper sulphide.

Western Mining Co.—In May the Carbonate Hill mines produced about 8000 tons of carbonate-of-zinc ore and the A. Y. & Minnie about 1000 tons of zinc sulphides.

Fairplay—Shipments of 18 tons per day are going out from this mine in Adelaide Park. The main orebody is 40 ft. wide and 14 ft. high, with an average grade of about $10 per ton. Small streaks of high-grade ore are being sacked and shipped separately.

Mt. Champion Mining & Tunnel Co.—Thirty-five men are employed and Manager Smith expects soon to start the new mill.

SAN JUAN DISTRICT

Gold King—Under the management of J. H. Slattery, associated with Otto Mears, the mine is operating satisfactorily under the leasing system. New Wilfley slimers will soon be added to the mill equipment. Railroad traffic will soon be resumed to Gladstone and the stored concentrates will then be removed and the mill pushed to full capacity. Slattery and Mear's are also operating the Iowa under lease and have several months' ore supply there.

Intersection—This mill, as yet the only one operating on the eastern range, will enlarge to 30 tons, adding a Wilfley table and Frue vanner to its present equipment. An attempt will be made to percolate the coarse sands. This mill is the pioneer in the treatment of the ores of this range.

Frisco Tunnel Co.—The framework for the new mill at Animas Forks is being framed at Silverton and the mill is to be installed soon. It will use chilean mills, classification and table concentration. It is the intention to make two table products, lead and zinc. Lack of iron will permit of table concentration without use of electrostatic or other treatment, it is claimed.

SAN MIGUEL COUNTY

Smuggler-Union—The machinery for the new mill is being installed and when completed a much larger saving on the ores from the lower levels will be effected and the mine probably operated more successfully.

Nellie—G. H. Hall, lessee, has increased his force to 17 men and will start the other five stamps of his mill.

TELLER COUNTY-CRIPPLE CREEK

Midget-Bonanza—A body of ore has been opened by Allen & Carr, lessees, and in the Gold Hill tunnel level an electric hoist has been installed to raise from a winze.

Doctor-Jack Pot—Supt. Carl Evans has leased the ground on the new eighth level, south of the shaft on the Smith-Riley vein to Jerome Beard and two blocks north will be leased this week. Wilson Brothers, leasing the Ingham block, have opened a shoot giving them 100 ft. of stoping. It was struck 200 ft. below the Raven Hill tunnel. Thomas Bailey will ship soon from his lease on the Lucky Corner and F. C. Whitford has just shipped 40 tons of $25 ore.

Henry Adney—This company, operating on Beacon Hill, is considering the purchase of the Maid of Orleans, Little Joe, Chickenhawk and August Flower claims, undeveloped ground but in a rich territory.

Gold Dollar—The May output was 1495 tons, of a gross value of $23,220. Average grade was $15.53 per ton.

Ajax—In May the shipments were about 1000 tons of ore of an estimated value of approximately $30,000. B. Colburn is superintendent. The mine has been shut down pending alterations in the Clancy process mill.

Cresson—This mine, under the management of Richard Roelofs, is credited with a production in May of 2400 tons, worth about $25 per ton in gold.

Masterpiece—This company is developing a large dike by a tunnel into Big Bull Mountain. A 6-drill compressor is being installed.

Gaylord—The foundations of the mill on Bull Hill are about completed and the installation of machinery will commence soon. Supt. W. A. Reed thinks that by Aug. 1, the mill will be in operation.

Delmonico—A rich oreshoot is reported to have been opened at 1000 ft., in this mine on Bull Hill, by Hinds & Luce, of Cripple Creek, lessees.

Idaho

BLAINE COUNTY

Golden Glow Mining Co.—The 900-ft. tunnel on the Trapper claim has encountered the vein at a depth of 1200 ft., and work is progressing on the vein. The property is owned by Portland, Ore., men, and is managed by William Schultz.

Boulder Consolidated Mining Co.—The vein on the Red Boy claim has been opened at a depth of 350 ft. The company is controlled by Boise, Ida., men, and William Schultz is manager.

Independence Mining Co.—The new 100-ton concentrator was placed in operation, June 1, and is expected to run continuously for some time, as a quantity of ore is blocked out in the mine. The company is involved in litigation. H. J. Allen is manager.

COEUR D'ALENE DISTRICT

Federal—Harry L. Day, former managing owner of the Hercules mine, at Burke, has been elected president and general manager of this company, succeeding F. H. Brownell, elected chairman of the Federal board of directors. The Hercules tonnage practically gives the Guggenheim interests control of the smelting of lead ores from this district. W. Clayton Miller preceded Mr. Day as manager. Mr. Day developed the Hercules from a prospect to the point where $5,000,000 was refused for the mine within the last year.

IDAHO COUNTY

Welch Tunnel Gold Mining Co.—This company was organized in 1911, by Elk City men, to develop a gold mine, two miles from that place. Preparations are being made to install a mill to treat free-milling ores. R. Kemp Welch, Elk City, formerly in charge of the Idaho Champion Mining & Milling Co., is manager.

Michigan

COPPER

Ahmeek—The hoisting and surface equipment for shafts Nos. 3 and 4 is on the ground and is being assembled. Extensive openings are being made underground. Plans are being made for the enlarging of the stamp mill, which will be necessary to take care of the increased production from the new shafts. The mill was originally laid out with this in view, insomuch that the pumping facilities and boiler capacity are ample to meet future needs.

Isle Royale—It is reported that a search for the Kearsarge lode will be instituted soon, and that a crosscut will be started from No. 6 workings to look for the Baltic or West lodes.

Island Copper Co.—This company, organized several years ago, is said to be preparing for operations on its lands on Isle Royale. These comprise about 92,000 acres. Plans include extensive diamond drilling and it is unofficially reported that about $500,000 will be expended in this work. Thomas F. Cole and associates, are interested.

Osceola Consolidated—A small force of men is at work in shafts Nos. 5 and 6, making arrangements preparatory to regular production. These shafts have not produced since March, 1910, but during the intervening time have been overhauled and put in shape to handle an increased tonnage. It is believed that these two shafts will be producing at the rate of at least 500 tons of rock per day each, within a short time.

Hancock—No. 2 shaft, at 3660 ft., has entered a copper-bearing formation, which is believed to be the Pewabic lode, the objective point in sinking. Should this prove to be the case, lateral openings will be started on the formations that have been revealed in the opening of this shaft, and the property put on a producing basis.

Winona—This company is gradually increasing its underground forces, in order to increase production, but it is having difficulty in securing the desired class of workmen.

IRON

A crew of men is cutting the right-of-way for the Chicago, St. Paul & Milwaukee Ry. between Crystal Falls and Iron River; camps have been constructed and a steam shovel is expected.

Peninsula Power Co.—This Iron Mountain company, which is furnishing power to mines at Iron River, has let a contract for the erection of a substation at the latter place.

Lucky Star—In the sinking of this shaft 15 ft. of quicksand were encountered at 55 ft. depth. It was found necessary to move the temporary headframe to one side, with rollers, and to use the drop-shaft method of sinking. The timber sets are put in with no space between, and the structure sinks by its own weight, while men at the bottom of the shaft dig out the sand and keep the shaft straight.

American—At this M. A. Hanna mine on the Marquette Range, work has been commenced on the erection of the iron-ore concentrator by Contractor MacArthur, of Denver. Spiles have been driven and the framework started; the site is just north of the shaft; it is planned to have the concentrator finished and in operation by winter.

Bristol—Work on the steel headframe being erected at this Crystal Falls mine was recently delayed by a strike of the steel workers.

Cleveland-Cliffs Iron Co.—A diamond-drill hole has been started west of Negaunee and a short distance south of the Jackson school-house; it is on the lands formerly belonging to the Jackson Iron Company.

Montana

BUTTE DISTRICT

Anaconda—At the Mountain View mine about 600 men are employed at present in the mine and on surface, and an average of about 1850 tons of ore per day is being hoisted. The airshaft has been sunk to a point 31 ft. below the 2000-ft. level and sinking has been temporarily discontinued to permit the cutting of a station on the 2000-ft. level; as soon as this is completed, crosscutting will be started on this level.

Elm Orlu—During the year ended June 1, 1912, this zinc and copper mine owned by W. A. Clark, situated just west of the Butte & Superior mine, was operated at a loss of $21,160. During that time 47,194 tons of ore were extracted at a cost of $6.14 per ton. Transportation costs were $92,226; ore treatment, $118,-629. Construction amounting to $9659 was done, making $500,293 total operating costs, against gross proceeds of $481,-133. Owing to the destruction of the concentrator of the Butte Reduction Works, where the Elm Orlu ore was treated, the mine has been closed down for the last six months, except for repair work.

Pilot Butte—The shaft on the Pilot claim is being sunk 80 ft. per month, and is now over 1100 ft. deep; it will be continued to the 2000-ft. level before more development is done. The old hoist formerly used at the Tuolumne mine, has been purchased and is being remodeled to a capacity for hoisting from 2500 ft. depth. About $123,000 have been raised among stockholders recently.

BROADWATER COUNTY

Butte & Radersburg—The shaft has reached the 200-ft. level, and preparations are being made to crosscut to the veins, of which there are three outcropping on surface.

DEER LODGE COUNTY

During the winter some development work was accomplished in the Georgetown district, although owing to the poor condition of the roads, little ore was shipped. The roads are now in good condition and a season of much activity is predicted for this region. Many properties are beginning to ship ore to the Washoe smeltery at Anaconda.

Oro Fino—The mine orebins are full and the mine, managed by Charles Bostrom, will begin hauling.

Holdfast—Robert Lindberg, who is operating this mine under a lease, has obtained good results lately, and will be ready to ship ore soon.

Georgetown Placer—Supplies and lumber for an active season's work have been purchased and work will be started when they arrive. The company owns placer ground in the district and will do development work.

Baltic Combination—Surface quarters are being erected at the mine and development work will soon be started.

FERGUS COUNTY

In the Cone Butte district, Vincent Gies and Herbert Jones began work on their claims a short time ago.

Hugh McIntyre is mining good ore in his mine, in the Cone Butte district, and has about a car of $100 ore ready for shipment.

JEFFERSON COUNTY

Baltimore—This mine near Boulder has been closed down by Jack Mulligan, of Butte, and Charles Whitcomb, of Helena, who have been operating it on a lease. They have been working there for some time and have taken out about 4000 tons of ore which brought a fair profit. B. E. Calkins, and others of Butte, own the property.

MADISON COUNTY

Clipper—Edward Smith, of Pony, who is operating this old mine near that place under a lease, has made a strike on the 1800-ft. level. Twenty-five men are employed and the mine is shipping ore.

Nevada

COMSTOCK LODE

Union Consolidated—North and south drifts have been started in the east vein on the 2500-ft. level, and both are in quartz. The vein is broken up where opened, and porphyry is mixed with the quartz. The east crosscut on the 2200 is in diorite.

Mexican—The new clarifiers in the mill are at work, and the result has been an increased tonnage and percentage of extraction. Eight bars of bullion, from the cleanup of one of the tanks, were shipped last week.

C. & C.—The new bearings for the Riedler pumps, on the 2000 station, are being fitted, and will permit these pumps to handle hot water direct from the deep levels.

Belcher—Development in a southerly direction on the 15-in. stringer, cut by east crosscut No. 4 on the 1400-ft. level, has been started.

Yellow Jacket—A car of concentrate has been shipped to the smeltery from a cleanup on dump rock, and run No. 7, on Crown Point ore, has been started.

ESMERALDA COUNTY

Blue Bull—The installation of a new 40-hp. electric hoist has been completed and enlarging the 400-ft. shaft on the Hat claim of this company from 4x7 to 4½x9½ ft., is under way, preparatory to sinking to 600 ft. From that depth a crosscut west will be run to explore the Hat claim. K. M. Simpson is manager. The company is undergoing reorganization and will be known as the Reorganized Blue Bull Mining Co.

Florence—Superintendent Dewey has started a raise on the rich orebody struck several weks ago in virgin ground on the 250 level. A crosscut to tap the new orebody on the 350 level is also under way. About 100 ft. of crosscutting will be necessary on the lower level. New orebins have been constructed on the surface to facilitate the handling of the ore from the new strike.

Pittsburgh-Silver Peak—Manager Bradley states that the recent strike of miners is no longer a matter of concern. New workmen have been imported and operations are practically normal.

International Smelting & Refining Co.—The company has established a state agency office in Goldfield. F. M. Chambers has been appointed state manager.

Diamondfield Extension—Sinking has reached the 50-ft. point and a station is being cut preliminary to crosscutting east and west.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended June 6, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,350	75,919
Tonopah Belmont	2,050	46,876
Montana-Tonopah	899	23,339
Tonopah Extension	1,035	22,167
West End	663	16,264
Midway	......	180
MacNamara	470	8,195
North Star	......	80
Totals	8,467	193,020
Estimated value	$211,675	......

Tonopah-Belmont—The report for May states that the company milled 7956 tons of ore producing 261,197 oz. silver and 2650.33 oz. gold, the net profits for the month amounting to $125,646.

MacNamara—In May the company treated 2084 tons of ore, being 427 tons in excess of April; the net profit for the month was $8567.

Tonopah Halifax—At a depth of 1275 ft., a quartz vein carrying low-grade ore and dipping at 36 deg. was entered; the shaft has penetrated the vein for 36 ft. but has not yet encountered the footwall.

Montana-Tonopah—The production for May was 4611 tons of ore, yielding $47,-614 in bullion and 54.70 tons of concentrates.

WHITE PINE COUNTY

Giroux—The company is reported to have rented a traveling crane and clamshell bucket from the Nevada Consolidated and to be making increased shipments to the Steptoe plant. June shipments will probably include 100 tons of concentrates from the run made three years ago at the company's plant at Kimberly.

New Mexico

GRANT COUNTY

W. T. Bryant intends to erect a 100-ton mill to treat the ores from his mine and to do custom work for other mines operating at Pinos Altos.

Dimmick—This silver mine is being unwatered.

Lucky Bill—Larsh, Ross & Co., of Silver City, recently purchased this mine from the Bryne-Wensley Mines Co., of Denver. The ore is lead carbonate and about 15 cars per month has been the production for a year.

Cleveland—The new machinery has arrived and will be erected soon. The usual shipments are being made. A car of ore and concentrates shipped recently is reported to have netted over $1300. Particular attention is being devoted to the zinc products.

SOCORRO COUNTY

Deadwood—A good tonnage of custom ore is being treated, delivered by four mines in process of development. A large ore reserve is accumulating in the mill.

Ernestine—The first 10-day bullion cleanup for June is being smelted.

Oaks—Fifty-five tons of ore were recently delivered to the Deadwood mill from a week's development at the Pacific and Johnson mines. Leasers have started work on the Susie and other mines.

Mogollon Gold & Copper Co.—One thousand feet of air pipe have been delivered at the Little Charlie tunnel and are being carried forward to the winze, which is developing one of the highest-grade orebodies in the district. The product is sent to the Deadwood mill.

New Jersey

American Smelting & Refining Co.—The strike of employees at the company's refinery, in progress for several days, was settled June 18. Slight concessions were granted by the company.

Oregon

LANE COUNTY

West Coast Mines—This property, near Orseco postoffice, is being worked, and an occasional brick is sent out. There are 30 stamps but only about 15 are busy. Power is furnished by an electric plant.

Mayflower—This mine is being developed and ore blocked out, and it is thought that the mill will soon be started. This mill was hauled in last summer. W. P. Eley, of Kelso, Wash., is manager.

Vesuvius—The buildings destroyed by fire recently will be replaced and development work done. Mr. Hard, manager, may put in an addition to the 10-stamp Hammond mill.

Utah

BEAVER COUNTY

Granite Copper Co.—This company's King-of-the-Hills property is reported to have shipping ore in a winze from the upper tunnel.

Moscow—The usual output of three or four cars per month is being maintained, yielding returns of about $1200. Six teams are hauling ore.

JUAB COUNTY

Victoria — Returns from two cars shipped recently were nearly $5000. Drifting is being done in several places on the 1200 and much development is in progress.

Eureka-Swansea Extension—The new electric hoist is ready for operation, and drifting to the east will be done on the 300-ft. level. Frank Nielson is superintendent.

Mammoth—The case brought by the company to prevent Werrett & Orton from shipping the old McIntyre mill dump is expected to come up for a hearing soon. An injunction was issued by Judge Marshall. Werrett & Orton purchased the dump, and shipped 3000 tons of the ore on which they made a good profit. There remain about 6000 tons, probably of the same quality. The company claims that the purchasers fraudulently misrepresented the dump's tonnage and obtained it at a low figure. The leasers deny this, and say that they paid the company the price asked, 75c. per ton, taking the company's figures with reference to the tonnage.

SALT LAKE COUNTY

Bingham-New Haven—Shipments of copper and lead ore are being made, the former being sent to Garfield.

Utah Copper—The contract for electric power with the Telluride Power Co., which was taken over when the company acquired the Boston Consolidated, will not be renewed. The power plant at the Magna mill is expected to be enlarged to provide ample capacity for both plants.

Bingham Mines—Two shifts are sinking the Yosemite shaft, to connect with the Mascotte tunnel, which will give a depth of 2200 ft. on the incline from the collar. The shaft is down 800 ft. There has been a good production of both copper and lead ore above the 800 level of the Yosemite. The Dalton & Lark and Commercial mines are shipping between 100 and 200 tons of lead and copper ores per day. Earnings for April were approximately $14,000.

Utah Bingham—At a recent meeting the stockholders authorized the sale of the property to the New Utah-Bingham Mining Co., to be organized by the directors. Stock will be exchanged share for share.

Michigan-Utah—Several of the directors accompanied by a tramway engineer have made an inspection of the tram line from the City Rocks mine at Alta, the repair of which is being considered. This tram extends to Tanners Flat, three miles above Wasatch. A movement is being agitated to reconstruct the old branch of the Denver & Rio Grande R.R. up to this point. If the tram line is repaired it will probably be used to send out Michigan-Utah ores through the lower tunnel of the City Rocks. With proper transportation facilities the output of this company's mines as well as of other Alta properties could be largely increased. On the Big Cottonwood side about 20 tons of ore per day are being shipped. A 78-ton lot recently marketed averaged 0.035 oz. gold, 51.7 oz. silver, 21.9% lead, and 1.2% copper, bringing net smeltery returns of $41.30 per ton.

Ohio Copper—The annual meeting was held in Portland, Maine, June 5, but little concerning this meeting has been made public. About 2000 tons of ore per day are being mined and milled. The gross earnings are estimated at about $35,000 per month. A part of the company's indebtedness to the Stewart Mining Co. and Davis-Daly is reported to have been paid off.

SUMMIT COUNTY

Park City shipments for the week ended June 7 were 3,533,720 lb. The Silver King Coalition, Daly West, Daly-Judge and New York Bonanza were the principal shippers. During May, the output of the camp was 7908 tons, which is higher than usual for this season of the year.

The new dam built by the Silver King Coalition, Daly-Judge and Daly West to hold tailings was placed in commission June 9. The water leaving the dam is clear of all tailings. The object was to divert the waters of Silver Creek to Richardson Flats so that the tailings, containing finely divided silver and lead, might be settled.

Daly-Judge—A new Richard-Janney classifier has been installed in the mill, and during the last 10 days the zinc middlings have averaged 43% zinc, as compared to a former rate of 25 to 40%. It is the best zinc middling that has been made by this company. Three of these new classifiers are in operation.

Silver King Coalition—It is reported that this property is being examined by English interests.

Little Bell—About 200 tons of ore are awaiting shipment. The roads are not yet opened.

Virginia

Zinn Iron Mining Co.—It is reported that this company has sold about 8000 acres of iron land in Rockridge and Augusta counties, to Pittsburgh men.

Washington

FERRY COUNTY

North Washington Power & Reduction Co.—This cyanide plant, which was designed to treat the ores of the Republic district, started operations recently with a capacity of 125 tons per day. H. W. Newton, Republic, is superintendent.

San Poil—The machinery for the new mill is in place and the mill about ready to start. This plant is smaller than the North Washington but is built along the same general lines.

Canada

BRITISH COLUMBIA

Victoria—J. P. Swedeberg has uncovered copper ore on this property, near Nelson. The mine is situated on a contact between augite-porphyry and limestone; it gives indications of becoming a producer. A compressor is installed and an aërial tramway connects the mine with the Canadian Pacific Railway.

Venus—W. Poole and associates have taken over and will soon commence opreations on this mine, situated in the Nelson gold belt. The ore will probably be treated in the Athabasca mill. There are uranium minerals in both this mine and the Juno, but so far no attempt has been made to recover them.

Richmond—This property in the Rossland district is under bond to Joseph L. Warner. Work was conducted through the winter and a shaft started in March is over 30 ft. deep. Surface water has hampered work. Four men are stripping and prospecting surface veins.

Le Roi—About 100 tons per day are being hoisted to the Black Bear tunnel and trammed to the ore bins on the Great Northern Ry. The ore is shipped to the smeltery at trail over the Canadian Pacific Railroad. Work is steadily progressing at Le Roi No. 2 mine.

Emerald—The company is installing a 4-drill compressor. This is one of the silver-lead properties, situated near the Sheep Creek gold belt, and has shipped steadily for some years.

Mother Lode—The company has had trouble with the tube mills, owing to faulty gearing. An auxiliary compressor is being put in for aëration and agitating purposes.

ONTARIO

Dryden Prospecting Syndicate—This company, in the Dryden district, has ordered a Davis Calyx core drill, from the Canadian Ingersoll-Rand Co., Ltd., capable of sinking 300 ft. and bringing up a core of 1¾ in. diameter.

Asbestos Corporation of Canada—A company, in process of organization under this title, of which W. G. Ross will be president, has taken over the assets of the former Amalgamated Asbestos Corporation.

ONTARIO—COBALT

Shipments of ore and concentrates, in tons, from Cobalt for the week ended June 14, and for the year to date, are:

La Rose.	85 70	1,577 25
Coniagas.	.	889 82
O'Brien. .	31 25	291 19
Right of Way . .	. . . . .	148 60
Chambers-Ferland		225 60
McKinley-Darragh	24 55	1,233 55
Nipissing	84 30	985 58
Hudson Bay.	31 60	314 22
Buffalo	32 20	507 72
Crown Reserve	25 85	236 11
Cobalt Townsite	54 95	591 73
City of Cobalt	. . .	145.81
Trethewey	. . . . . .	241 04
Colonial . .		41 60
Kerr Lake .	30 37	350 03
Cobalt Lake .	38 65	246 06
Drummond .		318 77
Temiskaming. .	.	416 87
Beaver.		187.89
Wettlaufer		111 21
Provincial		22.22
Casey Cobalt. .	43 85	68.35
Totals .	484 27	9,062 04

Bullion shipments in ounces

Nipissing.	80,315 12	1,741,456 81
Crown Reserve	7,998 00	215,201 00
O'Brien .	10,495 71	98,928 72
Wettlaufer .	3,032 00	3,032 00
Miscellaneous	63 75	16,322 56

Bellellen—Work is to be resumed on this South Lorrain property.

Beaver—During the three months ended May 31, 1244 ft. of drifting, crosscutting, sinking and raising were done, also 1076.5 sq.yd. of stoping. Results were satisfactory. The main shaft is 590 ft. deep. It is stated that a large tonnage of mill ore is blocked out. From Mar. 18 to May 31, 3786 tons of ore were milled, at a cost of $1.88 per ton, producing 67.83 tons of concentrates averaging 1244.8 oz. silver per ton. Extraction percentage was 84.4; total value recovered, $43,907; net profit of mill, $36.895. The mill is exceeding its designed capacity of 50 tons per day. The Erie Cobalt property, 40 acres, has been purchased for $1500, to conserve water for milling purposes. Cash balance, May 31, was $55,829, with $83,873 due from smelters.

Boyd-Gordon—It is stated that this Gowganda property is under option to the Mann mine, adjoining.

Ophir—Development is meeting with encouraging results.

Nipissing—During May the high-grade mill treated 175 tons of ore and shipped 298,973 oz. of silver. Good progress is being made with the low-grade mill. A large part of the concrete work is in and the framework of the buildings is erected.

Chambers-Ferland—The annual statement shows cash in bank and accounts receivable, $196,750; royalties, $17,606; balance, $179,143.

Cobalt Central—This property is being operated by the Pennsylvania-Canadian Co., and a quantity of good milling ore has been blocked out.

Cobalt Lake—A good quality of milling ore has been found on the 225-ft. level. The vein was picked up some time ago by a crosscut from No. 6 shaft.

John Black—Operations are being conducted by the Peoples' Silver Mining Co., of Montreal. The vein encountered in the winze, 100 ft. deep, from the crosscut on the 200-ft. level, runs from 4 to 16 in. of calcite and niccolite, but assays have been disappointing.

Casey Cobalt—This company has shipped a car of 43¼ tons of ore, which carries, according to sample, 216,336 oz. of silver, worth $132,235. This is said to be the richest car of ore ever sent from Northern Ontario.

ONTARIO—PORCUPINE

Little Pet—This property may be reopened soon.

Hollinger—The time for subscribing to the issue of 50,000 shares of treasury stock expired June 10, most of the shareholders taking up their rights at $10 per share.

Hollinger Reserve—The main shaft is being sunk to the 100-ft. level.

Dome Lake—A new plant is being installed.

American-Porcupine—A contract will be let for considerable diamond drilling.

Moneta—The shafthouse has been destroyed by fire and the underground workings flooded.

Standard—This mine has been closed down.

Miller Lake-O'Brien—In addition to high-grade ore, a good tonnage of milling ore is being developed at the 250-ft. level.

Donaldson—A strike of high-grade ore has been made at the 100-ft. level of this Elk Lake mine. The shaft has been in milling ore all the way down.

Crown Chartered—The shear zone has been cut at the 200-ft. level, over 100 ft. from the shaft. Over 800 ft. of underground work have been done at the 100-ft. level, which has disclosed many quartz veins.

Swastika—A vein of good ore has been cut on the 400-ft. level, about 26 ft. from the shaft. Its width has not yet been determined. It has been decided to install a 10-stamp mill.

Mexico

JALISCO

Compania Minera La Union—Neil Trumbull and H. K. Taylor have organized this company, to operate copper properties in the Ameca district.

MEXICO

Esperanza—In May, 19,099 tons of ore were crushed. Total receipts were $95,800; expenses, $80,891; estimated profit, $13,632; development, 846 ft. Further openings on the San Carlos vein disclosed ore from 2 to 4 ft. wide, assaying from $8 to $45 per metric ton.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, June 19—There is very little to be said about the coal trade in the West, which continues about on the same lines as last week. The Seaboard coal trade also continues dull but there are prospects of improvement as the accumlated stocks at tide are being worked off and New England buyers are beginning to come forward. Anthracite trade is a little more active but dealers and large consumers are still holding back and hesitating about putting in stocks. The collieries are reported to be working at about 85% of capacity. Steam sizes are in a little better supply; in fact there is said to be some accumulation at the storage yards.

Coal passing through Sault Ste. Marie canals, season to June 1, short tons:

	1911	1912	Changes
Anthracite..........	266,822	17,848	D. 248,974
Bituminous........	1,792,324	1,653,022	D. 139,302
Total..............	2,059,146	1,670,870	I. 388,276

The decrease this year was due to late opening of navigation and to the anthracite mining suspension in April and May.

The Southwestern Interstate Coal Operators' Association reports shipments as follows for the two months ended Feb. 29, in short tons:

	1911	1912	Changes
Missouri.........	429,030	587,212	I. 158,182
Kansas...........	812,074	1,039,049	I. 226,975
Arkansas.........	225,030	331,876	I. 106,846
Oklahoma........	422,158	616,713	I. 194,555
Total...........	1,888,292	2,574,850	I. 686,558

Total increase this year was 36.4%. These shipments cover over 90% of the coal mined in the states named.

The Hocking Valley Cases—At Toledo, O., June 11, the United States district court announced a fine of $42,000 upon the Hocking Valley Railroad Co. and a fine of $20,000 upon the Sunday Creek Co., of Columbus, O., a coal concern, for violation of the law relative to rebating.

The case will be appealed to the U. S. circuit court of appeals, as this is the first time that the question as to whether the giving of unlimited credit on freight bills is in violation of the act has been heard in court.

Iron Trade Review

New York, June 19—Very little change can be reported in the conditions affecting the iron and steel markets. Mills continue busy with a prospect of plenty of work to carry them through the summer. Specifications on contracts are large and considerable new business is expected between now and July 1, so that the position is strong.

Steel-mill operations continue at the high rate recently attained and here and there production is even increased. The country is making pig iron at the rate of practically 30,000,000 tons a year, equal to the best average ever maintained for a twelvemonth, and well in excess of the best output in any calendar year. This high rate is due entirely to the activity of the steel-works blast furnaces, as the merchant furnaces are not operating at as much as two-thirds of capacity. Without the blowing in of additional stacks, pig-iron production is likely to decline in the next two months, on account of the usual weather conditions, but most of the steel works will close for a few days in July for repairs and this will probably maintain the balance. Rumors that the Steel Corporation is about to buy bessemer pig iron are not credited in well informed quarters.

The extreme shortage of labor is being still more commented upon. It is probably responsible for two or three little strikes which have occurred in the Pittsburgh district in the past few days. It is evident that no great increase in production or consumption of steel can occur in the near future, as there is no additional labor supply to make or utilize much more steel.

In pig iron demand seems to be increasing. Basic is actively called for in the Central West and the demand for foundry iron is improving. Several additional merchant furnaces have blown in. In Seaboard territory several of the large pipe companies are buying additional iron. A large part of this business has been taken by Virginia furnaces. Prices continue about the same, except that Alabama makers have been offering No. 2 foundry at 25c. below the $11.50 which was recently asked for that grade

The coke market continues steady and rather quiet, although some large contracts for furnace coke for the balance of the year have recently been closed.

Republic Iron & Steel Co.—This company will soon begin the construction of four new merchant bar mills at Youngstown, Ohio, to supplant certain mills of an obsolete type at the Brown-Bonnell and Mahoning Valley works. On completion of these improvements the Mahoning Valley works will be abandoned and dismantled and the complete rehabilitation of the Brown-Bonnell works as a modern steel plant will have been accomplished. In addition to the new finishing mills the company will construct at Haselton byproduct coke works of 1000 tons daily capacity. This plant when completed will place all Northern blast furnaces on substantially a self-contained basis for coke, and the waste gas generated in coking will largely supplant the coal now used for heating purposes in the finishing works at Haselton. The cost of the improvements has been financed, bonds to the amount of $2,000,000 having been sold.

Baltimore

June 17—Exports for the week included 660 lb. selenium to Hamburg; 8,680,500 lb. steel rails and 432,265 lb. track material to Tampico, Mexico. Imports included 2476 tons spiegeleisen, 1645 tons ferromanganese and 1838 tons manganese ore from Great Britain; 24,600 tons iron ore from Cuba.

Birmingham

June 17—The pig-iron market in the Southern territory is not so active as it has been and sales are not as frequent as the manufacturers would like to see them. The quotations are not as firm as they have been, sales being made at $11.25 per ton, No. 2 foundry, basis, and reports have it that this price is being lowered for delivery during the third quarter of the year. There is a strong feeling still manifested as to iron for delivery during the fourth quarter, and $11.50 per ton is asked. Very few sales are being made now for that period, though the books of the various companies will show that there is a fairly good tonnage placed. The steel situation in Southern territory shows no change. There is activity in fabricated steel and the rolling mills of the Tennessee Coal, Iron & R.R. Co., at Bessemer, are working on full time.

Scrap iron is in good demand. Brass foundries, machine shops and foundries are feeling a little impetus in their trades.

Announcement is made that the American Radiator Co. has purchased land, at North Birmingham, and will erect a big plant during the next 12 months. The company has a small plant here now, leasing a pipe plant which was converted into a factory.

A committee of Southern pig-iron manufacturers, consisting of J. W. McQueen, vice-president of the Sloss-Sheffield Steel & Iron Co., C. D. Bannister, of the Woodward Iron Co. and H. S. Chamberlain, of the Chattanooga Iron Co., went to Washington the past week to confer with the Interstate Commerce Commission in reference to an early consideration of the petition of the Southern iron men looking to a lower rate on iron to the Ohio gateway points. The Southern manufacturers expect a reduction in the freight rates to the Ohio River product if the concession can be secured. No definite information was obtainable.

Chicago

June 17—The iron and steel market shows continued firmness for pig iron, despite light demand, and large sales of nearly all forms of manufactured products.

The requirements of the foundry melters, on whom this market chiefly depends, now are for small lots, frequently delivered. For last-half requirements in general, a few sales are being made; most of the business is for third quarter, in lots of a few hundred tons. Furnace agents quote $11.25, Birmingham, as the standard price for No. 2 Southern iron, and this means $15.60, Chicago; for No. 2 Northern iron, $14.25@14.50, at furnace, is asked. Some Southern No. 2 iron probably sells at $11 Birmingham and some for $11.50. For last-quarter deliveries, the furnace agents ask the higher prices. Summer dullness is apparently on the trade.

In manufactured products, the situation is highly promising for continued activity. Structural material is in larger demand for building and bridge work throughout Western territory, the price of material under 15 in. remaining 1.43c., Chicago. In railroad supplies there is increased activity, several large orders for standard rails having been placed, while light rails and track fastenings are in very good demand. Billets are still scarce at $28 for openhearth forging, though the demand is not large. Bars are strong and the mills are crowded with orders, with little seeking of new business; bar iron continues to sell for 1.25c. and soft-steel bars hold to 1.35c. Plates are in large demand for car-building purposes and sheets are strong.

Cleveland

June 17—Ore movement is heavy, but boats are finding some delays in loading at the upper ports.

Pig Iron—Business continues active, and some furnaces are pretty well sold up. Prices are a shade higher. Quotations are: Bessemer, $15.15; No. 2 foundry, $13.75; forge, $13.25, all Cleveland delivery.

Finished Material—Specifications continue heavy and mills are all busy. They are not at all inclined to shade prices to get business. Wire is the weakest spot in the market and structural steel the strongest.

Philadelphia

June 19—New business is pig iron has been chiefly in small lots, so far as foundry iron is concerned. There are some large inquiries, chiefly from New England, but the tendency of furnaces to ask higher prices has rather checked business. Basic is again the subject of negotiation, but forge is rather dragging. No. 2 X foundry is $15.25@15.50; basic $15.25; while $14.50@14.75 is asked for gray forge.

Steel Billets—A fair volume of small orders is coming in and prices are firm.

Bars—Less new business is coming in and the market is easier.

Sheets—The market is strong. There are inquiries for second half, but mills are not hunting new business.

Plates—The mills are busy and prices are firm. Inquiries are out for a good lot of plates for ship work.

Structural Material—Negotiations are on for several large lots, but business closed has been mainly for small orders. Prices are firmer.

Scrap—There has been more movement, especially in heavy melting steel. Dealers are generally confident, and not inclined to make concessions.

Pittsburgh

June 18—Despite the political excitement the steel market is giving a good account of itself. It is not improbable that were it not that the most strenuous convention of a generation is in session in Chicago there would be a distinct advancing tendency in some products, notably bars, plates and shapes. Several makers of these products are disposed to put up their prices, but do not regard the present moment as opportune. It is not unlikely that within a short time merchant bars will advance from 1.20c. to 1.25c. and plates and shapes from 1.25c. to either 1.30c. or 1.35c. The hoop market has gained in strength, and some contracts have been closed at 1.30c., although 1.25c. is still possible in some instances.

Pig Iron—The market is strong all along the line, although sales are relatively light. Nothing important has occurred in foundry iron since the purchases of 12,500 tons of third-quarter iron by the Standard Sanitary Manufacturing Co., noted in last report. It is believed that a little additional buying would force the market up. The Carbon Steel Co. is understood to have bought 6000 to 7500 tons of basic for second-half delivery, paying in the neighborhood of $13.25, Valley, and $13 iron seems scarcer than formerly, being available in any case only for early delivery. Bessemer has been quiet. The furnaces are exercised over the continued effort of Connellsville coke operators to secure $2.50 on second-half contracts, when expiring contracts are chiefly at $1.55@1.65. Last week some of the merchant operators curtailed production in order to force the prompt market to a level more in keeping with the demand for $2.50 on contract, but as very little prompt coke was called for the market did not respond to a great extent, and prompt furnace coke is quotable at $2.15@2.20. We quote pig iron as follows: Bessemer, $14.25; basic, $13@13.25; malleable, $13@13.25; No. 2 foundry, $13.25; forge, $13, all f.o.b. Valley, 90c. higher delivered Pittsburgh.

Ferromanganese—Imports have been light and the available supply of ferromanganese for sale is limited, but consumers appear to be well covered and are not inquiring for as much prompt material as formerly. There has been a little contracting for the first half of next year and a considerable tonnage of inquiry is out. We quote prompt at all the way from $50 to $55 and contract at $48.50, Baltimore.

Steel—There is less inquiry for prompt steel than formerly, but there is no surplus offered, some of the mills being behind in deliveries. The market is firm and we quote: Billets, $21.50; sheet bars, $22, f.o.b. maker's mill, Pittsburgh; billets, $21; sheet bars, $22, f.o.b. maker's mill, Youngstown. Rods are quotable at $24.50@25, Pittsburgh, but the stiffening tendency observed last week continues.

Sheets—Contracting for extended delivery continues in the case of a few lines and at full prices. The run of specifications on old contracts is very good, buyers being confronted with the prospect of unspecified tonnages being canceled at the close of this month, when many contracts expire. Mill operations are up to the limit permitted by the supply of steel and labor, and average a trifle over 90% of all the sheet capacity in the country. We quote: Black sheets, 28 gage, 1.90@1.95c.; galvanized, 2.95@3c.; blue annealed, 10 gage, 1.40c.; painted corrugated, 28 gage, 2.15c. per lb. and $1.35 per square; galvanized, 3.05c. per lb. and $2.55 per square.

St. Louis

June 17—The pig-iron market is steady, with business mainly in small lots. Southern No. 2 is quoted $11@11.50 Birmingham—$14.75@15.25 St. Louis—the higher figures being for second-half delivery. Northern No. 2 foundry is quoted around $15 for early deliveries. Finished material in fair demand.

Coke is quoted at $5@5.10 St. Louis for good foundry, with a sufficient supply.

Iron Ore Trade

The figures of the Cleveland *Marine Review* on dock stocks of ore at Lake Erie ports are as follows, In long tons:

Stocks on docks, Dec. 1, 1911	9,131,664
Stocks, May 1, 1912	5,881,245
Winter shipments to furnaces	3,250,419
Shipments May 1–Dec. 1, 1911	23,178,370
Total for the season	26,428,789

Stocks on docks, May 1, were 969,040 tons less than on May 1, 1911. The total shipments of Lake ore to furnaces through Lake Erie ports have been, for the years ending May 1, for 10 years:

1911–12	26,428,789	1906–7	30,099,769
1910–11	32,636,692	1905–6	28,984,358
1909–10	33,599,013	1904–5	20,057,070
1908–9	20,524,523	1903–4	18,739,995
1907–8	31,692,446	1902–3	21,905,251

The Lake Erie shipments will not vary far from 75% of the total Lake Superior ore.

Imports and exports of iron and manganese ores in Germany, three months ended Mar. 31, were, in metric tons:

	1911	1912	Changes	
Iron ore, imp.	2,078,363	2,676,903	I.	598 540
Iron ore, exp.	655,314	584,851	D.	70,523
Manganese, imp.	80,919	107,176	I.	26,257
Manganese, exp.	1,126	1,801	I.	675

Imports of slag and slag products in 1912 were 296,839 tons, an increase over 1911 of 148,795 tons; exports were 28,848 tons, an increase of 9436 tons.

Foreign Iron Trade

German Iron Production—The German Iron & Steel Union reports the production of pig iron in the German Empire in April at 1,427,559 metric tons, being 5182 more than in March. For the four months ended Apr. 30, the total make was, in metric tons:

	1911	1912	Changes	
Foundry iron	1,029,702	1,024,365	D.	5,337
Forge iron	194,080	182,072	D.	12,008
Steel pig	573,820	670,525	I.	96,705
Bessemer pig	118,186	122,257	I.	4,071
Thomas(basic)pig	3,191,599	3,543,291	I.	351,692
Total	5,107,387	5,542,510	I.	435,123

Total increase this year, 8.5%. Steel pig includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys.

METAL MARKETS

New York, June 19—The metal markets have been generally strong, but a little less active. The strikes at the copper refining works seem to be in a way of settlement.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
May 1912	$ 4,450,899	$ 3,346,491	Exp.	$1,404,408
" 1911	6,817,149	5,014,741	Exp.	1,802,409
Year 1912	26,225,801	19,653,285	Exp.	6,572,516
" 1911	10,176,807	29,005,312	Imp.	18,828,505
Silver				
May 1912	6,725,781	4,345,032	Exp.	2,380,749
" 1911	5,054,304	3,555,842	Exp.	1,498,462
Year 1912	28,623,028	20,384,764	Exp.	8,238,264
" 1911	28,665,500	18,454,155	Exp.	10,211,345

Exports from the port of New York, week ended June 15: Gold, $587,623, chiefly to Cuba: silver, $846,652, principally to London. Imports: Gold, $400,011; silver, $211,434, largely from South America and Mexico.

Gold—The price of gold on the open market in London remains at the usual bank level, 77s. 6d. per oz. for bars and 76s. 4d. per oz. for American coin. Most of the supplies arriving went to the Bank of England. In New York there was a considerable shipment of gold to Cuba.

Gold production in the Transvaal in May was $16,115,614, an increase of $868,181 over April. For the five months ended May 31, the total was $65,266,621 in 1911, and $75,129,373 in 1912; an increase of $9,862,752 this year.

Iridium—The current price for this metal is $64 per oz., New York.

Platinum—The market continues rather quiet, but the price seems to be fixed at the same point which it has held for some time. Dealers ask $45.50 per oz. for refined platinum and $48 for hard metal up to 10% iridium.

Our Russian correspondent writes, under date of June 6, that the market is dull and inactive. There is no demand from abroad and in St. Petersburg for the last fortnight no business has been done. At Ekaterinburg the offer of platinum by the stárateli increases; many miners have left the gold mines to work on the platinum mines. The quotations are: in St. Petersburg, 37,600 rubles per pood; at Ekaterinburg, 9.80 rubles per zolotnik. The prices are nominal and subject to negotiations. The prices are for crude platinum. 83% metal, and are equivalent to $36.85 per oz. in both markets.

Silver—The market has ruled steady the past week with fluctuations between 28$\frac{3}{16}$ and 28$\frac{5}{16}$d. Monsoon reports from India are good and prospects for silver are favorable. The market closes strong at 28¼d. in London.

Coined silver in the United States, on June 1, is estimated by the Treasury Department as follows: Standard dollars, $565,322,367; subsidiary coins, $169,884,577; total, $735,206,944. Of the dollars $483,223,000 are held against certificates outstanding.

SILVER AND STERLING EXCHANGE

June	13	14	15	17	18	19
New York	61½	61½	61⅜	61¼	61¼	61⅜
London	28$\frac{5}{16}$	28$\frac{5}{16}$	28¼	28$\frac{3}{16}$	28$\frac{3}{16}$	28¼
Sterling Ex.	4 8720	4.8715	4.8730	4.8730	4.8750	4.8750

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to June 6, as reported by Messrs. Pixley & Abell:

	1911	1912	Changes	
India	£3,887,400	£2,989,800	D. £	897,600
China	822,800	853,500	I.	30,700
Total	£4,710,200	£3,843,300	D. £	866,900

India Council bills in London averaged 16.05d. per rupee for the week.

Copper, Tin, Lead and Zinc

NEW YORK

June	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
13	17⅜ @17⅝	17 20 @17.30	45	4.50	4 40 @4.42½	6.80 @6.90	6.65 @6.75
14	17⅜ @17⅝	17.20 @17.30	45½	4 50	4 40 @4.42½	6 80 @6.90	6.65 @6.75
15	17⅜ @17⅝	17.20 @17.30	45¼	4.50	4 40 @4.42½	6.80 @6.90	6.65 @6.75
17	17⅜ @17⅝	17.20 @17.30	45¾	4.50	4 40 @4.42½	6.80 @6 90	6.65 @6 75
18	17½ @17⅝	17.25 @17.35	45½	4.50	4.40 @4.42½	6.80 @6.90	6.65 @6.75
19	17½ @17⅝	17.35 @17 45	45½	4 50	4 40 @4.42½	6 80 @6 90	6 65 @6.75

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

June	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
13	78$\frac{1}{16}$	78$\frac{11}{16}$	83¼	206½	196½	17⅜	25¾
14	78⅛	78¾	83¼	204	195¾	17½	25¾
15	......	.....	.....	......	......	....	......
17	79	79⅝	83½	207½	197½	17¾	25¾
18	79$\frac{9}{16}$	80$\frac{3}{16}$	84¾	207	197¼	17$\frac{13}{16}$	25¾
19	80⅜	80½	85	206¼	196¾	17$\frac{15}{16}$	25¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, ± £1 = ± 21¾c.

Copper—During the early part of the week the market was rather slack and electrolytic copper was easily obtainable at 17⅜@17½c., delivered, usual terms. The absence of nervousness on the part of domestic consumers in the face of the widely heralded strike at the Perth Amboy refinery was construed as indicating that they had well provided for their near-by requirements. On Monday the advance in the London standard market inspired a new buying movement from abroad and a fair volume of business resulted, leading some of the agencies to raise their price to 17⅝c., delivered, on Tuesday, which price was generally asked on Wednesday, but with no considerable volume of business reported. Prime brands of Lake copper sold right along at 17½c. until Tuesday, when these producers also advanced their price. At the close, the market is strong and advancing. Lake copper is quoted 17½@17⅝c. and electrolytic in cakes, wirebars or ingots at 17.35@17.45c. Casting copper is quoted nominally 17.05@17.15c. as an average for the week.

The London standard market, which was £78 1s. 3d. for spot and £78 13s. 9d. on June 13, advanced to £79 for spot and £79 12s. 6d. for three months on June 17, and again 11s. 3d. further on June 18, and closes at £80 7s. 6d. for spot and £80 10s. for three months. The transactions have been large.

European statistics for the first half of June show a decrease in the visible supplies of 955 tons, which, in view of the large decrease during May and the small stock, further accentuates the strong statistical position of the article.

Copper sheets are 22@23c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 18½c. base, carload lots at mill.

Copper exports from New York for the week were 5482 long tons. Our special correspondent reports the exports from Baltimore at 1338 tons.

Visible stocks of copper in Europe June 15 are reported as follow: Great Britain, 29,560; France, 5910; Rotterdam, 1600; Hamburg, 5860; afloat from Chile, 1450; afloat from Australia, 5700; total, 50,080 long tons, or 112,179,200 lb. This is a decrease of 2510 tons from the May 31 report.

Tin—The London dock strike continues, and the stocks of tin at London have dwindled down to about 300 tons, which is less than they have ever been before. The scarcity of spot tin, both in London and here, is acute, and as there has been a virtual stoppage of shipments from London for almost a month, and as the London dock strike continues, a very acute situation seems to be confronting us. Spot tin in New York has ruled at about 3c. over tin for shipment. July tin is already beginning to command a premium. At the close, shipment tin is quoted 45¼ cents.

The London market has been firm, and on June 17, spot advanced to £207 10s., futures to £197 10s. It closes at £206 5s. for spot and £196 15s. for three months.

The production of Billiton tin for the fiscal year ended Apr. 30 last, was 4484 long tons, an increase of 614 tons over the previous year.

Tin production of the Federated Malay States five months ended May 31 was 16,967 tons in 1911, and 19,114 in 1912; increase 2147 tons.

Messrs. Robertson & Bense report the arrivals of tin ore and concentrates at Hamburg, Germany, in May at 1651 tons from Bolivia.

Lead—The market is firm with a good business doing at last prices, 4.40@4.42½c., East St. Louis, and 4.50c., New York.

The foreign market is higher, Spanish lead being quoted at £17 18s. 9d., and English lead, 2s. 6d. higher.

Spelter—Consumption continues excellent and there is a good business doing from day to day. The market is somewhat firmer at 6.65@6.75c., East St. Louis, on the tonnage business with consumers.

The London market is unchanged, good ordinaries being quoted £25 15s., and specials, £26 per ton.

Base price of zinc sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7¼@7⅜c. per lb., New York, in carload lots.

Other Metals

Aluminum—Business continues rather quiet and sales have been only moderate. We continue to quote 22½@23c. per lb. for No. 1 ingots, New York.

The latest London quotation is £70@72 per long ton for ingots. This is equivalent to 15.21@15.65c. per lb., which is about on a parity with the New York price, freight and duty paid.

It is understood that the new agreement has received the assent of all of the European producers, but will not become fully effective until Jan. 1, 1913. An interim agreement will control the market until that time.

Antimony — Business is quiet and prices unchanged. Cookson's is quoted at 8.10c. per lb.; Hallett's is 7.75c.; while 7.10@7.25c. per lb. is quoted for Chinese. Hungarian and other outside brands.

Quicksilver—Business remains in good shape, with no change in prices. New York quotations are $41 per flask of 75 lb., with 60c. per lb. charged for retail lots. San Francisco, $41 for domestic orders and $38.50 for export. The London price is £8 5s. per flask, with £8 2s. 6d. quoted from second hands.

Cadmium—The latest quotations received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Joplin, Mo., June 15—The high price of zinc sulphide ore this week was $61.50, the base per ton of 60% zinc is $54@58.50. Zinc silicate sold at $28@30 per ton of 40% zinc. The average price, all grades, was $55.32. The high price of lead ore is $58.50, and the average price, all grades, is $54.76 per ton.

The zinc-ore market held to the same prices as the previous week, but may be said to be slightly easier; the demand was not so strong this week.

By Telegraph—A Joplin despatch of June 17 reports floods over the entire district, cutting down production fully one-half. A second dispatch, June 18, says that the flood conditions are less serious than at first reported, and the curtailment of output not over one-third at most.

SHIPMENTS, WEEK ENDED JUNE 15

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,104,820	....	1,225,940	$147,647
Joplin........	2,121,470	......	208,420	66,190
Duenweg....	757,180	65,120	44,810	23,565
Galena.......	764,600	......	51,760	21,778
Alba-Neck...	509,480	......	22,960	15,392
Spurgeon	118,160	296,440	81,590	9,878
Oronogo......	397,360	......	......	8,924
Miami.......	205,630	......	58,320	6,480
Granby	28,880	373,000	3,020	6,280
Jackson......	210,040	......	17,240	6,109
Carl Junction	192,340	......	......	5,673
Cave Springs.	193,180	......	......	5,408
Springfield ..	158,000	......	......	4,800
Aurora.......	141,470	......	......	3,677
Lawton.......	60,980	......	......	1,707
Carthage	49,230	......	......	1,329
Totals......	10,032,830	734,560	1,714,080	$334,837
24 weeks...	243,346,170	14,602,510	41,407,210	$7,414,216

Blende val., the week, $276,869; 24 weeks, $6,072,774
Calamine, the week, 11,022; 24 weeks, 214,640
Lead value, the week, 46,946; 24 weeks, 1,125,802

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January....	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February....	40 21	45.75	39 16	43.31	54 46	52.39
March.......	39.85	51.56	38.45	49.25	54.57	54.64
April.......	38.88	52.00	37 47	50.36	56 37	54.18
May....	38.25	55.30	36 79	53.27	55.21	52.45
June..... ...	40.50	......	38.18	......	55.49	......
July........	40 75	......	38 36	......	58 81	.....
August	42 50	......	41 28	......	50.74	......
September ..	42 63	......	41 29	......	59 33	......
October......	42.38	......	40.89	......	54.72	......
November...	45.40	......	43.25	......	57 19	......
December...	44.13	......	40.76	......	62 03	......
Year.......	$41.45	......	$39.90	......	$56.75	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., June 15—The highest and also the base price paid this week for zinc ore was $56. The base price paid for lead ore was $53@54 per ton.

SHIPMENTS, WEEK ENDED JUNE 15

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton...	961,600	....	404,800
Shullsburg...........	789,550	....	....
Mineral Point........	678,250	....	....
Platteville...........	476,060	....	191,000
Hazel Green.........	420,000	....	....
Harker...............	300 400	......	....
Galena	241,700	80,400	....
Cuba City...........	136,900	......	81,500
Total........	4,004,460	80,400	677,300
Year to date.........	94,414,600	3,834,510	13,062,170

Shipped during week to separating plants, 1,960,490 lb. zinc ore.

Chemicals

New York, June 19—General business is rather quiet and there is nothing new in the market.

Arsenic—Business is not particularly active and prices are unchanged at $3.87½ per 100 lb. for spot and $3.50 for futures. No Mexican arsenic has been received, but there have been some arrivals of English. The Anaconda Co. is not quoting prices at present and is believed to be pretty well sold up.

Copper Sulphate—The market is not over active but is firm. Quotations are unchanged at $5.50 per 100 lb. for carload lots and $5.75 per 100 lb. for smaller parcels. The troubles at the various refineries are interfering with the output.

Nitrate of Soda—The position in this article is firm and business is fair for the season. Prices are steady at 2.45c. per lb. for both spot and futures.

Messrs. Mortimer & Co., New York, report the position of nitrate in the United States on June 1 as follows, figures in long tons:

	1911	1912	Changes
Stocks, Jan. 1........	12,790	9,000	D. 3,790
Imports, 5 mos....	253,312	163,300	D. 90,012
Total supplies.	266,102	172,300	D. 93,802
Deliveries, 5 mos....	250,522	167,700	D. 82,822
Stocks, June 1.....	15,580	4,000	D. 10,980
Afloat for U. S......	93,000	125,000	I. 32,000

Quantities afloat include all cargoes due to arrive at United States ports before Sept. 15 next.

Petroleum

The monthly statement of the *Oil City Derrick* reports new wells completed in May as follows: Pennsylvania and West Virginia, 446; Lima-Indiana, 54; Kentucky, 16; Illinois, 91; Kansas-Oklahoma, 589; Texas-Louisiana, 123. In all the divisions there were 1321 wells completed, 158 more than in April. The new production was 53,944 bbl., a decrease from the April report of 10,784 bbl. There were 220 failures among the completed wells, and 120 gas wells, a total of 340, leaving 981 oil producers.

On the last day of May there were 513 rigs up and 1244 drilling wells, a total of 1757. This was an increase of 62 rigs and of 44 in wells drilling.

London dispatches report that the Nederlandsche Koloniale Petroleum Maatschappij, a new company organized by Standard Oil interests, has obtained some oil concessions in the Netherlands East Indies.

MINING STOCKS

New York, June 19—On June 13 prices on the Exchange were firm but trading light and chiefly professional. On the Curb copper stocks were firm and fairly active. Cobalts were quiet with only fractional changes. There were heavy sales of El Paso Consolidated. Yukon Gold, which has been quiet for a long time, now shows large dealings at advancing prices.

June 14 there was something of a break in prices on the Exchange affecting most of the leading stocks. Mining stocks on the Curb were quiet with hardly any change in prices.

June 15 the Exchange was again quiet and rather irregular, but with no further recession in quotations. The Curb also was quiet with mining stocks in only moderate demand.

June 17 the Exchange was dull but strong, prices advancing on limited trading. The Curb was rather slow and decidedly irregular. The active mining stocks were Braden, British Columbia Copper, Butte & New York and El Paso Consolidated.

June 18 the Exchange was dull and uncertain, dealers being disposed to wait for the result of the Republican convention at Chicago. The Curb was dull, with little doing in mining stocks. June 19 conditions remained about the same.

Mining and industrial securities listed on the New York Stock Exchange this week included $20,000,000 Baldwin Locomotive Works common stock; Guggenheim Exploration Co., 150,388 shares, $100 par value, with authority to add 57,545 shares on due notice. The last named stock has been dealt in on the Curb heretofore.

At auction in New York, June 13, the following securities were sold: Nevada-Utah Mines & Smelters Co., 100 shares, $10 par, $1 for the lot; Naica Mining Co. 2500 shares, $1 par, $6 for the lot, and 5000 shares $8 for the lot.

Boston, June 18—Even with copper at high prices the share market is almost stagnant. The political convention is attracting the general attention and the stock market is suffering from a state of apathy. Prices have shown quite general recessions, but even at that the metal-share market is one of good tone.

Butte & Superior has been the feature of the past week, rising $6.37½ to $51.75, with a fair reaction. American Zinc shares also rose sharply in sympathy with the move of the first named, advancing $2.50 to $33. There is talk of a consolidation of these two zinc properties and the listing of the holding company's stock in Paris. A prominent brokerage house is sponsor for both of these companies and recently underwrote stock issues of both.

Mayflower and Old Colony continue to be neglected and some days there have been no sales of one or the other. Late advices continue favorable. Hancock had a $2.75 advance to $37, which is its record price. Island Creek rose $6.25 to $65.75, reacting materially, and Pond Creek rose $1.50 to $19.87½ in sympathy. Other strong spots have been Isle Royale and Osceola. North Butte responded to

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	March	April	May
Alaska shipments.	4,987,916	1,243,911	1,720,391
Anaconda	25,900,000	25,480,000	25,800,000
Arizona, Ltd........	3,150 000	3,400,000	3,500,000
Copper Queen......	7,197,121	6,806,425	7,024,087
Calumet & Ariz....	4,652,000	4,104,000	4,424,000
Chino..............	1,108,381	....	....
Detroit........	2,246,238	2,506,718	2,092,478
East Butte..........	1,480,000	....	....
Mammoth............	1,939,310	1,718,450	....
Mason Valley......	1,140,000	....	....
Nevada Con........	6,380,000	6,115,095	....
Ohio...............	599,156	....	....
Old Dominion......	2,432,000	2,167,000	....
Ray..............	2,300,000	2,611,920	2,992,500
Shannon............	1,389,000	1,544,000	1,464,000
South Utah.........	299,000	284,215	236,884
United Verde*.....	2,250,000	2,250,000	2,500,000
Utah Copper Co....	8,160,000	8,615,775	....
Lake Superior*....	19,750,000	18,250,000	21,250,000
Non-rep. mines*..	6,792,463	8,250,000	....
Total production.	104,051,585	....	....
Imports, bars, etc..	23,519,215	26,842,014	....
Total blister.....	127,570,800	....	....
Imp. in ore & matte	8,736,874	9,350,972	....
Total....	136,307,674	....	....
Miami..............	2,755,000	2,554,352	2,565,000
Brit. Col. Cos.:			
British Col. Copper	... .	....	....
Granby	1,882,073	1,941,797	1,914,460
Mexican Cos.:			
Boleo..............	2,424,800	2,149,280	2,260,160
Cananea	2,834,000	4,654,000	....
Moctezuma	2,446,731	2,797,718	2,892,521
Other Foreign:			
Cape Cop., S. Africa	725,760	954,240	754,880
Kyshtim, Russia...	....	1,545,000	....
Spassky, Russia....	638,400	649,600	....
Famatina, Argen..	....	... .	....
Tilt Cove, Newf'd..	104,992	119,869	123,087
Exports from:			
Chile..............	3,584,000	6,496,000	3,696,000
Australia	8,064,000	9,408,000	7,840,000
Arrivals in Europe†	12,559,680	12,064,640	9,976,860

Figures are reports received from companies, unless otherwise stated. Bolco copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

Ohio Copper, Jan.. 576,581; Feb., 661,757 lb

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
V, 1911.........	126,962,544	64,543,963	61,978,557
VI..............	124,554,312	61,655,561	71,460,519
VII.............	112,167,934	56,982,582	74,880,658
VIII............	125,493,667	59,935,364	69,855,660
IX..............	115,588,950	57,311,584	50,824,011
X...............	118,255,442	64,068,307	60,084,349
XI..............	111,876,601	68,039,776	67,049,279
XII.............	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912.........	119,337,753	62,343,901	80,167 904
II..............	116,035,809	56,228,368	63,148,096
III.............	125,694,601	67,487,466	58,779,566
IV..............	125,464,644	69,513,846	53.252,326
V...............	126,737,836	72,702,277	69,485,945

VISIBLE STOCKS

	United States	Europe	Total
VI, 1911........	165,995,932	202,540,800	368,536,732
VII.............	157,434,164	195,932,800	353,366,964
VIII............	137,738,858	191,891,840	329,630,698
IX.	133,441,501	191,228,800	324,670,301
X...............	140,894,856	191,945,600	332,840,456
XI.....	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912.........	89,454,695	158,323,200	247,777,895
II..............	66,280,643	154,851,200	221,131,843
III.............	62,939,988	141,142,400	204,082,388
IV..............	62,367,557	136,819,200	199,186,757
V...............	65,066,029	134,176,000	199,242,029
VI..............	49,615,643	117,801,600	167,417,243

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

the increase in the quarterly dividend rate from 40 to 50c. by advancing $2.50 to $32.25. Heavy selling of Utah Consolidated knocked the price down $3 to $10, without bringing any definite news.

Curb trading has been of fair volume, but with unimportant price changes.

Assessments

Company	Delinq	Sale	Amt
Alpha Con., Nev	May 29	June 19	$0.05
Andes, Nev	May 28	June 18	0.05
Best & Belcher, Nev	June 3	June 27	0.10
Caledonia, Nev	May 21	June 11	0.10
Challange, Nev	June 8	July 2	0.10
Chollar, Nev	July 7	Aug. 5	0.10
Crown Point, Nev	June 24	July 17	0.10
East Tintic, Utah	May 30	June 25	0.005
Ely Con., Nev	....	....	0.05
Exchequer, Nev	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Glen Dale, Utah	May 25	June 25	0.00
Great Falls, Utah	June 26	July 27	0.002½
Hale & Norcross, Nev	July 2	July 29	0.05
Houghton Copper, Mich	May 17	....	1.00
Julia, Nev	May 15	June 5	0.05
Mineral Hill, Nev	Aug. 6	Oct. 6	0.01
New York Bonanza, Utah	May 8	....	0.02
Overman, Nev	June 29	July 23	0.10
Raven, Mont	Feb. 1	....	0.10½
Savage, Nev	June 4	June 26	0 10
Segregated Belcher, Nev	June 1	June 28	0.05
Seven Troughs, Nev	June 15	July 2	0.002½
Sierra Nevada, Nev	July 4	July 30	0.10
South Lake, Mich	June 3	......	2 00
Tintic Central, Utah	June 14	July 6	0.005
Utah Antimony, Utah	June 1	....	0.03
Yellow Jacket, Nev	July 4	Aug. 12	0.10

Monthly Average Prices of Metals

SILVER

Month	New York 1910	New York 1911	New York 1912	London 1910	London 1911	London 1912
January	52.375	53.795	56.260	24.154	24 865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24 483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28 038
June	53.462	63.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24.428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54 428	54.905	......	25.160	25.349	......
Year	53 486	53.304	......	24 670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York Electrolytic 1911	New York Electrolytic 1912	New York Lake 1911	New York Lake 1912	London, Standard 1911	London, Standard 1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62 893
March	12 139	14.698	12.447	14.868	54.704	65.884
April	12.019	15 741	12.275	15.930	54 034	70.294
May	11 989	16.031	12.214	16.245	54.313	72 352
June	12.385	......	12 611	......	56.365	......
July	12.463	......	12.720	......	56 673	......
August	12 405	......	12.634	......	56.266	......
September	12.201	......	12.508	......	55 253	......
October	12 189	......	12.370	......	55 170	......
November	12 616	......	12.769	......	57 253	......
December	13 552	......	13.768	......	62 068	......
Year	12.376	......	12.634	......	55.973	......

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41 255	42 529	July	42 400	......
February	41 614	42 962	August	43 319	......
March	40 157	42.577	September	39 755	......
April	42 185	43.923	October	41 185	......
May	43 115	46.053	November	43 125	......
June	44 606		December	44 655	......
			Av. Year	42 281	......

Prices are in cents per pound.

LEAD

Month	New York 1911	New York 1912	St. Louis 1911	St. Louis 1912	London 1911	London 1912
January	4 483	4 435	4 334	4.327	13 009	15 619
February	4 440	4 026	4 266	3 946	13 043	15 738
March	4.394	4.073	4 238	4.046	13 122	15.997
April	4 412	4 200	4 262	4 118	12.889	16 331
May	4 373	4 194	4 223	4 072	12 984	16 509
June	4 435	......	4 292	......	13.260	......
July	4 499	......	4 397	......	13 530	......
August	4 500	......	4 406	......	14.260	......
September	4 485	......	4 356	......	14 744	......
October	4 265	......	4 139	......	15.332	......
November	4 298	......	4.181	......	15.821	......
December	4 450	......	4 332	......	15.648	......
Year	4.420	......	4 286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York 1911	New York 1912	St. Louis 1911	St. Louis 1912	London 1911	London 1912
January	5 452	6.442	5 302	6.292	23.887	26.642
February	5 518	6.499	5 368	6.349	23 271	26 661
March	5 563	6.626	5.413	6.476	23 016	26.048
April	5 399	6.633	5.249	6 483	23 743	25 644
May	5.348	6.679	5 198	6.529	24.375	25.790
June	5 520	......	5 370	......	24 612	......
July	5 695	......	5 545	......	25.006	......
August	5 953	......	5 803	......	26 801	......
September	5 869	......	5 719	......	27 750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.161	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer 1911	Bessemer 1912	Basic 1911	Basic 1912	No. 2 Foundry 1911	No. 2 Foundry 1912
January	$15 90	$15.12	$14 40	$13.32	$14 75	$14.00
February	15 90	15.03	14 50	13.28	14 81	14.01
March	15.90	14.95	14 65	13.66	14.96	14.10
April	15 90	15.13	14 65	13.90	15 00	14 15
May	15.90	15.14	14 30	13.90	14.72	14.12
June	15 90	......	14 06	......	14.56	......
July	15 90	......	14 03	......	14 53	......
August	15 90	......	14 00	......	14 47	......
September	15 90	......	13 57	......	14 40	......
October	15.43	......	13.44	......	14.34	......
November	14.92	......	13.30	......	14 25	......
December	15.15	......	13.10	......	13.90	......
Year	$15 72	......	$13 94	......	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS June 18

Name of Comp.	Bid.
Acacia	.06
Cripple Cr'k Con.	.01⅜
C. K. & N.	.17
Doctor Jack Pot	.05¼
Elkton Con	.55¾
El Paso	.97¾
Findlay	.05
Gold Dollar	.17
Gold Sovereign	.01
Isabella	.12⅜
Jack Pot	.04
Jennie Sample	.05
Lexington	‡ 02
Moon Anchor	01
Old Gold	03½
Mary McKinney	.72
Pharmacist	.01⅜
Portland	.90
Vindicator	.85
Work	.01¾

SALT LAKE June 18

Name of Comp.	Bid.
Beck Tunnel	10
Black Jack	13
Cedar Talisman	02
Colorado Mining	15½
Columbus Con	27
Crown Point	02½
Daly-Judge	5 75
Grand Central	63
Iron Blossom	1 22½
Little Bell	41
Lower Mammoth	01
Mason Valley	‡11 50
May Day	10½
Nevada Hills	‡1.95
New York	‡ 04¼
Prince Con	1 62½
Silver King Coal'n	2 50
Sioux Con	06
Uncle Sam	.20
Yankee	‡ 10

TORONTO June 18

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7 20	Hollinger	11 10
Hudson Bay	‡70 00	Imperial	02
Temiskaming	40	Pearl Lake	16
Wettlaufer-Lor.	59	Porcu. Gold	35
Apex	.04	Porcu. Tisdale	02
Central	‡5 56	Preston E. D.	04
Crown Chartered	13	Rea	30
Doble	20	Standard	‡ 02½
Dome Exten	.29	Swastika	.14
Foley O'Brien	.18	West Dome	.15

SAN FRANCISCO June 18

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.06	Belmont	9.90
Belcher	.60	Jim Butler	.65
Best & Belcher	.13	MacNamara	.24
Caledonia	‡1 40	Midway	.40
Challenge Con	13	Mont.-Tonopah	2.24
Chollar	02	North Star	.15
Confidence	40	West End Con	1.65
Con. Virginia	54	Atlanta	.21
Crown Point	37	Booth	.08
Gould & Curry	03	C.O.D. Con	.10
Hale & Norcross	12	Comb. Frac	.14
Mexican	2 72	Jumbo Extension	.35
Occidental	55	Pitts.-Silver Peak	1.25
Ophir	1 12½	Silver Pick	.11
Overman	.62	St. Ives	.33
Potosi	.04	Tramp Con	‡.01
Savage	13	Argonaut	‡2.00
Sierra Nevada	.15	Bunker Hill	‡4.50
Union Con	.66	Cent. Eureka	.50
Yellow Jacket	.46	So. Eureka	‡3.50

N. Y. EXCH. June 18

Name of Comp.	Clg.
Amalgamated	85⅜
Am. Agri. Chem	61½
Am.Sm.&Ref.,com	84½
Am. Sm. & Ref., pf.	107⅜
Am. Sm. Sec., pf. B	89⅛
Anaconda	43⅝
Batopilas Min	1⅝
BethlehemSteelpf	69½
Chino	34⅛
Comstock Tunnel	‡.10
Federal M. & S., pf.	41½
Goldfield Con	4½
GreatNor.,ore.,ctf.	40½
Guggen. Exp	60¾
Homestake	94
Inspiration Con	19½
Miami Copper	28⅜
Nat'nalLead,com	57¼
National Lead, pf.	107½
Nev. Consol	22
Pittsburg Coal, pf.	89
Ray Con	21
RepublicI&S,com.	23¾
Republic I & S, pf.	79
SlossSheffi'd,com.	54⅜
Sloss Sheffield, pf.	98
Tennessee Copper	44
Utah Copper	63⅞
U. S. Steel, com	69¼
U. S. Steel, pf.	110⅝
Va. Car. Chem	48

N. Y. CURB June 18

Name of Comp.	Clg.
Barnes King	‡ 30
Beaver Con	.46
Braden Copper	7⅜
B. C. Copper	6
Buffalo Mines	‡1¼
Caledonia	¾
Con. Ariz. Sm.	⅝
Davis-Daly	2½
Diam'field-Daisy	8
Ely Con	¼
Florence	.95
Giroux	5½
Gold Hill Con	⅜
Greene Cananea	10
Greenwater	‡.06
Internat S. & R.	124
Kerr Lake	2½
Keystone	3
La Rose	3½
McKinley-Dar-Sa.	1 11/16
Min. Co. of A. new	3
Motherlode Gold.	15/16
Nev. Utah M. & S.	03½
Nipissing Mines	7¾
Ohio Copper	1½
Pacific Sm. & M	3/16
South Live Oak	3¾
South Utah M. & S.	¾
Standard Oil (Old)	910
Stand'd Oil of N.J.	382
Stand'd Oil Subs.	510
Stewart	1⅜
Tonopah	7⅛
Tonopah Ex	1 11/16
Tri-Bullion	½
Tularosa	‡ 13/16
Union Mines	3/16
United Cop., pfd.	10
Yukon Gold	3¾

LONDON June 19

Name of Com.	Clg.
Camp Bird	£1 9s 3d
Dolores	1 10 0
El Oro	0 16 6
Esperanza	1 11 3
Mexico Mines	7 5 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 5 0

BOSTON EXCH. June 18

Name of Comp.	Clg.
Adventure	9¾
Ahmeek	355
Algomah	6½
Allouez	47
Am. Zinc	31¾
Ariz. Com., ctfs.	5⅞
Bonanza	.40
Boston & Corbin	8
Butte & Balak	3¾
Calumet & Ariz	75¼
Calumet & Hecla	524
Centennial	24¾
Con. Mercur	‡.05
Copper Range	58¼
Daly West	5½
East Butte	13¼
Franklin	13
Granby	54½
Hancock	36¼
Hedley Gold	17½
Helvetia	1⅛
Indiana	19¼
Island Cr'k, com.	59
Island Cr'k, pfd.	90
Isle Royale	32
Keweenaw	1¾
Lake	39
La Salle	7
Mass	7
Michigan	3
Mohawk	67¼
New Arcadian	4¼
New Idria Quick.	‡6⅞
North Butte	31¾
North Lake	6⅛
Ojibway	4⅝
Old Dominion	58½
Osceola	125
Quincy	90
Shannon	15
Shattuck-Ariz.	22½
Superior	40
Superior & Bost.	2¼
Tamarack	43
Trinity	7¾
Tuolumne	4
U. S. Smelting	39⅝
U. S. Smelt'g, pf.	49
Utah Apex	2½
Utah Con	11
Victoria	4¼
Winona	‡6⅞
Wolverine	112
Wyandot	2½

BOSTON CURB June 18

Name of Comp.	Last
Bingham Mines	2¾
Boston Ely	1 9/16
Boswyocolo	.02½
Butte Central	6¼
Cactus	10
Calaveras	2⅝
Chief Cons	1⅜
Corbin	1 11/16
Cortez	1 3/16
Crown Reserve	3¼
First Nat. Cop.	2¾
Majestic	.66
Mazatan	‡½
Moneta Porc	‡.11
Nevada-Douglas.	3¾
New Baltic	3
Oneco	2¾
Raven Copper	.30
Rhode IslandCoal	.29
San Antonio	‡3
S. W. Miami	7½
South Lake	9¾
Trethewey	.45
United Verde Ext.	.43
Vulture	‡5.00

‡Last quotation.

The Engineering and Mining Journal

Vol. 93. JUNE 29, 1912. No. 26

Issued Weekly by the
Hill Publishing Company
John A. Hill, Pres. Rob't McKean, Secy.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N. W. 7.

Walter Renton Ingalls, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

Page

Editorials:

The Situation in Spelter......... 1255
The Price and Prospects of Silver 1256
By the Way...................... 1257
Conditions at Tonopah............ 1258
Senate Asks for Steel Industry Data 1258
Northwestern Metal Process....... 1258
New Keystone Copper Company.... 1258
Correspondence and Discussion:
Food Supply for Miners....Government Tests of Wire Rope....*The Slime Problem....Temperature Correction Chart for Tapes.. 1259
Sticking to the Job. E. P. Mathewson 1261
Wet Concentration of Furnace Slags...........H. W. Hardinge 1262
The Survey's Work on Potash..... 1263
Iron River District, Michigan...... 1264
South African Notes............... 1264
Details of Practical Mining:
*Copper Range Ore Skip....Ore Crushing Plant Underground....*A Double Gage Turnout....*Conservation of Water in Placer Prospecting....Repairing a Cracked Pump Cylinder....*Prevention of Drilling in Misfired Holes....Pulmotor at a Lead Mine....Remarks on Hoisting Ropes....*Testing Air Consumption of Drills....Concrete Survey Monuments 1265
Details of Metallurgical Practice. . 1269
Notes from Current Literature..... 1271
*Lining the Snake Creek Tunnel. Oscar N. Friendly 1273
Mine Sampling and Valuation. H. S. Monroe 1276
South African Diamond Fields..... 1277
The Casper, Wyo., Oil Field. C. E. Jamison 1277
*The Evolution of the Cableway. Henry M. Payne 1278
The Vicissitudes of Graphite Mining 1279
The Assay for Gold, Silver and Platinum 1280
The Sizing of Fine Dry Ore. Charles H. Brown 1281
Prospecting for Asbestos.......... 1283
Cuyuna Iron Ores................. 1284
New Jersey's Zinc Production...... 1284
*Determination of Carbon in Steel. W. L. Morrison 1285
Changes at Canadian Copper Co.... 1286
Patents 1287
Personal, Obituary................ 1288
Editorial Correspondence.......... 1289
Mining News...................... 1291
Markets 1297

*Illustrated.

The Situation in Spelter

Great strength has continued to prevail in the spelter market, the demand for this metal having been surprising and the failure of new production to develop having been disappointing. Not only has the new smelting capacity been slow in materializing, but also the supply of ore, especially of high-grade ore, has been less ample than is desirable. The strength of the market is, we think, based on these conditions and the conviction among consumers that the smelting capacity is likely to be diminished by troubles in the gas fields about as rapidly as it is increased in the coal fields, at least for a considerable time to come. In no other way can we explain their willingness to contract for their requirements an unusually long way ahead.

The failure of the gas supply of Kansas and Oklahoma was foreseen a long time ago and such a pinch as we have lately been experiencing was expected, but not exactly as it has come about; in other words, the operation of the economic factors producing it was delayed and drawn out more than was anticipated, and there were several relaxations from the early pinches and restorations of comfortable conditions before the acute and prolonged stringency became developed. This was not unnatural. It is indeed the ordinary course of a disease, either physical or economic. In this specific case, a supply of natural gas does not fail all at once. It becomes feeble and costly until most users are induced to give up the struggle for it, but after their retirement there is likely to remain one survivor who manages to get along for a time on the remnants, no longer harassed by the drafts by his competitors. Thus it has been at Iola. In other places the Kansas Natural Gas Co., a great exhauster of gas, has retired from fields that it could no longer suck advantageously, and has left the smelters with a squeezed orange but an ability still to get something from it without interference. Some of the smelters retreated to Oklahoma, where they have been unmolested, but there can be no doubt that sooner or later the Kansas Natural Gas Co. will pursue them there, in spite of state prohibitions, and the same acts will be repeated. In brief it is the same old story of the extinction of the buffalo, the stripping of our forest lands and the skinning everywhere of the virgin resources of the West.

In a general way the exhaustion of the natural gas of Kansas and Oklahoma was foreseen 10 years ago, but we became so familiar with the cry of wolf at the door that we did not believe in his presence when he really came. Otherwise, we think, the construction of new smelteries in the Illinois coal fields would have been begun several years earlier; and even later the existing smelters would have added more new furnaces to their plants than in fact they have done.

The use of natural gas in Kansas and Oklahoma has not been attended by the wastefulness that characterized an earlier era in Ohio and Indiana, but the smelters are in some measure responsible for their present troubles. It is true that wells were not allowed to blow off into the atmosphere and gas was turned off when not required, but the methods of using gas in smelting were, and still are, wasteful. For a long time no definite information respecting the consumption in smelting was possessed, but even after that knowledge was obtained a type of roasting furnace that is a great gas-eater was persistently retained. This is a particular plague now, when gas is short, the effort to obtain relief from which is exhibited in the strong demand for calamine ore, which does not need to be roasted.

The deficiency in ore supply is likely to be corrected more quickly than the deficiency in smelting capacity. The Joplin district proper seems indeed to have attained about its maximum, its output for many years recently having been about 275,000 tons per annum, plus or minus about 5%. In 1911 it was 268,500 tons, including both blende and calamine. The choicest part of the blende of this district is taken by smelters who produce sulphuric acid as well as spelter, or who produce a superior grade of spelter, and the competition among them creates a market price for this ore that nominally leaves but little, if any, margin of profit to the smelters. In fact the miners receive payment for the sulphur value of their ore, although such does not appear specifically, being represented rather by what would otherwise be an unduly high price for zinc.

Even this does not seem to stimulate any significant increase of production in this district. On the other hand the outputs of Oklahoma and Wisconsin are forging ahead rapidly, and beginning with this year we may also expect to see an important gain on the part of Tennessee, which also will produce a high grade of ore.

Among the districts west of the Rocky Mountains, the results have been rather disappointing, save at Leadville and Butte. Aside from these there is no district that exhibits any regular progress. In 1911 Colorado made the largest increase of production of any of the states. This was chiefly due, however, to the swelling output of calamine by Leadville, which is a low grade of ore and consequently does not add rapidly to the make of spelter. Not so with Butte, where there was also an important increase in 1911. The ore of its mines is of good grade and of good quality. The Butte & Superior mine seems to be second in magnitude only to the Franklin mine of the New Jersey Zinc Co., and with its new concentrating mill that has just gone into operation it will unquestionably make a much larger production in 1912. Besides the Butte & Superior the Elm Orlu mine is already a producer, while the Anaconda company is a potential producer. It is, we believe, only a matter of a year or two before we shall see Butte turning out 150,000 tons per annum of ore of about 50% grade. This, together with the increasing outputs of Wisconsin, Tennessee and Oklahoma, should prevent danger of ore shortage.

It seems, however, that the present situation in the spelter market is likely to run on until there is a material accession to the smelting capacity, the provision of which is slow. We might even expect to see the price for the metal soar above 7c., were it not for the relief which Europe can offer. There is evidently an abundance of spelter over there for sale at the present price of about £26, which is 5.65c. per lb. A little further advance in our market will enable European spelter to be imported with payment of duty of 1⅜c. per pound.

The Price and Prospects of Silver

Notwithstanding comparatively light shipments to India, silver has continued to hold the advance which began in December last, and which has carried the price up to over 60c. in New York. The average price for the month of May was 60.88c. in New York and 25.038d. in London, these figures being, respectively, 7.573c. and 3.455d. above those for May, 1911. The advance is apparently due to anticipation of a large coming business rather than to the immediate demand and is not altogether speculative. It is true that the Indian group which carried so much silver last year is still in the market, but its activities have been directed more to steadying the market than to forcing it up. The present strength is shown by the fact that the 900,000 oz. or more lost in the wreck of the "Oceana" some three months ago have been recovered and sold by the underwriters without in the least affecting the market.

The sales to India have been undoubtedly affected this year by the large shipments of gold from London to that country, which for the first four months of this year amounted to £7,088,315, or £2,481,165 more than in the corresponding period of 1911. Present indications are for another prosperous year in India; but whether the substitution of gold for silver in the exchanges will continue to so large an extent is problematic. The custom of centuries in the East does not change in a year or two, and a very large proportion of Indian wage earners are still too poor to require gold either for currency or hoarding. There is every prospect that they will continue in that condition for a long time to come.

The present strength of the market appears to depend largely on the prospect of heavy financial transactions with China and upon the success of the new government, which is expected to result in a reform and unification of the currency and in an increase of prosperity and trade. The loan, at any rate, is assured and the operations connected with it will require the remittance of a large quantity of silver.

Stocks of silver held in London just now are large; they are estimated by good authorities at more than £3,000,000 or 75,000,000 oz. Only a part—perhaps a comparatively small part—of this accumulation is in speculative hands. A large part is held in anticipation of exchange operations in connection with the new loan. Moreover, in the present condition of the money market it probably costs less to buy and carry the silver itself than it would to extend contracts for future delivery. It does not appear probable that the market will give way to any considerable extent for some time to come.

That the steel trade is not in as depressed condition as some people would have us believe, is shown by the improvements and additions to plants arranged for or actually begun by several large producers. In the Pittsburgh district, the Steel Corporation, the Republic Co. and several other new plants will add about 2,500,000 tons yearly to the capacity of the district for making open-hearth steel. From this total, however, must be deducted the bessemer converters which are to be dismantled at the Edgar Thomson works; but the net addition to steel-making capacity will be not far below 2,000,000 tons. Besides this, the Steel Corporation is starting to build additional mills at Gary, and to put $6,000,000 into the Minnesota Steel Works, at Duluth. All this is doing pretty well for a declining and profitless industry.

During recent months the conditions prevailing in the copper market have been psychologic rather than economic. Consequently the sensational break in the market this week tells us only that for the moment some persons wanted to sell more copper than would be taken except at a concession in price. As to the why and wherefore of this, who knows? It still remains to be seen, we think, on what level the market is going to stand when economic factors alone will govern.

By the Way

One of our contemporaries reports that Canadian patent No. 138,432 covers "an explosion and the method of producing it." Should think the patent would be badly damaged after a little blasting.

"Thomas," said the professor, "mention an oxide." "Leather," replied Thomas. "What is leather an oxide of?" "An ox'ide of beef."—Chicago *Evening News*.

"The impression is growing that an important factor in the steel market is the fact that steel products have been selling ex-Gary dinners"—so says the New York *Times*, a persistent advocate of controlled markets.

In speaking of compressed-air locomotives, *Echo des Mines* says that one rather unlooked-for result of the compressed-air locomotive is that the workings are rendered more healthful and cooler through the expansion of the air in the locomotive.

One of our contemporaries suggests the use of sodium hyposulphite in the determination of sulphur, for reducing ferric iron so that there will be no solvent action on the precipitated barium sulphate. We earnestly recommend the method for smelters who penalize sulphur.

"Supposing," said the examiner, "you had renewed the manhole gaskets, had tightened up the nuts on the manhole dogs and had got 125 lb. of steam, what would you do if a dog came off and the handhole plate fell in?" "I'd go in after it," answered the candidate. "Any plate that could fall in against a pressure of 125 lb. would be worth going after."

A recent novelty in the treatment of the asphaltic residues of the oil refineries which should appeal to the metallurgist, is that of bessemerizing them. This process, according to the Geological Survey, produces a sticky, and to some extent, an elastic material. This has been used for roofing, and to a small extent for rubber substitutes. We hope this is not a hot-air process.

While visiting the Calumet & Hecla Hospital at Calumet, says the Detroit *Saturday Night*, a visitor paused at the bed of an injured miner and solicitously inquired as to the nature of the man's injury and the cause of the accident. The Cornishman had broken his collarbone and was nothing loath to describe his accident. "You see, zur," he said, "it ware this way. Ah ware workin' oop in the shawft 'ouse. Just as Ah ware about t' step ont' plank, the bloody plank warn't there, and doon Ah went, plank an' all."

The following summary of Porcupine is credited to a man who was interviewed some months ago by the Montreal *Star*: "There are two good zones there and five or six exceedingly promising mines. The rest of the ground looks like a fine place to grow potatoes." In corroboration of this now appears the following in a Porcupine paper." "The Porcupine Lake Gold Mining Co., known locally as the Hunter property, has made a nice find, free gold being shown in the schist and quartz, which is a *palfrite* formation. There are two diamond drills working on these claims and the results have exceeded all expectations. *A nice clearing has been made on this property of about seven acres and manager J. T. Westron is having it sown with potatoes and other vegetables.*"

An engineer relates an amusing incident experienced while traveling over a remote mule trail in Central America when a revolution was about to break out. He had no passport and such a document was demanded before he was permitted to proceed. Having anticipated this he carefully preserved an advertising circular in which the printed matter was bordered by an elaborate scroll. It looked much like a college diploma, but only extolled the virtues of a brand of lubricating oils. Scrawling his name in a blank provided for that purpose the engineer presented the advertisement to the first colonel that demanded it. Fortunately that soldier could not read and the bearer was permitted to proceed unmolested on has way.

What some of us dreamed during high-school and college days as the life of an engineer was doubtless far different from what was actually encountered. On the whole, engineering is an interesting and fairly profitable profession, and yet it is not all a cinch, as many engineers can testify especially when they recall the earlier years of their professional career. A young engineer recently contributed to the *Sun* his experience which, we venture, is not an uncommon one in these days when the colleges of the country are turning out a new batch of graduate engineers, each June. This particular engineer records his discouraging experience as follows: "I have been out of work for nearly five months. It occurred to me that my experience may be of value to young men who contemplate entering the engineering profession. I received my education in a good school and had no difficulty in obtaining work on the engineering corps of railroads here and in the West at salaries ranging from $60 to $120 per month. Three times in the six years following graduation I was let out on 'indefinite leave of absence' because winter had set in, the appropriation ran out, or because a new régime, seeking a record for economy, always lops off the engineers' heads first. Not once have I lost a position for incompetence. I am now 30 years old, out of a job, with a profession which my past experience has proved to be unstable. Nor has my experience been exceptional. Have taken counsel with myself, decided to give up engineering, and try another line; but what? I may become a salesman, or learn enough stenography or typewriting to hold a steady position. This is certainly a lovely finish to the ideals accompanying the sheepskin. However, as I said, my object is not to register a calamity howl, but if possible to deter those youngsters who, inspired by pictures of 'engineers on the job' may fancy engineering a splendid, noble, lucrative profession. Splendid, yes, but far from lucrative. Thousands of men, who are in business and can't tell a cosine from a sump, are making salaries which are dazzling compared to those grudgingly paid to worried, hard working engineers."

The Radium Extraction Co. was organized to work the "immense tonnage of low-grade ores" of uranium and vanadium, discovered at Mount Paynter, South Australia, by Dr. Douglas Mawson. In addition to the immense deposits, there were alleged to be not less than 250 tons of 5% ore in the neighborhood of the company's No. 6 shaft. As a result of careful sampling, this latter quantity has dwindled to 30 tons, carrying under 5%, while the 1% ore has come down to "splashes" in irregular crevices (*Min. Journ.*, June 8, 1912), with no evidences of pitch blende or any orebody. The company funds are down to £1015 and authority is asked to dispose of the mines for anything that can be gotten. American radium investors please paste this in their hats.

On the maps of the coal fields of the United States, there is shown in the northern part of North Carolina a narrow belt in the Piedmont plateau, which is called the Dan River coal field. Although the region has been known for over a century, there is no record of coal produced from it. Speaking of a portion of this field, R. W. Stone says: "The bright, black carbonaceous shale exposed in a number of prospects at Walnut Cove is believed by some of the residents of that village to have fuel value, although none of them use it. . . . . I endeavored to burn in an open hearth some of the freshly mined mineral. Although the brightest, blackest lumps were kept red hot on a wood fire for several hours, they would not burn." And in conclusion: "After a thorough and careful examination of the Triassic beds in the Dan River field, the conclusion is reached that there is no reason to expect to find commercially valuable coal beds in this district. The beds of semi-anthracite found near Walnut Cove and near Leaksville are only a few inches thick and of small lateral extent. Being both thin and discontinuous, they are wholly unimportant. It is, therefore, useless to expend money and energy in this region in the hope of developing a coal mine."

Conditions at Tonopah

Tonopah Correspondence

The production of the Tonopah mines for May amounted to 37,302 tons, contributed by the following companies: Tonopah Mining, 14,948 tons; Tonopah Belmont, 7956 tons; Montana-Tonopah, 4611 tons; Tonopah Extension, 4497 tons; West End Consolidated, 3206 tons and MacNamara, 2084 tons. All of these companies are operating their own milling plants, amounting in all to 260 stamps and the above figures represent their present general average monthly production. This tonnage will, however, be greatly augmented by the operation of the new Belmont mill, which is expected to start in about two weeks and which will have a capacity of 15,000 tons per month.

Discovered in 1900

Tonopah was discovered in May, 1900, and from the time that operations were commenced, by leasers, in December of that year, to the end of April, 1912, it has produced $51,527,283, and six companies have together paid $13,003,559 in dividends. No company's ore resources have yet been exhausted, although the Tonopah Mining Co. realizes that owing to the cutting off of its orebodies by an intrusion of glassy trachyte, its operations may not last many years longer. The original discovery in the camp showed only four parallel outcropping veins, the extension of these on both their eastern and western course being covered by a later volcanic flow. In the 160 acres comprising the first locations, there have been developed 22 veins in all and in the Montana-Tonopah seven veins parallel to these, with other veins both east, west and north.

The producing area of the camp, measured from the extreme western workings in the Tonopah Extension and West End mines to the extreme eastern workings of the Belmont mine, is 8100 ft. long and 2700 ft. wide. In length it is practically continuous and is extending both west and east, more particularly on the east, where ore developments in the Mizpah Extension mine at a depth of 1000 ft., and in the Halifax mine, at a depth of 1300 ft., show that both mines will be productive. Both these properties are east of the Belmont mine and constitute an important extension of the eastern ore zone this month, demonstrating the continuation to the east of the different veins developed in the Tonopah-Belmont ground.

The deepest workings in ore are 1476 ft. in the Belmont mine and the veins and the ore-bearing trachyte have not yet been bottomed. This ore-bearing formation was covered by 800 ft. of cap rock which, in the Halifax mine, adjoining on the east, was sunk in for 1275 ft. before the trachyte was encountered, and in the Mizpah Extension, adjoining the Halifax on the north and a portion of the Belmont on the east, the trachyte has not been entered, although a depth of 1300 ft. has been reached. In the Mizpah Extension, as in the Montana-Tonopah, veins of rich ore have been opened in the West End rhyolite, and, on the western ore zone, this formation, as well as the trachyte and also the contact between these two, carries large bodies of payable ore.

In the original discovery, owned by the Tonopah Mining Co., and immediately east and west, and north and south, all the orebodies are greatly faulted, but this faulting is less frequent in the extreme east and west workings of the district. The orebodies vary in width from 6 ft. to silicified zones 160 ft. wide, much of which is not commercial, but in which oreshoots have been developed from 20 to 50 ft. wide and from 200 to 900 ft. long, the latter in the Belmont mine. The nature of these orebodies renders the estimation of possible ore reserves a difficult matter. In addition to the six producing companies mentioned, there are nine properties being vigorously prospected and from the position of these in relation to the proven orebodies, it is reasonable to predict that some of them will develop the extension of veins already shown in adjacent claims.

Senate Asks for Steel Industry Data

Washington Correspondence

A curious situation has been created in the Senate as a result of the resolution passed some time ago in which President Taft was asked to furnish Congress specifically with the figures showing details of the capital, income, corporation taxes, etc., of the companies engaged in the iron and steel business. These figures have never been given in segregated form by the Division of Internal Revenue in the Treasury, which was the reason for calling for them. President Taft, however, recently returned an answer in which he stated that he could not understand what corporations were intended.

This led to the offering of another resolution by Senator Hitchcock in which it is stated that the corporations engaged in the iron and steel industry regarding which information is desired are the 1048 corporations embraced in the Census Report for 1910. The resolution also requests that the Bureau of Corporations and the Census Bureau be required to aid in the inquiry asserting that they possess valuable data.

It is believed the resolution (which will shortly be passed) will give publicity to more details about the income of corporations engaged in the steel business than has heretofore been available.

Northwestern Metals Process

The Northwestern Metals Co. is erecting a plant near Helena, Mont., for the treatment of mixed sulphide ores. We are informed that a large part of the equipment is now in place and the remainder is being installed as rapidly as possible. The management of the company expects to have the plant completed and ready for operation by the coming fall.

The process of this company in the main is as follows: Chlorination with dry chlorine gas in a revolving cylinder, the chlorine being obtained from electrolytic cells. This chlorination converts the metals to chlorides and liberates sulphur, which is distilled off and collected as brimstone. Leaching of the chloridized ore with hot water, and filtering off the solution. Precipitation of iron and manganese by means of chlorine gas, caustic-soda solution and zinc oxide, and removal of the precipitate. Precipitation of gold, silver, copper and lead by agitation with zinc shavings or zinc dust, and removal of the precipitate. Precipitation of the zinc by means of a solution of sodium carbonate. The sodium carbonate is obtained by showering caustic-soda solution from the chlorine cells through carbon dioxide, which, in turn, is obtained from scrubbed and cleaned boiler chimney gas. The sodium chloride remaining after precipitation of the zinc is passed through an evaporator, where it is brought up to the proper degree of concentration, and is then returned to the chlorine cells.

New Keystone Copper Company

Operations at the New Keystone mine for the year ended June 1, 1912, were confined entirely to churn drilling, by means of one drill working on the day shift only, according to J. Parke Channing's report to the Board of Directors. In all, 19 complete holes were drilled, numbering 32 to 50, inclusive, the total length of holes amounting to 7840 ft. The previous total drilled was 14,107, making the total to date, 21,947 feet.

In addition to this, as reported last year, there exists upon the property a main shaft 330 ft. deep, 12,238 ft. of drifts, and 2318 ft. of raises and winzes. The main object of drilling was to prove the area lying to the west of the previously developed ore, and to define more clearly the orebody within the previously assumed limits.

Of the 19 holes drilled, 16 encountered ore, and the total ore developed to date, including development both by underground work and drill holes, amounts to 2,516,000 tons of an average grade of 2.25% copper. Churn drilling is still being continued at the western end of the property, toward the Live Oak line.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Food Supply for Miners

In view of the discussion concerning food consumption by miners, the following list of food consumed during one week by a party of 10 men and a cook, on Coronation Island, in southern Alaska, in July, 1904, may be of interest. These men were developing a small prospect, and were charged $1 per day for board. The endeavor of the company was to make the board as good as possible and yet to conduct the boarding house with as little loss as was consistent with conditions. The location made prices somewhat unusual, and also resulted in the use of certain articles of food which are not common. The island was visited every two weeks by a steamer which brought in fresh beef. When the fresh beef was exhausted, and this had to be used within a week after it was received, as it would not keep longer, canned and dried meats and fish took its place. Occasionally a deer was shot, but in figuring costs the deer meat is charged at the same price as an equivalent weight of beef. The price per unit, as well as the total cost of each item, is given for convenience of others who may be figuring on supplies.

WEEKLY FOOD SUPPLY FOR 11 MEN

	Price per Unit	Total Cost
25 lb. fresh beef..	$0 13¼	$3 31
2 lb. dried beef.	0 22	0 44
4 lb. bacon......	0.16¼	0.65
8 lb. mess beef (corned)..	0.12	0.96
8 lb. pork....	0 19	1.16
2 cans roast mutton...	0.25	0.50
1 can lunch tongue...	0 20	0.20
25 lb. ham	0 13	3.25
1/5 keg pigs' feet	2 25	0.45
2 lb. codfish....	0.09¼	0.19
4 cans oysters...	0 19	0 76
19 doz. eggs.....	0 27	5.13
1 gal. can tomatoes....	...	0.30
1 qt. can tomatoes..	.....	0.09
4 cans string beans...	0.10	0.40
3 lb. lima beans.....	0.06¼	0.19
2 cans peas.....	0.10	0 20
3 lb. cabbage..	0.04¼	0.13
3 cans corn.....	0.12	0.36
3 lb. parsnips....	0.02¼	0.07
10 lb. beets....	0 02¼	0 23
1 lb. beans.....	....	0 05
½ crate lettuce..	...	0.75
1 gal. pumpkin....	......	0.30
125 lb. potatoes.....	2 25	2 71
10 lb. onions....	0.04¼	0 43
3 qt cans peaches....	0.20	0 60
9 qt. assorted fruits...	0.20	1 80
1 gal. pears.......	0.31	0.31
2 lb. evaporated apples..	0.08¼	0.17
1 gal. cherries.....	0 40	0.40
5 lb. dried figs..	0 10¼	0 51
25 cans Carnation cream....	0.10	2 50
30 lb. sugar......	0.07	2 10
7 lb. coffee.	0 32¼	2 26
1 lb. tea.....	0 40	0 40
100 lb. flour..		3 10
10 lb. rolled oats...	0 04¼	0 43
10 lb. graham flour..	0.03¼	0 33
2 lb. cornstarch...	0.05	0 10
1 lb. rice...	0 08	0 08
1 lb. hominy....	0 09	0 09
1 pkg. gelatine.....		0 10
1 lb. baking powder.	0 41	0 41
1 lb. crackers...	0 10	0 10
2 lb. cheese	0 18½	0 37
1 pkg. yeastfoam. ...	0 05	0 05
1 qt. molasses.. ..		0 15
½ gal. syrup	1 31	0 66
10 lb. lard... ..	0 11¼	1 12
15 lb. butter...	0 30	4 50
20 lb. deer (or beef)	.	2 60
1 doz. pickles....	..	0 18
Spices, vinegar, extracts, raisins, currants.		1 50
		$50 13
Food consumed per man, $4.56.		
Wood, oil and soap, 50c. per day		$3 50
Cook per day, $1.50 and board, which is included in above 10 men and cook.....................		17 50
		$71 13

GEORGE A. PACKARD.

Butte, Mont., June 18, 1912.

Government Tests of Wire Rope

The Bureau of Standards has decided to make a series of tests upon wire rope and desires the coöperation of the manufacturers, engineers and users of this material. They are invited to state just what tests should be included, in their opinion, and also to give suggestions as to the conduct of the tests.

Some of the points that naturally suggest themselves are as follows:

(1) What should be proposed as a standard tensile test?

(a) Proper length of specimen, taking account of that critical length over and above which the strands will act as a unit.

(b) Type of end sockets or connection.

(c) Elongation, etc.

(2) What importance should attach to the torsion test? (Some authorities believe this to be superfluous) and what should be a standard test for torsion?

(3) What is suggested in the way of cold bend test over the usual methods.

(4) Little has been published in the matter of impact tests. It would seem as if this field is important and recommendations are desirable.

(5) What should be done in the matter of abrasive tests?

(6) Biggart, Stone and others have proposed and made tests in which the life of cables, and other properties, are investigated by passing them over a series of pulleys direct and reversed, the cables being subject to different direct tensions. What is the relative value of such tests, and how should they be carried out?

(7) Samples of cables have been taken under actual service conditions after a number of years' usage in mine or elevator service, and tests compared with the unused original material. Is anything in this line desirable?

(8) Are any other physical tests necessary?

(9) Chemical tests will be made. What are the suggestions in this respect?

(10) What number of duplicate tests is suggested for any one type or specimen? Tetmajer used two in his tests. Three would seem more desirable. For the individual wires he used eleven. Would not a lesser number, say six, be sufficient?

In conclusion, we shall be very glad for an expression of opinion as to what portion of the above mentioned points as they relate to tests shall have weight, also to have you mention any other features that will naturally occur from your experience. In any future publications made, appropriate credit for individual ideas will be given.

JOHN H. GRIFFITH,
For the Director of the
Bureau of Standards.

Pittsburgh, Penn., June 3, 1912.

The Slime Problem

In the JOURNAL of Apr. 27, the leading article on the slimes problem is exceedingly timely. Slimes are the bugbear of the base-metal mines, and if losses could be prevented and the mineral efficiently recovered, it would double the dividends of many of the largest and best mines on the continent. The same conditions existed up to recent times among the precious-metal mines with as dreary prospect of relief as now exists among the base-metal and refractory-ore mines, and I have long been impressed with the necessity of an economical and efficient method of extracting metallics from impalpable slimes. With this end in view, I have worked assiduously to find a remedy.

While plenty of good apparatus exists for the treatment of such material when granular, no matter how fine it is, for slimes of impalpable fineness no remedy has been hitherto available.

Believing the remedy would only be found in centrifuges that would multiply any suitable separating action, I have directed diligent and constant research in that field for several years, and the later results of this research appear to produce the desired remedial method. Centrifugal machines are by no means new; the past has produced endless numbers of them and among them not a few concentrators, all of which are deficient in principle and results. Centrifugal force and action are tractable and can be made to produce any movement or action it is desirable to perform and the previous undiscovered potentialities of this peculiar and useful force will astonish the average engineer, and even those who have hitherto considered themselves familiar with the subject. The machine herewith illustrated embodies entirely new principles that promise to overcome all previous difficulties and obstructions and makes possible a more general application of centrifugal force in treating ores by various methods.

In this machine, simplicity is the predominating feature, requiring small power. It contains but one movable member, a rotating centrifugal, which is illustrated by Fig. 1, in which *A* is the driving pulley, and *B* the inlet for the material to be treated. *C* is the centrifugal containing the diaphram *C'*, with an annular discharge opening *C''*. *E* is a centrifugal vacuum pump which accelerates and regulates the flow of liquid through the machine.

The member described is encased in a pressure chamber, Fig. 2, with a regulated discharge opening *F*, for the separated material, and a fresh-water inlet *G*

When the pressure chamber is filled with liquid, and the centrifugal rotated at suitable speed, a pressure is caused in the chamber, due to the rotation of the centrifugal, and the latter rotates under pressure proportional to its speed. The discharge opening *F* being closed, the liquid entering the centrifugal at *B* will pass through the centrifugal and discharge at *E* with no discharge at *C''* unless there are solids or substances which are heavier than the surrounding liquid. If this is the case, such material will pass through the annular discharge *C''* into the pressure chamber, and the solids will displace an equal volume of water which must enter the centrifugal at *C''*. This illustrates the possibility of solids passing out of the centrifugal against an inflowing current, and with the discharge open at *F* the liquid current is outward as well as the solids. Then if it is desirable to have the solids discharge against an inflowing current, water or washing liquid can be supplied through the opening *G*, and in this manner an inward flow into the centrifugal may be maintained at any desired velocity while the solids are being thrown outward against the inflowing stream into the casing. It is this principle that is utilized to separate metallic particles from the fine nonmetallic substances in the slimes, and also to separate solutions from treated cyanide slimes, or saccharine solutions, and wash the residues at one operation. The inflowing current is utilized only when it is desired to separate one solid from another or to wash the residues; otherwise the solids with sufficient liquids to carry them away, flow outward at *C''*. When it is desired to separate solids from liquids or turbid water or to thicken slimes, the amount of discharge at *F* will regulate the amount of solid or thickened discharge at *C''*, as well as regulate the consistency of the thickened material. By this action the stream entering the machine is separated as it flows through the machine and there is no accumulation in the machine to complicate its action and to increase strains, and but moderate speeds are employed. When it is merely desired to thicken slimes or separate solids contained in liquids, the centrifugal *C'* will have radial ribs above and below the diaphragm *C'*, but in separating one solid from another, no ribs will be placed above the diaphragm *C'*. For the latter service low speeds are sufficient.

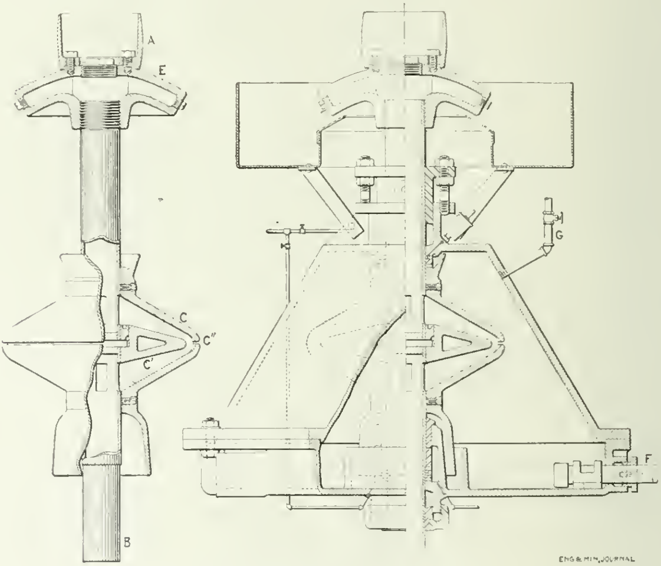
The same principle may be utilized to separate solids from any liquids, or one liquid from another, such as cleaning and dehydrating crude and other oils, also for purifying water and separating the solids from sewage, and for recovering water from tailings or factory refuse. The same principle may be applied to separating dust and other solids, or humidity, from air and gases for purifying gases, and it has many other applications. The principle is patented in various forms and is adapted to all forms of liquid separations and washing residues.

The machine is noncumulative and is continuous in action and is the only centrifugal yet produced that can be adjusted to separate rapidly and continuously solids from liquids in large volumes, and that will as readily separate solids of different gravities when they are of impalpable fineness.

The potentialities of centrifugal action are not by any means herein exhausted, for the possible refinements and variations of the above action are numerous, and it is reasonable to expect that the invention described will make it possible for the complete recovery of values from metal-bearing slimes by mechanical means. This machine is submitted to the engineering fraternity for its consideration and criticism.

L. C. Trent

Los Angeles, Calif., May 15, 1912



Trent Centrifugal Separator

Temperature Correction Chart for Tapes

I note the criticism of F. C. Armstrong, of Boulder, Colo., concerning my article on "Temperature Correction Chart for Tapes," which appeared in the Journal of May 18, 1912, p. 982.

I think Mr. Armstrong misinterpreted the meaning of this chart.

In my former article, I used as an example a distance of 70 ft. in a temperature of 90° F. In a temperature of 90° F., the tape would be too long by 0.013 ft.; this amount, subtracted from 70 ft., will give 69.987 ft., which is the distance as measured with the tape at a temperature of 90° F., so that the distance will measure 70 ft. at 62° F., or the temperature at which the tape is standard.

H. J. Rahilly.

Douglas, Ariz., June 15, 1912.

A Piece of Practical Forestry

Another interesting development in practical forestry beside the one mentioned by Doctor Raymond, in the Journal of June 22, 1912, is the use of convict labor in New York to run the afforestation nurseries. This seems to me also worth copying.

A. A. Nason.

New York, June 24, 1912.

Sticking to the Job

By E. P. Mathewson*

A few examples from experience are given to prove that keeping hard at work will count in the end, with a short biography of Mr. Mathewson.

I want to avoid the pedantic style of oratory and talk to you men, as one who has had a little experience in your chosen profession, to those just entering the arena. It has been suggested to me by your worthy president that I give you some account of my own personal experiences and those of friends of mine who have become prominent in the mining and metallurgical world. If you will pardon my speaking of myself, I will give you a brief account of my career.

After graduating from college, I was fortunate in securing a position as assistant topographer on the geological survey of Canada. I had several months' experience in that line, returning home at the expiration of the survey.

STARTS IN THE WEST

I found nothing in my chosen line of work and so I temporarily took a position as clerk in a wholesale establishment, all the time looking out for something in the profession. Nothing turned up that winter, so I made up my mind, after consulting with some friends, to try my fortune in the western United States.

I obtained a letter of introduction from the late Dr. T. Sterry Hunt to a man who was engaged in lead, silver and copper smelting in Colorado. This man had been a pupil of Dr. Hunt and had gone west shortly after graduation and amassed a considerable fortune. I did not know a soul in Colorado, but I met some people in Denver, who gave me the following advice: "Go to the gentleman to whom you have the letter of introduction and present the letter, and if he tells you he has no position vacant, ask him if he will allow you to push a slag pot away from the furnaces." I went to Pueblo, the following day and presented my letter. It so happened that the night assayer had just resigned, so I was offered the position as night assayer of slags and refinery products at the magnificent sum of $50 per month, the work being 13 hours night shift for two weeks and 11 hours day shift for two weeks. I liked the work and it seemed to agree with me.

At the time of my entering the employ of the company known as the Pueblo Smelting and Refining company there were 13 technical graduates ahead of me. Shortly afterward the manager who had given me work resigned and a new man was put in charge. A little later the metallurgist was offered a good position in Australia, and he left. He was followed by the assistant metallurgist, and within a short time so many changes occurred in the technical force that I found myself assistant superintendent in the plant before I had been two years in the employ of the company.

Mine was rather an exceptional case. I was assistant superintendent only one year when the superintendent resigned and I was appointed superintendent of the lead department, there being another superintendent of the copper department. Shortly afterward, the superintendent of the copper department resigned and the manager asked me to take charge of both departments; at the same time telling me that the wages of the men in the copper department would have to be cut in half. This was a very pleasant opening, as you can imagine. I went to the foreman of the copper department, explaining my new position and the decision of the management regarding wages. The foreman told me politely that he and his men would quit, which they did.

RUNNING FURNACES BY A BOOK

I thereupon took some men from the lead department and put them in charge of the copper furnaces. I had never seen a charge of copper refined, but there was an article published in the "Transactions of the American Institute of Mining Engineers" by Dr. Eggleston, which described fully the operation of refining copper in the Lake country. I got this article and camped at the works without sleep for 56 hours, directing the men I had put in charge of the copper furnaces in every step of the process. Whenever I got stuck I would retire to the office and consult the article, the result being that we ladled the biggest charge of copper that had ever been taken out of the furnace, and that charge was of the best quality ever taken from that furnace.

After that things went smoothly enough in the copper department, as the men I had broken in took up their work readily, and as they were accustomed to furnace work it was not difficult to train them to handle copper.

I want to say, for the benefit of you young men, that the salaries paid in those days were not what are paid nowadays for similar services. My salary, as assistant superintendent, was $125 per month, and that large sum was only obtained after strenuous efforts on my part to have the management recognize my ability. That was the only time in my life that I ever asked for an increase in wages; but the manager, I knew, had no knowledge of the value of the services of a technical man; and I was aware that in other establishments in the vicinity men in my position were paid considerably more than I was.

I remained with the Pueblo Smelting and Refining company until 1897. At that time the Guggenheim family had a number of smelting establishments, one of which was in Pueblo. The late Benjamin Guggenheim (one of the Titanic heroes) asked me to enter the employ of M. Guggenheim's Sons and take charge, as manager, of their Philadelphia smelter at Pueblo—the idea being that as soon as I found a man to take my place I should be transferred East. The transfer was made about three months after entering the employ of these gentlemen, and I was placed in charge of the refineries at Perth Amboy, N. J.

During the next five years I was sent out to various parts of the country, including Mexico, and was for two years in South America, at Antofagasta, Chile, representing the interests of my employers.

After two years in South America, I returned to New York and shortly afterward my association with M. Guggenheim's Sons (who had, in the meantime, joined interests with the American Smelting & Refining Co.) was severed.

A few months later I was offered a position in Montana as superintendent of blast furnaces at the Washoe smelters, then just constructed. This position I took and a few months later, owing to the resignation of the manager, I was placed in charge of the plant and have remained there ever since.

UP FROM THE RANKS

I will now give you, briefly, accounts of the lives of several men who are or have been prominent in the mining world. First, I recall a friend who was, at one time, employed by the Pueblo Smelting & Refining Co., in Colorado. This man was a graduate of Freiberg. He dropped into Pueblo one day without any acquaintance in the town; he applied for work at the smelter; was given a wheelbarrow and shovel and a position as laborer in the sampling mill. He did not mention the fact that he was a graduate of Freiberg, but it so happened that the furnaces were out of order and he dropped a hint to the foreman in charge as to a good way to bring the furnaces around. The foreman reported the

---

Note—The main portion of an address to the graduating class of the Montana School of Mines, at Butte, Mont., June 6, 1912.

*General manager, Washoe works, Anaconda, Mont.

matter to the manager and the manager asked him if he knew anything about furnaces. He said he did "know a little," so the manager gave him a trial as an assistant about the furnaces. He proved that he did know his work and gradually he was advanced until he was placed in charge of the plant. Leaving that plant, later on, he took charge of a smelting plant in another part of Colorado, and he was then offered a position as metallurgist to the Broken Hill company, in Australia. This position he accepted with many misgivings, but it proved that it was the beginning of the making of his fortune. He built up the smelting industry for the Broken Hill company and then interested himself in other companies in Australia, finally retiring with a large fortune a few years ago. He still retains an interest in the work.

Another man took a small, humble position with a placer-mining company in California, showed himself to be a good assayer; then later was put in charge of some small quartz properties; from there he was called to South Africa, at the time the Rand was coming into prominence; showed his ability as an organizer in organizing some of the big properties there and managing them, and is today one of the most highly paid consulting engineers in the world.

Another man, nearer home, worked for years as assayer in Anaconda, then in a similar position on the Pacific Coast, rising to the position of chief assayer at a large plant; then was offered a position as assistant to one of the managers in South Africa on the Rand, which he accepted. He filled that position satisfactorily and was advanced to the managership, and after several years' service in that capacity, returned to America to take up the work of consulting engineer, representing the capitalists who had been his employers on the Rand.

Another man, who began with pick and shovel around a smelter, gradually worked his way up to the superintendency of one of the large Colorado plants, was transferred to Butte, where he conducted some of the earlist experiments in the use of magnesite brick for the lining of converters; from there drifted into the mining end of the business, and is today one of the leading consulting mining and metallurgical engineers of the country.

Another man began as a field assistant to the geological survey of the United States; was afterward state geologist of Wyoming and from there drifted to Arizona, where he became connected with the Copper Queen Mining Co. His ability soon placed him at the head of the technical force of that company, and from that he was transferred to other larger concerns and given more authority, and today is the general manager of one of the largest companies in Mexico.

Another case: A young man sought employment at the Washoe smelter a few years ago as a laborer, said nothing about his technical knowledge, but put in a formal application for a position when a vacancy occurred in the technical staff. He was offered a position and we were surprised to find that he had been working for us for months as a laborer. He proved his ability in the technical line and when the opportunity was offered of a transfer to another company, at an increase of salary, he accepted, and today is the assistant superintendent of one of the largest companies in the country.

We have had many young men in Anaconda and in Butte who have worked their way up and today there are dozens of technical men employed about the mines and smelteries who are on the road to advancement.

The main things to be remembered by you are: To be not afraid to tackle any job that turns up. Never be above your position. Be sober and diligent. Faithful in business. True to your friends and to your employers. Learn to treat your associates and the men under you as men, and as soon as you can find the right girl (provided you have enough money to pay for the license), I advise you to get married. Do not wait to make your fortune before choosing your wife; if you do, the chances are 99 in 100 that you will never have one.

Mineral Output of New York in 1911

SPECIAL CORRESPONDENCE

The figures of mineral production by the New York mines and quarries during 1911, as compiled by the State Geologist, show a general falling off in these industries, the total value of the products amounting to $31,602,008, or about 10% under the total reported for the preceding year. The accompanying table gives the detailed statistics in practically final form, the items being ranged in order of descending value.

NEW YORK MINERAL OUTPUT, 1911

Product	Quantity
Brick, building, M.	1,078,019
Pottery and clay products	$4,291,441
Limestone and marble	$3,452,202
Iron ore, tons	1,066,148
Cement, bbl.	3,691,373
Salt, bbl.	10,082,656
Sand and sand-lime brick	$1,820,431
Natural gas, M. cu.ft.	5,127,571
Petroleum, bbl.	915,314
Gypsum, tons	446,794
Sandstone	$955,063
Trap	$899,414
Mineral waters, gal.	8,923,628
Talc ,tons	65,000
Pyrite, tons	69,867
Granite	$148,633
Graphite, lb.	2,510,000
Garnet, tons	4,285
All else[1]	$464,582
	$31,602,008

[1] Includes apatite, carbon dioxide, diatomaceous earth, emery, feldspar, marl, millstones, pigments, slate and zinc ore.

Among the few industries which held their own or showed slight advances were those of portland cement, pottery, pyrite and talc; for graphite, gypsum and salt the declines were small; in iron ore and clay and stone structural materials, a decidedly downward tendency was manifest.

A product not hitherto recorded from this state was zinc ore, of which a few hundred tons were shipped from the deposits near Edwards, St. Lawrence County, for experimental purposes. The shipments consisted of lump ore, which averaged 40% or better. It is proposed in the future to concentrate the ore, as a mill for the purpose has just been erected at the mines.

Wet Concentration of Furnace Slags

By H. W. HARDINGE*

A recent professional call upon me again brought forward the fact that many things which have been tried in the past, if worked to an ultimate result, might end in success. This is evidenced in perhaps the most pronounced manner, in the case of the development of cyanide treatment of gold and silver ores. The wet concentration of slags, however, can hardly be compared with the cyanide process from a broad economic standpoint, owing to the limited quantity of material to be worked, but might be utilized in a lesser degree.

PRECIOUS METAL IN SLAG LARGELY FREE

My experiments made in 1895 and 1896 were recalled a short time ago by an inquiry from a large smelting works for the best means of crushing a complex mixture of slags, furnace bottoms and general smeltery accumulations. The question was asked "Would it be possible to gain anything by concentration of the above mentioned material?" referring only to the metallic particles contained in the mass. My answer was the production of assay records, which show recoveries of from 40 to 70% of the silver and from 50 to 120% of the gold by wet crushing and wet concentration of lead- and copper-furnace slags.

The obtaining of more gold in the concentrates than was contained in the original slag is, of course, impossible, but the concentrates would often show over 100% recovery of the assay. This is due to inaccuracies of the original assay to an extent of 0.01 to 0.02 oz., as the gold in the slag would show only 0.03 to 0.04 oz. This excess over 100% gold, could be easily reabsorbed in the assay slag as was the original gold in the furnace slag. This gold and silver absorption in slags is absolutely known in all methods of assaying, and the excess gold values of the concentrate are thus readily accounted for.

---

*President, Hardinge Conical Mill Co., 50 Church St., New York.

In concentration there is no solvent absorption of the metals, as with slags, hence the precious metals follow the original particles of matte or prills of metal into the concentrates, and the high recovery would tend to prove the gold in slags is mostly metallic.

Before the above mentioned experiments were made it was a question with me as to the mode of occurrence of the metals in the slag, whether they were in the form of a material which could be separated by gravity, or as silicates, etc., which might even be lighter than some of the main constituents of the slag. My opinion was, that inasmuch as the metals concentrate, more or less, in the shell and in the bottom of a cooling pot of slag, gravity at least was the cause of these bottom concentrations. The metals also concentrate in some form of a quick transference from the center or molten portion of the slag pot to the side shell, where they were known to exist. Of course, it was fully understood that concentration of gold was partly attributable to particles of matte and prills of metal as occlusions in the slag, as well as in other lighter forms, the latter presumably predominating. Experiments proved, even beyond my expectation, that by wet concentration the metals were susceptible to accumulation as a concentrate.

FORMER CRUSHING DIFFICULTIES

The reason for not following these experiments to economic results was that the then best known method of crushing was by rolls. However, as I have always believed in experimenting even at some loss, for ultimate advancement, the then new feature of crushing by 42-in. diam., 6-in. face, high-speed rolls, was tried, and worked fairly well until the slag and matte cut the face of the rolls into small pits and corrugations, so that they were soon incapable of producing even a 20-mesh division at anywhere near the economic point between cost and result, when an 80- to 100-mesh material was desired.

We then made experiments with what was at that time known as the "Murphy barrel," being nothing more than a cylindrical tube or pebble mill in its earliest stages of development. The results obtained in the barrel were unexpected by me mainly on account of the fineness and the rapidity with which the work was performed. The concentration product of this pebble-mill material, when run over one of the first Wilfley concentrating tables ever made, was a surprise.

The possibilities of wet crushing a slag are far greater to-day with present improvements than they were at the time of my making these experiments about 15 years ago. The experiments were not further followed at the time mentioned owing to my skepticism as to how far and with what degree of economy pebble-mill crushing was possible, as well as a most active professional demand upon my time, but I always expected to return to the experiments so successfully started. Subsequent development of the pebble-mill shows that I was on the right track as to the absolute feasibility of wet crushing and wet concentrating a furnace slag. From the time of this experiment with the Murphy barrel I believe that I have been, professionally, one of the strongest advocates of the pebble-mill, which advocacy of the then apparently absurd idea of crushing, is now endorsed the world over, although at the time of the operation of this Murphy barrel I myself was sceptical of the statement that it would produce the results claimed for it. My assay records of several slag dumps show possibilities, not only of the one cited, but of others in Colorado, Arizona, Utah and Nevada. Blindly rushing to a conclusion that every slag dump will return satisfactory results will be fraught with disappointment, but the older slag dumps made during the earlier Western experiences in smelting, when only high-grade ores were treated, will justify reasonable investigation and experiments.

Phosphate Railroad Rates

The Interstate Commerce Commission has just handed down a decision in the case of Mayor and Council of Boston, Ga., *vs.* Atlantic Coast Line Ry. Co. *et al.* in which it orders a removal of discriminating rates on phosphate. The Commission holds as follows:

1. The record shows no substantial dissimilarity of circumstances and conditions affecting the transportation of freight to Boston, Ga., as compared with Quitman and Thomasville, Ga., both rail and water competition appearing to be practically the same at the three places, and the charging of a differential higher than the Quitman or Thomasville rate on all traffic to Boston from New York and from Ohio River crossings, on phosphate from Montgomery, Ala., is unduly prejudicial to Boston and unduly preferential to Quitman and Thomasville. Carriers ordered to remove the discrimination.

It is also held that the financial inability of defendants to extend to Boston the Thomasville-Quitman rates, even if this could be established as a fact, is no answer to the charge of favoritism.

The Survey's Work on Potash

WASHINGTON CORRESPONDENCE

Director Smith has filed with the House of Representatives a statement relative to the work of the Geological Survey apropos of the pending appropriations, in which he affords some new information concerning various phases of its work. In this he states with reference to the potash inquiries:

> We have reported on deposits of potash minerals in Utah and Colorado, and, on the extent of certain potash-bearing rocks, in which potash is in a more readily available form than it is in granite, from the hills in Wyoming. The reports on these have been published and distributed.
>
> In most of these cases the question of making potash available commercially having been already under consideration by private parties, we considered the function of the Geological Survey not to investigate processes but to give authoritative information to the public as to the extent of these supplies. In the case of alunite, the extent was not as great as was believed by some people in Utah and New York. Information regarding similar deposits in Colorado was also published. Then, we have published information on the percentage of potash in some of the bitterns, which are, you might say, noncommercial brines associated with salt brines, in the East. They are the underlying liquors that are not available for making common salt. In one case in Ohio it was shown that these brines carry a considerable portion of potash. We simply point out the facts, and we think it is for individual and corporate initiative to pursue the problem.
>
> We would like to continue the drilling. If we do not find potash at the Carson Sink we will be glad of an opportunity to use the equipment, which has already been purchased under this appropriation, in another basin where the geological conditions are such as, in our opinion, to favor the concentration of potash salts beneath the surface. Of course, the piece of work that might be considered as yielding the best result was accomplished by one of our geologists, together with one of the field men from the Agricultural Department, in southern California, down near Death Valley, where they proved the presence of potash. This had been discovered at a lake which is underlaid with a body of at least 90 ft. of impure salt, and the liquor which saturates that body contains as high as 44% of salts, and about 7% of these salts is potash.
>
> The question of commercial value resolves itself, I think, into a transportation problem. The salts appear to be in such condition, in this solution, as to facilitate the concentration of the potash, and that can be done probably by using windmills for power for pumping and simply using solar evaporation, because that is in as hot a country as we have. It is within 20 miles, I believe, of a new railroad, and the question becomes one of transportation. My own opinion is that it will afford a supply of potash that will be available for that western country, at least until the canal is completed. I do not see how it can compete on the Atlantic coast with the German product, because you un-

derstand, the German product already has a wide margin of profit, so they can cut prices considerably. But even if it only resulted in lowering the price of the German product to the consumers in the central part of the country it would accomplish a good purpose. The amount expended, I think, by the two departments is insignificant when compared with the result that has been accomplished, and I am anxious to continue drilling on a somewhat more extended scale, although that wil not involve the purchase of any more equipment.

Iron River District, Michigan

Negaunee Correspondence

Interest is manifested in Michigan over the report of developments in the Iron River district, from the advance sheets on the "Mineral Resources of Michigan," by R. C. Allen, state geologist. The report says:

> The development work of the last few years has shown three important and striking facts bearing on the future of the district: (1) The ore-bearing formation is exceedingly rich, i.e., the ratio of the volume of known ore to known iron formation is relatively high. (2) Ore reserves have already mounted to a high figure, and (3) probably only a small part of the producing area has been explored. The Iron River district has one of the great ore reserves of the state if not actually the largest. The following table is taken from the report of J. R. Finlay to the State Tax Commission in 1911.

TONNAGE ESTIMATED BY J. R. FINLAY

Mine	Tons of Iron Ore Reported in Sight	Total Tonnage Expected
Osana (James)	520,000	2,000,000
Chatham	43,000	100,000
Hiawatha	254,993	1,000,000
Baker & Tully	3,500,000	3,500,000
Dober (Riverton)	713,000	1,700,000
Baltic-Fogarty	460,000	3,000,000
Caspian	3,505,500	10,000,000
Youngs	250,000	1,000,000
Zimmerman	1,000,000	1,000,000
Berkshire	563,000	1,000,000
Davidson	2,000,000	2,000,000
Wauseca (Konwinski)	40,000	1,000,000
Chicagon	390,305	600,000
Michaels Expl	1,000,000	1,000,000
Blair Expl	372,259	1,400,000
Houlihan	578,000	5,000,000
Rogers	349,306	2,500,000
Donahue	371,137	800,000
McGovern	258,413	350,000
Bates		400,000
Wickwire		40,000
Erickson		732,000
N Y State Steel		2,000,000
Totals	10,169,213	42,122,000

> The above estimates bring out the striking fact that this district has an expected tonnage in mines and explorations of seven times the total shipments, and furthermore, that 15,882,000 tons or over 37% of the reserve is in properties which had not reached the producing stage before 1911. Notwithstanding the difficulties inherent in prospecting a drift-covered field, the Iron River district offers in the proved richness of the ore-bearing formation and the successful outcome of the many recent operations, one of the most attractive areas for exploration in the Lake Superior region.

Regarding the hypothetical connection of the Iron River district with the Gogebic Range to the west, the report says:

> Further work planned for the season of 1912 will throw more light on the structural conditions here discussed, but enough is already known to demonstrate that there is no direct connection between the Gogebic and Iron River districts. The iron-bearing series of the latter, if continuous westward, which is considered practically certain, passes south of the Archean mass which limits the Gogebic district on the south.

South African Notes

Johannesburg Correspondence

The Victoria Falls & Transvaal Power Co. has apparently overcome most of the earlier difficulties met with in the transformers and transmission line, and is now supplying power to the satisfaction of its customers. Its subsidiary, the Rand Mines Supply Co., has orders for 67,000 electrical horsepower and 66,000 hp. in compressed air, while the parent company has orders for 52,000 hp., making a total of 185,000 hp. to be supplied. Of this, provision has already been made to supply 132,000 hp. The company is creating £2,000,000 debentures and issuing half of this bearing 5½% interest, in order to provide the additional horsepower required. The February profit was £37,000, and an annual profit of £670,000 is anticipated.

In the Journal, Apr. 13, 1912, it is stated that 60,000 hp. is to be obtained from the Victoria Falls, in Rhodesia. Nothing is publicly known locally of any such project, and as electrical power generated locally or near Johannesburg from coal can be produced for about 0.3d. per unit, it is quite improbable that this project, which was the earliest one considered, will be revived, even if the Transvaal government would allow it to be carried on.

Native-labor Shortage

Owing to the shortage of native labor in recent years, a peculiar position has grown up among the mining houses of the Rand. Long ago they united to form the Witwatersrand native-labor association, which controlled recruiting on a coöperative basis all over South Africa. It was afterward agreed that the groups interested should also recruit for themselves in certain parts of the Union of South Africa, though the Witwatersrand association controls the chief source of supply in Portuguese East Africa. The curious position then arose of the mining houses keeping separate recruiting agencies and encouraging private recruiters to compete fiercely among themselves and with the Witwatersrand native-labor association. As a result, about three-quarters of a million pounds were spent last year in useless competition, with the inevitable effect of a great rise in native wages and in recruiting costs per ton mined. The houses are now endeavoring to arrange matters on an equitable basis and to unite again.

The trouble has arisen owing to the fact that some mines are much more popular with the natives than others, especially some rich outcrop mines, and these have always been able by a little private effort, to secure abundance of labor at the expense of the others less fortunate. In some mines, natives are still compelled to climb in and out from great depths. In the Randfontein mines, the natives have to climb 1800 to 2000 ft. Needless to say, this is a terrible tax on endurance and tends to a great decrease in efficiency.

At the recent meeting of the Central Mining & Investment Co., the chairman foreshadowed further amalgamations among the mines, and also hinted at amalgamations among the controlling houses.

Sand Filling at Simmer & Jack

At the Simmer & Jack mine, another borehole, 7 in. in diameter, is being sunk for the purpose of sand filling. It is intended to pass all the sand from the 320-stamp mill underground for filling purposes. This is becoming necessary for reclaiming pillars, etc., as the mine is nearing the end of its life; the ore reserves are being encroached upon to the extent of about 400,000 tons per year, and little development remains to be done.

Great stress is now laid on good classification, so that sand free from slime is sent below. This sand drains much better in the stopes behind the barriers. The sand pulp is thickened in diaphragm cones on the surface. The Hendryx agitator and Hardinge mill are at present under trial by the Mines Trials Committee on the Rand.

The profit declared by the Cape Copper Co. for last year is the smallest on record, owing to the exhaustion of the Ookeip and Narrap mines, near Port Nolloth, at the northwest corner of Cape Colony. Boring is proceeding in depth below both orebodies, and the Narrap bore recently entered a body of low-grade ore. The company has, however, acquired a mine in India, which may make that country a contributor to the world's copper output. Exploration over a mile of strike has shown the existence of 5 to 6% copper ore; 60,000 tons are fully developed and 50,000 tons are partially exposed to date.

The ore reserves at the Shamva mine, in Rhodesia, are now stated to be 1,808,000 tons, with a value between 7.2 and 4.6 dwt. per ton. The former figure was arrived at by not reducing the high assays encountered.

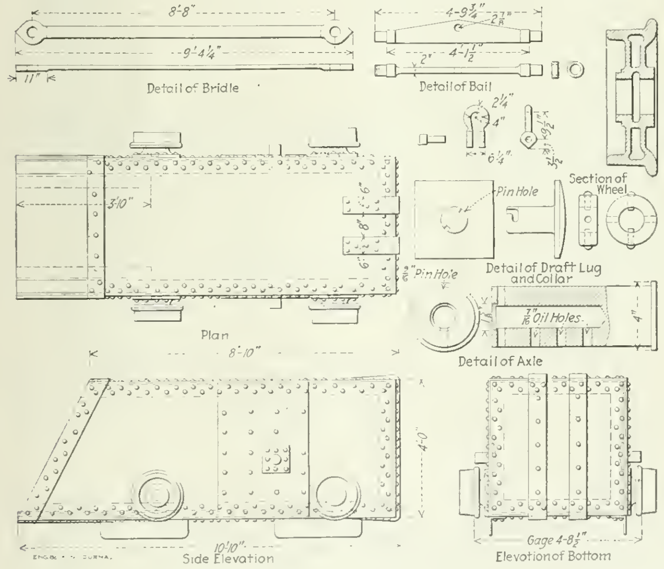
A blueprint map, which is later to be photolithographed, has just been issued by the Bureau of Economic Geology of the University of Texas, showing the iron-ore deposits, operating lignite mines, blast furnaces and producing oil fields of Eastern Texas.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Copper Range Ore Skip

The 6-ton skips used in the Copper Range mines in the Lake Superior copper country, present several novel details of construction, especially in the manner of attaching the draft lugs to the body of the skip, the system of oiling the wheels, and attaching the collars to the different lugs, bails and wheels. All hubs on which collars are used, are drilled for a split pin which holds the collars in place. The hubs are also cut with slots at 45° that receive the rivet pins of the collar.



DETAILS OF THE SKIP USED AT THE CHAMPION MINE

In the accompanying illustration of the skip the details of the draft lug and the collar used with it are shown. Projecting from the inside surface of the collar and at 90° from the hole drilled to receive the split pin, are two pins riveted into holes in the collar. In assembling the collar on the lug, the pins are slid into the notches to the bottom and then the collar is turned through an arc of 45°. This causes the pins to enter the grooves and when they are against the ends of the two grooves, the holes for the split pins in the collar are in line with the holes in the axle and the split pins may be forced through. In this way the collar is held at four points instead of at two, so that it is held on much more securely than ordinarily is the case. This security is desirable because a piece of rock may get in between bridle strap and the side of the skip and during hoisting the pins holding the collars in place may be subject to a strong shearing stress. All of the other collars are attached in a similar way.

The body of the skip is reinforced at the lugs by an extra plate. The bridle strap is bent so as to clear the front wheel. In order to keep the skip as low on the rails as possible, the wheels are mounted on hubs riveted to the sides instead of on axles. At the bottom there are two reinforcing straps, while on the under side and at the front end there are two straps that take the wear that comes on the skip's bottom when going over the roller of the dumps. By attaching the draft pins by lugs riveted to the body or the inside of the skip, the lugs are fastened much more securely than if riveted to the outside, as is the usual way.

The method of oiling the wheels is shown in the drawing of the axle. The ends are hollow and three holes in the walls let the grease out to the wheels. The wheels are made with a receptacle in them that also becomes filled with grease and acts as a reservoir, as can be seen by reference to the accompanying drawing of the wheel, there being four holes drilled through the brass bushing to connect with the reservoir. These grease cavities are closed by a screw plug that cannot be taken out without removing the collar from the axle. The grease is shot into the wheels by a plunger gun that screws into the axle so that grease can be forced into the hole so as to fill the cavity. Formerly when the wheels of the skip were filled with oil and the oiling of the axles was done by oil feeding down on them from these reservoirs, the wheels had to be filled four times per day, while the grease well has to be filled only once in 48 hours.

The rope is attached around a thimble. This thimble is now made solid instead of having its sides cut away and only reinforcing ribs going across, as they were formerly made; that construction proved to be too weak. The manner of attaching the lugs and collars, as well as the methods of oiling without the necessity of takoff the collars, was devised by W. J. Richards, the master mechanic of the Copper Range Consolidated Company.

Ore Crushing Plant Underground

A crushing and screening plant is being installed underground in the Round Mountain mine, at Round Mountain, Nev. It will be placed on the 450-ft. level, and will be similar to a plant already installed in the "Stringer Section." As mined, the ore contains many large boulders of rock, which itself is barren, but may envelop pieces of ore. In order to save this ore it is necessary to crush the boulders and sort the crushed material.

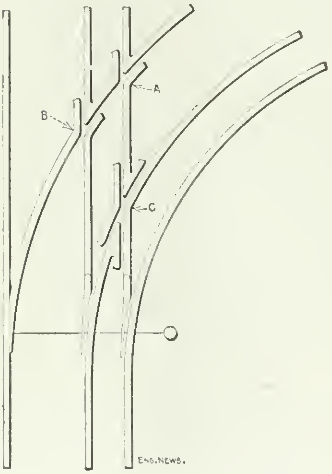
The plant will comprise a 12x20-in. jaw crusher, and an 18-in. belt conveyor to carry the crushed material to a trommel 10 ft. long by 40 in. diameter, which will be set above loading pockets cut out of the rock above the level. The fine material will be trammed to the shaft, hoisted and sent to the mill. The waste, or coarse material, will be hauled by mules, through a tunnel, to daylight.

According to the last annual report of the Round Mountain Mining Co., the crusher installation will effect great economies in handling and sorting the material mined. A better grade of ore will be produced, as under these new condi tions about 66% of the gross tonnage mined will be rejected as waste whereas during the last year 54% was rejected. It will also increase the total recovery of precious metals as it will be possible to send to the mill the greater part of the ore contained in the boulders, which heretofore has been rejected with the waste.

A Double Gage Turnout

The turnout shown in the accompanying illustration is used, states Frederick MacCoy (*Eng. News*, Jan. 25, 1912), wherever 36-in. and 4 ft. 8½-in. tracks are used together in Mexico.

This turnout is used at the Esperanza mine in the El Oro district, in the state of Mexico. The gage of the mine tracks is 36 in., while that of the main railroad line is of the standard gage of 4 ft. 8½ in. A motor car runs on the narrow-gage tracks, drawing either narrow- or standard-gage cars. One lever is used to operate both switches. Frogs *A* and *B* are standard while *C* is a crossing frog.



Double-gage Turnout Used on Mine Tracks

Repairing Cast-Iron Tanks

A cement for repairing cast-iron tanks is prepared by melting at a low heat—to prevent the brimstone catching fire—five parts of sulphur, two parts of black lead and two parts of sifted cast-iron filings. Before applying the cement, states the *Engineer and Fireman*, warm the metal by laying a red-hot iron over it. The metal must be perfectly dry, so as not to generate steam. Then stop up the damaged part with the cement, applied in a soft state by gently heating it in an iron ladle.

Conservation of Water in Placer Prospecting

By S. O. Andros*

In the desert country it may often happen that in making a preliminary examination of placer ground, the problem of obtaining water sufficient for rocking the dirt from the prospect holes is a serious one. I have often had occasion to put down a series of prospect holes across a channel where the available water has been three, four, and sometimes six miles distant. While the outfit will, of course, include a wagon, the party can usually be lessened by one man if the teamster is not continually employed in hauling water. With the usual method of handling dirt from a dry hole sunk by hand, it will require from four to six barrels of water per day, the larger amount being necessary only when the surface material is a loose sand. This amount of water can be reduced somewhat by using the rocker shown in Fig. 1, and the degree of accuracy in determining the value of the deposit can be increased greatly.

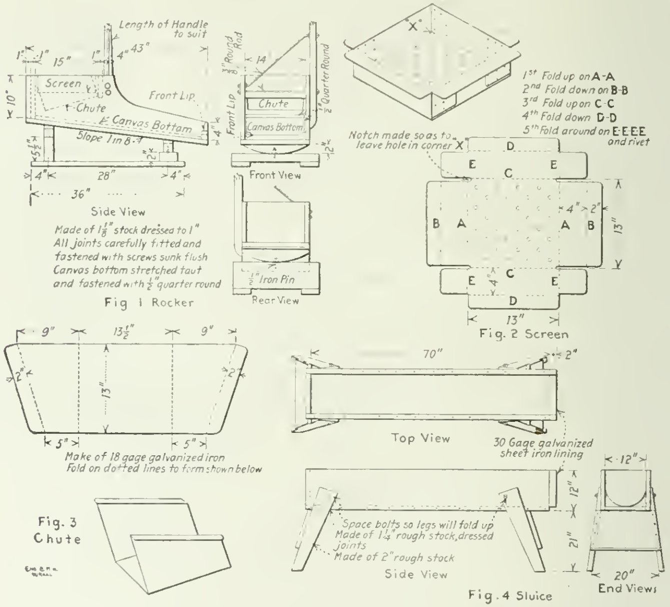
The ordinary California rocker made of rough lumber fastened with nails, becomes in two or three days a rickety affair not conducive to accuracy and wasteful of water. Where the accuracy of determination of metal content is the prime factor, the five or six dollars increased cost of a rocker that will develop no cracks is unimportant.

Rocker Specially Designed

The rocker shown in Fig. 1, devised in 1905 by R. G. Coates and me, and used successfully by us since that time, will cost between $15 and $25, depending on the section of the country in which it is built. The canvas stretched over the bottom of the rocker eliminates the possibility of any colors becoming lodged in the cracks between the boards. Eight-ounce duck is sufficiently heavy for this purpose. A priming coat and two coats of paint will further add to the certainty of saving all the colors the dirt carries. I use riffles of dressed stock ½-in. square, spaced 9 in. apart along the bottom of the rocker. It is well understood that the dimensions as given in the cut are elastic and will be varied to suit conditions. The dimensions as given are well adapted to a free-washing gravel.

The screen in Fig. 2 should be made of galvanized iron of a weight adapted to the size of the boulders, varying from 18 gage for small pebbles of 1-in. diameter to 10 gage for boulders of 4 to 5 in. in diameter. The chute in Fig. 3 need never be heavier than 18 gage.

The sluice box shown in Fig. 4 is intended primarily, and was first used, for prospecting by sinking drill holes. The attached folding legs are more convenient than the use of separate horses and the space on the wagon occupied



Construction Details of a Rocker for Use in Placer Prospecting by the horses when moving from one place to another can be used otherwise to good advantage. A shutter of ¾-in. stock cut to fit the open end of the sluice and covered with felt will retain perfectly a thin pulp. I have found that the use of the sluice box for softening gravel slightly cemented saves time in rocking and its use makes the rockerman's labor easier.

---

*Field assistant in coal-mining investigations, Department of Mining Engineering, University of Illinois, Urbana, Ill.

Whenever the water supply has been small or the water distant from the prospect holes, I have used a conserving box. The box is made of 1x12 rough lumber and its dimensions are: Length, 6 ft.; width, 4 ft.; height, 12 in. The box can be knocked down for transportation. The rocker with its base is placed in the box, which is filled with water. Rocking is then begun and at the end of 30 minutes the puddling is so complete that the box shows no leakage. The water in the conserving box can be used during an entire day's run. Where four barrels of water per day are necessary with the usual ground pool and its return channels, one barrel of water every other day will be found a sufficient quantity when the conserving box is used. It will be found advisable to shovel out the tailings as seldom as possible, since each shoveling slimes the water to a great extent.

Repairing a Cracked Pump Cylinder

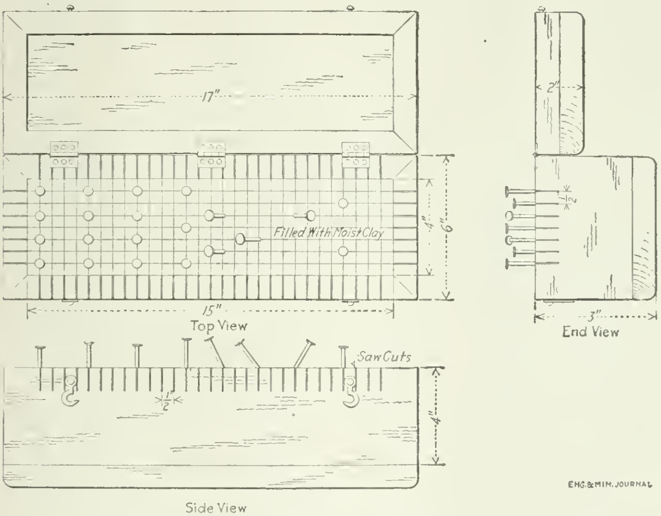
A cracked pump cylinder was repaired, states F. H. Coleman, in *Power*, by drilling a hole at one end of the crack and tapping for a ⅜-in. plug. Another hole was then drilled close to the first, the drill extending into the first plug about ⅛ in. The second hole was then tapped and plugged, and the method continued until the crack was covered. It was then smoothed off with a file and calked. Straps ⅜ in. thick used with iron cement further secured the job.

The pump has been running for some time with a 110-lb. pressure without signs of leaking.

Prevention of Drilling into Misfired Holes

By John T. Fuller*

A common cause of accident in shaft sinking is drilling into a misfired hole or striking a pick into a misfire while mucking. Such accidents are due frequently to lack of information as to the exact situation of the holes of the blasted round.



Clay-filled Box with Nails, Showing Position of Drill Holes

There are several ways of lessening the danger. One is to have the succeeding shift charge and blast the holes drilled by the preceding shift. This second shift then mucks out and drills the holes for the next shift to blast. A second way is to have each shift drill, blast and muck its own round, leaving the shaft clean for the next shift.

Both of these methods, however, involve more or less of an upset of the usual order of doing things, which, in these days of labor unions and labor troubles is, to say the least, not appreciated. The usual order is to have the shift coming on muck the rock broken by the preceding shift, then drill and blast a round of holes, leaving the muck in turn for the succeeding shift.

In a large shaft, sunk under my direction, the device herein described was used to aid in locating the holes drilled by the previous shift. A box was made of the same shape as the shaft and built to a convenient scale, as shown in the accompanying sketch. It was about 4 in. deep, and along the edges saw cuts about 1 in. deep were made, the distance between each representing 1 ft. of length or width of shaft. A substantial cover with hooks to fasten it securely shut was also provided. This box was filled with moist clay, leveled off even with the edges and lines scribed across the surface of the clay by a pocket knife and a straight-edge, using the saw cuts as guides.

The box of clay thus represented the shaft bottom, subdivided into 1-ft. squares. When the miner went down to charge the holes he carried this box with him; also a pocketful of 20-d. wire nails. Before charging a hole, he would thrust his tamping stick to the bottom, which enabled him to gage the direction of the hole. He would then thrust a wire nail into his clay model as closely as possible to the direction and position of the hole in the shaft bottom. The squares greatly aided properly locating the holes in the model. Thus, when the miner had completed charging and had lighted the round, he returned to the surface with an almost exact reproduction of the layout of holes.

The box, with its record, was turned over to the miner in charge of the succeeding shift, with such other information as could be gathered from listening for, and counting the reports, etc. When the men went down to muck out after the smoke had cleared, they took the box with them, using it as a guide in directing the mucking and in locating any possible misfires after the shaft had been cleaned out and before work was started on the new round of holes. It was then a simple matter to withdraw the nails, smooth over the clay and prepare the box for the next record. Not a single accident due to drilling or mucking into misfired holes occurred in this shaft, although it was about 30x8 ft. and was sunk to the 1000-ft. level.

Pulmotor at a Lead Mine

By Claude T. Rice

A Dräger pulmotor is kept at hand at the mines of the St. Louis Smelting & Refining Co., in the lead district of southeastern Missouri, although at those mines little trouble from gas and fire is to be expected. However, hoisting and hauling in the mines are done by electricity, consequently there is a possibility that somebody may receive an electric shock The pulmotor is one of the few devices that seem to be of real assistance in case of such accident. Moreover, it is also dependable in restoring a person overcome by gas. It is simply an artificial respirator that rhythmically pumps dilute oxygen into the lungs, inflating and contracting them in a natural manner without any roughness or movement of the limbs of the body as in ordinary systems of inducing respiration. The device has been thoroughly tested and is now used by all the first-aid corps at coal mines. The cost of a pulmotor is not high considering its efficacy in case of accident.

---

*Consulting engineer, 505 Park St., Honesdale, Penn.

The Dräger or some other form of helmet for fire-fighting is being provided at several metal mines where much timber is used underground. Now that electricity is being used so extensively in and about mines and mills, and often at high potential, it should also become customary for mining companies to provide some device such as the pulmotor for aiding in restoration of employees overcome by electric shock. It should be remembered that because of the damp condition of miners' clothes and mine workings, shocks at voltages that cause little trouble on surface often are serious when received underground.

Remarks on Hoisting Ropes

The latest Prussian statistics on shaft hoisting ropes are exhaustively and critically discussed by Professor Herbst, of Aix-La-Chapelle, in a series of articles in *Glückauf*. The general conclusions arrived at, states the *South African Mining Journal*, are of special interest and are as follows:

The protective effect of lubrication has not been plainly proved in dry shafts. This observation suggests the conclusion that the present lubrication processes for wet ropes leave room for improvement, although it is certain that all now-known lubricative agents rapidly disintegrate in shafts where the water is salty or sour. Future experiments in this direction may provide a remedy.

Galvanizing or coating with zinc does not appear to have a really protective effect in wet shafts, the reason probably being that zinc coating has but little power of resistance to salt water. It is also suggested that the wires have suffered in the galvanizing process, for, although it has been proved by Winter and others that the process, when properly and carefully executed, does not unfavorably affect the ropes, it is also well known that it often reduces the tensile strength of the rope by 50% or more.

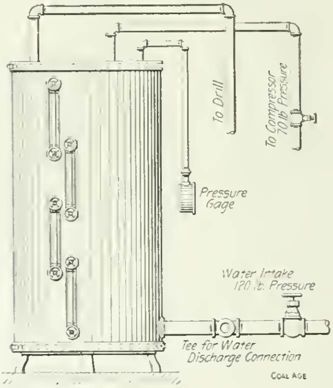
The hauling efficiency of ropes in dry shafts stands in the proportion of 100 to 60 or 70 to that in wet shafts, a fact which, in view of the high price of ropes, means a substantial economic advantage for dry shafts.

Tensile strength between 160 and 180 kg. per sq.mm. does not unfavorably affect the flexibility or hauling strength of the ropes, while ropes of more than 180 kg. per sq.mm. have given substantially lower efficiency figures.

The greater or less strain, as expressed by a higher or lower safety factor, put upon ropes has had no influence upon their consistency. It may, therefore, be assumed that the advantages of a higher factor of safety are neutralized by its disadvantages, that is, greater rope thickness combined with reduced flexibility and greater dead weight.

Testing Air Consumption of Drills

The apparatus herein described has been satisfactorily used in testing the air consumed by rock drills. As shown in the accompanying illustration, a vertical air receiver is connected to the compressor line by a 1-in. pipe, fitted with a globe valve, and a 1-in. outlet pipe is led from the receiver to the drill. Water gages are placed one above the other throughout the entire height of the receiver, and a pressure gage is supplied. At the bottom of the receiver a 3-in. pipe with globe valve furnishes water, and between the receiver and intake valve a tee connection is provided as a discharge.


To Drill
To Compressor 70 lb Pressure
Pressure Gage
Water Intake 120 lb. Pressure
Tee for Water Discharge Connection
Coal Age

Air Tank and Connections

Before starting the test, water is allowed to flow into the receiver until it is just visible in the lower gage, and a chalk mark is made opposite this level. The receiver is then filled with air at the desired pressure, the air shut off and the test begun. As the drill takes air from the receiver, the operator maintains a constant pressure by regulating the water valve. Simultaneously with the stopping of the machine a chalk mark is made at the water level then shown by the gage and the water drained off in preparation for the next test.

The distance between chalk marks, depth of hole drilled and time of drilling are noted. The cross-section of the tank being known, the distance between the chalk marks makes it possible to find the volume of air used, at the given pressure, and from these figures the amount of free air can be computed.

It may happen, states *Coal Age*, that in spite of the control provided by the water supply, the air pressure will decrease during a test. In this event, the amount of free air used may be calculated as follows:

Let
P = Initial pressure,
P_1 = Final pressure,
B = Height above initial water level to top of receiver,
A = Cross-sectional area of receiver in sq.ft.,
R = Rise of water in receiver, in ft.,
H = Atmospheric pressure.

Then each foot rise of water in the tank, represents the consumption of A cu.ft. of air and if the pressure had remained constant at P, the volume of free air used would have been given by

$$V = RA \times \frac{P+H}{H}$$

However, the expansion of the air that remains in the receiver, from pressure P to P_1, represents the consumption of a volume of free air equal to

$$V_1 = A\,(B-R)\left(\frac{P+H}{H} \quad \frac{P_1+H}{H}\right)$$

and the total amount of free air used is then $V + V_1$. It may prove to be simpler to let V represent the initial amount of free air in the tank at pressure P and V_1 represent the final amount of free air at pressure P_1. Then

$$V = A\,B\,\frac{P+H}{H}$$

$$V_1 = A\,(B-R)\,\frac{P_1+H}{H}$$

and $V - V_1$ will give the amount of free air consumed during the test.

Concrete Survey Monuments

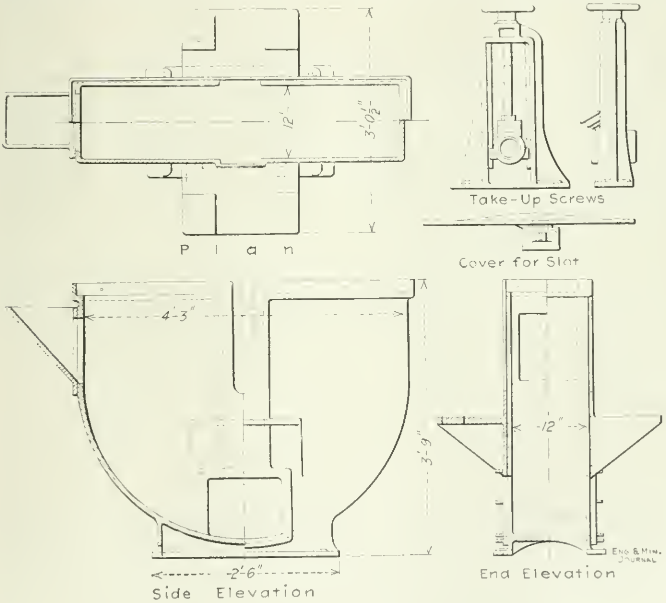
Concrete survey posts for marking the township and section corners in a forest reserve of 475,000 acres have been suggested by the U. S. Geological Survey. It is said that satisfactory concrete posts have been made in conical forms of thin sheet iron, with locked joints like a stove pipe. To give these sufficient strength while the concrete is rammed into place, they are bound with several rings of heavy wire. As these forms cost only a few cents each, one can be provided for each corner and left in place, and will aid in protecting the cement from drying too rapidly. A 12-in. hole, three feet deep, dug with a post-hole digger, is filled nearly to the top with cement and broken stone. The conical form is then placed on top of the soft concrete base, filled with cement and well tamped. A tablet is forced into the cement through the open top of the form. Heavy wire (plain, galvanized or barbed) for reinforcing the posts will add considerably to their durability. If reinforced a top diameter of four inches, increasing to about six inches at the ground surface, will, states *Engineering News*, probably give sufficient strength.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

A Steel Elevator Boot

A steel elevator boot with the pulley take-up screws supported by shelves on the outer sides is used in the No. 3 mill of the Doe Run Lead Co., near Rivermine, Mo. The boot was designed, as illustrated in the accompanying drawing, by H. R. Wahl, mechanical engineer for the company, and is used on elevators raising dry or wet material. The boot of a wet elevator must be considerably wider than the boot of a dry elevator, although a 10-in. belt is used in each.



Steel Elevator Boot with Outside Take-up Bearings

The ends of the shaft of the lower pulley pass out of the sides of the boot to the adjustable bearings supported on the shelves through slots which are closed by slides that can be fastened in place by setscrews after the adjustment has been made.

Openings are provided at bottom of the boot through which the material within can be cleaned out in case of shutdown. The feed hopper is used only on elevators raising wet material. The hopper opening can be closed with a cast-iron plate if the boot is to be used on an elevator raising dry material, as no hopper is necessary. Rubber gaskets are used in all the joints of a boot for a wet elevator. The boot is attached to the housing by four bolts so that it may be easily opened if necessary.

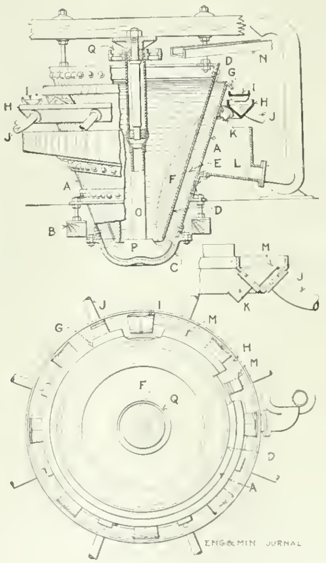
Stroke Counter for Compressors

At the power plant of the St. Louis Smelting & Refining Co., in southeastern Missouri, the stroke counters on the air compressors are connected with the low-pressure air cylinders. This allows the placing of the counter with the other indicators on the main gage-board of the engine.

A ¼-in. pipe is tapped into the low-pressure air cylinder and is carried over to a small cylinder on the main gage-board. The piston of this cylinder rises and falls with the pressure in the main cylinder, and the counter is in turn operated by the movement of the piston in the auxiliary cylinder. This enables the assembling of all indicators in a handy, practical manner on the main gage-board and enables easier watch to be kept of everything in connection with the work being done by the engine.

A New Pulp Distributor

The apparatus illustrated in the accompanying drawing has been patented (U. S. pat. 1,020,251) by H. C. Behr and C. F. Schmitt, of the Consolidated Gold Fields of South Africa, Ltd., and was designed for subdividing a stream of pulp for supplying a number of tube mills or concentrators with an individual feed of the same character as regards dilution and composition as the original stream of pulp. The apparatus may also be used for sampling pulp or as a measuring device for pulp or water.



A Cone-Type Pulp Distributor

The device consists of an outer cone *A*, bolted to standards *B*, and closed at the apex by a cap *C*. Within the cone *A* a second cone *D*, open at the apex, is suspended from overhead supports, so as to leave an annular chamber *E* between the two cones. The width of this chamber can be varied by raising or lowering the inner cone by the adjustable bolts, by which it is suspended.

The inner face of the cone *D* is contracted by the filling *F*. The outer cone is equipped with an overflow lip *G*, by which the pulp is discharged into the circular trough *H* that encircles the rim of the outer cone and which is divided into a number of compartments corresponding to the maximum number of streams, into which the main stream is to be divided. From the bottom of each of these compartments two discharge pipes *J* and *K* lead, *J* to an attached pipe that conveys the pulp discharged into the corresponding compartment to a tube mill or concentrator, while *K* discharges into a launder *L* that encircles the outer cone of the distributor. A flap valve *M* can be thrown to close either of these discharge pipes.

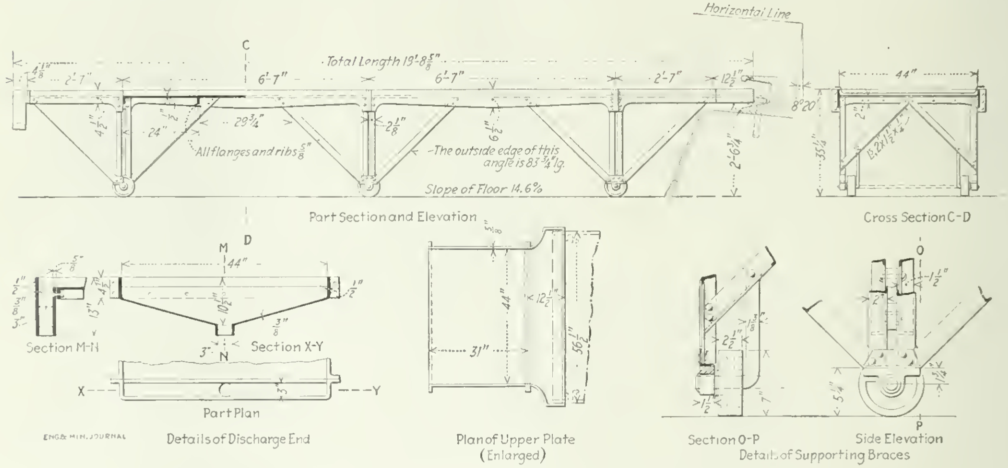
The main stream of pulp is delivered to the chamber within the inner cone through the launder *N*. The pulp flows downward in the inner cone, thence rises through the annular chamber, between the inner and outer cones, overflowing as a homogeneous mixture into the trough *H*. Any pulp discharged into the launder *L* flows to a pump by which it is raised back into the feed launder *N*. In case that there is any tendency for the solids in the pulp to settle and clog the discharge opening of the inner cone, a stirring device *O*, carrying vanes *P* and driven by the pulley *Q*, is provided. The horizontal driving pulley is driven by a quarter-turn belt from any convenient shaft near the distributor. The device prevents the coarse grains from settling in a compact mass and clogging the device.

If it be desired to shut off the stream of pulp to any tube mill or concentrator, the flap valve *M* of the compartment in the trough *H* corresponding to the feed of that machine is thrown over so as to close the discharge pipe *J* and open the discharge *K*; then the portion of the pulp received in that compartment will run into the launder *L* and thence be raised by the pump back into the feed launder *N*. In that way the feed to each of the other machines is increased proportionately when one of a number of machines is stopped.

North Star Amalgamation Tables

The amalgamation tables in the Central mill of the North Star Mines Co., at Grass Valley, Calif., differ from those in the North Star mill of the same company and from the tables generally used in stamp mills, in that they are built entirely of metal. The construction of the table is shown in the accompanying illustration. It consists of an iron and steel support for the copper plates, equipped with legs mounted upon rollers so that the table may be moved away from in front of the battery at cleanup time or at any other time when it is desired to gain free access to the front of the batteries.

The copper plates are bent upward at the sides so as to come up to the top edge of the sides of the steel support, over which the plates are again bent, in a curve of fairly large radius, so as to lie horizontally over the edge in a band about one or two inches wide. These bends along the edges are well rounded so that the amalgamator experiences no difficulty in taking off amalgam—in tables where there is a sharp corner at the sides it is almost impossible for the attendant to remove the amalgam close up against the sides of the table.



ALL-METAL AMALGAMATION TABLE USED IN CENTRAL MILL OF NORTH STAR MINES CO.

At the North Star and Central mills mercury is fed to the battery at hourly intervals, the quantity being governed by the condition of a narrow strip of amalgam that is allowed to remain on the upper edge of the lip plate from one cleanup day to the next. The condition of this strip is an index to the condition of the amalgam on the chuck block.

The plates are dressed once per 24 hr., a whisk broom being used for the purpose. About 12 min. is spent in dressing each table, there being one for each battery of five stamps. The work is done by the amalgamator and by the concentrator attendant, both under the direction of the mill foreman. After the daily cleanup the upper plate of each battery is treated with mercury, the quantity used depending upon the judgment of the foreman. In general four ounces of mercury is added at the mortar for every ounce used on the plates. About 2½ oz. of amalgam is recovered from the mortars for each ounce cleaned from the plates. While the plates in front of one battery are being cleaned the pulp is run over the plates of the adjoining stamps.

Japan Gold Size for Joints

A jointing material of considerable value, not generally known, is Japan gold size, which is a liquid used by painters as a drier. In connection with pneumatic plants it can be used successfully and for compressor cylinder joints made with brown paper it has proved superior to the ordinary red lead and boiled-oil paint.

The material is sold by paint dealers and keeps well. Upon exposure to air it dries rapidly, forming a tenacious, adherent, transparent coating. Unfortunately, states A. L. Hass in *Power*, I have no data as to its behavior in joints having to withstand steam heat, but see no reason why it should not be tried.

Wooden Gaskets for Boilers

An engineer in the South uses, for his steam boiler handholes, gaskets sawed out of ⅝-in. white pine boards, states the *Engineer and Fireman*. They have to be screwed up about twice when heated up, and when taken out are about ⅛ in. thick. As they are cheap a new one is put in each time the boiler is cleaned.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Use of Lands Held for Protection

The profitable use of land, which must be held in order to protect other rights, is again noted in the report of Ezra B. Whitman, Water Engineer of Baltimore. The city of Baltimore will probably acquire between 2000 and 3000 acres in the vicinity of a new reservoir site. In order that some income may be derived from this property it is proposed to re-forest this land, with the idea of later cutting the timber along scientific lines.

It will be recalled by our readers that the Tennessee Copper Co. recently established some experimental farms, in this case not so much to gain any benefit from the land in question, but to prove that the smoke from their smeltery was not injurious to vegetation. However, it has been claimed that the farms in themselves produced a profit. The same thing was done recently by a large chemical firm in New Jersey, and it is reported that the corn crop raised much more than paid for all of the labor and supervision expended upon it. Mining and smelting companies which must acquire lands near them to protect water power, mill sites or for dumping purposes, might be able to do something along the same line.

Gas Analysis in Fighting Mine Fires

A recent bulletin (Technical Paper No. 13) of the Bureau of Mines, is devoted to the systematic sampling of gases from burning mines, as an aid in fighting the fires. For instance, in a burning mine, samples were drawn from behind a dam erected to seal off the fire. One of these showed O_2, 1.69%; CO_2, 8.07; CO, 1.58; CH_4, 3.39; H_2, 1.37; N_2, 83.90%. Another, two days later, showed, O_2, 3.00%; CO_2, 8.14; CO, 1.41; CH_4, 1.21; H_2, 0.35; N_2, 85.89%. From these it would be inferred that the dams were tight, and that the fire was being brought under control.

Again, in the same mine, entrance was made to an area about 2000 ft. from the fire, also behind stoppings, and a man protected by a helmet took a sample of gas 800 ft. from the dam. At this point the air showed, O_2, 9.38%; CO_2, 5.33; CO, 1.02; CH_4, 1.13; H_2, 0.48; N_2, 82.66. Owing to the stagnant condition of the air, and the large percentage of CO_2, no apprehension would be left as to this air feeding the fire, while the knowledge that the CH_4 percentage was so low was valuable, as showing an explosion need not be feared from a sudden inrush of air. In other cases, samples withdrawn in this manner proved that the dams were not tight (shown by increase of free oxygen) which led to their timely strengthening.

Qualitative Reagent for Potassium

A reagent for the qualitative determination of potassium is prepared as follows (*Annal. de Chim. Analyt.*, Apr., 1912). To a solution of 100 grams of sodium nitrite in 200 c.c. of water add 60 c.c. of 30% acetic acid, and then 10 grams of cobalt nitrate. Filter after allowing to stand two days, and make up the volume to 400 c.c. To use the reagent, place two colorimetric glasses on a mirror, place in the first 5 c.c. water, in the second 5 c.c. of the solution to be tested, then add to each one, 2.5 c.c. of the reagent and 5 c.c. of 25% alcohol. A turbidity with as little as 2 parts per 1,000,000 indicates potassium.

Composition of Analcite

The mineral analcite is the most important normal metasilicate among the zeolites, and has been the subject of repeated investigations. The usually accepted formula is $Na_2Al_2(SiO_3)_4.2\,H_2O$. Foote and Bradley (*Amer. Journ. of Science*, May, 1912) deduce its formula as $Na_2Al_2(SiO_3)_4.2\,H_2O.xH_2Si_2O_5$. This does not necessarily mean that the compound $H_2Si_2O_5$ is necessarily in solid solution, as it may exist in highly complex silicates. It may be noted that the water of crystallization of the zeolites does not behave as does ordinary water of crystallization, i.e., the vapor pressure at a given temperature does not remain constant as the substance is dehydrated, but continually diminishes. For this reason zeolites do not lose a definite number of molecules of water by heating at any certain temperature or through any certain range of temperatures.

Prevention of Ankylostomiasis

The danger from hookworm disease through energetic mine sprinkling has been commented on several times: Experiments have proved (*So. Af. Min. Journ.*, Jan. 20, 1912) that a 1% solution of ferrous sulphate, or a 2½% solution of calcium chloride or salt prevents the disease.

The use of these chemicals in concentrated solution in wet mines also seems indicated. Where it is available sea water is effective.

Effect of Metal-Bearing Aggregate on Concrete

The attention of mining engineers should be given a late report by A. F. Coleman (*Eng. Record*, June 1, 1912), who used a rock carrying 0.3 to 0.6% Ni; 0.2 to 0.4% Cu; Fe, 15 to 18%; S, 0.5 to 0.75%, for the aggregate in concrete. Three years' exposure to the weather completely disintegrated the structures built of this material, while neighboring structures built with the same cement and sand, but nonmetalliferous stone, show no signs of disintegration. The trouble is alleged to have been caused by sulphides.

Flux for Scrap Lead Refining

A flux for refining scrap lead consisting of three parts of caustic soda and one part of sulphur has been patented recently in Germany (*Brass World*, June, 1912). About two pounds per 100 lb. of lead are employed. The lead is heated to about 400 to 500° C., the flux added, and the whole mass well stirred. It is stated to be effective in removing zinc, arsenic, antimony, tin and copper. [The use of sulphur for producing a dry, easily skimmed dross with white metals is, of course, well known.—EDITOR.]

Preservation of Mine Timbers

The general question of the preservation of mine timbers is dealt with in a recent bulletin of the Department of Agriculture (Bull. 107). The great importance of timber preservation is urged on the ground that of timber sent underground, wear destroys 5%; breakage and fire, 20%; waste, 25%; decay and insect attack, 50 per cent.

A simple and inexpensive method of protecting timbers is by peeling. Bark retards the loss of moisture from timber, and unbarked wood therefore offers more favorable conditions for fungus growth than wood from which the bark has been removed. Moreover, the space between the bark and the wood is an excellent breeding place for many forms of wood-destroying insects. In dry workings, the life of the wood may be increased 15% by peeling although in wet situations peeling seems to have but little effect.

Seasoning also adds to the life of mine timbers in dry places, although it is of doubtful value in wet workings. Moreover, both peeling and seasoning, if done at the shipping point, will save greatly in the expense of shipping and handling.

Timber which is to be treated should be round rather than square, as sap wood is more easily impregnated than heart wood. Zinc chloride and creosote oils have shown the best results up to date. A wood-treatment plant will pay for itself if the amount of wood to be treated is large; if small, brush-treatment is recommended. If treatment is to be given, the timber should be carefully inspected, as expensive treatment is wasted on unsound timber.

Sulphur in Steel

The effect of sulphur on steel has been exhibited in a new way by F. Rogers, who reports his experiments to the Iron and Steel Institute, May, 1912. Doctor Rogers has worked out a method for the examination of the fractured surfaces of steel, similar to the ordinary method of contact printing. In applying this method, he finds that the speed of printing is often 100 times as great on a fracture as on a cut surface taken as near the fracture as possible. From this he argues that the fracture is through the particles of manganese sulphide in the steel. While it may be urged that in a cut surface there has been a "flow" of metal produced over the manganese-sulphide particles, the author believes this cannot be the case, as contact prints made under otherwise similar conditions are alike whether the cut be rough-cut, filed smooth, polished with emery, or highly polished for microscopic examination. In the same way, the intensity of the fracture print seems independent of the method by which the fracture is produced.

From this the author further deduces that it is by no means immaterial whether a steel carries 0.035% S, or 0.05% S. Any increase, however small, must be deleterious.

The Refining of Blister Copper

The late H. H. Emrich has a paper on the refining of blister copper in the June Bulletin of the A. I. M. E., from which we abstract the conclusions. The impurities in cast electrolytic copper are present in about the same proportion as they exist in the heaviest float slime, and are there because of that float. Copper of good conductivity can be deposited from an electrolyte containing as high as 17 grams of arsenic per liter. Of anode impurities, all the lead, 26.7% of the arsenic, all of the antimony and all of the nickel went to the slime. The author attributes the sliming of the nickel to the formation of a nickel speiss, and believes that a surplus of nickel over that necessary to satisfy the arsenic would be dissolved.

Huff Electrostatic Concentrators

The following details of the general features of the Huff electrostatic installations are taken from a paper by Henry A. Wentworth on "Electrostatic Concentration or Separation of Ores" (*Bull.* A. I. M. E., June, 1912). The cost of construction and of operation depends upon the general costs in a given region, upon the size of operations, and whether the plant is to run as an independent concentrator, or as an adjunct to other operations. However, the following details will, with modification to suit the circumstances, give a proper total.

The flow is ordinarily: Rotary drier (not roaster); screens (12, 12-20, 20-50, and minus-50 mesh); roughing machines for making finished tailings; finishing machines for making finished concentrates; and a recrushing device for the middlings. The dust is drawn from each piece of apparatus and collected (saved if of sufficient value, discarded if not). The separators are upright, about seven feet high, and occupy about 1.5x6 ft. of floor space. Allowing room for attendance, each machine occupies about 5x8 ft. of floor space. From nine to 12 tons per separator can be taken as an average on the initial machine floor. The general tonnage area is about four square feet per ton for separators, and about six square feet per ton including elevators, belts, etc. The Midvale, Utah, plant with a daily capacity of 75 tons of fine material, occupies a building 40x40 ft., but there is a large amount of unoccupied space at present. The driers are usually in the basement, and the screens in a tower above the concentrator floors. The general costs of installation are similar to those of the ordinary gravity concentration, except that the elevators do not have to handle water, and because of the small size of the building there is a minimum of distributing machinery.

The operating costs, outside of dry crushing, are: Drying, power, labor, and repairs. Crude mine ore usually contains 1 to 5% of moisture, say 3% as an average. As a fairly efficient drier will evaporate 5 lb. of water per lb. of coal, this means about 12 lb. of coal per ton of ore, say $0.03 per ton of ore. Fine middlings from wet tables will carry 15%, but as the drier will then be more efficient, the cost will only be $0.11 to $0.12. A 3-hp. generator set will supply the electrostatic power for separation. Mechanical power for driving the separators is figured at ⅓ hp. per separator, including line losses, so that with large installations the entire power, including elevators, screens, etc., amounts to approximately ⅙ hp. per ton of daily capacity. As everything in a properly designed mill is automatically handled, with the exception of firing the drier, the labor required is needed only for watching the mill and for loading the products. In general, the costs of operation in an electrostatic mill do not differ materially from those in a similar mill using reciprocating tables.

The Combustion of Carbon

The sequence of events when carbon burns in oxygen is discussed by Rhead and Wheeler (Chem. Soc. Proc., p. 105, 1912; abstr, *Journ.* Soc. Chem. Ind., May 31, 1912). The alternatives are:

(*a*) $C + O_2 = CO_2$, followed by

(*b*) $CO_2 + C = 2CO$;

and

(*c*) $2C + O_2 = 2CO$, followed by

(*d*) $2CO + O_2 = 2CO_2$.

The authors attempted to obtain evidence as to which reaction is most likely to take precedence at different temperatures, by determining the relative velocities of the above reactions under the same experimental conditions. The results obtained showed: (1) that some carbon monoxide is produced during the oxidation of carbon at low temperatures, under conditions which do not admit of the reduction of carbon dioxide by carbon. On the other hand, (2), carbon dioxide is produced at low temperatures in quantity which cannot be altogether accounted for by the supposition that carbon monoxide is first formed and then oxidized to carbon dioxide. When carbon is burned at low temperatures, therefore, carbon dioxide and carbon monoxide are produced simultaneously.

Roumanian Petroleum Production

In 1911 there were 1,404,400 metric tons of petroleum delivered to the Roumanian refineries (*Journ.* Soc. Chem. Ind., May 31, 1912), compared with 1,215,300 metric tons in 1910, an increase of over 15 per cent. The yield from the refineries in 1911 was: Benzine, 260,653 metric tons; burning oil, 312,711 metric tons; mineral oil, 24,703 metric tons; and residue, 783,136 metric tons. About half the production was used in Roumania.

Murex Process

According to the Prussian *Zeitschrift für das Berg-, Hütten- und Salinenwesen*, the Murex process has been tried at the Bergwerkswohlfahrt mine, Zellerfeld district, producing lead concentrates carrying 50% lead, with a 2% tailing. The ore is reduced to 1 mm., emulsified with oil and magnetite dust, and then passed over a strong electromagnet, which extracts the magnetite covered galena.

Lining the Snake Creek Tunnel

By Oscar N. Friendly*

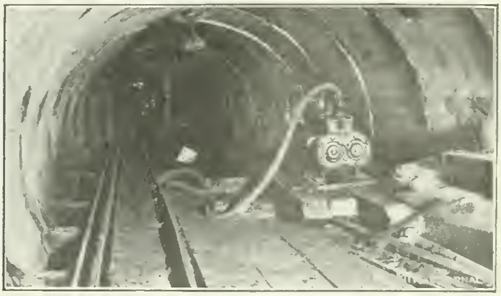
The Snake Creek drainage, development and mining tunnel in the Park City district, Utah, was started in the spring of 1910. Swelling ground was shortly encountered, necessitating the use of temporary timber sets, followed closely by the specially designed egg-shaped reinforced-concrete lining. By this construction the tensile stresses are borne largely by the steel; the compressive, by the concrete.

The Snake Creek tunnel is designed to be the main artery for a project to develop, mine and drain the territory of the Snake Creek Mining & Tunnel Co.'s property and adjacent holdings in the Snake Creek, Upper Cottonwood and Park City districts, situated in Wasatch, eastern Salt Lake and Summit Counties, Utah. It is financed by the Knight and Daly-Judge interests, both of whom have valuable holdings in the territory to be developed.

Tunnel for Drainage and Mining

The driving of this costly adit is the result of a desire to open up the mining possibilities of this region, at depth, and in a manner which will permit mining and development work on a large scale, and on an economical basis. In this region, where depth is imperative, water presents an almost insurmountable barrier for deep-shaft mining without an adequate gravity drainage. The officers of the tunnel company are: Jesse Knight, president; H. Otto Hanke, vice-president; G. W. Lambourne and J. William Knight, directors. G. W. Lambourne, as general manager, has general management of all operations. I have acted as the engineer of the company.

Start of Snake Creek Tunnel before Reaching Bad Ground.



Unfinished Lining and Pump for Handling Seepage

The lines of the tunnel were run in the autumn of 1909, and ground was broken the following spring. The work is being carried on by contract. Free & Taylor have the contract for driving the first 13,350 ft. They are required, by the specifications, to make a minimum monthly advance of 300 linear feet.

The dimensions of the bore are as follows: Height of back above top of rail, 6½ ft.; width, 9 ft. 4 in. in the clear. On the right-hand side a concave water channel is cut, 4 ft. in width and 4 ft. 2 in. in depth below the top of the rail. Ties are of 3 x 7 Oregon fir, with 3-ft. centers. On the right-hand side a 16-in. No. 16 gage galvanized-iron ventilator pipe is laid on the ties. On the left-hand side a 4-in. air main is carried. The grade of the tunnel is 3 in. to the 100 ft. (0.25%). The width of the tunnel is designed to permit room for a double-track haulageway. The right-hand side, over the ditch, will accommodate the ingoing or empty trains; the left hand, the outgoing or loaded trains. This will permit the heavy traffic to pass over the portions of the ties resting on solid rock. The capacity of the tunnel for transportation is practically unlimited. It is planned to run a series of laterals where conditions justify. The main tunnel will later be run as two separate headings, one of which will prospect and drain the Daly-Judge property.

Trouble with Swelling Ground

The first 3000 ft. of the tunnel were cut through ground of good standing quality. At this point, however, serious difficulties were met with. The formation changed from a limestone to a highly decomposed black lime shale with pronounced swelling qualities. This was first timbered with 10x10 Oregon fir by the contractors. Swelling of the ground caused immediate trouble. Although constant work was done on the timbering, at the end of four months conditions were so serious that the company found it imperative to take steps to re-line this portion of the tunnel, for a distance of 305 ft. I was asked to submit plans for holding this ground permanently. The purpose of this article is to give details of these plans, methods, and cost of erection, as it is believed they are along new lines, and may be of interest to the profession.

A few words on the conditions met with at the beginning of this work, and the nature of the ground may be of value. The formation, as before mentioned, was a decomposed black lime shale, almost jet black in color. The harder portions were composed of masses containing innumerable fractures and slips, which disintegrated rapidly when exposed to the action of air. The softer portions were a black sticky mud, looking and feeling not unlike the ordinary paste shoe blacking, and containing large boulders (nigger heads) of hard limestone. The latter made spiling difficult and in many cases required blasting.

One of the most difficult features of the work to overcome during the placing of the concrete, was the handling of the large flow of water in a manner which would insure safety from flooding the fresh cement. This was made doubly difficult by unavoidable caves, due to the fact that the tunnel was being enlarged and retimbered at the same time that the new lining was being placed. This phase of the work is in a large measure responsible for the high cost of the temporary lining. An 18-in. steel riveted pipe was finally procured to carry this flow, which amounted to five second-feet. This pipe gave good satisfaction.

---

*Mining engineer, Daly-Judge Mine, Park City, Utah.

A series of concrete bulkheads was constructed to a height of 2 ft. above the rail on each side of the portion of the ground to be concreted, and the water transferred through the pipe, which was laid on ties, from bulkhead to bulkhead. A simpler solution would have been to seal the tunnel entirely, but this was impracticable. The fractured nature of the ground permitted too much seepage. Holding the water back under even a 3-ft. head required the presence of two pumps and a number of bulkheads to handle this flow through the crevices, and keep the water below the bottom of the concrete.

Timber Sets Precede Concrete

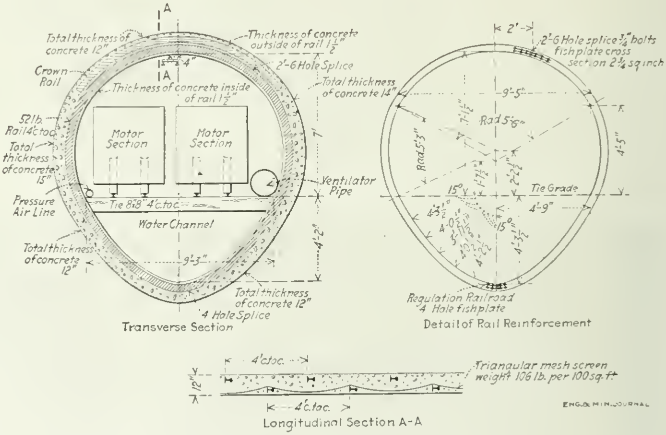
The plan adopted for placing the temporary lining was to retimber, with regulation tunnel sets, the portion of the tunnel directly in front of the advancing concrete forms. Special effort was made to keep the new lining as close to the retimbered portion as the work would permit. Notwithstanding this, however, great trouble was experienced in holding the ground for this short length of time. The soft-bog bottom permitted the posts to sink. Two caves carried away portions of the new timbering on different occasions, one of which closed the tunnel completely, causing a delay of two weeks in regaining the lost ground. At points, the height of the unbroken back above the caps approximated 40 feet.

In the heaviest part of the ground the caps were six 8x8 Oregon fir timbers to the set, which were placed on 4-ft. centers,—three side by side and two deep, making the cap of each set 24x16 in. Spiling and breastboarding was of 5x7-in. Oregon fir. In this part of the work the caps would show flexure within 24 hours after being placed in position, using all the clearance and requiring cutting to allow room for the concrete lining. In this part the strength of the lining was increased, and provision made against a concentrated load at the center of the arch, as will be described later.

Throughout the work, precautions were taken to leave no open spaces outside the concrete to endanger the structure, after completion, from sudden falls of rock. Open spaces above the spring of the arch were filled with aspen-pole lagging, both above and below the timbering. This affords a cushion and provides against impact. The accompanying halftone showing a section of lining at a point near start of work, before spiling became necessary, illustrates the manner in which this was done.

The dimensions inside the temporary lining were: Height, bottom of cap to bottom of ditch, 13 ft.; width between posts at tie grade, 13 ft.; batter of posts, 1 in 7. The original tunnel, 6½ ft. above the rail and the ditch, 4 ft. 2 in. below rail, had, through a large portion, decreased in height 2 ft. and the ditch bottom rose a like amount, due to swelling. All rock removed was trammed by horses 3000 ft. to the portal. None of it was of a nature to permit its being used as filling or aggregate.

Before entering into the details of the form of construction adopted, a few words as to the direction and nature of the pressures may be of interest. The maximum pressure was not from the top but from each side, near the top of the posts and parallel to the bedding planes; the force exerted being in the nature of a squeeze, due to swelling from air slack. A second line of pressure is in the ditch where the ground exerts an upward force, which acts quickly when the surface is exposed to water. In the worst portions there is no solid bottom, though occasional hard ribs are present.


A
A
Total thickness of concrete 12"
Thickness of concrete outside of rail 1½"
4"
2'-6 Hole Splice
Crown Rail
Thickness of concrete inside of rail 1½"
Total thickness of concrete 14"
52 lb. Rail 4' c to c.
Total thickness of concrete 15"
Motor Section
Motor Section
7'
Ventilator Pipe
Pressure Air Line
Tie 8"x8" 4' c. to c.
Water Channel
4'-2"
Total thickness of concrete 12"
9'-3"
Total thickness of concrete 12"
4 Hole Splice
Transverse Section
2'
2'-6 Hole splice ¾" bolts fishplate cross section 2¼ sq. inch
9'-5"
Rad 5'-6"
Rad 5'-3"
7'-1½"
4'-5"
2'-2½"
1'-7½"
15°
Tie Grade
4'-9"
4'-3½"
4'-0½"
3'-11½"
15°
4'-0½"
4'-2½"
4'-3½"
Regulation Railroad 4 Hole fishplate
Detail of Rail Reinforcement
4' c. to c.
12"
Triangular mesh screen weight 106 lb. per 100 sq. ft.
4' c. to c.
Longitudinal Section A-A
ENG. & MIN. JOURNAL

Design for Reinforced-concrete Lining, Snake Creek Tunnel, Park City District, Utah

Various Methods of Reinforcing

In the straight-roof and batter-wall system of reinforced-concrete lining commonly met with, the concrete is permitted to take stresses for which it is not adapted. The inside (tunnel) face along the battered wall is subjected to extreme tension, due to the bending movement caused by the pressure from along the sides. This applies both longitudinally and transversely. Where the top has no curvature, the center or weakest portion is subjected likewise to the same objectional tension. In the case of the arched roof, with straight batter wall, when load is on center of arch, the upper corners on the outside (rock) face will meet with the same tensile force and in a place difficult to overcome. Engineers have, in a measure, attempted to reinforce the concrete by the use of various types of iron bars, but for tunnel work, this method leaves much to be desired.

Another popular method has been to use a steel set of *I*, *H*, or built-up beams bedded in the concrete. This system unquestionably gives a strong structure, but tends to place the steel and concrete indiscriminately in places of tension and compression. Of necessity, a portion of the metal lies along the neutral axes, and does no work. An additional objection lies in the fact that the straight wall and roof must be adhered to in this form of construction, and even though expensive segment sets be used, all the advantage gained by arch or circular construction is lost.

Concrete and Steel Compared

Roughly speaking, for the same sectional area, the compressive strength of steel is 30 times that of concrete, and the tensile strength 300 times as great, with a cost of 50 times as much per unit column. For tensile forces, steel has but one-sixth the cost of concrete, while for compressive forces, concrete has but six-tenths the cost of steel. Manifestly the most perfect reinforced-concrete structure, from an engineering standpoint, is the one which gives the maximum strength for the least expenditure of materials and labor; or the one which most nearly approaches the condition where all the compressive stresses are taken up by the concrete and all the tensile stresses by the steel; and also takes advantage of the flexibility of the materials of construction, to permit the use of the best load-sustaining shapes. It was with this idea in mind that I designed the structure here described.

Structure is Egg Shaped

The structure, as can be seen by reference to the accompanying transverse section, in egg-shaped, point down, of proper size to accommodate a double-track, electric-haulage system with a water channel 4 ft. 2 in. below the rail. On 4-ft. centers are placed oval forms of mild-steel 52-lb. rails, spliced at bottom, and two feet from center of arch at top. The lower splice is made by the regulation four-holed railroad fishplate. The upper splice was specially made and was designed to have a slightly greater strength than the rail itself. The splice was so placed as to enable the complete use of all the metal in a 30-ft. rail; circumference of form, 34 ft.; length of segments, 19 and 15 ft.; length of crown rail, 11 ft. This oval steel was placed 1½ in. from the inner (tunnel) face of the concrete, on 4-ft. centers. The 11-ft. or crown rail was placed on 4-ft. centers also, but staggered 2 ft. with reference to the ovals. This crown rail is placed 1½ in. from the outside (rock) surface of the concrete.

CATCHING-UP CAVE AND WATER UNDER TRACK, SNAKE CREEK TUNNEL

Wrapped about and extending between the oval rails throughout the complete oval, is a heavy triangular-mesh, mild-steel netting, weight 106 lb. per 100 sq.ft. This netting has a width of 54 in., allowing a 3-in. lap over each rail, and covers the interior portion of all the lining. It is allowed to sag to within 1½ in. of the inside face at a point midway between the forms. The ties on which the tracks are laid are 8x8 Oregon fir, and are firmly sealed in the concrete walls. The thickness of the concrete is 12 in. on top and bottom, with walls of 14 and 15 in. thickness. This is the minimum thickness used, and it was exceeded on an average of 42%. Reference to the sections will make the form of construction clear.

Functions of Steel and Concrete

The reasons for using this method of placing the reinforcements are these: As said before, the maximum stresses act from the two upper corners. This would cause a compressive stress on the outside (rock) face at the point of application, and a tensile stress at a point directly within. This compressive force is carried by the concrete; the tensile force by the steel in the inner rail. At the same time this force will exert a tensile force on the outside (rock) face at a point near the center of the arch. The crown rail is here to take this tension and together with the weight of the ground on the cap above, prevents any upward movement. The corresponding compressive stress directly below on the inner face is carried by the inside form and the concrete. The crown rail also will help distribute and take care of any stress caused by impact from falling ground above. At the same time these forces from the corners exert a similar series of forces, compressive inside and tensile outside, at a point near the spring of the arch. At this point the concrete is sealed tightly against the posts and wall, which will prevent any outward displacement. The oval rail, at this point, acts against compression. The concrete here is, in places, 30 in. thick. At this point it must also take up the horizontal thrust from the weight on the arch, but as said before, being sealed tightly against the wall, no outward movement is possible.

Below, in the ditch, the swelling ground exerts a constant pressure. The tensile forces on the inside (tunnel) face are taken care of by the oval rail. The tensile forces on the outside meet with no resistance from steel, but are provided for by the high curvature of the point and the upward pressure of the ground at this place. The 8x8 ties sealed in the concrete, in addition to furnishing the necessary foundation for the tracks, tend to prevent the egg from collapsing along its long axes and to add stiffness to the structure.

In addition there will be a longitudinal stress between the steel forms tending to force the walls inward. For this reason, the netting was placed as shown. This force will subject the entire inner face, where not otherwise acted upon by the stronger forces described above, to a tensile force. The wire was therefore made to sag as near the inner surface as practicable. The netting, in addition to taking care of this tensile force, acts as a bond, and takes up internal stresses due to the natural contraction of the concrete in setting. All steel was placed at least 1½ in. from the surface to protect it against oxidation.

In the heavier portions of the ground, special precautions were taken to prevent a concentrated load from the bending of the caps from being applied at the center of the arch. The method here used was to concrete tightly against the caps along the side, allowing a small clearance between them and the top of the concrete in the center. In addition, five-foot, 20-lb. rails were placed longitudinally along the arch and resting on the forms. However, this was only done in one place where the failing caps made it probable that the concrete would take weight before setting.

COST OF SNAKE CREEK TUNNEL CONSTRUCTION

Opening Tunnel	
Supplies:	
Timber	$1,653.16
Powder	98.35
Supplies	721.25
Tramming (feed)	226.10
Power	541.74
Cement bulkheads	28.00
Total supplies	$3,268.60
Labor:	
Supervision	$2,032.50
Timbering	4,163.55
Mucking	2,872.07
Tramming	1,173.25
Compressormen	1,010.00
Outside general	258.00
Aspen filling	173.90
Blacksmith	344.75
Insurance	155.00
Total labor	$12,183.02
Reinforced Concrete Lining	
Supplies:	
Cement	$2,603.32
Steel	1,761.85
Gravel and sand	30.00
Total supplies	$4,395.17
Labor:	
Placing concrete and reinforcement	$1,797.51
Gravel, sand and water	1,648.15
Fitting reinforcement	214.26
Plastering ditch	173.66
Total labor	$3,833.58
Grand total	$23,680.37
	Per foot
Total footage costs:	
Cement and steel f.o.b. Salt Lake	$9.66
Haulage and freight on above to tunnel	4.75
Labor in placing lining	12.56
Total cost of lining	$26.97
Cost of opening tunnel and temporary lining	50.66
Total cost of work	$77.63

The aggregate used was dump material composed of hard, cherty limestone. The natural fines in it were used in place of sand. While it was not an ideal aggregate, the absence of sand in the proximity of the tunnel made its use necessary. No sand was used except in the plastering of the water channel. The cement was all portland. The mixture was 1:7 at first, which was later changed to 1:6. Tests showed the aggregate to set to a strength of 10% under the requirements of the standard specifications, which was considered very satisfactory under the circumstances.

Costs High

The cost of the work is somewhat higher than in most places, owing to the higher wage scale, $3.25 to $4 per day, and to the high cost of freight and haulage over mountain roads. The accompanying cost tables are self-explanatory.

The high cost of preparing the tunnel is due to the difficulties with which it was necessary to contend, and has no relation to the method of lining used. The same work would have been necessary had any other kind of permanent lining been adopted.

The rails were old railroad rails in first-class condition, of which a ready supply is available at 1c. per lb. The cost of each set of three rails, two segments and crown bent hot, splices made and ready to be set in place, including the cost of all materials, was $19.55 f.o.b. Salt Lake City. The weight per set was 800 lb. One of the chief advantages claimed for the system of reinforcement used is the low cost of material and construction, as compared with the high cost of raw material of an H-beam set where all material must be new. The disadvantages of the beam-set construction seem to be: The high cost of making; the greater cost of erection, together with the impossibility of placing the metal without waste of material in the structure where it will do all the work it should do in concrete construction. The bent-rail form, therefore, involves but a small fraction of the cost of the beam set. It also has the advantage of being applicable to arched and curved linings; is elastic in its uses; the forms can be varied in their distances apart, etc., according to conditions on the ground, without extra expense or delay. The time of erection and centering one rail form in the tunnel by four men varied from 20 to 30 minutes.

The work of preparing the tunnel was done by day's pay; mixing and placing the concrete and reinforcement by contract to Mitchell & Jordon, contractors. The crew were in charge of Free & Taylor, the tunnel contractors.

In conclusion, I will say that the concrete has now stood for three months in the heaviest portion of the ground without showing any effect from the weight it is supporting. Accurate instrument measurements show that there has been no settling or movement in any direction.

Mine Sampling and Valuation[*]

By H. S. Munroe[†]

In connection with the subject of mine valuation, some charts which I use in my lectures on the subject at the School of Mines may be of interest to the members of this society. The first of these charts is intended to emphasize the importance of taking into account the specific gravity of the ore in obtaining average values from a series of samples. For the purpose of illustration I assume five samples taken at uniform distances in a galena vein, varying in thickness from 10 to 60 in. and the ore varying from 10% to 80% of lead.

TABLE I. AVERAGES OBTAINED WITHOUT USING SPECIFIC GRAVITIES

	Thickness, inches		Per cent. lead		Inch-per cent.
	60	×	10	=	600
	20	×	40	=	800
	50	×	25	=	1250
	10	×	80	=	800
	10	×	60	=	600
	5/150		5/215		150/4050
Averages	30 in.		43.0%		27.0%
			(Arithmetical)		(Volumetric)

TABLE II. AVERAGES OBTAINED USING SPECIFIC GRAVITIES

Thickness, inches		Specific gravity		Inch-gravity		Per cent. lead		Inch-gravity-per cent.
60	×	3.0	=	180	×	10	=	1800
20	×	5.0	=	100	×	40	=	4000
50	×	4.0	=	200	×	25	=	5000
10	×	7.5	=	75	×	80	=	6000
10	×	6.0	=	60	×	60	=	3600
150				150/615				615/20400
				4.1 Average spec. grav.				33.17 Average per cent.

Calculating the average in the usual way by multiplying the thickness in inches by the per cent. in lead and dividing by the total number of inches, we find for our average value 27%, which we may call the volumetric average. This is less than the arithmetical average, which in this case is 43%. Neither of these results, however, is correct, as the values obtained from sampling must be given weight in proportion to the tons of ore which each sample represents. In the second table I have introduced specific gravity as well as thickness.

If we multiply the thickness in inches by the specific gravity of the sample, we obtain a product which we may call the inch-gravity value, which is a unit proportional to the tonnage represented by the sample. Multiplying this by the per cent. of lead found by assay we get an inch-gravity per cent. product. Dividing the sum of these last products by the total of the inch-gravity column we obtain as the average per cent. 33.17, which lies between the volumetric and the arithmetric average. This we may call the gravimetric average.

Tables III and IV illustrate the necessity of pursuing the same plan when dealing with a gold or silver ore in which the gangue consists largely of heavy sulphides. The volumetric average obtained by the inch-dollar basis is $5.43; the real average value based on tonnage will be $6.47.

TABLE III. VOLUMETRIC (USUAL) METHOD

	Thickness, inches		Value, per ton		Inch-dollar
	15	×	2	=	30
	10	×	1	=	10
	5	×	12	=	60
	3	×	20	=	60
	2	×	15	=	30
	5/35		5/50		35/190
Averages	7 in.		$10		$5.43
			(Arithmetric)		(Volumetric)

TABLE IV. GRAVIMETRIC METHOD

Thickness, inches		Specific gravity		Inch-gravity		Value per ton		Inch-gravity value
15	×	2.6	=	39	×	2	=	78
10	×	2.8	=	28	×	1	=	28
5	×	3.8	=	19	×	12	=	228
3	×	4.0	=	12	×	20	=	240
2	×	3.5	=	7	×	15	=	105
35				35/105				105/679
Averages				3.0 Spec. grav.				$6.47 Gravimetric average

In both cases it will be seen that the errors that result from neglecting the specific gravity of the ore may be serious. The specific gravity of the different samples may be readily determined by the bottle method, using for this purpose material from the portions of each sample which are rejected when crushing and working down the mine sample to the usual bottle sample for assaying.

I shall also call attention to the use of the well known formula for determining the probable error of the arithmetical mean of a number of observations. The use of this formula for the study of sampling data will give us valuable information as to the accuracy of the final result and enable us to deal intelligently with high assays.

If n = number of observations, and d = difference of each from the arithmetical mean, then the

$$\text{Probable error} = 0.6745\sqrt{\frac{d^2_1 + d^2_2 + d^2_n}{n\,(n-1)}}$$

E. H. Garthwaite has given some interesting results[1] from the sampling of a gold mine in Rhodesia. In one case, the second example cited, 71 samples were taken at 2-ft. intervals. A summary of these results, as given by Mr. Garthwaite, is given in Table V. It will be noticed that there are a number of high assays and, apart from this, that the range in values is very great.

Including all assays, the average value is 43.35 dwt. Applying the formula we find a probable error of plus or minus 8.15 dwt., that is, the value lies somewhere between 35.20 dwt. and 51.50 dwt.

---

[*] A paper read at the meeting of the New York section of the Mining and Metallurgical Society of America, May 16, 1912.

[†] Professor of mining, School of Mines, Columbia University, New York.

[1] Trans. I. M. M., January, 1907.

If we omit the one high assay, which lies between 700 and 800 dwt., the average of the remaining 70 samples lies between 31.08 and 33.49 dwt., or, say, 32.29 dwt., or somewhat less than the lowest probable value. Even omitting this high assay, the probable error is plus or minus 4.16 dwt., which still leaves much uncertainty as to the real value of the ore. It is evident in this particular case that the mine is very spotty, and that a safe average value can be obtained only by increasing the size of each sample or the number of samples taken. If large samples had been taken it is possible that the variation in value would have been less and the probable error much smaller.

TABLE V. SUMMARY OF ASSAY RESULTS

Assay value, dwt.	No. of samples	Assay value, dwt.	No. of samples
0- 5	13	50- 75	6
5-10	17	75-100	5
10-20	17	100-200	3
20-30	3	200-300	1
30-40	5	300-700	none
40-50	none	700-800	1
			71

TABLE VI. EFFECT OF VARYING SAMPLING DISTANCE

Sampling distance, ft.	Average value, dwt.	Average width, in.	Sampling distance, ft.	Average value, dwt.	Average width, in.
2	43.35	32.0	8	22.74	32.0
4	35.16	32.0	10	20.26	32.5
4	50.84	32.5	10	90.37	30.0
6	28.17	32.0	10	44.85	30.0
6	66.57	29.5	10	29.97	34.0
6	33.52	33.0	10	29.87	32.0
8	35.13	31.0	Independent sampling		
8	79.34	32.0	10	14.60	35.3
8	33.18	33.0	10	16.00	32.0

Mr. Garthwaite made some interesting comparisons of results that would have been obtained with other sampling distances. For example, taking every alternate sample in the mine he obtained two sets of results for a 4-ft. sampling interval. By taking every third sample he obtained three results, which would have been obtained by sampling at 6-ft. intervals. By taking every fourth sample he obtained four sets for an 8-ft. sampling interval, and in a like manner, by taking every fifth sample he obtained five different values for the mine with a sampling distance of 10 ft. These results are given in Table VI. Making the proper substitutions in the formula, the probable error in each case is as shown in Table VII.

Comparing the theoretical range of values it will be seen that with the 10-ft. sampling interval the values actually obtained in the mine ranged from 14.60 dwt. to 90.37 dwt. The error of the mean is only a probable error; therefore, the actual error is certain to be more than this probable error in some cases. The same will be observed in the case of the probable and actual errors in the 8-ft. sampling interval, although the number of results being small, the variation is not so great. The 6-ft. sampling interval with only three results shows a very close correspondence with the theoretical values. The 4-ft. sampling interval with only two results does not reach the theoretical extreme values. We may extend the application of the formula by computing the probable results for 1-ft., 6-in. and 3-in. sampling intervals. Under the last supposition 561 samples would have been taken, forming a sample practically continuous, but even in this case the values would range from 40.25 dwt. to 46.45 dwt., or a range of 14.3% if referred to the 43.35 dwt. average.

TABLE VII. PROBABLE ERROR IN SAMPLING RESULTS

Sampling distance, ft.	Samples taken	Average value, dwt.	Probable error	Extreme values (theoretical)	Results obtained
10	15	43.35	±17.74	25.51—61.09	14.60—20.26—29.87—29.97—44.85—90.37
8	18	43.35	±16.42	26.93—59.77	22.74—33.18—35.13—79.34
6	24	43.35	±14.12	29.23—57.47	28.17—33.52—66.57
4	36	43.35	±11.45	31.90—54.80	35.16—50.84
2	71	43.35	± 8.15	35.20—51.50	43.35 sampling distance actually used.
1	141	?	± 6.12	37.23—49.47	28.6% probable variation.
0.5	281	?	± 4.10	39.25—47.45	18.7% probable variation.
0.25	561	?	± 3.10	40.25—46.45	14.3% probable variation.

South African Diamond Field

Johannesburg Correspondence

The Premier Mine, for the six months ended Apr. 30, 1912, treated 4,233,200 loads (16 cu.ft. each) of blue ground for a yield of 881,518 carats of diamonds. The yield per load in depth shows a continued and disquieting decrease. The yield for this period was 0.208 carat per load, compared with 0.213 of last year and 1.25 at commencement of operations. Flottmann hand hammer drills are now used for drilling in the opencut.

The report of Voorspoed Diamond Mining Co., for the year ended Dec. 31, 1911, shows that 1,715,884 loads, of 16 cu.ft. each, were washed and 42,464 loads of waste rejected. The total working cost was 2s. 3.92d. per load washed; the cost of treatment was 8s. 3.9d. and 14.10 carats per 100 loads were recovered, against a yield of 16.62 carats for 1910. The working profit amounted to £21,840. The treatment plant is unsuitable, pug mills being unable to break up the blue ground properly, and rolls will have to be installed.

The annual report of the Roberts Victor Diamond Mining Co., which was once the richest diamond mine in Africa, shows that pipes, like lodes can go wrong in depth, as the 630-ft. level was declared unpayable, owing to the presence of boulders, broken ground and a contracted pipe. A fissure or dike leading from the pipe is being worked and about a year's work remains in sight.

The Casper, Wyo. Oil Field

By C. E. Jamison*

About 50 wells have been drilled in the Salt Creek oil field, 45 miles north of Casper, all being reported as productive. The daily production per well ranges from 100 to 1600 bbl. The oil is high in grade, of paraffin base, 39° to 42° Bé. Analyses show it to contain 17% gasoline, 30 kerosene, 53% lubricating oils, paraffin and coke.

Two refineries have been erected at Casper, and two 6-in. pipe lines have been laid to the field. Gasoline, kerosene, fuel oil, and a large variety of lubricants are now being produced. Reliable figures are difficult to obtain. However, it is reported, on what seems to be good authority, that the Chicago & Northwestern Railway is now consuming 3500 bbl. of fuel oil per day, while the Burlington has recently signed a contract calling for 4000 bbl. per day.

As the refineries are new and not yet working at full capacity, the output of the field is somewhat curtailed—about 6000 bbl per day. The production of which the fields are capable at the present time is between 12,000 and 15,000 bbl. The largest company in the field is the Wyoming Oil Fields Co., Ltd., a consolidation of the French, Dutch and Belgian interests. The Midwest Oil Co., financed by Colorado and Eastern men, is a close second. These companies own the two refineries.

The Wyoming Oil Fields, Ltd., owns 20 producing wells in the Shannon field, six miles north of the Salt Creek field. The oil from this field, a lubricant, contains 12% kerosene, 87 lubricating oils, and 1% paraffin. The Midwest company reports that it will drill 40 wells during the present summer, the Wyoming Oil Fields 30 wells, various smaller companies from one to two wells each. An area 4 by 13 miles is reported as proven.

The use of sodium oxalate is recommended by the Bureau of Standards for standardizing permanganate solution (*Journ. Am. Chem. Soc., April*, 1912), as being readily prepared, stable, and readily tested for purity.

---

*State geologist, Cheyenne, Wyo.

The Evolution of the Cableway

By Henry M. Payne*

Six stages are noted in the evolution of the traveling cableway. The features of the first were vertical towers with fixed anchors; of the second, yielding anchors; of the third, towers and anchor cars built as units; of the fourth and fifth, inclined front or working legs and the ballast directly under point of tower; the sixth or latest type uses suspended counterweights and inclined oscillating sheers pivoted at lower ends.

A careful study of traveling cableways, in the libraries and patent offices of both Europe and America, reveals six distinct stages in their evolution.

EARLY TYPE OF CABLEWAY

One of the first cableways to be erected in this country was installed for use in the construction of the Chicago drainage canal in 1893. This is illustrated in Fig. 1, and consists of two heavily constructed timber towers, standing plumb, built over many car-wheel trucks, mounted on four standard-gage track rails each. The anchor cars or traveling deadmen, H_1 and H_2 were similarly constructed.

Anchor car H_1 was loaded with closely piled limestone 12x30x5 ft., weighing 2 tons per cubic yard piled, or a total weight of about 133 tons, plus the weight of the car. Anchor car H_2 had mounted upon it the boiler and engine for operating a haulage system, and sufficient limestone to equal the weight of anchor car H_1.

A 2-in. common steel cable with a breaking strain of 124 tons passed over well lubricated, end-grained, hard-wood saddle blocks at the points GG, in the tower tops, to the anchor cars. This cable was put in place at a given catenary indicated by the line DD, assuming that the deflection at AA allowed an adequate safe factor for loads.

A comparison of the breaking strain of the cable and the weight of the anchor cars or deadmen, readily shows the intended rigidity of this design, and that the whole structure was to have no other movement than its lateral travel on the rails.

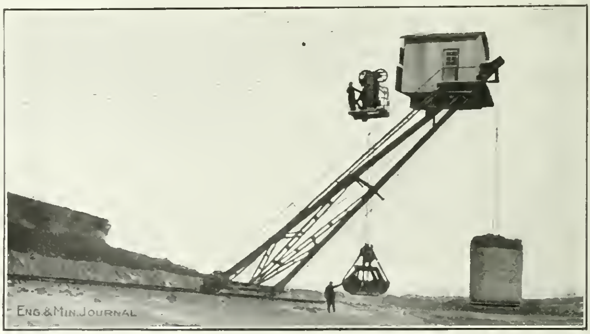
The action of the cable under these conditions was such, due to the deflection AA, that it was found impossible to approach near enough to the tail towers to excavate the material at F, and with the load at the point B, the deflection was approximately the same as when at A, forming a grade in the cable of about 35°, which bend was also disastrous to the life of the cable. Similar difficulty was experienced at the opposite end, thereby preventing sufficient clearance for the spoil bank or storage pile.

The total weight of the anchors being far in excess of the ultimate breaking strain of the cable, it became necessary on account of the short life of the cable, to redesign the whole cableway.

WEIGHT ON ANCHOR CARS REDUCED

Fig. 2 shows the result. The pile of limestone on the anchor car H_1 was reduced to 3 ft. in height, making the weight about 80 tons instead of 133. A corresponding decrease was made from the anchor car H_2, thus reducing the cost of track construction and permitting greater facility in moving the towers.

Under the same working conditions as in Fig. 1, the deflection at AA is the same, but instead of rigidity, we have the yielding of the anchor car, as indicated by the dotted lines at H_1, when the cable is under load. The anchor car ceases to be a deadman and becomes a balance weight, making it possible to carry the load to the towers, for as the load approaches the tower, the balance weight H_1, falling, picks up the cable and load, thereby reducing the grade to approximately zero, as may be noted by the deflections at B, and the relative grades of the cable when the load is at C.



THE LATEST TYPE OF CABLEWAY, THE BALANCED CABLE CRANE

TOWER AND ANCHOR AS A UNIT

This was a material improvement, but the frequent derailments of the anchor car H_1 made further changes necessary, as shown in Fig. 3, where the tower and anchor car are built as a unit, and the front or working legs of the tower are given a greater angle, while the back legs are placed nearly vertical. The anchorage is also moved in, obviating the use of the heavy ballast under the track at H_1.

From all these changes there may be deduced six conclusions: (1) That the cable support is no longer a fixed point, or fulcrum, but a lever. (2) That the yielding of the structure is a balance to the load, or work done; a "relief valve" to the strain on both cable and towers. (3) The increased angle in the front legs of the tower more nearly approaches the resultant of the forces, or the line of compression. (4) The nearly vertical position of the back legs removes all compression and changes them into tension members. (5) The ballast pile of limestone has been moved in and materially reduced in weight. (6) The tower and car combined form a simple gravity anchor.

In this form of construction, with yielding tower, the fulcrum is the inner track rail at F, the initial cost for towers, track, rails, grading, moving, etc., is less, and the available storage space is increased.

About the time of the failure of the type shown in Fig. 1, W. F. Brothers of Philadelphia took out letters patent on the balanced cableway shown in Fig. 6, toward which it is evident that all these later types were tending.

FRONT LEGS OF TOWER INCLINED

In Fig. 4, the action of the cable is comparatively the same, but we find radical changes in the towers. The front legs were given a still greater angle, approximating the resultant of the forces, and the ballast brought in to its most efficient position, directly under the point of the tower. The wheel base is also cut down to five tracks, from the original eight in Fig. 1, the rock ballast is eliminated except under the front rail, and although the towers are lighter, the factor of safety is in excess, and the load capacity is more than doubled.

It is of interest to note that the best

---

*Mining engineer, Stephen T. Williams & Staff, 346 Broadway, New York.

cableway record up to 1893, with the type shown in Fig. 1, was made by the installation on the Chicago drainage canal, noted above. This required eight standard rails for each tower, covering 103 ft. of ground space, with a span less than 500 ft. in length, the tower and ballast at each end weighing in excess of 200 tons. The best day's work was 150 cu.yd., and the life of the whole installation was less than 1000 cubic yards.

Today we find at work on the great Gatun locks at Panama 26 towers, of the type shown in Fig. 5, working 13 cableways, and occupying less than 60 ft. of ground space each. The total weight of each tower and ballast is about 50 tons. They have a working span of about 800 ft., and a daily capacity of 1000 tons each, while the life of the cables is in excess of one year. In 1893, 1000 tons per cable, with a 500-ft. span; in 1912, 300,000 tons per cable, with more than an 800-ft. span!

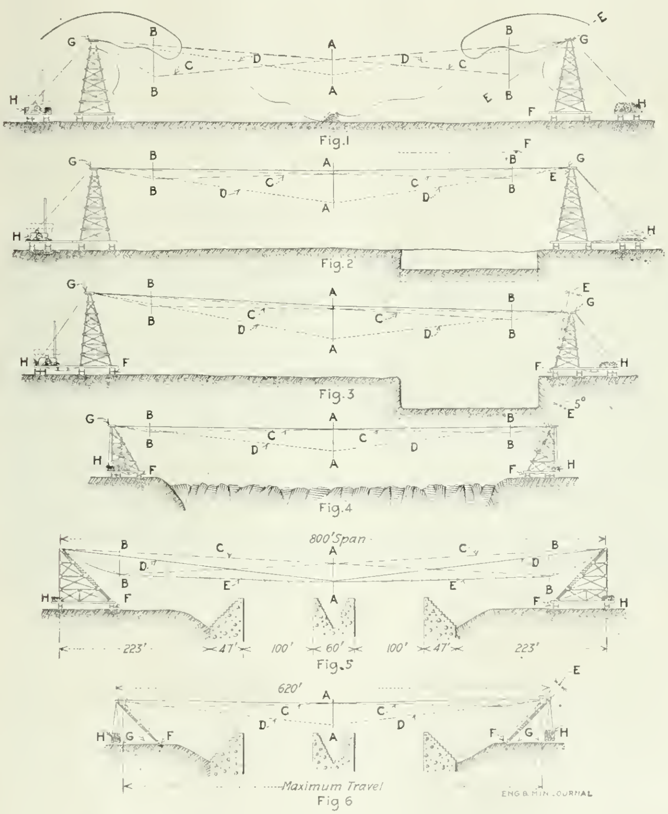


Diagram Showing the Evolution of the Cableway

Fig. 6, which represents the latest type of balanced cable-crane, has suspended counterweights, taking the place of fixed anchors, with inclined oscillating towers or shears, pivoted at the lower end. The weight of the cable and car, with its load, is thus automatically maintained in equilibrium. The counterweights eliminate the dead load, reducing the resistance to the rolling car, and permitting a much smaller motor to convey the load. Traveling ropes are eliminated, and all shock is taken up when the skip is raised or dumped. The rope remains practically level at all points in the span, enabling the operator to stop and start at any point under maximum load, and the one motorman raises, conveys and dumps the skips or clam-shell buckets, reducing cost of operation and increasing the safety of the men working underneath, who must otherwise depend upon the transmission of signals.

One of the striking features of this type is its adaptability to storage coal or ore plants, where one of the traveling shears may operate in a circle around the other, being motor driven, and thus covering every point of a given area.

I am indebted to A. P. Man for the following formulas, deduced by him from the balanced cable-crane in operation at his mines in Virginia:

Let S = span; M and N = divisions of S; Y = distance to load on M side; W = weight of 1 ft. of cable; G = load; T = tension; H = deflection. Then the deflection due to the cable alone, is

$$H = \frac{MNW}{2T}$$

at center

$$H = \frac{WS^2}{8T}$$

and the deflection due to load alone, is

$$H = \frac{GNY}{TS}$$

at center

$$H = \frac{GS}{4T}$$

and the total deflection is

$$H = \frac{WMNS + 2GNY}{2TS}$$

at center

$$H = \frac{WS^2 + 2GS}{8T}$$

Example: Where $W = 6.12$, $S = 525$ ft., and $T = 66{,}000$ pounds.

$$H = \frac{6.12 \times 275{,}625}{8 \times 66{,}000} = 3.2 \text{ ft.}$$

The balanced cable-crane type was used at Hale's Bar, Tenn., in the construction of the great dam there, and in various other heavy pieces of construction in New York and elsewhere. A typical installation is shown in the accompanying halftone. The same apparatus was used in the erection of the bridge over the gorge of the Zambesi River, in Africa. This bridge had a clear span of 870 ft., and its deck was 460 ft. above the river. The one balanced cable-crane in use brought steel to gangs at both ends of the bridge, and also put over all the material for the railroad, making it possible to complete over 100 miles inland before the bridge was in use.

The Vicissitudes of Graphite Mining

Concerning graphite mining, a recent bulletin of the U. S. Geological Survey makes the following statements: "Today there are more abandoned graphite mines and mills in the United States than there are in operation. The number of times that some of these properties have changed hands in the course of a few years evinces a record of misrepresentation and disappointment that can hardly be equalled in any other branch of mining. . . . It should be clearly understood by anyone who contemplates the development of one of the flake-graphite deposits that the technology of concentrating such materials is yet in its infancy;

that there are no well established systems of treating the materials, such as exist, for example, for the treatment of gold or copper ores; and that the product obtained is variable in quality and in market value and subject to severe competition with foreign graphite. The largest part of the foreign graphite that comes into this country is brought in by American firms who either control or own the foreign mines or have purchasing agents abroad, and are, therefore, in a position to take immediate advantage of any change in the markets at home or abroad. In general, the cost of producing flake graphite is so high and the price at which it is sold so low that even under the most economic conditions the margin of profit is small. Moreover, certain rocks that carry graphite contain other minerals which preclude any possibility of successful concentration—such, for example, are rocks in which graphite flakes are interleaved with mica—and a careful study of the material by an expert should precede any attempt at development."

The Assay for Gold, Silver and Platinum*

The assay formerly carried out for determining the fineness of gold alloy to one-tenth of one-thousandth part has had to undergo an amplification, by the additional determination of platinum, as this metal has increased in value and found extensive industrial use.

Its exact determination has caused considerable difficulties. Platinum alloys require a high temperature for cupelling, which causes large losses of precious metals, moreover, the bead obtained contains lead and is friable. When alloyed with silver the platinum dissolves in nitric acid with a brown color, but usually incompletely; the residue breaks up into fine powder which cannot be readily collected and which does not frit together when annealed.

Below, a scheme will be given which allows the platinum content to be determined within 5 one-thousandths or less according to the accuracy and skill of the operator.[1]

Preliminary Assay Run First.

As a unit of weight for alloys containing more than 250 one-thousandths gold plus platinum, one-half gram is taken; for alloys with less than 250 thousandths, one gram; for preliminary assay 500 mg. of the sample[2], which has been reduced to convenient shape by hammering or rolling, or more correctly, by granulation, are cupelled in the muffle at a temperature of 900 to 950° C. with a quantity of lead that must be increased with the amount of base metals in the alloy, that is to say from three to fifteen grams of lead. The bead obtained always retains traces of base metal, principally lead. This retained lead increases with high-platinum contents to such a degree that sometimes the bead will weigh more than the sample originally weighed up. From the more or less gray, flat and rough appearance of the bead one may be able to judge of the approximate amount of gold plus platinum. It is safer, however, to treat the bead like the subsequent synthetic assay, by dissolving the silver in concentrated sulphuric acid and weighing the residue gold and platinum, thus obtaining the approximate assay.

For the main or synthetic assay, 500 parts are weighed in duplicate and chemically pure silver is added so that the silver is to the gold plus platinum as 10 : 1. This mixture is now cupelled in the muffle with the requisite quantity of lead. The weight of the resulting bead less that of the fine silver added represents the original gold-platinum-silver content.

The loss of silver in the cupelling operation which may amount to from five to 35 parts by weight depends upon the temperature, the quantity of lead added, the duration of cupellation, the kind of cupel used, the amount of silver present and the composition of the alloy. It can be determined by trial with a series of alloys of different composition, but more accurate results are obtained by simultaneous cupellation of a proof of approximotely the same composition at the sample.

High Silver Advantageous

Alloying with much silver has the advantage that a lead-free button is obtained[3] that is easily removed from the cupel and that no notable loss of gold and platinum arises from the cupellation, for the loss of these metals decreases with the increased amount of silver added. The bead is put without previous hammering or rolling into a mattrass such as is used in gold assaying and digested with about 25 c.c. concentrated H_2SO_4, sp. gr. 1.84, over a circular gas burner.

The acid is heated without boiling, to avoid local overheating, and effects solution of the silver in 25 or 30 min. The residue of gold-platinum with its surcharge of silver then remains in one piece, which precludes mechanical losses in the subsequent decanting of the solution. Heating the acid to the boiling point causes disagreeable bumping without effecting a perfect solution of the silver, even on replenishing the acid; furthermore platinum is notably soluble in boiling concentrated H_2SO_4, and is then lost. After brief cooling the solution is carefully decanted and the residue is washed with hot water. It is advisable to pass the water through a filter. Now fill the mattrass with distilled water and turn it upside down in an annealing cup or porcelain crucible; the residue will sink to the bottom of the latter. It is gently ignited with the filter in the forepart of the muffle.

Reduce Gold with Hydrazine Chloride

The residue is now dissolved in the smallest possible quantity of *aqua regia*, the largest portion of the acid evaporated, diluted with distilled water to about 150 c.c. and the chloride of silver produced filtered off. In consequence of its strong reducing power and its convenient applicability, hydrated chloride of hydrazine is preferably used in reducing Au and Pt. Although it often carries some Pt with it in precipitating the Au, when proper precautions are taken its reducing power is diminished by an addition of HCl and lowering the temperature. The Au is precipitated from the solution after the addition of 15 c.c. HCl of sp.gr. 1.10, by about one gram of hydrazine chloride, and the solution is left standing at 18 or 20° C. for an hour with occasional stirring so that the precipitated gold will unite. After filtering, incineration of the filter and ignition the gold is ready to be weighed. This gold—often somewhat platiniferous—is cupelled in the muffle with a small quantity of lead and five to six times its weight of fine silver and, thereafter, the silver and any platinum that may be present dissolved by boiling with nitric acid. The residue is fine gold. In the filtrate from the precipitation of the gold the platinum is precipitated at a boiling heat, with an excess of ammonia, in about 10 min. With low-platinum content the large excess of HCl is removed by evaporation and gentle boiling, as the ammonium chloride formed in large excess, will prevent the precipitation of the Pt by the formation of complex ions, or the precipitation may be done by caustic potash and ammonia in which case the filter must be washed thoroughly with hot water acidulated with HCl. The examination of ores and metallic wastes for silver-gold-platinum is made by scorification or crucible assay with subsequent treatment of the resulting lead button in the manner indicated above.

It is reported that a lead smeltery is being erected at Martinschizza, near Fiume, Austria, to treat ore from Broken Hill, Australia. The ore will be landed at the port of Buccari.

---

*Translation by O. H. Hahn, of an article by Trenkner, assistant to the master of the mint, at Berlin, Germany.

[1] The French limit is 10 one-thousandths.

[2] Most platinum fusions are made by adding silver to them in order to obtain a more homogeneous and fusible alloy.

[3] Sharwood, Cupellation of Platinum Alloys. Journ. Soc. Chem. Ind., Vol. XXIII, No. 8.

The Sizing of Fine Dry Ore

By Charles H. Brown*

In machines of the Vibromotor type for sizing dry ore, fine-mesh wire and silk screens are used, mounted on shaking or gyrating frames. This article describes the operating difficulties experienced and how they were overcome.

In the sizing of crushed ore by machines of the “Vibromotor” type, in which a series of discharging screens is used, there are many factors that affect the capacity of the machine and the cost of upkeep to a much greater degree than might be anticipated.

It will be my purpose in this article to explain the reasons why difficulties arise and their remedy, rather than to deal with the cost of sizing. My remarks are intended to suggest ways of reducing expenses to those already operating these machines rather than to furnish data for contemplated installations. In other words, I hope to enable some fellow operator to avoid the duplication of some of my unpleasant experiences in using this type of machine while engaged as superintendent of the milling department of the Ozark Smelting & Refining Co., at Magdalena, N. M. This article is not to be regarded as a criticism of this type of machine, for there is no doubt that many problems of ore sizing may be solved by its use.

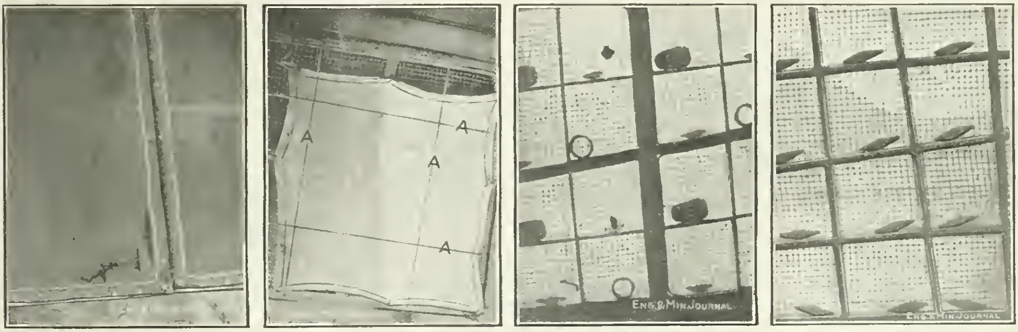


Fig. 1 Fig. 2 Fig. 3 Fig. 4

Vibromotor Screens and Ring, Brush and Rubber Screen Beaters

Character of Pulp Affects Capacity

Among the more important factors that may influence the successful sizing of ore may be named:

(1) The character of the ore; whether in general composition it consists of carbonates, sulphides, or mixtures, and particularly the constituents of the gangue, whether they be quartz, limestone, magnetite, or either massive or specular hematite.

(2) The fineness to which it is necessary to crush the ore in order to free the mineral, also whether the valuable minerals are associated with the harder or the more easily crushed constituents of the ore.

(3) The quantity of very fine material contained in the ore as received from the mine, and the quantity of fines made in crushing.

(4) The complexity of the ore in regard to the separation of the constituent minerals and whether or not a suitable process can be developed for treating the slime portion and to what extent the sizing must be carried to leave the very fine material capable of treatment.

As the rate of feeding affects the capacity and efficiency of the machine, one of the first requisites is to determine the maximum rate of feed that the machine will take without sending undersize particles into coarser sizes. The screens must not be so heavily loaded that they cannot properly agitate the ore over their surfaces so that the undersize can pass through. If a screen is overloaded the lighter particles of ore may float on top and be carried to the discharge instead of passing through the screen; or the corner of an oversize particle may be forced through the aperture by the weight of the particles on top of it.

It may be well here to regard the manner in which ore passes over a screen. When particles of different sizes but of the same specific gravity are agitated together the larger pieces rise to the top. When particles of the same size but of different specific gravity are agitated together the particles of low specific gravity rise. In sizing ore as it comes from the grinding machinery the pulp consists of a mixture of particles of the same size and different specific gravity and those of different sizes and the same specific gravity, hence crowding the machine would result in bad sizing. This crowding also causes blinded screens from wedged particles, and broken screens from overload and excessive wear on the threads or wires necessitating frequent renewal of the screens attended by loss of time to clear and repair them.

The maximum practical capacity of a screen is obtained when the gyrations of the ore are so free that each particle has ample opportunity to have its smallest dimension turned toward the aperture. It must be borne in mind that sizing ore consists of passing the small particles through the screen. If the sectional area exposed to the separating medium in concentration, of any particle is greater compared with its volume, than that of the other particles in the product, the product containing such particles is really unsized and is liable to cause trouble in table concentration. It is frequently noted in concentrating iron and zinc sulphides, that the pyrite, although of greater specific gravity, often breaks into thin particles, and passes off the screens into a product consisting of particles of sphalerite of the same sectional area as the original unbroken particles of pyrite but of greater specific gravity. Naturally when it comes to dry concentrating on tables, the pyrite is floated into the zinc. It is sometimes impossible, of course, to operate a machine so that this splitting up of the particles can be overcome.

---

*General manager, Machine, Automobile & Construction Co., Magdalena, N. M.

Screens Must be Tightly Stretched

Well stretched screens play a most important part both in regard to the capacity and the efficiency of mechanical classifying apparatus. It is impossible to do good work with bagged screens, for as the surfaces of the screen tend to form dish-shaped places, the ore collects so deeply that the gyrations of the machine cannot properly agitate it; the excessive weight forces oversize through the screen, and the screen can not readily pass its load to the next one, or discharge it. It is this condition more than any other, except leakage at the bottom joints of the doors, that causes slimes to come over in the sizes. By well stretched screens is meant not only screens stretched tightly, but stretched so that the aperture is left rectangular. Enough tacks must be used at the edges, so that when the load is on the screen its weight will not pull the rows of meshes into a wavy line at the edge of the frame. The spacing of tacks to hold screens tight will vary from one inch centers single row 6-oz. tacks on 18-mesh to ⅜-in. tacks on 60-mesh light-tinned wire cloth.

The crushed ore should be warm, a temperature of 100° F. to 150° F. is good. I have seen well-stretched screens, well cleaned and with a moderate feed, that after operating four hours on cold dry pulp, would be almost completely blinded to as coarse as 28-mesh particles and I have seen particles as coarse as 34-mesh coated over with slimes as smoothly as if they had been painted. Of course with silk screens it is necessary to guard against a temperature that would injure the cloth.

The question of the removing, cleaning, and replacing screens, without damaging them, and with a certainty of replacing them in the place they belong, with a minimum loss of time to the machine, is of no small importance. When it is remembered that the material from which the silk screens are made costs from $1.75 per yard for 4XX (approximately 75 mesh) to $7 per yard for No. 25 standard (approximately 200 mesh) for cloth 40 in. wide and that although this fine-mesh cloth will stand a surprising amount of wear with good treatment, it is easily torn by careless handling, the importance of avoiding accidents to the screen is apparent.

Screen Frames Must be Carefully Handled

The best way to remove the screens from the machine for cleaning, is to use two pairs of 12-in. gas pliers, the handles of which have been bent at the end to afford a good grip. The screen frame at each side is gripped, care being taken to get hold of the sides of the frame instead of the end, then by a good stiff pull the frame is usually readily removed. The frame cannot wedge because the force is exerted at the same instant at each side. This manner of removing frames avoids the almost invariable result of shoving the thumbs through the screen, or of torn fingers, when removing the frames by hand.

The cleaning of silk screens is best done with an ordinary short-bristle scrub-brush made of manila fiber. These brushes are excellent for cleaning wire screens if the ore is not wedged into the apertures. In case that the ore is wedged badly we have found that a pressed-tin lid, like those used on baking-powder cans, used with circular edge next to the screen will more readily remove the wedged particles than any other means, and with practically no damage to the screen if care is exercised. The thin edge catches the particle and pulls it up out of the aperture instead of shoving it through.

Much care must be exercised in the cleaning of fine wire screens by any method so that they will not be bagged by stretching the wire in bearing too hard on the screen. Any screen that becomes badly bagged had better be restretched or replaced at once.

Mistakes in Replacing Screens Must be Avoided

The replacing of screens in the machine without having a system of marks to go by, is a most exasperating task. It is usually necessary to employ some unskilled labor for helping clean and replace screens, unless there is a complete set of extra screens so that no cleaning need be done until after the machine is started. In replacing sizer screens it is ridiculous to try to judge each size by the eye. As it is necessary to get the machine in running order in as short a time as possible a green hand is apt to shove some screens into the machine whether he knows where they go or not.

One satisfactory system of identifying the screens is to use a series of small brass tags with the screen numbers plainly stamped on them. One of these tags is let into and firmly tacked to the outer edge of the left corner of the frame and just above where the frame slides when being removed from the machine, a corresponding number is cut or stamped on the jamb of the machine. This method permits of checking the screens after they are put in.

Another way to readily identify screens, and one that I have used with good results, is a system of colors. In this arrangement only such colors of paint are used as will be in marked contrast to the others. The under edge of the outside end of each screen frame is painted with a color corresponding to a given mesh. The number of this mesh is cut or stamped with large dies into the jamb of the machine at the left edge of the screen, and a stripe about 1½ in. wide is painted across the jamb, corresponding to the color of the screen frame. In case the screen is a discharge for that product the stripe of the jamb has a white border about ⅜ in. wide painted around it.

In the room where the screens are repaired, a color board, with the number of each corresponding screen marked opposite the color, is hung so that the repair man may constantly refer to it. In this way each worn-out screen is immediately replaced by a new one of the same mesh. Right here let me say that some manufacturers and dealers in wire screens make a practice of sending out screen cloth cut to size, with a number of meshes in a single bundle with perhaps part of them stamped or tagged and possibly none of them with tags. This practice is occasionally annoying, as everyone knows who has had to deal with it, as frequently the repair man will put the wrong screen on a frame, which means that if the system of screen arrangement is adhered to the screen must be removed from the frame, in which operation, if the screen be of fine mesh, it is often seriously damaged. Screens are expensive and dealers should see to it that each one is plainly marked or tagged before being bundled for shipment.

Marking the Screen Frames

Screen frames should, if possible, be painted before they are used, and the surface on the jamb of the machine that is to be stamped and striped should be thoroughly cleaned with gasoline. We use paints made by the Sherwin-Williams Co., as we have found the colors very bright, the paint sinks well into the wood and dries readily, leaving a glossy surface that sheds the dirt. The blank frames are not painted, neither is the jamb, but the letter *B* is cut into them.

In case a large number of sizes are being made, it is better to run the colors so that those that are used in the wire screens may be repeated in the fine silks. This enables one to employ only such colors as are readily distinguished and the operators are not liable to put a silk screen in the place of a wire one after once having become acquainted with the system. The number is put on the jamb of the machine in connection with the color in order to more readily refer to the size and to increase the knowledge of the men. After the screens are in, the man in charge can run down the left-hand corners, comparing the colors of the screens, and sizer jambs and at the same time touching each screen with the ends of his fingers detect any mistake at once.

The repairing and renewing of screens has formed a distinct line of thought for every man who has undertaken to operate, in an economical way, a machine of this type. Naturally everyone learns some valuable things from his experience and probably some of the readers of the Journal will have some points far in advance of those given here—if so let's have them. These conclusions and observations have, however, only been arrived at after many experiments and trials.

Silk Screens Require Supporting Wires

The most serious trouble that we have experienced from wire screens was caused by bagging in the sizes ranging from 20 to 34 mesh and by bagging under the load and from blinding in the sizes ranging from 34 to 50 mesh. In the silk screens trouble arose from wear and breaking from the load, which breaking was indirectly caused from the length of the span being too great for the strength of the cloth after it had become a little worn; by imperfect stretching of the screen when mounting; by the spacing of the tacks being too great; and by the short inside edge of the frame coming in contact with the screen cloth when the screen was loaded. This sharp edge forms the shoulder against which the ore strikes when thrown by the motion of the machine. The inside edge of the frame may be beveled at 45° so that the selvage will do the bending and take this wear, thus doing away with the sharp edge. In Fig. 1, is shown a photograph of a screen that "died from a complication of diseases." The break at the corner was induced by improper stretching and probably by overload. The split at the side was caused from wear on the corner of the frame. The tacks are spaced too far apart. The frame is of the step variety, which type of frame tends to pile the ore up on the lower screen next to the partition, and the lower part of the screen is usually worn and broken long before the rest of it needs replacing. This type of frame has been found unsatisfactory for our use

In Fig. 2 is shown the manner in which we avoided breakage in silk screens from too great a span and the bagging of wire screens from the same cause. The lines *A-A-A-A* on the photograph represents strands of piano wire stretched across the frame, so that the screen is divided into 16 areas having supports at all sides instead of four areas. The sizes of piano wire used are the gages corresponding to No. 22 B & S for wire screens, and No. 26 for silk.

These wires were each mounted separately, being fastened at the ends to 3-d. nails driven into the frame with the points slanted outwardly. The nails are driven in until the wires "sing." The reason piano wire is used is that it does not give trouble from stretching, and is free from flaws. The screens gave us no trouble from cutting where they rested on the wires, the brushes were able to work right up to the wires, and there was little tendency to blind along the wire. The advantages in preventing sag and broken screens are apparent.

Rubber Beaters Used on the Shaking Screens

We had another condition that caused us some concern. Our ore had to be crushed so that half of it would pass through 50 mesh. This threw a heavy load on the next screen which was 4XX silk (approximately 75 mesh.) These silk screens, owing to the excessive wear and strain put upon them, gave us much trouble and incidentally about one-third of our total sizer expense. In order to overcome this we instituted a series of experiments on the use of wire screens of this aperture. We found that 60-mesh wire on this ore with the ordinary arrangement would blind in a few hours, and so we modified the screen frames, and tried out different types of brushes, singly, in pairs and in combination with each other. Fig. 3 is a photograph showing one of these especially arranged frames, with different types of brushes arranged so as to show conclusively which would do the best work. In Fig. 4 is shown a partial view of the arrangement adopted from this series of tests. The extra partitions shown are wedge shaped in cross-section and are only ¼ in. wide at the top. The edges of the upper surfaces are rounded.

The rubber cone beaters shown in Fig. 4 were found much preferable to either of the other types of brushes shown in Fig. 3, for this fine wire screen. The sole-leather carrier with its knob on the bottom and the two small tufts of bristles at one end gave fair results, but the round rings were almost useless. The serious objection to the rubber beaters is that they wear rapidly, but it was found that they would have their portion of the fine wire screen practically clean when the tuft brush would be getting badly behind with its work and the screen over the ring brush would be almost blind.

Tharsis Sulphur & Copper Co.

The report of the Tharsis company, operating in the Huelva district in Spain, shows a total copper-ore production of 327,348 tons, exclusive of 5420 tons of the so called "cupreous sterile." treated at the mines. Copper precipitate shipped from the mines amounted to 2249 tons, while pyrites and washed-ore shipments were 477,364 tons. The total refined copper produced at the English works amounted to 3393 tons, a decrease of 101 tons from the 1910 figures.

Of the total assets of the company (£1,642,478), no less than £1,106,183 is in securities and cash. The company is attempting to reinvest this in other mining properties, as already noted in the Journal, but so far has found no property suitable to its requirements.

Prospecting for Asbestos

The following hints on prospecting for asbestos are offered by the U. S. Geological Survey (*Bull.* 470-K). Asbestos occurs only in ancient crystalline rocks of Paleozoic or earlier age, and the rocks in which it is found are almost invariably of igneous origin, peridotite altered to serpentine being by far the most important. The conditions most important to observe are purity of the serpentine, its flexures and the presence of granite. The purer the serpentine the more likely it is to form asbestos, while the more abundant the fractures, especially if the serpentine be intruded by granite, the more likely it is that the circulating magmatic waters will form asbestos.

There are three types of asbestos fiber: Cross, slip, and mass fibers. Cross-fiber asbestos occurs in veins and the fibers, if undisturbed, run directly from wall to wall. Slip fiber occurs in slipping planes, the direction of the parallel fibers in the plane indicating the direction of slipping. If the slipping is extensive the shear zone or fault plane may have a mass of slip fiber a foot or more in thickness and many feet in length and breadth, forming a definite vein deposit of considerable size. Mass fiber occurs in fibrous bundles or groups and the fiber may be parallel or divergent. It is strongly contrasted with the cross-fiber and slip-fiber types in that it does not occur in veins but forms the whole mass of the rock in which it is developed.

There are four modes of occurence of asbestos in the United States. The first is as cross-fiber veins of chrysotile in serpentine derived from peridotite, a deep-seated igneous rock, at Lowell, Vt., and Casper, Wyo. So far as known, it is the most important mode of occurrence and is well illustrated at the Thetford mines in Canada. A second mode is a cross-fiber vein of chrysotile with serpentine in limestone. Its most important illustration is in the Grand Cañon of the Colorado in Arizona. The third mode of occurrence is as mass-fiber amphibole (anthophyllite), composing stocks and dikes of fibrous amphybolite, and is well illustrated in the deposits worked for many years at Sall Mountain, Ga. Asbestos of this mode has recently been opened and has attained some importance at Kamiah, Ida. The fourth mode is slip-fiber veins in rocks which, for the most part, are cortlandite and pyroxenite, but which locally pass into peridotite, as at Bedford and Rocky Mount, Va. Commercial asbestos has been found in the first and third modes of occurrence only. Attempts have been made, but unsuccessfully, to mine asbestos of the second and fourth modes of occurrence.

Dominion Steel Corporation

The annual meeting of the Dominion Steel Corporation was held at Montreal, June 12. President J. H. Plummer, in his annual adress, complained of the action of the Canadian government in refusing to renew the bounties on wirerods, which, he said, had been a distinct disappointment to the company, as it had expected a renewal of the bounty pending an investigation by the Tariff Commission. He contended that the steel business had been treated unfairly in being refused a higher degree of protection. Canada imported yearly about 1,000,000 tons of iron and steel at an expenditure of $25,000,000. If this were manufactured at home, from $16,000,000 to $18,000,000 of this amount would go to Canadian workingmen. Reviewing the year's business, Mr. Plummer pointed out that the steel department has suffered in common with American steel companies, owing to lower prices and smaller demand, but indications pointed to a revival in business. The position would be helped by the completion of the finishing mill and other improvements. The coal output at present was larger than at any time in the company's history, and the earnings of this branch last year had been most satisfactory. Since Apr. 1, 1912, the output was 192,000 tons ahead of the same period last year. A dividend of 4% was announced, the president stating that if it were not that the company looked forward to the removal of some depressing factor, it would not continue to pay this dividend on the common stock. The financial statement presented, covering the period of 21 months, from July 1, 1910, to Mar. 31, 1912, showed surplus after the payment of dividends amounting to $1,484,945, of which $700,000 was set apart as a special appropriation for depreciation and renewals, leaving a net surplus of $784,945.

The increase in output came up to expectations, the figures for two fiscal years ending Mar. 31 being as follows, in tons:

	1910–11	1911–12
Coal Co.		
Cape Breton collieries	3,752,298	4,063,395
Cumberland collieries	109,863	342,868
Total coal	3,862,161	4,406,263
Steel Co.		
Wabana ore	544,792	602,168
Pig iron	248,715	290,588
Steel ingots	301,940	335,553
Rails	133,896	153,498
Wirerods	18,600	70,633
Blooms and billets	34,110	43,950

During the year the amount expended on new collieries and other property of the coal company, in Cape Breton, amounted to $1,576,931, and on the Cumberland property to $23,353. The operations at all the collieries have been carried on steadily and satisfactorily. The new mines in the Lingan district are making an excellent showing in tonnage and quality, the coal from No. 6 colliery having greatly improved at depth. Expenditures on capital account on the Dominion Iron & Steel Co. amounted to $2,714,539, in addition to which $1,400,000 was paid on account of the purchase money for Dominion Coal stock. The former board of directors was reëlected.

Cuyuna Iron Ores

SPECIAL CORRESPONDENCE

Data concerning the grade of Cuyuna Range ores in Minnesota are now available from the records of the developed mines and from the logs of more than 2500 drill holes. Most of the ore so far developed is nonbessemer in character and there is little reason to expect that the district will become an important contributor to the bessemer-ore supply. The Cuyuna ore is generally a hydrous, siliceous limonite with a mixture of hematite, and some fairly large bodies of hematite, especially on the north range. Only a little of the developed ore contains over 60% iron, and according to a calculation made by a local engineer, a determination of all of the ore containing over 40% iron would show an average of about 45%. This is an approximation of the low grade of the ore. The commercial minimum in the district is accepted at 51.30% iron for the nonbessemer standard. Much of the ore above 45% and below the standard can be utilized in operation by mixing with grades above the minimum. How much of this below-standard ore will be available in this way depends somewhat on mining conditions. Another calculation on the grade of the ore shows that on the basis of the development up to 1912, an estimate of the average iron content of the developed ore analyzing over 50% iron shows an average iron content of about 53%. A small amount of magnetite is found in the orebodies. The extensive magnetite-bearing schist which accompanies the orebodies is not now of commercial interest.

IRON CONTENT DECREASES WITH DEPTH

The highest-grade ore has generally been found nearest the erosion surface and the iron content decreases with depth, the limit of commercial ore being about 200 ft. on the south range and from 300 to 450 ft. on the north range. The deepest ore disclosed so far is 850 ft. on the north range. These depths, of course, are based on the datum of the erosion surface, not on the actual surface of the overburden which is everywhere from 50 to 306 ft. deep. In depth the ore grades abruptly into iron carbonate and other ferruginous material, the evident primary source of the orebodies. The phosphorous content is estimated to average about 0.30% although it varies from 0.04% to 0.60% or more. Notwithstanding the intimate relation of the slate to the orebodies the ore is relatively low in alumina and does not average above the iron ores of the other Lake Superior districts. Considerable silica is found in all of the ore, the silica content having a constant inverse relation to the iron.

The moisture content of the Cuyuna ores varies from 6 to 14%. An average moisture standard is 10%. This relatively high percentage is due perhaps to the orebodies having formed reservoirs so that the ore is physically saturated in the ground. With the development of underground mining and the drainage of the orebodies, this moisture content will probably be materially reduced. Portions of the Cuyuna deposits are highly manganiferous, yielding up to 25% manganese and averaging in large bodies 15%. The marketing of this product is engaging the interest of some operators. Under present trade conditions there is practically no demand for this manganiferous-iron ore. The Cuyuna ores, though sometimes soft and earthy, are generally hard and porous and the ore from the district receives a classification as "old range" on account of this physical structure, which gives it a preferential price of 20c. per ton over the Mesabi ores. It is likely that under special conditions bodies of higher-grade ore, possibly of bessemer grade will be disclosed in the district as development proceeds.

Mt. Lyell Mining & Railway Co.

The report of the Mt. Lyell Mining & Railway Co., of Tasmania, for the half year ended Mar. 31, 1912, shows operations greatly hindered by strikes. Only 1500 tons of blister were produced (as against 3841 in the half year preceding), carrying 1482 tons of copper, 102,454 oz. of silver, and 1858 oz. of gold. Ore reserves now stand as follows: Mt. Lyell mine, 2,457,429 tons, carrying 0.532% Cu, 1.96 oz. Ag, and 0.028 oz. Au; North Mt. Lyell, 998,457 tons, carrying 6.0% Cu, 1.33 oz. Ag, and 0.005 oz. Au.

A hydro-electric installation is to be put in at Lake Margaret, seven miles away, and the steam plant at the smelting works thrown out of commission. To provide funds for this and other expenditures, 100,000 shares are to be issued at 25s. per share, or 25% premium. Owing to the strikes, profits for the half year amounted to only 1.7%, or £20,523.

New Jersey's Zinc Production

The New Jersey Zinc Co. treated 306,168 tons of ore at its concentrating plant, and shipped 67,896 tons of crude ore to the smelters in 1911, according to the U. S. Geological Survey.

Determination of Carbon in Steel

By W. L. Morrison*

A rapid method based on the direct combustion of the sample in an electric furnace, and the absorption of the evolved CO_2 in a bulb resting constantly on a scale pan. The time of determination is four to six minutes.

While carrying on experimental work with an electric furnace, a rapid and accurate method for the determination of carbon in steel was desired. Colorimetric methods were tried and worked fairly well on carbons up to 0.80%, but above that they were unreliable. Even with the low-carbon steels, results often went astray, due to the varying physical condition of the steel.

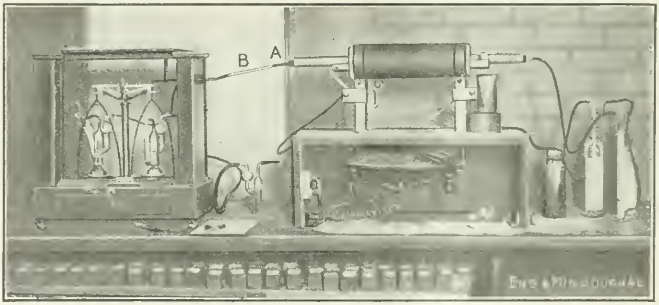
In looking for a better method, I used that described by A. L. Queneau (Eng. and Min. Journ., Mar. 18, 1911; *Met. and Chem. Eng.*, Sept., 1911). In the use of this method I obtained good results, for the crude method that it is. However, results would go low once in a while, due to a lack of the proper precautions. The men in the laboratory were broken in to the use of this method on the preliminary tests from the electric furnace, but after giving it a thorough trial for a month it was considered too unreliable for control work.

I finally turned my attention to the direct combustion of steel in a Haskins furnace as a last resort. The train used for this work is similar to that described by Johnson in his book on chemical analysis of special steels. The oxygen was purified as described, but the CO_2 gas resulting from the combustion of the carbon in the steel was purified and dried in a modified apparatus. A ⅜-in. glass tube, 8 in. long was used. Two-thirds of the tube was filled with calcium chloride and the other third with zinc sponge. The CO_2 passes through the zinc, then through the calcium chloride, shown by *A*, *B*, in the illustration. An analytical balance is included in this train, as also shown.

Too Sensitive Balance Undesirable

The CO_2 is absorbed in a Johnson bulb, resting on the balance pan, the bulb being weighed while the train is aspirating. In connection with this work a cheap balance is better than the more expensive one. Balance No. 2088 (Eimer & Amend's catalog) is the one used. The knife edge on the beam supporting the pan support should not be lifted. The agate plane which rests on the agate-knife edge, should be so constructed that it will not turn with the slight torsion caused by the rubber tube connected to the absorption bulb. This is remedied by the use of the cheaper grade of balance as stated.

A hole is made in the side of the balance case, as near the back as possible, a glass tube of sufficient length to allow rubber connections on both ends, is inserted and fastened, either with a little waterglass or glue. The outer end of the glass is connected to *AB* by rubber connection. A ⅛-in. black, light-wall, rubber tube is connected to the glass tube inside the balance case, the other end of the rubber tubing being connected to the absorption bulb, on the left pan of the balance, as shown in the illustration. A slight drooping of the tube should be allowed, to decrease the friction when weighing. It is important that a pliable rubber tube be used, otherwise the friction is increased and the sensitiveness of the balance decreased. A counterpoise bulb is used on the right pan of the balance. In weighing the absorbed gas it is much easier to weigh to a stand-still, or a slight swing.



Ignition Apparatus for Carbon in Steel

Details of Ignition

In the operation of the train the furnace is run at a temperature of 940 to 1000° C. A half-factor weight of drillings is used. The drillings are placed in an alundum boat containing 90-mesh alundum sand. After thoroughly blanking the absorption bulb by continued aspiration with oxygen, the light weight is taken with the train aspirating the usual rate, which is usually about the same when the final weight is taken. After taking the light weight the drillings are introduced in the furnace, and the current of oxygen cut down to a few bubbles. As soon as the steel begins to burn, the supply of oxygen is gradually increased, giving the train all it will take without causing an excess bubbling in the absorption bulb. The burning of the steel usually requires from one to two minutes, depending on the carbon content. As soon as the burning is finished the supply of oxygen is cut down to a normal rate of aspirating. I use a faster rate of aspirating than that used on the regular combustion trains, without any loss. About 1½ to two minutes is required for the absorption of the CO_2 gas in the caustic solution. The determination of carbon in steel by this rapid method can be made in four to six minutes, depending on the carbon content. The drillings come from the furnace a fused mass of oxides.

Gas Bubbles Do Not Jar Balance

There is no noticeable vibration in the balance due to the bubbling of the gas in the absorption bulb, as might be expected. Using an absorption bulb as counterpoise eliminates to a certain extent any error due to change in temperature, or the presence of oxygen in the balance case. The oxygen valve is placed at the end of the box next to the balance, in order that the operator may control the supply of oxygen as he sits before the balance.

This method is more rapid than any method heretofore used, and is accurate. This rapid-combustion train is used for determination of carbon in the preliminary tests from the electric furnace. Three different men operate the train during the 24-hr. day, in conjunction with their other combustion work, and it is surprising how close the results check with those obtained on the regular train. The average error varies during the course of a week from one to two points of carbon. With the rapid-combustion train as outlined above, and shown in the cut, an operator can get out at least 80 combustions in eight hours. There are no absorption bulbs to handle, the final weight is taken as soon as the CO_2 gas is absorbed, which means a saving of at least two minutes. I find that the balance as used in this work is sensitive to an amount equivalent to ½ point of carbon.

---

*Chief chemist, Simonds Manufacturing Co., Lockport, N. Y.

Recent Changes at Canadian Copper Co.*

The former acid converters, 10 in number, at the smeltery of the Canadian Copper Co. at Copper Cliff, Ont., have been replaced by five Peirce-Smith shells, 37 ft. 2 in. long by 10 ft. in diam,, outside measurement. They turn on four 12-ft. riding rings. The throat is placed at the center of the shell, instead of at the end, as in the Garfield plant. There are 44 tuyeres, 1¼ in. in diam., 7 in. apart. No tuyeres come directly under the throat. The length inside the lining is 33 ft. 3 in. long, the bottom is 2 ft. thick, the tuyere wall is 18 in. thick and the front wall 15 in. thick. The roof is 12 in. and the brick directly around the tuyeres 24 inches.

Oil Actuated Converter Tilter

Tilting is done by wire ropes passing around the converter shell (Eng. and Min. Journ., June 3, 1911). As the usual hydraulic equipment would not be suitable to the climate of Northern Ontario, oil is used instead of water, the oil being moved in the cylinders by air pressure. Two tanks are provided, one for regular use, one for emergency. These tanks are ¾-in. steel, 4 ft. in diam., 15 ft. high. A small amount of oil is pumped into these cylinders, and the space above filled with air at 75-lb. pressure. More oil is now forced in, compressing the air to 300 lb. When the converter is turned, the oil is used, allowing the air to expand, and the pressure to fall. At 200 lb., the oil pump automatically starts until the pressure again reaches 300 pounds.

The entire plant is electrically driven, and if the power goes off for any reason while the converter is blowing, it is obvious that the matte would normally flow back into the tuyeres. To avoid this, the spare tank referred to, is connected to the tilting cylinder by a valve held closed by a solenoid brake. The flywheel of the converter blower is large enough to turn the blower over for 15 or 20 sec. The solenoid brake goes off the instant the power does, and the converter is immediately turned up, before the flywheel stops.

Charging the Converter

The initial charge for a basic converter is about 60 tons of matte. About 10% of previously dried quartz is then dumped in, and the blast turned on. The charge is then blown 30 to 45 min., and slag skimmed. Five or six tons more of matte are added, with three tons of siliceous material, and the converter again blown. The length of blow, amount of slag to be taken off, the weight of matte added after each skim, and the flux added are all factors of the grade of the matte, and have to be determined by experience.

Repeated blowings, skimmings, and additions of matte are kept up until 70 or 80 tons of finished product remain in the converter. This may require 300 to 400 tons of furnace matte, and 30 to 50 hr. blowing time.

Apart from the advantage of larger units, there is no slopping over of the converter, less siliceous flux is needed, and the converter slags are cleaner, but as all the converter slag is re-smelted anyway, this last is not material.

Reverberatory Furnaces Fired with Coal Dust

Two interesting reverberatory furnaces have been built at Copper Cliff, expressly designed for firing with pulverized coal. They are 19x112 ft. in hearth area. The side walls are 27 in. thick. The roof is 20 in. thick for the first 35 ft. near the coal burners, and 15 in. the rest of the way. The extreme height inside is six feet. The bottom is an inverted magnesite arch of 12-in. spring. The spring of the roof is 19 inches.

In building these furnaces, a trestle 14 ft. high was built, and furnace slag poured from this until a block of slag was built up within the line of the outer walls, 10 ft. above the yard level. On this foundation were built the side walls of the furnace. Inside these side walls, slag was again poured to build up a hearth about 2 ft. thick. Between the two furnaces openings were formed by concrete retaining walls, so as to leave tunnels entering the slag foundation at the yard level, and at both sides of the furnace.

Furnace Bottom Construction

The hearth of the furnace was finally made by building an inverted arch of concrete of the same curve as the purposed magnesite arch on top of the slag foundation. On this, a layer of firebrick was laid flat, 2¼ in. thick. Over this, 9-in. magnesite brick were laid in a mixture of ground magnesite and linseed oil. Expansion strips of wood were placed between every six courses, allowing ¼-in. expansion per foot.

The side walls are silica brick, 18 in. thick, lined with 9-in. magnesite brick, the latter not supporting any of the roof. The tap hole is so placed that 12 in. of matte always remain in the furnace.

Slag is taken out at the sides of the furnace, about 11 ft. from the front, just before the furnace commences to narrow. The furnace slopes gradually up to the space usually occupied by the skimming door, where there is a straight outlet for the products of combustion. This is a 6x9-ft. flue, 70 ft. long, leading to a dust chamber 15x19x177 ft., which in turn communicates with a 200-ft. stack, 15 ft. 4 in. in diam. at the top, 17 ft. 2 in. at the bottom.

At the fire end of the furnace there are two sets of charging bins, each having five hoppers, which discharge through sliding gates into the furnace.

Coal Dust Firing

The method of firing is as follows. Coal is dropped from the trestle into storage bins. From these it passes through a coal cracker on to a conveyor belt. The coal, ½ in. or under, is carried by this to a bin, whence it goes by screw conveyor, to a Ruggles Coles dryer. From here it goes to two Raymond impact pulverizers. These grind it so that most of it will pass 200 mesh. This pulverized coal is sucked by a fan up to a separator on the top of the building and sent by screw conveyors to the furnace bins. From these it is taken by five variable-speed screw conveyors, 4 in. in diam. These deliver the coal into five burners, dropping it in front of nozzles which carry air from a fan. The air blast sends the coal into the furnace in the form of a cloud or spray of dust which burns just like fuel oil. Each burner can be run separately, and the amounts of coal and air varied at will.

The slag from the converter building is brought to the reverberatory furnace in 10-ton pots drawn by locomotives, through the tunnels between the furnaces. Through openings in the tunnel roofs, the reverberatory cranes pick up the pots and pour the slag into the furnace. The matte is then tapped into the same pots, which have the slag skull for a lining, and taken to the basic converters.

Flue dust and green-ore fines are at present charged through the side doors by hand. The amounts were still low when the description was written, as the charge was wet and frozen, and the plant had been in operation only a short time.

In general, there is no difficulty in firing in this manner. Combustion is complete, and the ash Mr. Browne states offers no difficulties. A small amount of ash settles in the flue near the end of the furnace, and is removed through cleaning doors about twice a week.

---

*Abstract of a paper presented at the Toronto meeting of the Canadian Mining Institute, by D. H Browne, entitled, "Recent Improvements and Additions to the Smelting Plant of the Canadian Copper Co."

Mining and Metallurgical Patents

A Classified List of New Inventions

A copy of the specification of any of these patents issued by the United States Patent Office will be mailed by "The Engineering and Mining Journal" upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COPPER

ORE TREATMENT—Improvements in the Metallurgical Treatment of Oxidized Ores of Copper or Products Containing Copper. W. Dewar, London, Eng. (Brit. No. 10,143 of 1911.)

ROASTING—Process for Roasting Ores. Charles Gabrielle. (U. S. No. 1,018,609; Feb. 27, 1912.)

GOLD AND SILVER

AMALGAMATOR.—Charles C. Ellis, Chattanooga, Tenn. (U. S. No. 1,027,244; May 21, 1912.)

CYANIDING—Improvements in Apparatus for the Extraction of the Precious Metals from Pulp and Solutions. Turbo Amalgamator & Extraction Co., Ltd., London, Eng., and A. A. Lockwood, Surrey, Eng. (Brit. No. 22,627 of 1911.)

CYANIDING—Separating Device. John Edward Rothwell, Denver, Colo. (U. S. No. 1,028,789; June 4, 1912.)

STAMP MILL—Ore-Crushing Stamp Mill. Philip R. Stanhope, Denver, Colo. (U. S. No. 1,026,717; May 21, 1912.)

IRON AND STEEL

BLAST FURNACE CONSTRUCTION. James B. Ladd and David Baker, Philadelphia, Penn. (U. S. No. 1,027,738; May 28, 1912.)

BLOWING ENGINE—Apparatus for Supplying Air to Blast Furnaces, Converters, and the Like. Ralph H. Sweetser, Columbus, Ohio. (U. S. No. 1,027,781; May 28, 1912.)

CHARGING FURNACES—Apparatus for Charging Open-Hearth Furnaces, Etc. James Smith, Ealing, England, assignor to Babcock & Wilcox Co., Bayonne, N. J. (U. S. Nos. 1,028,619 and 1,028,620; June 4, 1912.)

GAS FILTRATION—Filtration of Furnace Gases. F. Muller, O. Johannsen, and P. Pape, assignors to Company Rudolph Böcking & Cie. (U. S. No. 1,022,496; Apr. 9, 1912.)

HARDENING—Method of Treating Steel. Auguste J. Rossi, Niagara Falls, N. Y., assignor to Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,028,389; June 4, 1912.)

ORE TREATMENT—Process of Treating Pulverulent Ores of Iron. Soc. Anon. des Ciments Portland Artificiels de Buda, Haren, Belgium. (Brit. No. 9901 to 1911.)

REFINING—Process of Refining Iron or Steel. Karl Albert Fredrik Hiorth, Christiana, Norway. (U. S. No. 1,028,070; May 28, 1912.)

SCRAP—Balling-Furnace. Morris Sellers and Hal M. Nicholls, Chicago, Ill. (U. S. No. 1,029,234; June 11, 1912.)

LEAD, ZINC AND OTHER METALS

ALUMINUM—Process of and Composition for Coating Aluminum or Its Alloys for Soldering, Etc. Braxton Davenport Avis, Jr., Clarksburg, W. Va. (U. S. No. 1,029,522; June 11, 1912.)

ANTIMONY AND ARSENIC—Method of Treating Antimony and Arsenic Ores. A. Trifonoff and D. Gardner, St. Petersburg, Russia. (Brit. No. 19,328 of 1911.)

MAGNESIUM—Melting and Casting Magnesium and Alloys Thereof. Berthold Hoffmann and Robert Suchy, Griesheim, Germany, assignors to Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany. (U. S. No. 1,028,216; June 4, 1912.)

TIN—An Improved Process for the Recovery of Tin from Ores and other Tin-Bearing Materials by Conversion into Volatile Tin Compounds. A. Richards, London, Eng. (Brit. No. 26,644 of 1911.)

VANADIUM—Process of Extracting Metals. Auguste Henri Perret, Paris, France. (U. S. No. 1,028,774; June 4, 1912.)

ZINC—Agglomerating Process for the Recovery of Lead Contained in Fine Residues of Zinc Furnaces. Alexandre Folliet, Brussels, Belgium. (U. S. No. 1,029,182; June 11, 1912.)

ZINC—Improved Method in the Metallurgy of Zinc. Charles Victor Thierry, Paris, France. (Brit. No. 19,973 of 1911.)

ZINC—Improvements in and Relating to the Separation of Zinc from Zinc Sulphate Solution. K. Namekawa and J. Miyazawa, Tokyo, Japan. (Brit. No. 5967 of 1911.)

ZINC—Recuperative Zinc-Smelting Furnace. John Zellweger, St. Louis, Mo. (U. S. No. 1,028,417, June 4, 1912.)

ZINC-ORE ROASTING—Recuperative Roasting Kiln. John Zellweger, St. Louis, Mo. (U. S. No. 1,017,839; Feb. 20, 1912.)

NONMETALLIC MINERALS

ASBESTOS—Machine for Separating Asbestos from the Rock. Jesse E. Werner, Philadelphia, Penn. (U. S. No. 1,027,163; May 21, 1912.)

FULLER'S EARTH—Method of Separating and Purifying Fuller's Earth and Analogous Materials. Charles C. Ruprecht, Blakely, Ala. (U. S. No. 1,024,104; Apr. 23, 1912.)

SULPHUR—Improvements in and Apparatus for the Production of Sulphurous Acid from Sulphur. W. Field, Linz-on-Rhine, Germany. (Brit. No. 21,996 of 1911.)

MINING—GENERAL

BLASTING—Portable Detonator Magazine. Abram S. Hamilton, Nanaimo, B. C., Canada. (U. S. No. 1,026,860; May 21, 1912.)

BLASTING—Safety-Fuse. Harry A. Yates, New York, N. Y., assignor, by mesne assignments, to Y. & G. Electric Fuse & Engineering Co. (U. S. No. 1,028,173; June 4, 1912.)

DRILL—Pneumatic Drill or Like Machine. George Harry Hayes, Chicago, Ill., assignor to Chicago Pneumatic Tool Co. (U. S. No. 13,410; Apr. 30, 1912.)

DRILL—Rock Drill. Martin E. Thomas, Bowling Green, Ky., assignor of three-fourths to Willis W. Hester and Baley P. Belk, Bowling Green, Ky. (U. S. No. 1,026,886; May 21, 1912.)

DRILL BIT. John Sohacki and George W. Cook, Larksville, Penn. (U. S. No. 1,026,530; May 14, 1912.)

DRILLING—Fluid-Controlled Drill-Steel-Forming and Drill-Bit-Sharpening Machine. John George Leyner, Denver, Colo., assignor to The J. Geo. Leyner Engineering Works Co., Littleton, Colo. (U. S. No. 1,026,872; May 21, 1912.)

DRILLS—Automatic Turning Device for Fluid Hammer-Drills. John James Purcell, Burke, Ia. (U. S. No. 1,028,275; June 4, 1912.)

DRILLS—Dust-Collector for Drills. William Prellwitz, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,023,594, Apr. 16, 1912.)

HOISTING—Safety Device for Electric Hoists. Jay H. Hall, Cleveland, Ohio, assignor to Electric Controller & Manufacturing Co., Cleveland, Ohio. (U. S. No. 1,027,126; May 21, 1912.)

MINE-CAR COUPLING—Automatic Coupling for Mine Cars. Daniel H. Taylor, Tercio, Colo. (U. S. No. 1,028,634; June 4, 1912.)

MINE-CAR-DOOR LOCK. John Amos Rivers, Monongah, W. Va. (U. S. No. 1,026,964; May 21, 1912.)

MINE-CAR WHEEL—Robert F. Phillips and Louis J. McCloskey, Carrick borough, Penn., assignors to Phillips Mine & Mill Supply Co., Pittsburgh, Penn. (U. S. No. 1,026,454; May 14, 1912.)

ORE-LOADER. Nels P. Flodin, Marquette, Mich., assignor of one-half to Joseph P. Hodgson, Ishpeming, Mich. (U. S. No. 1,026,502; May 14, 1912.).

SUPPORT FOR MINING TOOLS or Machines. William Prellwitz, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,027,759; May 28, 1912.)

TUNNELING MACHINE. Adolph Fred Walther, Oakland, Cal. (U. S. No. 1,026,335; May 14, 1912.)

UNLOADING DEVICE for Mine Skips. Charles L. Lawton, Hancock, Mich. (U. S. No. 1,026,988, May 21, 1912.)

ORE DRESSING—GENERAL

CONCENTRATING TABLE. Gustave A. Overstrom, Chicago, Ill., assignor to Overstrom Concentrator Co., Butte, Mont. (U. S. No. 1,026,764; May 21, 1912.)

CRUSHING—Crusher Head for Grinding Mills. Harry A. Hunt, Wilmington, Del. (U. S. No. 1,026,319; May 14, 1912.)

CRUSHING MILL. Thomas Joseph Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co. (U. S. No. 1,027,222; May 21, 1912.)

LAUNDER—Ore-Concentrating Launder. Philip R. Stanhope, Denver, Colo. (U. S. No. 1,029,089; June 11, 1912.)

MAGNETIC SEPARATOR. Joseph Weatherby, Jr., New Cumberland, Penn., assignor to Andrew J. Dull, Harrisburg, Penn. (U. S. No. 1,024,538; Apr. 30, 1912.)

METALLURGY—GENERAL

CONVERTERS—Blast Connection for Converters. Richard Bernhard and Arthur Niedermeyer, Milwaukee, Wis., assignors to Power & Mining Machinery Co. (U. S. No. 1,026,556; May 14, 1912.)

CONVEYING APPARATUS for Use in Treating Ores. Henry John Stehli, Montclair, N. J., assignor to Dwight & Lloyd Metallurgical Co., Jersey City, N. J. (U. S. No. 1,027,084; May 21, 1912.)

CONVEYING APPARATUS—Mechanism for Treating Ore. Arthur S. Dwight, New York, N. Y., assignor, by mesne assignments, to Dwight & Lloyd Metallurgical Co., Jersey City, N. J. (U. S. No. 1,027,110; May 21, 1912.)

LADLE CAR. Erwin C. Sherman, Youngstown, Ohio, assignor to William B. Pollock Co., Youngstown, Ohio. (U. S. No. 1,026,708; May 21, 1912.)

METALLURGICAL FURNACE. George Hillard Benjamin, New York, N. Y. (U. S. No. 1,026,197; May 14, 1912.)

RECOVERY—Process and Apparatus for Recovering Metals from Their Ores. John A. Potter, Los Angeles, Cal. (U. S. No. 1,026,999; May 21, 1912.)

REDUCTION—Improvements in and Relating to the Reduction of Metal Ores. S. E. Sieurin, Hoganas, Sweden. (Brit. No. 14,027 of 1911.)

ROASTING—Improvements in or Relating to Ore-Roasting Furnaces. Emile Bracq, Lens, (Pas de Calais,) France. (Brit. No. 19,642 of 1911.)

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Herbert Haas is in Arizona on professional business.

J. Fred. Dierolf is developing mines at El Recreo, Anaime, Colombia.

J. Parke Channing has returned to New York from a long trip through the West.

Ludwig Vogelstein, of L. Vogelstein & Co., New York, sailed for Europe this week.

Norman Carmichael, general manager of the Arizona Copper Co., is visiting New York.

Robert Linton, general manager of the Sierra Consolidated Mines Co., is in Pittsburgh.

Quincy A. Shaw, president of the Calumet & Hecla Co., has returned to Boston from Europe.

Howland Bancroft has gone to Utah on professional business. He will return about July 1 to Denver.

Henry H. Armstead has left New York for Colorado Springs, where he will remain for a few weeks before returning to Guanajuato, Mexico.

Richard S. McCaffery, professor of mining and metallurgy in the State University of Idaho, left Moscow, June 19, on his way to New York.

Edward L. Dufourcq sails from New York July 2, on a business trip to England and France. He expects to return about the middle of August.

A. H. Storrs and G. P. Bartholomew have returned to New York from the examination of coal and timber lands in eastern Kentucky, after a three weeks' absence.

J. Read, superintendent, and Fritz Cirkel, consulting engineer, of the Champs d'Or Rigaud Vaudreuil, engaged in hydraulic mining in Beauce County, Quebec, have resigned.

Berthold Hochschild, president of the American Metal Co., New York, sailed for Europe, June 20, to be gone about three months, partly on business and partly on pleasure.

J. D. Hull, Seattle, Wash., has recently accepted the agency of the Edgar Allen American Manganese Steel Co. His territory is to be the western half of the state of Washington.

Dr. J. Bonsall Porter, head of the mines department of McGill University at Montreal, sailed for England, June 13. He will represent McGill at the Universities Congress in Edinborough.

James Jacoby, of Denver, Colo., is making an examination of some properties at Round Mountain, Nev. He will go from there to Oasis, Mono County, Calif., to look after some mines there.

Agnan Lefevre and Henri Engelbach, French engineers, who are members of the International Congress of Navigation, which met in Philadelphia last week, are in Duluth, examining the ore docks.

Prof. E. Dulieux, of L'Ecole Polytechnique, Montreal, recently returned from a visit to Gowganda and Porcupine, and left, June 15, to continue his investigations of the iron deposits of Quebec for the Provincial government.

A. J. McDonald has resigned his position as general superintendent of the talc mines and mills of the International Paper Co., at Gouverneur, N. Y. He had held that position since the organization of the company 19 years ago.

Ralston Bell has returned to Great Britain from the Ivory Coast, where he has spent a year in the management of gold mines for the French West African Co., and will have his address for the present at 11, Marchhall Crescent, Edinburgh, Scotland.

Earl E. Hunner, for years past in the engineering department of the Oliver Iron Mining Co., has been appointed chief mining engineer for the Arthur Iron Mining Co. The operations of the Great Northern iron ore properties will be handled in the name of this company.

C. E. Julihn has been chosen superintendent of the Utah Mining Co., on the Comstock Lode, in Nevada, succeeding the late James H. Kinkead, inventor of the Kinkead mill process of crushing, and proprietor of the mill of that name that has successfully treated Ophir and other Comstock ores.

OBITUARY

Henry Rhodes, a California pioneer of 1849, died at Campbell's Flat, in Tuolumne County, on June 13. He was 87 years old and had been engaged in mining in Tuolumne County in the earliest gold diggings.

Mason Whiting Mather, mining engineer, died at Oakland, Calif., June 14. He was 74 years old. Mr. Mather served with the naval engineering corps during the Civil War. He was a direct descendant of Col. Joe Mason and also Jonathan Edwards. He went to California from Colorado about 16 years ago. He was for several years manager of the Plumbago mine in Sierra County, California.

James H. Kinkead died suddenly at Reno, Nev., June 9. He was born in Ohio 69 years ago and when 19 years old went to California. In the early days of the Comstock lode he went to Nevada and was for a number of years connected with different mines on the lode. Later he removed to Reno and had since lived there, holding several official positions at different times. While on the Comstock he invented the Kinkead mill for treating the lower-grade ores and established a custom mill, which was at one time a successful enterprise.

Francis Steer Fox died in Salt Lake, Utah, June 16, aged 84 years. He was born in England, but was brought to this country when a child by his parents, settling first in Baltimore and later in Cincinnati. In 1852 he crossed the plains with a wagon train to California. He engaged in mining there in several places, finally settling in Plumas County, where he lived for a number of years. In 1881 he removed to Park City, Utah, where he held a position with the Ontario Mining Co. until 1898, when he retired from business and settled in Salt Lake City.

Frank E. Jordan, a pioneer mining man of California and recently a resident of Berkeley, died at Los Gatos, June 16. Mr. Jordan went to California in the early seventies and later went into Yavapai County, Arizona, where he was identified with the development of that section. He was one of the original locators and owners of the power rights of the Arizona Power Co.; was associated with Senator W. A. Clark in securing some of the holdings of the United Verde Copper Co. He retired from active mining and returned to California in 1904, residing at Pasadena and Berkeley. He was 64 years old.

James Sheridan, one of the best known of the early prospectors in the Minnesota iron country, died at Duluth, Minn., June 15, aged 72 years. He was born and brought up in Illinois and served through the war in an Illinois regiment. After the war he went to Michigan where he was for a number of years employed in different mines on the Marquette range. About 1880 he went to Minnesota and was concerned in the discovery and opening of the famous Chandler mine at Ely on the Vermillion range. From there he went to the Mesabi range, where he located and opened the Sheridan and two or three other mines. He retired some years ago and has since passed a good deal of his time in Mexico.

Societies and Technical Schools

University of Minnesota—Professor Newton H. Winchell, of Minneapolis, for many years state geologist of the Minnesota Geological and Natural History Survey, has presented his geological library to the University of Minnesota. This library is probably one of the best private collections of geological literature in this country and was built up through the years when Professor Winchell, as editor of the *American Geologist*, had unusual opportunities for obtaining the earlier serial and regional reports of this and foreign countries. Many of its volumes are priceless. The library is now being installed in the Department of Geology at the University of Minnesota and will be known as the "Winchell Library of Geology," to which hereafter donations and exchanges should be addressed.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

June 19—The undertaking by the South Eureka Mining Co. to dispose of the tailings from the mill is also being joined in by other mines on the Mother Lode in Amador County. This work is to be done to adjust the complaints made by the farmers on Jackson and Dry Creeks. The mine owners along the lode from Jackson to the town of Dry Creek have spent $15,000 in clearing away the débris from the streams into which the tailings have been run. This débris has been largely from sources other than the quartz mills. In some instances the creeks were dammed and obstructed by fallen trees and the shore wash. In almost every instance where the tailings have been detrimental to the land the cause has been that the streams were obstructed and the tailings not allowed to pass. The plan of the South Eureka company is to build ditches to carry the tailings into a ravine that provides a natural impounding basin for a length of about nine miles. This ravine heads in south of the Eureka mine and extends to within about three miles of the town of Ione. The Central Eureka mine, which joins the South Eureka on the north, will carry the tailings from the stamp mill into a ravine which has its head between these two mines. The Kennedy Mining Co. has recently purchased a large acreage of land adjoining the Kennedy on the south, and it is said that this field will be the depositary of the tailings from the Kennedy mill.

There has never been a time that the mining operators on the Mother Lode in Amador County were unwilling to do all possible to prevent any detriment to the soil of the farm lands by the tailings. A good deal of the complaint has been really without basis. Investigations have shown that a great deal of the damage has been done by the sands washed down from the hills by freshets. The excessive floods of 1910-11 brought down accumulations of sand and débris that collected along the streams. Much of this came from the old placer claims that had been worked for years. The mill tailings did cause some overflow. But the majority of the creeks had been operated by subirrigation and dams were put in which caused the formation of big ponds in the streams. These dams were allowed to remain and the farmers did not realize that these were the cause of overflow and damage to the soil. The committee of mines looked over the streams and considered the complaints of the farmers and agreed that if the farmers would clean out the creeks and keep them cleaned along the unobstructed flow of water, the mine owners would pay for any damage done by the tailings. The mine owners paid for the cleaning out of the creeks and they expect that the farmers will at least assist in keeping them clean and thus prevent the damage that might otherwise result.

Denver

June 20—The laudable efforts of the Denver Chamber of Commerce, which launched the Colorado Grubstake & Mining Co. a year ago, in the interests of the mining industry, have not met with success. About $9000 were originally raised, most of which was used in equipping prospectors in the hope that they would find valuable claims, or discover a new mining camp somewhere in the state. About 30 or 40 claims were staked and recorded but when capital was appealed to this year for money to develop the properties discovered, which were to be owned half by the discoverers and half by the company, it failed to respond, and the affairs of the company have been closed out and the corporation dissolved.

Butte

June 19—For the purpose of making arrangements for the construction of a zinc concentrator, which will be situated on the side of Timber Butte, about two miles south of Butte, Senator Clark, accompanied by W. A. Clark, Jr. and Arthur McGuire, assistant chief engineer of the San Pedro, Los Angeles & Salt Lake R.R., is in Butte, to remain the rest of the month. Senator Clark will install uptodate methods and machinery for concentrating zinc ore. A new gallows-frame has been ordered for the Elm Orlu mine, and an additional spur track will be installed. The shaft is being sunk again and is now 1500 ft. deep. It has not yet been decided whether the railroad extension from the mill to the main line will be operated by steam or electricity, but Mr. McGuire accompanied Mr. Clark here to consult with him as to the best route for the line, and method of operation. When the plans are completed the work will be started and rapidly pushed to completion.

With the object of assisting the state board of examiners in establishing a sanitarium for the treatment of miners' consumption and tuberculosis, the Anaconda company has made a donation of $25,000, which will enable the board to begin the erection of buildings immediately on the chosen site near Warm Springs. The plan has been under agitation for years by the Miners' Union and citizens of Butte, and several bills placed before the legislative assemblies from time to time, have been defeated, up to the last session, when Representative McNally of Silver Bow County succeeded in passing the bill. The state appropriated $20,000 for the purchase of the site, and the erection of the buildings, with a maintenance appropriation of $5000 per year. The board decided that this amount was insufficient, and had it not been for the donation of the Anaconda company, the work would have been delayed until at least another meeting of the legislature. The company offered either the $25,000 cash, with the option of buying any site selected by the committee, or $5000 per year for maintenance, together with the donation of a site. The former offer was accepted and the erection of the buildings will be started soon.

Salt Lake City

June 20—In connection with the recent decision of the Department of the Interior and the Land Office, placing a new construction on the mining statutes requiring a mine or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes, making it difficult or impossible to secure patent to valuable mineral property in demonstrated mineral districts, it is interesting to note that in two of the most productive camps of the state, Park City and Tintic, actual outcrops of commercial ore were almost unknown. In Park City there was a small outcrop on the old Ontario vein and an outcrop (?), or galena float, in Woodside Gulch, on what is now the Silver King Coalition property. Under the present ruling the development of this camp, which has produced ore worth $100,000,000 and paid dividends of $40,000,000, would have been greatly retarded. In Tintic the greater part of the camp absolutely lacked outcropping mineral.

Resolutions protesting against the new regulations were adopted by the Salt Lake Stock and Mining Exchange, and forwarded to Utah's representatives in Congress. These call attention to the fact that it is often desired to locate only a small fraction of ground in places, where the depth of the deposits is such that the cost of making actual discovery on every claim is prohibitive. Also that the mining industry is being retarded and that it would be to the advantage of the Western states if legislation along the following lines were enacted to correct the recent ruling: That congress should enact legislation covering cases where mining claims are located in a recognized mineral district, and the land embraced therein has no value for timber, power sites, water, or agricultural purposes, but is valuable only for its mineral resources; it should be sufficient, in the case of lode claims, to discover mineral-bearing rock in place, or to demonstrate geologically that the mineral-bearing formation or horizon (known to be mineral-bearing in other properties in the district) is within the ground, without actual discovery of the presence of mineral; that any discoveries, or indications of mineral upon which a reasonably prudent man would be justified in spending his time and money in developing such claims in the hope of ultimate success should be sufficient to satisfy the land department.

Negaunee, Mich.

June 22—The Volunteer mine at Palmer and the Rogers mine at Iron River have closed down; the Maas mine at Negaunee, which has been idle for a year, will start operating with a large crew about July 1, and the Negaunee mine adjoining has begun working two shifts in place of the one shift which has been worked for some time. The Volunteer had been employing 180 men and had been hoisting 200 tons of high-grade bessemer ore per day, which was being shipped from the pocket, although no stockpile shipments had been made from the good-sized stockpile on hand. The mine is operated by the Volunteer Ore Co., composed of G. A. Tomlinson, C. A Congdon, T. F. Cole, and associates of Duluth, while Thomas Pellow, of Negaunee, is general superintendent. The closing of the mine is due to the low price of ore, as it was believed that not enough profit was being made from the sales; the orebody, while high grade, is costly to mine and is narrow. It is believed that the mine will be reopened when more satisfactory sales are arranged for; in the meantime the pumps will be kept going.

The Rogers mine of the Rogers-Brown interests, three miles east of Iron River, was sinking a shaft and developing for production next season. The cessation of operations will be only temporary as there is a large orebody of favorably situated ore at this mine, and elaborate preparations had been made for mining it along uptodate lines, including the sinking of a concrete shaft through quicksand. It is believed that the shutdown is only for the purpose of curtailing expenses temporarily. Captain Walter Gulgren, who was in charge of the sinking, has gone to the Cuyuna Range for another company; H. L. Chamberlin, the superintendent, has been transferred to the Chicagon mine.

The action of the Cleveland-Cliffs Iron Co. in increasing forces at the Negaunee mine and reopening the Maas, both large mines, is treated as a sign of better times on the Marquette Range, as the sentiment prevailing is that when the Cleveland-Cliffs acts, it is for sound reasons. Three or four hundred additional men will be given employment. The Maas mine has been idle since last summer.

Silverton, Colo.

June 20—Prospecting is being extensively carried on this year and many old prospectors have returned to the district to search for mines in neglected territory. The discovery of ores, both while exploiting virgin territory and while exploiting the workings of supposedly worked out mines, is having a good influence in the revival of activity around Silverton.

It is believed here that a sale of the Buffalo Boy mine will be consummated soon. This event would largely increase activity on the eastern range, as it is claimed that the Buffalo Boy ore is a good cyaniding possibility and it is hoped that its sale will mean the erection of a large plant of this character. The sale of the Emma mine, in Ice Lake Basin, to Boston men last year, has raised much enthusiasm regarding the porphyry-filled fissures of this section carrying high-grade argentiferous galena. The last cars of ore shipped from the Emma mine carried in excess of 70% lead.

Increased activity will evidently take place in the Ice Lake region and on the entire eastern range. The success of electrostatic separation for the zinc ores has already stimulated the production of ores carrying lead, zinc, copper, iron, gold and silver and there is probably far more ore of this character exposed in San Juan County than in any other.

Fairbanks, Alaska

May 29—The quartz miners are considerably discouraged over the outlook, mainly on account of high transportation costs and the wage scale. Freight from Seattle is $60 per ton, and Fairbanks to the mines varies from $5 to $20 per ton Wages for all classes of labor, muckers receiving as much as skilled miners, are $5 per day and board. It costs $2.25 per day to feed a man. Hay and oats are $90 per ton in Fairbanks. A team of two horses and a driver receives $25 per day. Wood is $12 per cord delivered at the mines on Cleary Creek.

The camp must be considered a base-ore camp from the grass roots down. From the surface to water level a large portion of the gold is free milling, but the veins carry silver iodides and bromides which are lost. Antimony and bismuth occur, the former being quite prevalent. Heavy iron sulphides are appearing at water level and stringers of galena carrying silver. Zinc has also come in with the galena on Cleary Creek. The majority of the veins are narrow, from stringers up to 18 in., although there are larger lodes of lower grade. It is a shipping camp, with Tacoma as the destination, but the transportation companies controlling the steamers do not seem to offer any encouragement. Their steamers and barges go down the Yukon without a pound of freight and the ocean steamers from St. Michaels to Tacoma also. They charge $40 per ton under 500 tons and $20 per ton for 500 tons and over. With railroad and teaming, for shipments over 500 tons, this will amount to about $30 for transportation. It is hoped that the Interstate Commerce Commission will give the camp relief. There is no coal available for smelting until a railroad opens the Matanuska field and connects with the Yukon River.

Toronto

June 22—At a meeting of the directors of the Canada Cement Co. Ltd., at Montreal, on June 21, the questions of the supply of cement on hand and the difficulties of transportation were taken up. Official figures show that on June 12 the company had on hand 1,085,503 bbl. of cement, while unfilled orders west of the lakes amounted to 149,214 bbl., of which 60,707 bbl. were in transit. On the same date the company was short 300 cars, and their deliveries at the head of lake navigation by boats was 182,254 bbl. less than they had planned, owing to late opening of navigation, shortage of steamers, etc. Having in view the growth of the West the directors authorized the building of four steamers for the company's use. The capacity of the company's present mills is 10,000,000 bbl. per year, which is being increased as rapidly as is justified by the market.

The organization of the Asbestos Corporation of Canada, which has taken over the assets of the Amalgamated Asbestos Corporation, was completed on June 20 by the election of the following board of directors: President, W. G. Ross; vice-president, Howard E. Mitchell; W. McMaster, H. J. Fuller, Thomas McDougall, W. U. McCarter and C. W. Colby. Mr. Colby goes on the board as the representative of British interests. The capital consists of $3,000,000 first mortgage, 4-year 5% bonds, and $4,000,000, 6% preferred stock, participating with the common after the latter has received 5% dividends on $3,000,000 common stock.

The Mining News

The Current History of Mining

Alabama

Alabama Consolidated Coal & Iron Co.—In Trenton, N. J., June 21, the Court of Chancery appointed receivers for this company in proceedings brought by the American & British Manufacturing Co. This follows an unsuccessful attempt to reorganize the coal and iron company. The receivers are Halsey M. Barrett, of Newark, N. J., Parry Coffin and Harrison S. Matthews, of Birmingham, Ala. In addition to a heavy bonded indebtedness, on which default has been made, the company had a current liability, Apr. 31 last, of $726,485. A pay roll aggregating $40,000 was not met last week.

Alaska

The first spring shipment from Yukon Territory and the interior amounted to $255,000, and arrived in Seattle June 17.

Fairbanks District

Newsboy—The mine commenced operating the 5-stamp mill, May 12. It is not known definitely what results have been obtained, although the ore averages $40.

Mizpah—Messrs. Thompson and Guis will erect a two-stamp Nissen mill this summer. The vein is 18 in. wide and will average about $50. The shaft is down 100 ft. and 100 ft. of drifts have been run on the first level.

Arizona

Gila County

Superior & Boston—The mine continues to ship ore from the stope below the sixth level on the Great Eastern vein and is preparing to reopen the Limestone shaft and mine the ore on the second and third levels of the Limestone vein.

Arizona Commercial—Enlargement of the Copper Hill shaft continues. After the foreclosure sale in July, it is purposed to erect at this shaft the double-drum hoist now at the Eureka shaft and connect it with an electric motor, current to be transmitted from the Old Dominion. Compressed air will also be furnished by this plant and development work started below the fourth level.

Old Dominion—The company is cancelling many of the leases on its various properties, on account of the passage by the state legislature of the miner's lien law, which provides that liens shall attach to mining claims for debts contraced by lessees.

Miami—Construction work has been started on the new machine shop and change house at No. 4 shaft. These buildings will take the place of the ones at No. 2 shaft, which are situated directly over the orebody and will have to be abandoned, as mining progresses. No. 4 is the permanent working shaft, situated at some distance from the orebody.

Southwestern Miami—Churn-drill holes Nos. 5, 6, 7 and 8 are 705, 460, 360 and 160 ft. deep, respectively. No. 6 hole has been drilled to a depth of 545 ft., but is being enlarged by under-reaming, which has progressed to a depth of 460 feet.

Barney—Churn-drill hole No. 3, corresponding to hole No. 5 on the Southwestern Miami, is 705 ft. deep.

South Live Oak—Drilling has been resumed in hole No. 1 and is proceeding satisfactorily. The hole is 675 ft. deep in granite, carrying carbonates of copper and some chalcocite. The hole is evidently in the oxidized zone and it is hoped that after this is passed through ore will be encountered.

Black Warrior—Underground work has been discontinued. E. M. White, manager, says that this is temporary and that work will be resumed in three or four weeks, after the construction work is completed. A new stable and warehouse are being erected, necessitated by the recent sale of the campsite to the Inspiration company for the erection of its proposed 7500-ton concentrator. Ore that has been accumulating in the bins is being shipped.

Duquesne—Three men are mining the gold-lead ore on contract and about 100 tons are ready for shipment. The ore occurs as free gold and lead carbonate, with limonite-stained quartz at and near the intersection of fissures in limestone, closely associated with porphyry dikes; it averages from $15 to $25 per ton in gold and lead.

New State—Two new dwellings have been erected and the sinking of the shaft on the Republican claim will be resumed soon. The shaft is 50 ft. deep and has disclosed a variable width of high-grade lead-carbonate ore, carrying wulfenite, the latter decreasing in amount with depth and the amount of lead carbonate increasing. Four men are employed.

Pinal County

Ray Consolidated—This company shipped 125,000 tons of crushed ore to the Hayden concentrator during May, and is working 1600 men per day underground. The payroll for May was $142,000. The placing of pumps to drain mine No. 2 has been finished, and the installation of a signal system for the mine is under way; the electric haulage line to the Ray Central is completed, and trolley wires are being strung; the hill, which prevents the laying of a spur to the Ray Central, is to be cut away, and a force of 50 men is employed there. Experimetal launders are in process of erection at the southern section of No. 2 mine, and, if successful, others will be installed wherever it is found that precipitation will justify.

Calumet-Pinal Mines Co.—The properties were sold at auction recently, at Florence, to Nott E. Gild, who will transfer the titles to the Tortolitas Copper Company.

Mammoth-Collins—This property has been optioned by A. B. Bement and associates.

Caledonia—Copper ore, with gold and silver contents, has been found on the 100-ft. level of the initial shaft.

California

Amador County

Argonaut—John Ferri, a miner, was killed by falling 70 ft. in the inclined shaft. There was no blame attached to the company.

Oneida—M. Mucibobich, a miner, was killed by caving ground at the 1800-ft. level. He was a machine man, but at the time of the accident was assisting another man shoveling, to clear a space for the machine.

Calaveras County

A suit has been filed in the Superior Court of San Andreas by L. J. Hutchinson and M. Arendt against the Sierra Ry. Co. for $5000 damages alleged to have been done to the chlorination works at the Jones mine on Carson Creek. The damage was caused by the explosion of dynamite in a freight car. The chlorination works have been idle for several years.

Inyo County

Four Metals Co.—The $120,000 bonds of this company were sold to W. W. Watterson, of Bishop, on June 10. These bonds were deposited in the Inyo County Bank in 1910 to secure creditors. Through the sale of the bonds the creditors will receive a percentage of the money now due them. By this arrangement L. D. Gordon and associates will secure control of the Cerro Gordo mine.

The mine will continue operation and is shipping zinc ore at the rate of 1000 tons per month. New machinery including compressors and concentrators will be installed.

Skidoo—Since May 1 the cyanide precipitates shipped by express to the Selby smeltery had a total value of $10,800.

Kern County

Powel—The milling of 12 tons of ore from this mine, northwest of White's camp, at the Red Dog mill, netted 1500 lb. of tungsten concentrates and some gold.

Butte—Forty-four tons of ore from the Shipsey lease returned $4400 in gold at the Red Dog mill; 40 tons are also being milled from the King Solomon lease.

Lamberson & Co.—Twenty-one tons of ore from the King Solomon lease are ready for milling.

King Solomon—It is reported that the property will be sold by J. J. Miller to Edward Shipsey, G. W. Beck and associates.

Custer—A 3-ft. vein of lead-silver ore has been disclosed in the 204-ft. level of this mine, 24 miles southeast of Keeler. The orebody has been cut at the 180-ft. level. Ore is sacked for wagon haul to Keeler. The recent equipment includes a 16-hp. gasoline hoist, orebins, ore screens and an automatic dumping device. The mine has been idle since 1883. John Thorndyke is leaser.

Modoc County

A plat has been filed of the new town of Branley, situated in the center of the Highgrade district and surrounded by the Big Four, Alturas, Josephine, Consolidated, Huckleberry and Seven Lakes mines. The townsite comprises 60 acres divided into 20 blocks. The geographical position is midway between Fort Bidwell and New Pine Creek. A road has been opened through the snow from Branley to the two other camps. It is probable that two new postoffices will be established, one at Modoc and one at Triangle.

Mono County

Noonday—The old Cornish pumps have been taken out and an electric pump will be installed to unwater the shaft. The bringing in of electric power has made mining and milling profitable in the Bodie district.

Shasta County

Gladstone—The 900-ft. shaft is being deepened to 1500 ft. There is also a 3000-ft. adit. Thirty stamps are dropping. The product of this mine for 1911 is reported at $362,000. E. L. Young, French Gulch, is superintendent.

Sierra County

Shipsey & Smith are in good ore on their quartz property in Jim Crow Cañon, and contemplate the erection of a stamp mill.

Sierra County's efforts to secure a branch of the state highway from Marysville to Downieville along the Yuba River at water grade, have been indorsed by resolutions passed by the Yuba County supervisors at Marysville. This would give a road with little grade and practically snowless at all seasons, which would greatly aid in the development of the large mining and timber interests in Sierra County.

Trinity County

Enterprise—The last cleanup amounted to $3500. Four small machine drills are in use in the stopes.

Alaska—New track and cars have been installed in the lower tunnel.

Oversight—No. 2 tunnel is being pushed ahead rapidly. When it reaches the vein, it will give about 160 ft. of stoping ground and will effect a saving in ore extraction.

Tuolumne County

App—The Tonopah-Belmont Development Co., that recently had this mine sampled, has definitely decided not to purchase it.

Colorado

Clear Creek County

Dives-Pelican & Seven-Thirty Mining Co.—This company's claims, on Sherman Mountain, at Silver Plums, and the 250-ton Pelican mill, have been sold at sheriff's sale for $32,750, and were bidden in by George E. Tarkington, for three years manager of the property.

Alco Mining & Milling Co.—Mining is to be resumed by James J. Cully, general manager. A new hoist and compressor are to be installed and the shaft will be sunk another 100 feet.

Poso-Gilpin—The company has been shipping heavily from the lateral on the Dyke lode, in the Newhouse tunnel, and has let a contract to Morrow & Wright for the erection of orehouses and bins at the mouth of the tunnel.

Lake County—Leadville

Winthrop Gold Mining Co.—The machinery is in the Leadville yards, awaiting an answer to the request that the South Park R.R. put in a spur to its property, in Big English Gulch. The company has agreed to do the grading if the railroad will lay the rails.

Across-the-Ocean—Manager Gilroy has a pumping plant installed and is shipping regularly from the shaft on North Breece Hill. He expects to sink the shaft deeper and to connect with the lower levels of the Great Hope.

Chrysolite—The Leadville Light & Power Co. is installing a 22-hp. hoist at the Chrysolite shaft.

Las Animas County

Victor-American Fuel Co.—An explosion in the Hastings mine, on June 19, is reported to have killed 13 men and injured others.

Ouray County

Camp Bird—The directors have decided to alter the date on which the financial year ends, from Apr. 30 to June 30, to conform with that of the Santa Gertrudis Co., Ltd. The Camp Bird earnings are estimated at £230,000, which, together with a dividend of £157,000 from the Santa Gertrudis, make total receipts of £387,000 from Apr. 30, 1911, to June 30, 1912. Approximately £66,000 will be carried forward. Developments at the Santa Gertrudis are satisfactory.

Mono-Baltic Mining Co.—It is claimed that these mines, in the Red Mountain district, near Ironton, are capable of producing 150 tons per day of $20 ore, and that E. W. Averil, of Boston, president, will arrive soon in Ouray, to build a 200-ton smeltery. P. Carbally is superintendent.

Poughkeepsie—This mine, in Poughkeepsie Gulch, was celebrated in the early days for the richness of its ore shipments, and its dumps are said to contain several thousand tons of low-grade ore that will now pay to treat. H. L. Damschroder, Ouray, states that the mine may be reopened and a mill built this summer.

San Juan County

Some tungsten ore has been brought in from Taylor & Elston's new find on the Million lode which shows a pay streak 1 ft. wide of huebnerite in quartz. They report having six tons of this ore on the dump which will run 15% tungstic acid. This is the second strike of good tungsten ore that they have made this year. They claim that both finds appear to be important.

Gold King—The railroad to Gladstone is in operation and the mill will be put in shape to run at full capacity. The mine is operating under the leasing system and the use of the mill will be apportioned among the different leasers, although the same mill crew will carry on all operations. The ore is pyrite, carrying gold.

Silver Lake—This company, which resumed operations last year, has been producing steadily and will soon commence the production of ore from the Aspen mine, running the 300-ton concentrator at its full capacity.

Ross Mining & Milling Co.—This company has resumed operations under a complete new management. Operations have started on the Champion and Galty Boy mines. This company owns the only smeltery at Silverton.

Green Mountain—Work has again been resumed. An effort will be made to make a good zinc product in the mill. Last year a car of crude ore was shipped which is reported to have run in excess of 50% zinc.

SUMMIT COUNTY

Gold dredging at Breckenridge is flourishing; there is an abundance of water and several of the old "high-bar" placers are again being operated. The three dredges, operated by the Colorado Gold Dredging Co., the French Gulch Co., and the Reliance Co., are steadily at work, in Swan and French Gulches.

TELLER COUNTY—CRIPPLE CREEK

Happy Year—Mining has been resumed at the Bull and Raven Hill properties, by D. O. Darnell, lessee. Mining was suspended because heavy snow drifts blocked the road and prevented the hauling of supplies.

Little Wonder Mining Co.—This company has been incorporated to do general mining business in Cripple Creek, with a capitalization of 50,000 shares of $1 each. The directors are: Franklin Brooks, H. G. Lunt, C. S. Thomas and others.

Portland—This company has completed the installation of the cyanide process in the Colorado Springs mill, to take the place of its old chlorination plant. The capacity is 450 tons.

United States Reduction & Refining Co.—The tailings dump of the Standard mill, at Colorado City, will be worked over by P. A. Hardwick and Frank Dunnington, who will construct a 40-ton experimental amalgamation plant, using the Hardwick process for concentrating.

Idaho

BLAINE COUNTY

Red Elephant—P. A. Danaher, who is working the tailings dump, started his new concentrator June 1. He estimates it will take three years to rework the dumps.

Pulaski Mineral Co.—This company, which has been working the Elkhorn and Noonday group of claims for three years, suspended operations June 1. H. J. Hardess is manager.

Queen-of-the-Hills Extension—This mine has been bonded to E. J. Gordon, of Hiawatha, Kan., who is developing it through the Queen-of-the-Hills tunnel.

BONNER COUNTY

International Smelting & Refining Co.—This company has made a contract to handle the ores from the Idaho Continental mines, north of Priest Lake, and 23 miles from Porthill. It is reported also that $150,000 have been advanced by the smelting company to equip the mines and that an auto-truck road will be constructed for summer use. New machinery will be installed.

COEUR D'ALENE DISTRICT

Snowstorm—The new mill has been placed in operation and is doing excellent work. In fact, it has proved such a success that the machinery for a new unit is being contracted for, and work will be begun on it soon. The copper mineral is finely disseminated in hard quartzite gangue and has always been difficult to handle. The Hardinge mill, which has been installed for fine grinding, has done away with this trouble to a great extent, freeing the minerals without an excess of slimes.

Rex—This property is to be operated again in July. The lease has been extended and the arrangements are nearly completed to finance and operate the mine. Work was suspended some time ago, owing to financial difficulties. R. E. Sloss, manager, will be in charge again.

Michigan

COPPER

Adventure—The crosscut from the new No. 5 vertical shaft has encountered what is believed to be the No. 3 lode of the series revealed about three years ago in the drilling explorations and which gave the richest cores. This lode has been reached about 850 ft. from the shaft. Drifting continues on the No. 2 lode with good results.

Old Colony—No. 14 drill hole has encountered a copper-bearing formation of encouraging appearance.

Quincy—No. 9 shaft is down over 2000 ft. and an improvement has been noted in the mineralization for the last several hundred feet. Sinking will continue until the shaft has reached the drifts from No. 8 shaft, which have been extended beyond this shaft, and when this has been done lateral openings will be started at various points.

Houghton—Recent developments at this property have been satisfactory; a winze sunk on the main lode has come into some heavy copper and the West lode is opening good ground.

Hancock—No. 2 vertical shaft is bottomed in a trap formation at 3675 ft. The lode recently cut by the shaft has not been definitely identified, but has the characteristics of the Pewabic lode and the management is reluctant about making any statements regarding its identity.

Osceola—A statement for the first half of 1912, with June results estimated, shows: Rock stamped, 623,750 tons; cost, $1.19 per ton; copper per ton, 13.5 lb.; total cost per lb., 10.67c.; and $496,506 estimated earnings.

Superior—Developments on the West lode, which is being opened from the 12th to the 18th levels, continue satisfactory. The shaft is sinking below the 19th level, but this station will not be cut until the shaft has reached the 20th level, when crosscutting to the lode will be started from both points at the same time. This company is sending about 800 tons of rock per day to the mill.

IRON

Rolling Mill—Stockpile shipping by steam-shovel began recently over the Lake Superior & Ishpeming Ry.; a large stockpile of high-grade ore is on hand. A Sullivan hoist has been ordered for No 2 shaft, and will be installed in the old engine house. The new 90-ft. headframe being erected by contractor J. S. Wahlman, is of the same design as the one over shaft No. 1, except that the timbers are 12x12 instead of 14x14 in.; there will be no backbrace, but the cable will be run along the ground and under a sheave at the foot of the headframe, then up over the top sheave and down, making the resultant of the pull on the headframe a vertical one. The foundation is of eight concrete piers; the headframe will be covered with corrugated iron similar to No. 1.

Minnesota

It is rumored that a washing plant will be erected at Swan Lake, to treat low-grade iron ore from the Great Northern lands.

Montana

BUTTE DISTRICT

Pilot—As a result of work done on the 900- and 1300-ft. levels, it is believed by the engineers that the Berlin vein of the North Butte company passes through the property. It has been decided to sink the shaft to the 2000-ft. level before any further development work of importance is done, in order to determine if better ore will be found than on the levels above. Considerable zinc ore has been discovered on the 1300-ft. level in a vein of northwest strike, opened by the main crosscuts. On the 900-ft. level, a vein carrying manganese silicate and blende was encountered 40 ft. from the shaft and drifted upon for 260 ft. It is reported that the east drift is coming into good zinc ore.

BROADWATER COUNTY

Keating—When the branch of the Chicago, Milwaukee & Puget Sound R.R. is completed, the company, which is shipping at present about 100 tons of ore per day, will probably increase this amount. Twelve miles of grading have already been completed on the most difficult part of the road, and track laying will commence soon. The shaft has reached the 800-ft. mark, and after a 50-ft. sump has been sunk from this point, crosscutting will be commenced on the 800-ft. level. On the 700-ft. level, about 50 ft. of drifting have been done on the vein from the intersection by the crosscut, showing about 4 ft. of ore.

FERGUS COUNTY

New Year—This mine and mill, acquired some time ago by the Rhinegold company, composed principally of Chicago men, are again running. The new company is doing considerable development work, and the mill has been entirely remodeled to a capacity of 400 tons of ore per day. Bullion is being turned out regularly.

GRANITE COUNTY

Henry Jupenlatz, who owns a placer mine in Princeton Gulch, is preparing to install hydraulic washing machinery and to operate on a larger scale than formerly.

Wasa—Representatives of the United States Smelting, Refining & Mining Co., have taken an option on this group of claims, in the Dunkleberg district, from Edward Challender and A. Hallender, of Granite, and work will be commenced July 1. The six claims are traversed by a wide contact vein between walls of slate and porphyry, carrying zinc and copper, with some gold and silver. On account of the high percentage of zinc in the ore, it is not profitable to ship with the present poor facilities, but the conditions are said to be favorable for a concentrator.

JEFFERSON COUNTY

Flemming—Work is progressing at these mines, recently acquired by the Dow interests. A separate organization will probably be effected to operate the property. Shaft sinking has started and machinery will be installed.

LEWIS AND CLARK COUNTY

St. Louis Mining & Milling Co.—The management has changed and George H. Quinby is manager, succeeding W. Mayger. The mill has been operating 20 of the 60 stamps. Development will be pushed actively and the intention is to erect a 100-ton cyanide plant to treat the tailings. The property is in the Marysville district.

PARK COUNTY

United States Gypsum Co.—The company has taken an option on a bed of gypsum, at Electric, near Livingston. Development will be started with a view of erecting a plant for the working of the deposit in case it warrants.

POWELL COUNTY

Twin City Mining & Milling Co.—Steam sinking equipment has been installed on the Ella Churchill claim on the property, nine miles southeast of Elliston. The main 4x8-ft. working shaft is 100 ft. deep. A crosscut will be started at 200 ft. The ore is a sulphide, carrying gold, silver, lead and copper. The crosscut at 80 ft. opened 3½ ft. of shipping ore. The vein is 20 ft. wide between walls. The company is controlled by St. Paul men; William M. O'Connell is president and Allan McNaughton is manager.

Nevada

COMSTOCK LODE

Consolidated Virginia—A connection has been made with the 2300-ft. level by the three-compartment raise from the 2400-ft. level. Further work is contemplated in the ore on the 2400 and at an intermediate level. Returns received from the smeltery on 520 tons of ore milled at the Kinkead mill gave a net cash yield of $14,066. The concentrate shipment netted $11,728 and the bullion $2337.

C. & C.—It has been announced that the new temporary pumping plant at the 2300 station will probably be ready for a test run by July 1, and when in steady operation work will be started cleaning out and enlarging the 2500 station, where new pumps will be placed.

Mexican—The mill has been brought up to its capacity, and a higher percentage of extraction has been recorded. Bullion shipments this month are expected to clear the company entirely of indebtedness.

ESMERALDA COUNTY

C. O. D. Consolidated—A new discovery has been made in virgin ground on the 100-ft. level about 50 ft. easterly from the shaft, and it is believed to be the extension of an orebody opened several years ago by leasers on the surface but subsequently lost by a surface fracture.

Florence—Approximately 150 tons of ore, averaging $150 per ton, have been shipped from the new strike on the 250-ft. level, since about a month ago. All ore extracted in any part of the mine that returns an assay less than $100 per ton is being stored in such stopes for the present. Superintendent Dewey estimates the value of the entire tonnage of such stored ore at $200,000 at present.

EUREKA COUNTY

Windfall Mining Co.—Superintendent George Edwards, of this company near Eureka, has bonded from Senator Sweeney and others, a silver-lead-zinc property in the Mount Hope mining district, about 28 miles north of Eureka. It is expected that Salt Lake men will operate the property with a steam shovel.

Nevada Central Copper Co.—The Fort Wayne electric drills recently received are working well and the management is preparing to ship ore.

HUMBOLDT COUNTY

There has been a gold strike about 25 miles northeast of Winnemucca, on the east side of Paradise Valley. The formation is a sugar quartz.

An important lawsuit is now going on between two companies in the National district over the apex of the main vein of the National Mines Co. Considerable money is involved. H. V. Winchell is the geologist, and L. G. Campbell and Judge Dickerson are the leading attorneys. The mine has lately found a vein of rich ore on the 800-ft. level.

Kramer Hill—This property near Golconda is being operated steadily; there is a small mill and the ore averages about $8 per ton.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended June 13, are as follows:

Mines	Week	Year to Date
Tonopah Mining..	3,550	79,469
Tonopah Belmont..	2,050	48,926
Montana-Tonopah.	1,090	24,429
Tonopah Extension	1,010	23,177
West End.	700	16,964
Midway.......		180
MacNamara.. ..	465	8,660
North Star..		80
Totals.. .	8,865	201,885
Estimated value.	$221,625	..

Manhattan Big Four—The company has decided to erect a mill on its property the plans for which have been drawn by J. C. Wilkinson, of Goldfield. The mill will comprise 10 stamps of 1050 lb., two tube mills, 16x5 ft., and amalgamating tables.

Philadelphia—This Manhattan custom mill, of 10 stamps of which C. R. Logue is manager, will install a complete cyanide plant.

Associated Milling Co.—This Manhattan company, of which Charles Kirchen is manager, contemplates increasing the capacity of its plant by the addition of five stamps and another tube mill.

Montana-Tonopah—In a statement accompanying Dividend No. 6 the profits for the first five months of this year are reported at $135,634, and the June profits are estimated at $30,000. The cash balance is $171,470, and the company also owns the control of the Commonwealth mine at Pearce, Ariz., which it is now developing.

Mizpah Extension—In a raise from the east drift on the 1000-ft. level the company has opened 3 ft. of specimen ore showing native silver, stephanite and black sulphides. This is believed to be the eastern extension of one of the Belmont veins.

New Jersey

Alpha Copper Co.—The real estate and personal property of this copper company, consisting of 1200 acres of land, mining plant and mines, situated in the Watchung Mountains, three miles north of Somerville, have been sold at sheriff's sale, subject to a mortgage held by the Manhattan Trust Co., of New York, of $315,000, and one held by the Camden Safe Deposit Co., for $2500. The property was bought by George H. Gardner, of New York, for $5000. The mine was first opened nearly a century ago and has been worked at intervals by several different companies.

New Mexico

Socorro County

Socorro—Approximately 45,000 oz. of gold and silver bullion and 25 tons of high-grade concentrates were produced in May.

Deep Down—An average of 15 tons per day is being sent to the Deadwood mill from the south stope, under lease.

Treasure—The recent fire, which consumed the old orebins, caused but little delay in ore-hauling, new ones being erected in a short time. The mill was able to run continuously, having a considerable tonnage in reserve. The regular daily delivery of 70 tons is being made.

North Carolina

Cleveland County

The old sulphur mine, nine miles north of Kings Mountain, has been purchased by a coal company, and it will be put in operation as soon as the machinery, which has already been shipped, can be installed.

American Gold Mine Co.—This company recently purchased the Logan gold mine, south of Kings Mountain. New machinery is being installed and the plant will soon be ready for operation. H. A. Beard, of Battle Creek, Mich., is interested.

Oregon

Douglas County

Oregon-Colorado—F. J. Hard, manager of this property, is making arrangements to install a smeltery for treating the copper ore that has recently been blocked out. A vertical depth of 900 ft. has been obtained.

Lane County

Star Consolidated—This property owned by Portland, Oregon men, is to be sold to Los Angeles men who will open the tunnels long idle. A 5-stamp Allis-Chalmers mill is in good condition.

South Dakota

Black Hills District

Columbus Consolidated—In the *Journal* of June 8, it was stated that judgments against this property must be redeemed before Oct. 5; otherwise the property would pass to J. T. Milliken, president of the Golden Cycle Mining Co., of Colorado. Mr. Milliken has informed us that he has not acquired, either directly or indirectly, any of the obligations of the Columbus Consolidated company.

Homestake—The company will add five motors to the electrical equipment in its mines. These will consist of one 10-, two 15- and two 25-hp. motors, and will be furnished by the General Electric Company.

Utah

Juab County

Tintic shipments for the week ended June 14 amounted to 179 cars; for the week ended June 7, 171 cars.

Iron Blossom—No. 1 shaft, damaged by caving, is in first-class condition. Ore marketed recently brought in about $15,000.

Uncle Sam—At the annual meeting it was reported that there is a quantity of zinc ore in the mine, which can be shipped to the Oklahoma market at a profit.

Colorado—Crosscutting is being done from the Crown Point shaft to explore this mine at depth. Work has been resumed in the old tunnel started west several years ago before ore was encountered.

May Day—An increasing tonnage of zinc ore of shipping grade is being opened. This ore carries 15% zinc, and is being followed in search of a commercial body. Representatives of an eastern zinc company recently made an examination of the mine.

Dragon Consolidated—A raise from the 300-ft. level of the Star workings has broken into 3 ft. of ore carrying silver and copper. The diamond drill to be used in prospecting the south end of the property is ready for operation. The drilling operations are being conducted on company account. A tunnel has been started near the company's main shaft, from which shipments of iron ore were taken.

Utah Ore Sampling Co.—This company's plant at Silver City has put on a night shift as the business has been increasing for several months. About 800 tons per day are being sampled.

Beck Tunnel—The output for a recent week was 100 tons. The best showing is in the ground adjoining the Uncle Sam. Ore is being found on the 175-ft. level. The annual report showed that 1816 ft. of development work were done during the year; 42,041 tons of ore were mined and marketed, bringing net returns of $46,051. The company reduced its indebtedness $15,000.

Shoebridge—The lease on the old mill dump by H. F. Gear, has nearly expired. Since the beginning of the lease 31 cars have been shipped. The dump is said to have brought from $3 to $4 per ton.

Swansea Consolidated—From May 16 to June 8, this company shipped ore which brought $13,000 net. The average of daily shipments is about 75 tons, valued at about $7 per ton. The north drift on the 940-ft. level has followed ore 200 ft. from the winze. Mining will soon be started on the 800. Somewhat heavier pumping has been required during the present month.

Opohongo—A raise from the 1000-ft. level has broken through into the workings made when the property was being developed through the Black Jack. Four cars of ore per week are being shipped, averaging about $1100 per car.

Tintic Mining—This company's shaft at Mammoth is down 200 ft., and is sinking at the rate of 5 ft. per day. The work is being done in search of the Gold Chain orebody.

Salt Lake County

Ohio Copper Co.—A plan for reorganization has been made, providing for the formation of a new company, to acquire all assets and properties of the old company, subject only to the lien of $1,250,000 bonds outstanding. The capitalization will be $8,000,000 in 1,600,000 shares, par $5. Old stockholders can subscribe for new stock, share for share by payment of $1 per share; 250,000 shares will be set aside for conversion of bonds and not more than 39,000 shares can be utilized for underwriting. The board of directors is said to include W. A. Allison, John C. Montgomery, J. Fred Pierson, Jr., J. A. Heinze and Stanley Gifford.

Daly West—Regular mill operations will be resumed soon. The plant has been tested and found to be in good order. One shift will be worked at present. There is developed a sufficient quantity of milling ore to keep the plant busy for several months. While mill operations were suspended a steady production of shipping ore was made.

Silver King Consolidated—Galena ore has been opened in a winze sunk on the Jewell vein from the 1550 level. Drifting will be done on the ore.

Telegraph—Work has been resumed and 40 men are employed. About 100 tons per day of copper-iron ore are being mined with one shift.

Tooele County

Ophir Consolidated—This company, at Ophir, will make additions to its electrical equipment, consisting of one 50-hp., three 35-hp. and one 15-hp. motors, and three 50-kv.-a transformers. This apparatus will be supplied by the General Electric Company.

Washington

Stevens County

Redwood Copper Co.—Development has been underway for some time and includes 400 ft. of tunnel, 183 ft. of winze near the breast of the tunnel, and 165 ft. of raising, for ventilating. The objective point is a limestone contact, estimated to require about 100 ft. more of sinking and from 100 to 200 ft. of drifting. From surface indications, it was expected copper would be found but the adjoining mine, has opened silver-lead ore at greater depth. Operations ceased Apr. 1, but are expected to resume soon. William E. Albee, 608 Phœnix Building, Minneapolis, Minn., is secretary.

Canada

Ontario

Canada Union Furnace Co.—Work has been started on the construction of the plant of this company, Port Colborne, Ont., contracts having been let involving an expenditure of about $500,000. The total cost will be in the neighborhood of $2,000,000. The plant is expected to be ready for operation by the end of the year.

Canada Cement—F. P. Jones, of this company, is leaving for the West, to complete plans for the new $1,000,000 cement plant, to be built at Medicine Hat.

Ontario—Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended June 21, and for the year to date, are:

La Rose... .		1,577 25
Coniagas.. ..	41 21	1,000 26
O'Brien. .	.	294 49
Right of Way ...		148 60
Chambers-Ferland..		225 60
McKinley-Darragh.		1,233 55
Nipissing		985 58
Hudson Bay... .		314 22
Buffalo ..	30 92	613 39
Crown Reserve		236 11
Cobalt Townsite..	112 00	736 56
City of Cobalt....		145 84
Trethewey		241 04
Colonial....		41 60
Kerr Lake...		350 03
Cobalt Lake .	32.15	277 54
Drummond....	20 74	339 30
Temiskaming.	64 10	586 92
Beaver..		187 89
Wettlaufer		111 21
Provincial .		22 22
Casey Cobalt		68 35
Totals	301 13	9,363 17

Bullion shipments in ounces

Nipissing	18,914 4	1,760,371 21
Buffalo	9,034 0	47,972 00

Dominion Safety Explosives Co.—The Coleman Township council has granted permission to this company, organized by Sir Henry Pellatt and other Toronto men, to erect a plant about three miles from Cobalt, between Mud and Sharpe Lakes, for the manufacture of dinitrolite.

Lumsden—High-grade ore has been encountered in the underground workings.

Temiskaming—The output for the first six months of the present year amounted to 1,000,000 oz., as compared with 1,250,000 oz. for the 12 months of 1911.

Buffalo—During the last year there was a small decrease in the total production over the previous year. The total silver produced amounted to 1,525,262 oz. There was no decrease in the ore reserves for the year. The mill treated 46,801 tons, averaging 32.25 oz. and the recovery was 80.63%. The cash surplus is now $385,577.

Crown Reserve—A statement for the five months ended May 31, shows a gross production of 1,143,142 oz. Net surplus was $52,889 after the payment of $442,203 in dividends. Total surplus, May 31, was $817,741.

Cobalt Lake—Good ore has been encountered in the crosscut on the 225-ft. level.

Nova Scotia—This mill will resume operations. It has been closed for some time, owing to the company having assigned.

Calcite Lake—An order winding up this company has been granted by the court, at Toronto; E. R. C. Clarkson, Toronto, was appointed liquidator.

Trethewey—A statement as of May 31 showed: Cash in banks and due from smelteries, $147,221; ore ready for shipment and in transit, $55,820; total, $203,041. The mine's production for May was about 60,000 oz.; gross profit, $36,000; expenses, $16,000; net profit, $20,000. A ballot paper has been sent to the shareholders to give them an opportunity to vote as to whether 1,000,000 shares in the treasury should be cancelled, or retained for the purpose of acquiring new properties.

Ontario—Porcupine

McEnaney—This mine is the first Porcupine property on which free gold has been found on the 300-ft. level. The vein is about 5 ft. wide and gives good assays.

Bewick, Moreing & Co.—It is stated that this company will resume work on its property adjoining the North Dome.

North Dome—Free gold has been encountered on the 50-ft. level.

Plenourum—Recent development work has been encouraging.

Dome—Sinking will soon be started from the 100-ft. level of No. 2 shaft. The management expects to treat 10,000 tons per month in the mill.

Hollinger—Ten stamps have been started in the mill. It is expected that they will all be dropping in a few days.

Mulholland—The main shaft is down 200 ft., and crosscutting to pick up the vein is in progress.

Swastika—The vein has been cut in the crosscut on the 400-ft. level. The company is considering the erection of a mill.

Alexo—This nickel property, situated about four miles from Kelso, will soon start shipping to the Mond Nickel Co. The production will be one car per day. A tramway is being built to connect the mine with the siding.

Moneta—No. 1 shafthouse was destroyed by fire, June 15, stopping underground work temporarily in one drift.

Porcupine Gold—The mill is only partially in operation, owing to delay in receiving the motor. The crusher and one ball mill are handling a small tonnage.

Canadian Finance & Exploration Co.—The stock has been oversubscribed. After June 20 the company will be ready for business.

Standard—This property has been permanently closed down.

Dome Extension—Prominent Philadelphia men are negotiating for the control of this company.

McIntyre—Good ore has been encountered in the north crosscut on the 200-ft. level.

Mexico

Sonora

Empire—Work is reported to have been resumed at the Major Domo mine of this company, in charge of B. Bound. Machinery has been purchased and will be installed soon.

Santa Rosalia—The mine is expected to be in operation again soon. W. J. Edwards, of Cananea, representing the company, was recently at the mine. A Michigan man is expected to take charge.

San Nicolas—Good gold and silver ore is said to have been found recently. A leasing company is operating the mine, which is in charge of Frank Bergesen.

Cuba

Ponupo Mining Co.—It is reported that the property at La Maya, near Santiago, was burned recently by a rebel band.

Africa

Transvaal

Gold production in May is reported at 779,662 oz., being 42,002 oz. more than in April, and 93,711 oz. more than in May, 1911. For the five months ended May 31, the total was 3,291,585 oz. in 1911, and 3,790,971 oz.—or $78,357,371—in 1912; an increase of 499,386 oz. this year.

The number of negro laborers employed in May was: Coal mines, 8460; diamond mines, 14,538; gold mines, 193,829; total, 216,827; a decrease of 3259 from April.

Asia

Chosen

Oriental—During April, 23,915 tons of ore were treated, yielding $138,030 gross and net $67,547. Operating costs were $69,730 and $753 were spent on improvements and development. The Kuk San Dong 40-stamp mill was hung up the full month because of shortage of labor.

South America

Breitung Mines Corporation—This company has filed articles of incorporation in Delaware, with a capitalization of $10,000,000, to operate in Central and South America. The Breitung interests identified with the Michigan iron mines are supposedly conneced with the corporation.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, June 26—Little is to be said of the coal trade this week. In the West, business is reported rather dull and very little is doing at the principal centers. Lake trade has slowed down a little and supplies at the Lake ports seem to be rather limited, so that vessels are going up light. The Seaboard bituminous trade is quiet—even more so than usual at this season. Coastwise business is dull and Eastern buyers are not fairly in the market so far.

Anthracite business is looking up a little in the domestic sizes, dealers apparently being anxious to save the 10c. which goes off the discount on July 1. Steam sizes are in fair demand, but with no special rush. The collieries are working a little better, but are hardly yet up to full capacity, and there is not much coal going to the storage yards.

Coastwise shipments of coal from the leading Atlantic ports, four months ended Apr. 30, in long tons:

	Anthracite	Bituminous	Total
New York..........	5,340,283	3,841,990	9,182,273
Philadelphia.......	622,055	1,370,065	1,992,120
Baltimore..........	69,227	1,250,087	1,319,314
Newport News......	....	972,425	972,425
Norfolk...	....	1,639,385	1,639,385
Total....	6,031,565	9,073,952	15,105,517
Total, 1911........	6,355,083	8,551,036	14,906,119

Total increase this year 199,398 tons, or 1.3%. New York covers all the harbor shipping points and includes barge shipments to city and neighboring wharves. Shipments include bunker coal.

Coal and coke carried on Pennsylvania R.R. lines east of Pittsburgh and Erie, five months ended May 31, short tons:

	1911	1912	Changes
Anthracite........	5,128,186	3,688,943	D. 1,439,243
Bituminous......	16,414,271	18,956,936	I. 2,542,665
Coke...............	4,452,114	5,340,912	I. 888,798
Total....	25,994,571	27,986,791	I. 1,992,220

The total increase this year was 7.7%. The loss in anthracite was due to the suspension of mining.

Coal Rates—On the complaint of the Marion Coal Co., the Interstate Commerce Commission decided, in Washington, June 21, that the rates charged by the Delaware, Lackawanna & Western R.R. on anthracite from the Wyoming field to the tidewater terminal at Hoboken were excessive. Reductions were ordered on prepared sizes from $1.58 a ton to $1.33; on pea coal, from $1.43 to $1.24, and on buckwheat coal, from $1.28 to $1.09. The new rates are to become effective on Aug. 15 and remain in effect for at least two years.

Further reductions in freight rates on bituminous coal from the Pittsburgh district to Great Lakes ports were denied by the commission. The Pittsburgh Coal Co. and John W. Boileau wanted the commission to increase the reductions it made on Mar. 11, from 88 to 78c. a ton, in order to remove alleged discriminations in favor of West Virginia coal.

Iron Trade Review

New York, June 26—The near approach of midsummer has not brought about any considerable change in the iron market. Business remains active with heavy specifications and most of the mills are still busy.

The finished-steel market is likely to be very quiet in July and August, but as the mills are practically filled up for almost their full output in the next two to four months this is not likely to produce any weakness. Prices are quite firm all along the line, and in some quarters are showing a hardening tendency. For several weeks the opinion has been expressed in responsible quarters that bars, plates and shapes would probably advance $1 a ton before long and while no advance has actually occurred the prospect remains, and may develop into an actual advance after the conventions are out of the way. During the convention excitement the mills have not felt like taking any serious steps.

In pig iron in Eastern territory, some large orders have been placed for foundry iron and a number of inquiries have been received. Prices are rather firmly held, but do not advance. There is a renewal of interest in basic pig with many inquiries and some contracting at small advances, both in the East and the West.

The coke situation is still unsettled. The coke makers are still asking higher prices for spot and for new contracts, which furnace-owners are unwilling to concede. Until prices are more settled, business will be irregular.

The labor situation is a sore spot in the trade. There is some scarcity of labor, while uneasiness and discontent are widely manifest. There have been several small strikes in different places and settlement seems difficult. Some of the blast furnaces in eastern Pennsylvania have advanced wages 10%, but others are slow to follow.

The taking of testimony in the Steel Corporation suit of the government has been adjourned till September.

Baltimore

June 24—Exports for the week included 215,250 tons pig iron to Leith, Scotland. Imports included 22,750 tons iron ore from Cuba.

Birmingham

June 24—Confidence is expressed on all sides in Southern territory that the pig-iron market will take on activity again in a few weeks. There is yet some iron to be sold for delivery during the third quarter of the year. Prices range around $11.25 per ton, No. 2 foundry. Reports that concessions are being made on that price are not to be verified, the $11.25 quotation being considered the minimum. Some manufacturers are expressing the belief that $11.50 will be the minimum and $12 the general quotation before long. The manufacturers have lost no courage because of the temporary quietness. There has been further reduction in the accumulated stocks of iron; in fact, but one company now has iron in its yards attracting any attention. One furnace is scheduled to go into blast this week and two others during the first part of July. With iron at $12 per ton it is estimated there will be a material improvement in the make.

The appointment of receivers for the Alabama Consolidated Coal & Iron Co. by the Court of Chancery at Trenton, N. J., last week—Harrison S. Matthews, of Birmingham; Halsey W. Barrett, of Newark, N. J., and Harry Coffin, of Birmingham, being named—did not cause any surprise. The application for receivers was made by the American & British Manufacturing Co., of New York, alleging insolvency. Harrison Matthews, one of the receivers, who has been in general charge of the corporation, announced in Birmingham that the receivership will be temporary, and will clear the way for the reorganization and financing of the company whereby $2,500,000 in cash will be obtained for improvements as recommended by experts who recently reported on the property for Eastern interests. The statement from Mr. Matthews includes the assertion that Charles M. Schwab, head of the Bethlehem Steel Co., is one of the large capitalists who will become interested in the Alabama properties.

By Telegraph—A petition in involuntary bankruptcy has been filed in the Federal court here by local creditors against the Alabama Consolidated Coal & Iron Co. and Judge Grubb, after hearing arguments presented by attorneys for the creditors, named Harry W. Coffin and W. E. Leake as receivers. Objection being raised, Judge Grubb did not appoint Harrison S. Matthews as the third receiver. The petition for the bankruptcy was filed by local creditors on accounts amounting to $15,000. While it is admitted that the proceedings in the court here are ancillary to the New Jersey receivership, it is contended by attorneys for the creditors that the receivers appointed by the New Jersey court can have no authority over property in Alabama and that the first proceedings instituted, with the consent of the company amount to nothing more than "paper receivership." One consequence already of the financial embarassment was the refusal of men in mines near Gadsden to continue at work which resulted in the shutting down of furnaces at that place.

Chicago

June 25—Sales of the leading lines of iron and steel products continue good. The demand for pig iron has fallen off, apparently into the dullness of midsummer business. Prices of pig iron, in all grades, continue firm and there seems no prospect that they will decline.

The sales of pig iron that are made are of small lots—a carload to 500 tons chiefly—and there are few inquiries for larger lots. Occasionally a small lot is bought for last-half delivery; more frequently the demand is for quick delivery. Small purchases, often, seem to be the desire of the average melter. Northern No. 2 iron brings $14.50@15 at furnace and Southern No. 2 sells for $11@11.50, Birmingham, or $15.35@15.85, Chicago. At these prices Northern is more largely in demand, but Southern is strong. Lake Superior charcoal sells for $15.75@16, in small lots.

Railroad purchases are fair; the demand is chiefly in track fastenings, but here and there a new purchase of standard rails adds to the large tonnage on which the mills are working. Structural material sales have a large aggregate in business widely distributed and this buying forms such a steady and large total that its activity seems destined to keep up all summer. Material under 15 in. continues at 1.43c. Plates are in heavy demand at 1.43c. for ¼-in.; tank plates and sheets also are in large demand, at unchanged prices. Billets continue scarce at $28 for openhearth forging.

Cleveland

June 24—Ore movement down the Lakes is heavy, but is all being handled by contract boats.

Pig Iron—Sales are good and inquiries continue to come in. Quotations are, for Cleveland delivery, $15.15 for bessemer $13.75 for No. 2 foundry, $13.25 for gray forge and $16 for Jackson County silvery.

Finished Material—Mills are all busy and in some lines deliveries are rather behind. In sheets, plates and bars deliveries on new orders are not promised before August; in structural shapes even a longer delay is wanted. Bar iron has been $1 per ton to 1.30c. Cleveland.

Philadelphia

June 26—The pig-iron market shows few large sales, but a good many small orders, which make up a fair aggregate for the week. The only call for iron in a large way is from the pipe foundries. Forge iron has dragged. Basic is inquired for on a good scale. No. 2X foundry may be quoted $15.25@15.50 and forge $14.50@14.75; while $15.25 is asked for basic iron.

Steel Billets—Lots of 500 tons or so are wanted, but no big business. Mills are full and ask $23.40@24.40 for rolling and $28.40 for forging billets.

Bars—Iron bars are wanted mainly in small lots to fill up stocks. Iron bars are firm at 1.30@1.35c., while 1.35c. is named for steel bars.

Pipes and Tubes—Tubes are strong. Pipes a little quieter than they have been.

Sheets—Mills are full and small orders are coming in steadily.

Plates—More new orders are coming in and mills are rushed. Prices are strong, 1.40@1.45c. being obtained.

Structural Material—Some large business is pending and small orders are plenty. The market is firm, and prices steadier, at 1.40c. on large orders and 1.45c. on small business.

Scrap—Supplies are good and demand not pressing, but dealers are inclined to sit tight on prices.

Pittsburgh

June 25—The iron and steel market has assumed a quieter aspect but has lost nothing of its strength. New buying is lighter, and specifications are perhaps a trifle lighter, except in the case of contracts expiring with the month, specifications on such contracts being quite heavy. The total of specifications for finished steel received this month will probably make a new monthly record for the year, as several mills can already clearly foresee such a result.

Pig Iron—A sale of 2000 tons of malleable for third quarter is reported at $13, Valley, which represents the minimum of the market, extended delivery having sometimes brought $13.25. Foundry iron is still available on the basis of $13.25, Valley, though in rather limited quantities. The purchase of basic iron by the Carbon Steel Co., Pittsburgh, referred to last week, proves to have been at $13.25, Valley, for equal deliveries over second half, involving 7500 tons or more, and the basic market is now firm at that figure as a minimum, the $13 price for prompt iron having entirely disappeared. Bessemer has been quiet and not overly strong. Interest in sales and prices of pig iron yields to the question of coke supply for second half for furnaces not covered by long term or annual contracts, as the Connellsville operators persist in asking $2.50, while the furnaces are equally fixed in staying out of the market at that figure. The rival claims are wide apart, though somewhat interesting. The operators have a list of 10 furnaces which they say are about to blow in, making a very sizable increase in the coke consumption, but there is a serious question as to several of these furnaces at any rate. They also claim that the high price of copper will increase the sale of smelter coke, helping the situation, but the market fact is that smelter coke has declined lately, and is now easy at about $1.65. The argument most likely to convince is that the operators are holding $2.50 by mere force of opinion, and show no signs of weakening. The recourse of the furnaces is to use outside coke, as from West Virginia, and to buy Connellsville coke from time to time in the prompt market instead of contracting. The prompt market is now $2.15@2.20. Never before have contracts been made at much above the prompt market, though the reverse has sometimes occurred. This deadlock as to coke is probably tending to make pig iron quieter than it otherwise would be. We quote: Bessemer, $14.25; basic, $13.25; No. 2 foundry, $13.25@13.50; malleable, $13@13.25; forge, $13, all f.o.b. Valley furnaces.

Steel—The market is firm, producers being very well sold up, but is not particularly active. We continue to quote: Billets, $21.50; sheet bars, $22, f.o.b. maker's mill, Pittsburgh; billets, $21; sheet bars, $22, f.o.b. maker's mill, Youngstown. Rods are quotable at $24.50@25, Pittsburgh.

Sheets—The sheet mills are operating at between 90 and 95 per cent. of capacity, many plants running full. Prices are slightly firmer. On contracts for extended delivery mills are regularly obtaining better prices than the rates quoted by a few mills for early shipment. Contracting by the automobile manufacturers is expected to be heavy in July, for the new season. One or two large contracts have already been placed. There is less competition on these grades of material than on common sheets, and full prices, premiums in some cases, are obtained without difficulty, consumers being willing to pay for good service. We quote: Black sheets, 28 gage, 1.90@1.95c.; galvanized, 28 gage, 2.95@3c.; blue annealed, 10 gage, 1.40c.; painted corrugated, 28 gage, 2.15c. per lb. and $1.35 per square; galvanized, 3.05c. per lb. and $2 and $2.56 per square

St. Louis

June 24—The pig-iron market is firm. Business is mainly in small lots, but foots up a pretty good total. Southern No. 2 foundry is $11.25 Birmingham, or $15 St. Louis, with $11.50 Birmingham asked for fourth quarter. Northern No. 2 is quoted around $14.50. Business in finished materials is good.

Coke is $5@5.10 St. Louis.

Iron Ore Trade

Sales of such Cuban iron ore as is offered in the market have been made to Eastern furnaces recently, the total being about 100,000 tons. The price for second-half delivery is said to be 7¼c. per unit, f.o.b. cars at Philadelphia. This is an advance of ¼c. on first-half contracts. Small advances are now asked on Swedish and Spanish ores generally.

Foreign Iron Trade

German Foreign Trade—Exports and imports of iron and steel and of machinery in Germany, four months ended Apr. 30, metric tons:

	Exports	Imports	Excess
Iron and steel..	1,926,473	213,596	Exp. 1,712,877
Machinery......	161,766	26,448	Exp. 135,318
Total..........	2,088,239	240,044	Exp. 1,848,195
Total, 1911.....	1,778,614	206,542	Exp. 1,672,072

Increase in exports this year, 309,625 tons; increase in imports, 33,502 tons.

METAL MARKETS

New York, June 26—The metal markets have been fairly active, and generally strong, notwithstanding a break in copper prices in London.

Our market report next week will cover the period from Thursday, June 27, to Tuesday, July 2. Our average quotations for June will be reported on July 2.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
May 1912..	$ 4,450,899	$ 3,346,491	Exp. $1,404,408
" 1911..	6,817,149	5,014,741	Exp. 1,802,409
Year 1912..	26,225,801	19,653,285	Exp. 6,572,516
" 1911..	10,176,807	29,005,312	Imp. 18,828,505
Silver			
May 1912..	6,725,781	4,345,032	Exp. 2,380,749
" 1911..	5,054,304	3,555,842	Exp. 1,498,462
Year 1912..	28,623,028	20,384,764	Exp. 8,238,264
" 1911..	28,665,500	18,454,155	Exp. 10,211,345

Exports from the port of New York, week ended June 22: Gold, $302,600, chiefly to Argentina; silver, $882,319, principally to London. Imports: Gold, $804,084; silver, $61,847, largely from France and Mexico.

Gold—The price of gold on the open market in London remains at the usual bank level, 77s. 6d. per oz. for bars and 76s. 4d. per oz. for American coin. Most of the supplies arriving went to the Bank of England. In New York $2,000,000 gold has been taken for export to Paris, and more is expected to go.

Platinum—The market continues rather quiet, but the price remains fixed at the same point which it has held for some time. Dealers ask $45.50 per oz. for refined platinum and $48 for hard metal up to 10% iridium. The foreign market is reported steady.

Iridium—The current price for this metal is $64 per oz., New York.

Silver—The price of silver rose to 28$\frac{9}{16}$d. in London on favorable monsoon reports but later reacted to 28$\frac{5}{16}$d. on selling by Indian Bazaars. The market closes steady at 28$\frac{5}{16}$d. The news as to the arrangement of the proposed Chinese loan is conflicting, but it seems probable that definite progress is being made.

SILVER AND STERLING EXCHANGE

June	20	21	22	24	25	26
New York....	61⅝	61¾	62	62	61¾	61½
London ...	28⅜	28$\frac{7}{16}$	28$\frac{9}{16}$	28$\frac{9}{16}$	28$\frac{7}{16}$	28$\frac{5}{16}$
Sterling Ex..	4.8750	4.8725	4.8725	4.8725	4.8725	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to June 13, as reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India......	£4,008,700	£2,999,800	D. £1,008,900
China	822,800	853,500	I. 30,700
Total......	£4,831,500	£3,853,300	D. £ 978,200

Exports of gold from Great Britain to India five months ended May 31 were £5,651,035 in 1911, and £8,020,611 in 1912; increase, £2,369,576 this year.

Copper, Tin, Lead and Zinc

NEW YORK

June	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
20	17½ @17¾	17.40 @17.50	45¼	4.50	4.37½ @4.42½	6.85 @6.95	6.70 @6.80
21	17½ @17¾	17.45 @17.55	45¼	4.50	4.37½ @4.42½	6.85 @6.95	6.70 @6.80
22	17½ @17¾	17.45 @17.50	45¼	4.50	4.37½ @4.42½	6.90 @7.00	6.75 @6.85
24	17⅜ @17⅝	17.25 @17.35	45½	4.50	4.40 @4.42½	6.90 @7.02½	6.75 @6.87½
25	17⅜ @17⅝	17.25 @17.35	45½	4.50	4.40 @4.42½	6.90 @7.05	6.75 @6.90
26	17⅜ @17⅝	17.25 @17.35	45½	4.50	4.40 @4.42½	6.90 @7.05	6.75 @6.90

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

June	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
20	79⅝	79⅞	84¾	206¼	196¾	17$\frac{13}{16}$	25¾
21	79⅛	79⅞	84¾	206	196¾	18	25¾
22	......	...	.	......	.....	. .	.....
24	77¼	78⅛	83	206¾	197	17$\frac{13}{16}$	25¾
25	77⅛	78	82¾	207½	198	18	25½
26	78¼	79⅛	83¾	207¾	199	17$\frac{13}{16}$	25¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; ± £25 = 5.44c.; £70 = 15.22c. Variations, £1 = ± 21¾c.

Copper—Following our last report, the market experienced a further advance on the strength of relatively small business, some electrolytic having been sold at 17¾c. for delivery in Europe, although any important demand would doubtless have been supplied at a lower price if necessary to secure the orders. Some uncertainty in the speculative position of the London market was detected as early as June 21. On June 24 there was a sharp drop as the effect of realizing sales of some large blocks of copper in the London market. The consequence of this was to create uncertainty among consumers everywhere, and they have naturally held aloof. In the meanwhile, the principal producers, who have put themselves in comfortable position and temporarily have no need to sell copper, have maintained their price previously asked, but, of course, have sold no copper, and the market during the last three days has been made by the relatively small transactions through second hands. Although the London market rallied somewhat on Tuesday and Wednesday, there was but little demand for refined copper, and buyers are disposed to proceed cautiously, in view of the high level of prices and this week's disturbance in London. The statistical position of the metal continues to be strong, and it is hoped that the increase in production which is likely to make its appearance toward the end of the summer will be readily absorbed, but, of course, there is no certainty about that. Anyway, it is recognized that the consumption of copper, both in this country and in Europe, at the present time is already very large. At the close, Lake copper is quoted 17⅜@17⅝c., and electrolytic at 17.25@17.35c. Casting copper is quoted nominally at 17@17⅛c. as an average for the week.

The London market, which on Thursday and Friday, June 20 and 21, ruled at

£79 2s. 6d. for spot and £79 17s. 6d. for three months, declined sharply on Monday, June 24, to £77 5s. for spot and £78 2s. 6d. for three months. The immediate cause was the rumor that hidden stocks of copper had been discovered, but the real cause was that for a long time past there has been bull speculation in London standard copper and large bull accounts had accumulated, not all of which were in strong hands, so that the position had become vulnerable. The market rallied somewhat on Tuesday and further on Wednesday, and closes at £78 5s. for spot and £79 2s. 6d. for three months.

Copper sheets are 22@23c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 19@19¼c. base, carload lots at mill.

Copper exports from New York for the week were 4524 long tons. Our special correspondent reports the exports from Baltimore at 831 tons.

Tin—The position continues to be an extraordinary one. The London strike is not yet settled, although it has been running for almost a month, and there are several thousand tons of tin in vessels at London which cannot be discharged. During the past week some of this tin has been reshipped to the continent, whence it is being forwarded to the United States, and shipments from the East Indies are now being made to continental ports, so that the squeeze on this side will not extend much further. In the meantime, however, tin for spot delivery continues to command a premium of 2½ to 3c. per lb. over shipment tin. Under these circumstances, American consumers have been restricting their purchases to a minimum and in consequence, notwithstanding the small supplies, the price of spot tin has not gone over 48¾ cents.

The market in general has been firmer, London closing at £207 15s. for spot and £199 for three months.

At New York the price for June delivery has ruled about 48¼@48½c. and for July tin 45¼@45½c. The market closes at 48½c. for spot and 45½c. for July.

Receipts of Bolivian tin in Great Britain in May included 16 tons of bars and 1463 tons concentrates, equivalent to a total of 894 tons fine tin.

Lead—Consumption of pig lead is improving and there is a good business doing. Lead in New York is unchanged at 4.50c. Lead in St. Louis has been somewhat easier at 4.37½ to 4.42½ but the market closes at 4.40 to 4.42½ cents.

The London market continues strong, Spanish lead being quoted £17 18s. 9d. and English lead 2s. 6d. higher.

Spelter—The market is very strong. Stocks in the hands of producers and consumers are low and consumption is increasing. The outlook in the galvanizing trade is excellent. Prices are higher, the close being quoted 6.75@6.90c. according to delivery; New York 6.90 to 7.05 cents.

The London market is unchanged at £25 15s. for good ordinaries and £26 for specials.

Other Metals

Aluminum—Business has not been specially active. We continue to quote 22½@23c. per lb for No. 1 ingots, New York.

Antimony—Business is chiefly of a retail order, with prices unchanged. Cookson's is quoted at 8.10c. per lb.; Hallett's is 7.75c.; while 7.10@7.25c. per lb. is quoted for Chinese, Hungarian and other outside brands.

Quicksilver—Business has been quiet, and prices are unchanged, though rather nominal. New York quotations are $41 per flask of 75 lb., with 60c. per lb. charged for retail lots. San Francisco, $41 for domestic orders and $38.50 for export. The London price is £8 5s. per flask, with £8 2s. 6d. quoted from second hands.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, five months ended May 31, figures in long tons, except quicksilver, which is in pounds:

Metals	Imports	Exports	Excess	
Copper, long tons	50,389	22,859	Imp.	27,530
Copper, 1911 ...	63,250	33,893	Imp.	29,357
Tin, long tons....	18,878	18,821	Imp.	57
Tin, 1911......	17,360	19,537	Exp.	2,177
Lead, long tons	91,221	21,937	Imp.	69,284
Lead, 1911	86,467	*28,149	Imp.	58,318
Spelter, l'g tons	57,053	3,733	Imp.	53,320
Spelter, 1911....	54,508	4,272	Imp.	50,236
Quicksilver, lb...	2,384,648	939,645	Imp.	1,445,003
Quicksilver, '11	2,210,799	1,262,733	Imp.	948,066
Minor met's, tons	2,356	11,484	Exp.	9,128
Minor, 1911. .	2,323	8,717	Exp	6,394
Ores				
Tin ore and con.	12,019	....	Imp.	12,019
Tin ore, 1911..	12,050	....	Imp.	12,050
Pyrites	388,043	....	Imp.	288,043
Pyrites, 1911...	395,274	....	Imp.	395,284

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Minor metals include nickel, aluminum and the minor metals and alloys.

Copper, Tin, Lead and Zinc

Joplin, Mo., June 22—The high price of zinc sulphide ore this week was $61.50, the base per ton of 60% zinc is $52@58. Zinc silicate sold at $28@30 per ton of 40% zinc. The average price, all grades, was $54.30. The zinc-ore market slumped $2 per ton on the low grades, but only 50c. on the high grades. Competition was not so strong this week, several companies being out of the market and others with short orders. Production was off from 700 to 1000 tons, on account of the heavy rains and flood of last Sunday night.

SHIPMENTS, WEEK ENDED JUNE 22

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,285,160	. .	1,230,400	$154,435
Joplin........	2,048,510	......	250,900	65,281
Galena..	648,620	53,290	42,430	20,104
Duenweg.. ..	644,800	......	27,050	18,784
Alba-Neck ...	570,120	......	......	16,533
Oronogo.....	411,630	......	......	11,086
Spurgeon ..	252,620	273,560	......	10,923
Granby . . .	98,370	312,070	6,000	7,890
Cave Springs.	256,000	......	12,380	6,990
Miami.......	211,760	......	......	6,082
Aurora.... ..	111,410	.....	......	2,896
Carthage	72,470	......	......	1,956
Lawton.......	66,000	......	......	1,782
Springfield ..	61,130	......	......	1,711
Wentworth.	......	......	30,640	788
Totals.. ..	9,738,600	638,920	1,599,800	$326,241
25 weeks...	253,084,770	15,241,430	43,007,910	$7,740,457

Blende val., the week, $271,602; 25 weeks, $6,344,376
Calamine, the week, 10,152; 25 weeks, 224,792
Lead value, the week, 44,487; 25 weeks, 1,171,289

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January.....	$41 85	$44.90	$40.55	$43.54	$55.68	$58.92
February....	40 21	45.75	39 16	43 31	54 46	52.39
March.......	39.85	51.56	38.45	49.25	54.57	54.64
April........	38 88	52.00	37 47	50.36	56 37	54 18
May.........	38.25	55.30	36 79	53.27	55.21	52.45
June	40.50	.....	38.18	......	56 49	......
July........	40 75	..	38.36	......	58.81	....
August	42 50	. ....	41 28	.....	60.74	......
September .	42 63	......	41 29	......	59 33	......
October.....	42.38	......	40.89	......	54.72	. ....
November...	45.40	......	43.25	......	57 19	......
December ..	44.13	......	40.76	......	62 03	......
Year... ...	$41.45	......	$39.90	......	$56.76	......

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., June 22—The base price paid this week for 60% zinc ore was $56. The base price paid for 80% lead ore was $54@55 per ton.

SHIPMENTS, WEEK ENDED JUNE 22

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point... ..	878,170	. .	....
Shullsburg......	803,500	. .	. . . .
Benton. . .	788,600	....	692,000
Galena	602,400	....	......
Platteville .	567 300	74,110	233,300
Hazel Green....	350,000	....	....
Highland..........	316,300	....	....
Rewey.	169,000	....	....
Harker.............	167 110	. .....	....
Cuba City.	65,280	64,850	..... .
Potosi................	....	50,000	.. .
Total................	4,707,660	188,960	925,300
Year to date..........	99,122,260	4,023,470	13,987,470

Shipped during week to separating plants, 2,044,910 lb. zinc ore.

Other Ore Markets

Zinc Ores For Rocky Mountain blende of good quality, especially as to iron and lead contents, the current price, delivered at smelting works in Kansas and Oklahoma, is for the zinc contents, less eight units at the St. Louis price for spelter; with a deduction of $16 to $18 per 2000 lb. of ore.

Tungsten Ore—Ferberite, wolframite and huebnerite ores, $6.50@7 per unit per ton of 2000 lb. of ore containing 60 per cent. of tungsten trioxide. For scheelite ore, 50c.@$1.50 per unit less. These prices are delivered; a recent offer is noted of $5.50 per unit for huebnerite, 60% WO_3 f.o.b. railroad.

Vanadium Ore—A recent quotation for vanadinite, containing at least 10%, is 75c. per lb. for the V_2O_5 in the ore.

Molybdenum Ore—Recent prices offered for molybdenite, carrying 25% MoS_2, are $25 per ton; for wulfenite, at least 25% MoO_3, $100 per ton, f.o.b. railroad.

New Caledonia Ores

The final corrected statements for 1911, as given by the *Bulletin du Commerce*, of Noumea, report the exports from New Caledonia as follows, in metric tons:

	1910	1911	Change
Ores:			
Nickel. .	115,342	120,060	I 4,718
Copper	800	.	D. 800
Lead	44	. . . . .	D. 44
Chrome. .	28,244	32,806	I. 4,562
Metals:			
Nickel matte	768	2,993	I 2,225
Copper matte.	.	1,529	I 1,529
Iron, blooms. . . .	. .	4	I. 4

Of the nickel ore exported in 1911 there were 54,709 tons to England; 40,247 to France; 17,904 to Germany and Holland; 7789 to Belgium. Of the chrome ore 6401 tons went to the United States direct; 5775 to Italy; 1500 to France; 491 to Holland. The balance, 18,741 tons, went to Australia, for transfer there to other vessels.

Chemicals

New York, June 26—The general markets are rather dull.

Arsenic—Some shipments are being received from Canada; also from Anaconda. English arsenic is also arriving. Trade has been good and spot parcels are pretty well cleared up. Spot white arsenic is easier, at $3.75 per 100 lb., while $3.62½ per 100 lb. is asked for futures.

Copper Sulphate—The market is quiet, but steady. Quotations are unchanged at $5.50 per 100 lb. for carload lots and $5.75 per 100 lb. for smaller parcels. Production is not large, and there may be an advance soon.

Nitrate of Soda—Trade is a little dull, but prices are firm. Spot and July nitrate commands 2.42¼@2.45c. per lb., while 2.45c. is asked for August and later deliveries.

Petroleum

Exports of petroleum and petroleum products from the United States in May were 177,343,826 gal. For the five months ended May 31 the exports were 669,346,367 gal. in 1911, and 694,224,215 gal. in 1912; an increase of 24,877,852 gal., or 3.7%, this year.

MINING STOCKS

New York, June 26—On June 20, the Exchange recovered somewhat from its previous quiet and sales were larger, generally at firm prices. On the Curb, mining stocks were also firm and developed a good volume of business with some advances. Braden Copper was specially active and some of the Cobalt stocks were in demand.

June 21 the Exchange was quiet again, with only small changes in price. The Curb was more active, but irregular. Ohio Copper declined, but Braden and Mason Valley gained. Other mining stocks were steady but not in much demand.

June 22 both Exchange and Curb were very dull, with little business and no changes. The Chicago convention seemed to absorb more attention than stocks.

June 24 the Exchange was still dull and uncertain, but the range of prices was perceptibly lower. On the Curb the market was rather narrow. El Paso Consolidated was lower and Yukon Gold was quiet. Cobalts were dull but steady. Copper stocks were generally off a fraction.

June 25 the Exchange was still dull and rather inclined to weakness. The Curb also was quiet, except for fair sales of copper stocks. June 26 the situation was much the same, the Baltimore convention attracting attention.

At auction, in New York, June 20, there were sold 41,000 shares Rawhide Coalition Mines Co., at $15 for the lot.

Boston, June 25—The mining-share market was just getting into its own when the sharp break in the London copper warrants occurred on June 24. The market was going ahead with leaps and bounds and many stocks sold at their record prices for the year. Notable among these were Calumet & Hecla, which rose $28 to $539, Isle Royale $3.87½ to $35.50 and Osceola $5.50 to $130.50 per share.

The whole copper-share list indicates a tendency to draw away from the environments of Wall Street, where the political and crop influences are uppermost. Many of the recent increases in copper-mining dividends do not represent the present high level for copper, so that any continuance of this price will accrue to the mining companies. This is the foundation upon which many expect to see a board, active market.

Mayflower and Old Colony have taken on a new lease of life in response to further favorable drill developments. Six

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	March	April	May
Alaska shipments.	4,987,916	1,243,911	1,720,391
Anaconda......	25,900,000	25,480,000	25,800,000
Arizona, Ltd... .	3,150,000	3,400,000	3,500,000
Copper Queen......	7,197,121	6,806,425	7,024,087
Calumet & Ariz....	4,652,000	4,104,000	4,424,000
Chino...............	1,108,381	1,150,000	1,275,850
Detroit...	2,246,238	2,506,718	2,092,478
East Butte. ...	1,480,000	1,400,000	....
Mammoth........	1,939,310	1,718,450	....
Mason Valley......	1,140,000	1,503,056	1,520,000
Nevada Con.... .	6,380,000	6,115,095	6,063,462
Ohio...............	599,156	675,000	....
Old Dominion.....	2,432,000	2,167,000	....
Ray...............	2,300,000	2,611,920	2,992,500
Shannon............	1,388,000	1,544,000	1,464,000
South Utah.........	299,000	284,215	236,884
United Verde*	2,250,000	2,250,000	2,500,000
Utah Copper Co ..	8,160,000	8,615,775	9,564,919
Lake Superior*....	19,750,000	18,250,000	21,250,000
Non-rep. mines*..	6,792,463	7,625,000	....
Total production.	104,051,585	97,400,495	....
Imports, bars, etc..	23,519,215	26,842,014	....
Total blister. .	127,570,800	124,242,509	....
Imp. in ore & matte	8,726,874	9,350,972	....
Total....	136,307,674	133,593,481	....
Miami.............	2,755,000	2,554,352	2,565,000
Brit. Col. Cos.:			
British Col. Copper	... .	1,043,173	875,000
Granby	1,882,073	1,941,797	1,914,460
Mexican Cos.:			
Boleo.......	2,424,800	2,149,280	2,260,160
Cananea	2,834,000	4,654,000	4,690,000
Moctezuma	2,446,731	2,797,718	2,892,521
Other Foreign:			
Cape Cop., S. Africa	725,760	954,240	754,880
Kyshtim, Russia...	....	1,545,000	....
Spassky, Russia..	638,400	649,600	....
Famatina, Argen..	....	....	....
Tilt Cove, Newf'd..	104,992	119,869	123,087
Exports from:			
Chile...............	3,584,000	6,496,000	3,696,000
Australia	8,064,000	9,408,000	7,840,000
Arrivals in Europe†	12,559,680	12,064,640	9,976,860

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
V, 1911.........	126,962,544	64,543,963	61,978,557
VI.	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII..........	125,493,667	59,935,364	69,855,660
IX............	115,588,950	57,311,584	50,824,011
X.	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII............	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912....	119,337,753	62,343,901	80,167,904
II..............	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326
V.......	126,737,836	72,702,277	69,485,945

VISIBLE STOCKS

	United States	Europe	Total
VI, 1911........	165,995,932	202,540,800	368,536,732
VII............	157,434,164	195,932,800	353,366,964
VIII...........	137,738,858	191,891,840	329,630,698
IX.............	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI...	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912..	89,454,695	158,323,200	247,777,895
II..	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV..	62,367,557	136,819,200	199,186,757
V........	65,066,029	131,176,000	199,242,029
VI...	49,615,643	117,801,600	167,417,243

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

mining companies listed in Boston have increased their rates over the amount paid last year.

On the Curb trading has increased and prices are firm. Houghton Copper has been the feature with a $3 advance to $8. Eagle & Blue Bell has been active and higher.

Assessments

Company	Delinq	Sale	Amt
Best & Belcher, Nev	June 3	June 27	$0.10
Buffalo, Mont	June 4	July 2	0.002½
Challange, Nev	June 8	July 2	0.10
Chollar, Nev	July 7	Aug. 5	0.10
Confidence, Nev	July 15	Aug. 9	0.20
Crown Point, Nev	June 24	July 17	0.10
Ely Con., Nev	....	....	0.05
Exchequer, Nev	May 23	June 13	0.05
Glen Dale, Utah	May 25	June 25	0.00
Great Falls, Utah	June 26	July 27	0.002½
Hale & Norcross, Nev	July 2	July 29	0.05
Houghton Copper, Mich	May 17	....	1.00
Julia, Nev	May 15	June 5	0.05
Mineral Hill, Nev	Aug. 5	Oct. 5	0.01
O. K. Silver Mining, Utah	July 15	Aug. 1	0.002½
Overman, Nev	June 29	July 23	0.10
Savage, Nev	June 4	June 26	0.10
Segregated Belcher, Nev	June 1	June 28	0.05
Seven Troughs, Nev	June 15	July 2	0.002½
Sierra Nevada, Nev	July 4	July 30	0.10
Silver Mt., Ida	July 15	Aug. 15	0.002
South Lake, Mich	June 3	......	2.00
Tintic Central, Utah	June 14	July 6	0.005
Union Consolidated, Nev	July 12	Aug. 7	0.15
Utah Antimony, Utah	June 1	....	0.03
Utah, Nev	July 12	Aug. 6	0.05
Yankee Con., Utah	....	....	0.02
Yellow Jacket, Nev	July 4	Aug. 12	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28.038
June	53.462	53.043	......	24.651	24.486	......
July	54.150	52.630	......	25.034	24.286	......
August	52.912	52.171	......	24.428	24.082	......
September	53.295	52.440	......	24.567	24.209	......
October	55.490	53.340	......	25.596	24.594	......
November	55.635	55.719	......	25.680	25.649	......
December	54.428	54.905	......	25.160	25.349	......
Year	53.486	53.304	......	24.670	24.592	......

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.711	12.275	15.930	54.034	70.294
May	11.989	16.031	12.214	16.245	54.313	72.352
June	12.385	....	12.611	....	56.365	....
July	12.463	....	12.720	....	56.673	....
August	12.405	....	12.634	....	56.266	....
September	12.201	......	12.508	....	55.253	....
October	12.189	......	12.370	....	55.170	....
November	12.616	......	12.769	.....	57.253	.....
December	13.552	......	13.768	......	62.068	.....
Year	12.376	....	12.634	.....	55.973	.....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	.....
February	41.614	42.962	August	43.319	....
March	40.157	42.577	September	39.755	....
April	42.185	43.923	October	41.185	......
May	43.115	46.053	November	43.125	......
June	44.606		December	44.655	....
			Av. Year	42.281	......

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	4.194	4.223	4.072	12.984	16.509
June	4.435	......	4.292	......	13.260	......
July	4.499	......	4.397	......	13.530	......
August	4.500	......	4.406	......	14.260	......
September	4.485	......	4.356	......	14.744	......
October	4.265	......	4.139	......	15.332	......
November	4.298	......	4.181	......	15.821	......
December	4.450	......	4.332	......	15.648	......
Year	4.420	......	4.286	......	13.970	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.644
May	5.348	6.679	5.198	6.529	24.375	25.790
June	5.520	......	5.370	......	24.612	......
July	5.695	......	5.545	......	25.006	......
August	5.953	......	5.803	......	26.801	......
September	5.869	......	5.719	......	27.750	......
October	6.102	......	5.951	......	27.256	......
November	6.380	......	6.223	......	26.795	......
December	6.301	......	6.151	......	26.849	......
Year	5.758	......	5.608	......	25.281	......

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	15.14	14.30	13.90	14.72	14.12
June	15.90	......	14.06	......	14.56	....
July	15.90	......	14.03	......	14.53	....
August	15.90	......	14.00	......	14.47	....
September	15.90	......	13.57	......	14.40	.....
October	15.43	......	13.44	......	14.34	.....
November	14.92	......	13.30	......	14.25	.....
December	15.15	......	13.10	......	13.90	......
Year	$15.72	.....	$13.94	.....	$14.49	......

STOCK QUOTATIONS

COLO. SPRINGS June 25

Name of Comp.	Bid.
Acacia	.05¾
Cripple Cr'k Con.	.01⅞
C. K. & N.	.17½
Doctor Jack Pot	.05¾
Elkton Con	.63
El Paso	.97⅞
Findlay	.05
Gold Dollar	.17½
Gold Sovereign	.02⅞
Isabella	.12¾
Jack Pot	.04⅛
Jennie Sample	.04½
Lexington	‡ 02
Moon Anchor	01
Old Gold	03⅞
Mary McKinney	.71½
Pharmacist	.01¼
Portland	92½
Vindicator	87¾
Work	.01⅞

SALT LAKE June 25

Name of Comp.	Bid.
Beck Tunnel	09
Black Jack	14½
Cedar Talisman	02
Colorado Mining	.16
Columbus Con	28
Crown Point	02
Daly-Judge	5.60
Grand Central	65
Iron Blossom	1.27½
Little Bell	41
Lower Mammoth	02½
Mason Valley	‡11.50
May Day	.10
Nevada Hills	‡1.95
New York	‡ 04¼
Prince Con	1.62½
Silver King Coal'n	‡2.50
Sioux Con	.05½
Uncle Sam	.20½
Yankee	.10

TORONTO June 25

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7.10	Hollinger	13.00
Hudson Bay	‡70.00	Imperial	02
Temiskaming	41	Pearl Lake	20
Wettlaufer-Lor.	66	Porcu. Gold	36
Apex	.03	Porcu. Tisdale	01
Central	‡5.56	Preston E. D.	04
Crown Chartered	12	Rea	35
Dobie	25	Standard	‡ 02½
Dome Exten.	.28	Swastika	.12
Foley O'Brion	.15	West Dome	.10

SAN FRANCISCO June 25

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.05	Belmont	10.00
Belcher	65	Jim Butler	65
Best & Belcher	.11	MacNamara	.24
Caledonia	1.00	Midway	.44
Challenge Con	.12	Mont.-Tonopah	2.52½
Chollar	.02	North Star	16
Confidence	.40	West End Con	1.80
Con. Virginia	54	Atlanta	.23
Crown Point	.45	Booth	.08
Gould & Curry	02	C.O.D. Con	.10
Hale & Norcross	15	Comb. Frac.	.15
Mexican	2.87½	Jumbo Extension	.35
Occidental	55	Pitts.-Silver Peak	1.10
Ophir	1.05	Silver Pick	.11
Overman	.62	St. Ives	.33
Potosi	.03	Tramp Con	‡.01
Savage	13	Argonaut	‡2.00
Sierra Nevada	.12	Bunker Hill	‡4.50
Union Con	.54	Cent. Eureka	‡.50
Yellow Jacket	.40	So. Eureka	‡3.50

N. Y. EXCH. June 25

Name of Comp.	Clg.
Amalgamated	85½
Am. Agri. Chem.	59
Am.Sm.&Ref.,com	84¾
Am. Sm. & Ref., pf.	107½
Am. Sm. Sec., pf. B	87½
Anaconda	44
Batopilas Min.	1½
BethlehemSteelpf	69½
Chino	33¾
Comstock Tunnel	‡.10
Federal M. & S., pf.	40⅞
Goldfield Con.	4⅜
GreatNor.,ore.,ctf.	41½
Guggen. Exp.	60¼
Homestake	94
Inspiration Con.	19
Miami Copper	27⅞
Nat'nalLead,com.	57½
National Lead, pf.	108
Nev. Consol.	21¾
Pittsburg Coal, pf.	91
Ray Con	21½
RepublicI&S,com.	24½
Republic I & S, pf.	79½
SlossSheffi'd,com.	54½
Sloss Sheffield, pf.	100
Tennessee Copper	43¾
Utah Copper	63⅛
U. S. Steel, com	69¼
U. S. Steel, pf.	110½
Va. Car. Chem.	48¼

N. Y. CURB June 25

Name of Comp.	Clg.
Barnes King	‡ 30
Beaver Con	.45
Braden Copper	7⅛
B. C. Copper	6
Buffalo Mines	1.40
Caledonia	¾
Con. Ariz. Sm.	11/16
Davis-Daly	2 7/16
Diam'field-Daisy	9
Ely Con	7/32
Florence	.92
Giroux	5⅛
Gold Hill Con.	⅜
Greene Cananea	10⅜
Greenwater	.05
Internat. S. & R.	124
Kerr Lake	2 13/16
Keystone	2½
La Rose	3½
McKinley-Dar-Sa.	1¾
Min. Co. of A. new	3
Motherlode Gold	1 1/16
Nev. Utah M. & S.	03½
Nipissing Mines	7⅞
Ohio Copper	⅝
Pacific Sm. & M.	5/16
South Live Oak	3¾
South Utah M.&S.	¾
Standard Oil (Old)	865
Stand'd Oil of N.J.	378
Stand'd Oil Subs.	525
Stewart	1¼
Tonopah	7⅛
Tonopah Ex.	1 15/16
Tri-Bullion	½
Tularosa	‡1⅞
Union Mines	3/16
United Cop., pfd.	10
Yukon Gold	3 13/16

LONDON June 26

Name of Com	Clg.		
Camp Bird	£1	8s	9d
Dolores	1	10	0
El Oro	0	16	0
Esperanza	1	10	0
Mexico Mines	7	5	0
Oroville	0	4	9
Stratton'sInd.	0	3	1½
Tomboy	1	5	6

BOSTON EXCH. June 25

Name of Comp.	Clg.
Adventure	9⅝
Ahmeek	‡355
Algomah	6½
Allouez	48½
Am. Zinc	32⅜
Ariz. Com., ctfs.	5½
[illegible]	46
Boston & Corbin	8
Butte & Balak	3½
Calumet & Ariz	75½
Calumet & Hecla	530
Centennial	24½
Con. Mercur	‡ 05
Copper Range	59⅞
Daly West	6
East Butte	13¼
Franklin	12¾
Granby	55
Hancock	34
Hedley Gold	17
Helvetia	1⅜
Indiana	19
Island Cr'k, com.	62¾
Island Cr'k, pfd.	89
Isle Royale	34¾
Keweenaw	‡1¾
Lake	39¼
La Salle	7½
Mass	‡7
Michigan	‡3
Mohawk	70¼
New Arcadian	‡4¼
New Idria Quick.	‡6⅞
North Butte	31
North Lake	6¼
Ojibway	4⅞
Old Dominion	59½
Osceola	129
Quincy	93½
Shannon	15⅛
Shattuck-Ariz.	22½
Superior	47½
Superior & Bost.	2⅛
Tamarack	44
Trinity	7
Tuolumne	3⅞
U. S. Smelting	44¾
U. S. Smelt'g, pf.	50½
Utah Apex	2⅜
Utah Con	10¾
Victoria	4⅜
Winona	6½
Wolverine	114
Wyandot	2¾

BOSTON CURB June 25

Name of Comp.	Last
Bingham Mines	4¼
Boston Ely	1½
Boswyocolo	03
Butte Central	6½
Cactus	13
Calaveras	2¼
Chief Cons	1¾
Corbin	1⅞
Cortez	1
Crown Reserve	3½
First Nat. Cop.	2¼
Majestic	56
Mazatan	‡½
Moneta Porc	07
Nevada-Douglas	3¼
New Baltic	2½
Oneco	2½
Raven Copper	.29
Rhode Island Coal	28
San Antonio	‡3
S. W. Miami	7½
South Lake	9½
Trethewey	45
United Verde Ext.	.36
Vulture	‡5.00

‡Last quotation.

TA
1
E42
v.93

Engin.

E/MJ. Engineering and
mining journal

ENGIN STORAGE

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY